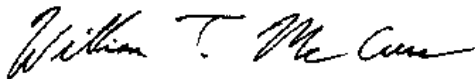


**Chevron Environmental Management
Company**

Health and Safety Plan

Former Tappan Terminal Site
Hastings on Hudson, New York

November 2007



William T. McCune
Senior Geologist II/Project Manager

Health and Safety Plan

Former Tappan Terminal Site
1 Railroad Avenue
Hastings-on-Hudson, New York

Prepared for:
Chevron Environmental Management
Company

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Our Ref.:
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Date:
September 2007

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G	Task-/Site-Specific Job Safety Analysis Forms
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J	Daily/Periodic Excavation Inspection Form

K	Excavation and Trenching Policy and Procedure Memo
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X	Daily Safety Meeting Log/Permit-to-Work Form
Y	Map to Hospital and Evacuation Route Map
Z	ARCADIS BBL Utility Clearance Standard Operating Procedure/Checklist

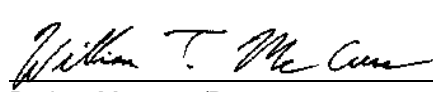
Approvals and Acknowledgments

Approvals

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

Project Name: Chevron Environmental Management Company – Former Tappan Terminal Site, 1 Railroad Avenue, Hastings-on-Hudson, New York

Project Number: 45866.001

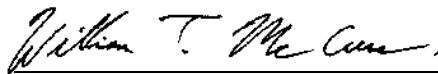
 11/21/07
Project Manager/Date

 11/21/07
Health and Safety Manager/Date

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.

 11/21/07
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.

Site Supervisor/Date

Chevron Acknowledgment

I acknowledge receipt of this HASP. I have reviewed and accept this HASP with respect to project hazards, regulatory requirements, and ABBL/ABBLES procedures.

 11/20/07

Chevron Project Manager/Date

Subcontractor Acceptance

I have read and this Health and Safety Plan (HASP) with respect to project hazards, regulatory requirements, and ARCADIS BBL procedures.

Project Name: Chevron Environmental Management Company – Former Tappan Terminal Site, 1 Railroad Avenue, Hastings-on-Hudson, New York

Subcontractor/Date

Subcontractor/Date

Subcontractor/Date

Subcontractor/Date

[illegible]

Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
ARCADIS BBL	ARCADIS of New York, Inc.
CFR	Code of Federal Regulations
COC	constituent of concern
CPR	cardiopulmonary resuscitation
CRZ	Contamination Reduction Zone
dBa	decibels
DEET	diethyltoluamide
DOT	Department of Transportation
°F	degrees Fahrenheit
FM	Factory Mutual Engineering Corporation
EMS	Emergency Medical Services
EZ	Exclusion Zone
HASP	Health and Safety Plan
HSO	Health and Safety Officer
HSS	Health and Safety Supervisor
IDW	investigation-derived waste
II	Incident Investigation
JMP	Journey Management Plan
JSA	Job Safety Analysis
kV	kilovolt
LPO	Loss Prevention Observation

LPS	Loss Prevention System
LEL	lower explosive limit
mph	miles per hour
MSDS	Material Safety Data Sheet
MOC	Management of Change
MOT	Maintenance of Traffic
NIOSH	National Institute of Occupational Safety and Health
NRR	Noise Reduction Rating
NYSDEC	New York State Department of Environmental Conservation
OE Tenets	Tenets of Operation Excellence
OSHA	Occupational Safety and Health Administration
OTIPS	One Team Incident Prevention System
PFD	Personal Floatation Device
PIC	Principle-in-Charge
PID	photoionization detector
PM	Project Manager
PO	Project Officer
PPE	personal protective equipment
ppm	parts per million
RMSF	Rocky Mountain Spotted Fever
ROD	Record of Decision
SOP	Standard Operating Procedure
SPSA	Safe Performance Self-Assessment
SSE	Short Service Employee
SZ	Support Zone

TCP	Traffic Control Plan
TLV	Threshold Limit Value
UL	Underwriters Laboratories
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1. Introduction

1.1 Objective

The purpose of site activities is to install soil borings and monitoring wells, groundwater sampling, soil sampling, test pit excavation, decontamination, and brush removal. This document must be accompanied by an attached Site-Specific/Task Specific Job Safety Analysis (JSA) identifying characteristics and information specific to tasks to be performed.

Project activities potentially include the following tasks:

- Mobilization/demobilization
- Brush removal
- Installation of soil borings and groundwater monitoring wells
- Test pit excavation
- Soil sampling
- Groundwater sampling
- Decontamination
- Fence removal and re-installation

The objective of this Health and Safety Plan (HASP) is to provide a mechanism for establishing safe working conditions at the site for the individual tasks. 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 Description and Site History

The Former Tappan Terminal site is located on 15 acres along the Hudson River waterfront in the Village of Hastings-on-Hudson, Westchester County, New York. The

site comprises two properties, the Exxon/Mobil property, which is located adjacent to the Hudson River, and the Uhlich Color Company, which is located along the railroad tracks that define the eastern boundary of the site. The Uhlich property is a former pigment manufacturing facility, and the Exxon/Mobil property was most recently used as a petroleum distribution terminal. The Uhlich Color Company was recently acquired by the Magruder Color Company, and has discontinued operations at the site. A small portion of the southern end of the Exxon/Mobil property is leased to the Pioneer Boat Club for use as a marina.

Limited access to the site is from Railroad Avenue at the southeast corner of the site and over the Zinsser Bridge that crosses the railroad tracks. Both portions of the site are surrounded by a chain link fence that is in good repair. This bridge has fallen into disrepair, and is no longer open to vehicular traffic.

1.3 Policy Statement

The policy of ARCADIS of New York, Inc. (ARCADIS BBL, formerly known as Blasland, Bouck & Lee, Inc.), is to provide a safe and healthful work environment for employees. No aspect of operations is of greater importance than injury and illness prevention. A fundamental principle of safety is that accidents and injuries are preventable. ARCADIS BBL and ARCADIS BBL subcontractors will take reasonable steps to eliminate or control hazards in order to minimize the possibility of injury, illness, or accident.

This HASP describes the procedures that must be followed during site activities performed at the site. Operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without the prior approval of the Project Manager (PM) and an ARCADIS BBL Health and Safety Officer (HSO) or his designee. This document will be periodically reviewed to confirm that it is current and technically correct. Changes in site conditions and/or the scope of work will require a review and modification to this HASP. Such changes will be completed in the form of an addendum to this HASP or a revision of this HASP.

The provisions of this HASP are mandatory for ARCADIS BBL personnel and ARCADIS BBL's subcontractors assigned to the project. Visitors to the work site must also abide by the requirements of this HASP. Employees of other consulting and/or contracted companies may work in accordance with their own independent HASPs provided that those HASPs meet the minimum requirements of this HASP.

This HASP is not intended or represented to be suitable for use by other organizations, reuse by Chevron Environmental Management Company (Chevron), or others on extensions of this or any other project. Any reuse without prior written approval or adaptation by ARCADIS BBL will be at the user's sole risk and without liability and legal exposure to ARCADIS BBL. The policies and procedures presented in this document shall not be construed to supersede any federal, state, or local regulations and do not relieve any employer, agent, or invitee involved in the project from complying with applicable federal, state, and local regulations.

This HASP was prepared by ARCADIS BBL and is intended to be implemented during ARCADIS BBL project activities at the site. During such activities, a potential exists for the presence of personnel from client-contracted companies performing work on site. Non-ARCADIS BBL contractors are solely responsible for their own actions, and those of their employees, agents and invitees activities on the project site. Neither delivery of the HASP to Chevron nor the presence of ARCADIS BBL or ARCADIS BBL's employees shall be construed to imply that ARCADIS BBL has any responsibility for the actions of separately-contracted parties present at the project site.

1.4 Modifications to the Health and Safety Plan

Although the HASP focuses on specific site conditions described here, it must remain flexible because conditions may change and unforeseen situations may arise that require deviations from the original HASP. This flexibility allows modification of the HASP by the PM, the Health and Safety Supervisor (HSS), and the HSO to take into account changing site conditions, such as new data on chemical hazards, weather, and modifications to the scope of work.

Recognizing that corrective action activities at the site are long-term and may consist of many different field tasks, this HASP has been organized in a manner that will easily identify the current ongoing work being conducted. In addition, addendums to this HASP, as needed, will be clearly displayed in Attachment B (Addendum and Changes to HASP Log). Changes to the HASP must be approved by the HSO and the PM. If unanticipated field conditions are encountered that are not addressed in this HASP, these conditions shall be immediately reported to the HSS, PM, and Chevron PM. If necessary, any field activities shall be halted until the HASP has been amended to reflect changed conditions and reviewed and approved by the HSO, PM, and accepted by the Chevron PM.

1.5 References

This HASP complies with applicable Occupational Safety and Health Administration (OSHA) regulations, United States Environmental Protection Agency (USEPA) regulations, and ARCADIS BBL health and safety policies and procedures. This HASP 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*, National Institute of Occupational Safety and Health (NIOSH), OSHA, United States Coast Guard (USCG), USEPA (86116, October 1985).
- *Title 29 of the Code of Federal Regulations (CFR)*, Part 1910.
- Title 29 CFR, Part 1926.
- *Pocket Guide to Chemical Hazards*, DHHS, PHS, CDC, NIOSH (2005).
- *Threshold Limit Values (TLV)*, American Conference of Governmental Industrial Hygienists (ACGIH) (2007).
- *Guide to Occupational Exposure Values*, ACGIH (2007).
- *Quick Selection Guide to Chemical Protective Clothing*, Forsberg, K. and S.Z. Mansdorf, 2nd Ed. (1993).
- *Health and Safety Manual*, ARCADIS BBL, Inc.
- *Site Specific HES Protection Plan Generation and Implementation Process – (Health and Safety Plan [HASP] Process)*, Chevron (2005).

1.6 Definitions

The following definitions (listed alphabetically) are applicable to this HASP:

- *Contamination Reduction Zone (CRZ)* – Area between the exclusion zone and support zone that provides a transition between contaminated and clean areas. Decontamination stations are located in this zone.

- *Emergency* – Any occurrence (including any failure of hazard control or monitoring equipment) or event (internal or external) to the permit space that could endanger confined space entrants.
- *Exclusion Zone (EZ)* – Any portions of the site where hazardous substances are, or are reasonably suspected to be present, and pose an exposure hazard to on-site personnel.
- *Hazardous Atmosphere* – An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is escape unaided from a permit space), injury, or acute illness from one of the following causes:
 1. Flammable gas, vapor, or mist in excess of 10% of its lower flammable/explosive limit (LFL/LEL).
 2. Airborne combustible dust at a concentration that meets or exceeds its LEL. (NOTE: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet [1.52 m or less]).
 3. Atmospheric oxygen concentration below 19.5% or above 23.5%.
 4. Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published.
 5. Any other atmospheric condition that is immediately dangerous to life or health.
- *Incident* – All losses, including first-aid cases, injuries, illnesses, near misses, spills/leaks, equipment and property damage, motor vehicle accidents, regulatory violations, fires, and business interruptions.
- *Near Miss* – An incident in which no injury, illness, motor vehicle accident, equipment or property damage occurred, but under slightly different circumstances could have occurred.
- *On-Site Personnel* –Chevron personnel or site owner personnel involved with ARCADIS BBL activities, ARCADIS BBL, and ARCADIS BBL-subcontractor personnel involved with the project.

- *Project* – All on-site work performed under the scope of work.
- *Site* – The area described in Section 1.2 – Site and Facility Description, where the work is to be performed by ARCADIS BBL personnel and subcontractors.
- *Subcontractor* – Includes contractor personnel hired by ARCADIS BBL.
- *Support Zone (SZ)* – All areas of the site, except the EZ and CRZ. The SZ surrounds the CRZ and EZ. Support equipment and break areas are located in this zone.
- *Visitor* – All other personnel, except the on-site personnel.
- *Work Area* – The portion of the site where work activities are actively being performed. This area may change daily as work progresses and includes the SZ, CRZ, and EZ. If the work area is located in an area on the site that is not contaminated, or suspected of being contaminated, the entire work area may be a SZ.

2. Roles and Responsibility

2.1 All Personnel

All ARCADIS BBL and subcontractor personnel must adhere to the procedures outlined in this HASP during the performance of their work. Each person is responsible for completing tasks safely and reporting any unsafe acts or conditions to their supervisor. No person may work in a manner that will conflict with these procedures. After due warnings, the PM will dismiss from the site any person or subcontractor who violates safety procedures.

All ARCADIS BBL 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 personnel will attend an initial hazard briefing prior to beginning work at the site and take a written test that documents their understanding of the site-specific risks. The test can be found in Attachment C. The test will be administered at the beginning of each phase of work for personnel involved in that specific phase of work. A phase of work may involve more than 1 day and more than one specific task.

All ARCADIS BBL and subcontractor personnel that will be performing or overseeing work on this project must attend a Chevron Loss Prevention System (LPS) training session. This training session explains the objectives, elements, and requirements of LPS to personnel that will be expected to perform or oversee work on Chevron property or sites. Personnel will not be allowed to perform work on Chevron property or sites prior to attending an LPS training session.

Cell phone use while driving is prohibited when working on all ARCADIS BBL and Chevron projects. This includes driving on site, as well as driving to and from the site. Hands-free devices are also prohibited.

The roles of ARCADIS BBL personnel and subcontractors are outlined in the following sections. Key project personnel and contacts are summarized in the task-specific JSAs (Attachment G).

2.1.1 Stop Work Authority

Every ARCADIS BBL employee, ARCADIS BBL subcontractor, and Chevron employee at a Chevron work site is empowered, expected, and responsible for

stopping the work of another coworker if the working conditions or behaviors are considered unsafe. No repercussions will result from this action.

Site or project conditions that are possible reasons to stop work and to consider modifications to this HASP include:

- Site temperatures outside the range predicted in this HASP (possibly resulting in greater risk of heat or cold stress).
- Personal Protective Equipment (PPE) breakthrough or unexpected degradation.
- Unusual odors that can not be identified.
- Unexplained, elevated readings on an organic vapor monitor.
- Unexpected changes in soil coloration or texture that might indicate undisclosed contamination.

This list is not comprehensive and should be used only as guidance (also refer to Section 9 for emergency response procedures).

If anyone is discouraged from exercising the "Stop Work Authority" or are penalized for doing so, they should report this action to Chevron's (Health and Environmental Safety) Manager at 925.842.0623.

2.1.2 Tenets of Operational Excellence

The Tenets of Operation Excellence (OE Tenets) are an extension of the Chevron's values and principles that apply to all ARCADIS BBL employees, ARCADIS BBL subcontractors, and Chevron employees at Chevron work sites. Any deviation from "always" in the OE Tenets requires a Management of Change, including a risk assessment with involvement of appropriate subject matter experts. A Management of Change Form is included in Attachment D and a Management of Change Tracking Log is included in Attachment E. The following OE Tenets are intended to protect people, the environment, and equipment:

1. Always operate within design or environmental limits.
2. Always operate in a safe and controlled condition.

3. Always confirm that safety devices are in place and functioning.
4. Always follow safe work practices and procedures.
5. Always meet or exceed customer's requirements.
6. Always maintain integrity of dedicated systems.
7. Always comply with all applicable rules and regulations.
8. Always address abnormal conditions.
9. Always follow written procedures for high-risk of unusual situations.
10. Always involve the right people in decisions that affect procedures and equipment.

Every ARCADIS BBL employee, ARCADIS BBL subcontractor, and Chevron employee at a Chevron work site must take action if a tenet is violated.

2.1.3 Chevron Compliance Reporting Process and Hotline

Chevron has established a **Compliance Reporting Hotline Number at 800.284.3084.**

This is a risk-free and anonymous way to report to Chevron, a Chevron or Contractor violation of U.S., State or Local Laws and Company Policies, including but not limited to:

- health, safety, and environmental (not reporting incidents)
- discrimination/harassment/retaliation
- conflicts of interest
- theft, bribes, kickbacks
- fraudulent transactions

When appropriate (when appropriate action is not taken by ARCADIS BBL and/or Chevron management), Chevron contractors may use the reporting hotline.

2.1.4 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, a Near-Miss Reporting Hotline is available. The hotline will be checked daily and data will be entered into the Chevron One Team Incident Prevention System (OTIPS) 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.

NEAR-MISS REPORTING HOTLINE: 1.866.242.4304

2.1.5 Short-Service Employee Program

Recognizing that employees who are new to ARCADIS BBL or one of their subcontractors 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 hat. The following procedures apply to SSEs:

- Employees new to ARCADIS BBL or one of their subcontractors will be designated as an SSE for 6 months.
- ARCADIS BBL or subcontractor firm employees with less than 6 months experience in a similar job will be designated as an SSE.

Additionally, the following apply:

- All SSEs have to be approved by the Chevron PM by submitting the SSE Form (Attachment F).
- A two- to four-person crew may have only one SSE on site.
- A crew of five or more may have no more than 20 percent of the crew staffed with SSEs on site.

2.2 ARCADIS BBL Personnel

2.2.1 Project Officer

The Project Officer (PO) is responsible for providing resources to confirm that project activities are completed in accordance with this HASP and for meeting all regulatory and contractual requirements. The PO has the ultimate responsibility for LPS Stewardship for all Chevron projects.

2.2.2 Health and Safety Officer

The HSO (or his designee, the Health and Safety Manager [HSM]) has overall responsibility for the technical health and safety aspects of the project, including review and approval of this HASP. Inquiries regarding ARCADIS BBL health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The HSO or his designee must approve changes or addendum to this HASP. The HSO will provide the process measures for implementation of LPS for Chevron projects.

2.2.3 Project Manager

The 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 HSS has the equipment, materials, and qualified personnel to fully implement the safety requirements of this HASP, and/or subcontractors assigned to this project meet the requirements established by ARCADIS BBL. It is also the responsibility of the PM to:

- Consult with the HSO on site health and safety issues.
- Verify that subcontractors meet health and safety requirements prior to commencing work.
- Validate, via questioning, the performance of Safe Performance Self-Assessments (SPSAs).
- Review Loss Prevention Observation (LPO) forms.
- Participate in LPO feedback sessions.

- Verify that all incidents are thoroughly investigated.
- Report all near-misses to the HSM/HSO, PM, PO and the Chevron PM within 24 hours.
- Validate that near-miss investigation corrective actions are implemented within the same time period.
- Contact the PO immediately and the Chevron PM prior to close of business on the day of the incident and schedule an Incident Investigation (II) conference call within 24-hours of notification of an injury or accident.
- Approve, in writing, addenda or modifications of this HASP.
- Suspend work or modify work practices, as necessary, for personal safety, protection of property, and regulatory compliance.
- Participate in all incident investigations (IIs) and confirm that they are reported to the HSO, client, PO, and Principle in Charge (PIC).

2.2.4 Health and Safety Manager

The HSM is responsible for providing technical support to the PM and HSS. Inquiries regarding ARCADIS BBL health and safety procedures, project procedures, and other technical or regulatory issues shall be addressed to this individual. The HSM is responsible for investigating injuries, illnesses, and near-miss incidents; assisting in developing corrective action plans; and verifying corrective actions.

2.2.5 Health and Safety Supervisor

The HSS is responsible for implementing this HASP, including communicating requirements to on-site personnel and subcontractors. The HSS 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.

Additional responsibilities of the HSS include the following:

- Review site activities with respect to compliance with this HASP.
- Maintain required health and safety documents and records.
- Consult with the PM on site health and safety issues.
- Coordinate site and personal air monitoring as required, including equipment maintenance and calibration.
- Conduct site safety orientation training and safety meetings.
- Conduct LPOs at the site and complete the LPO forms.
- Participate in all IIs and confirm that they are reported to the HSS and PM immediately.
- Report all near-misses to the PM within 24 hours. Begin near-miss investigation immediately and implement corrective actions.
- Validate, via questioning, the performance of SPSAs.
- Contact underground utility locator personnel to mark out underground utilities, as needed.
- Stop work, as necessary, for personal safety, protection of property, and regulatory compliance.
- Obtain a site map and determine and post routes to medical facilities and emergency telephone numbers.
- Notify local public emergency representatives (as appropriate) of the nature of the site operations, and post their telephone numbers (i.e., 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 HSM/HSO.

- Verify that all on-site personnel have had 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.
- Issue/obtain any required work permits (e.g., hot work, confined space).

2.3 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.

All subcontractor personnel that will be performing or overseeing work on this project must attend a Chevron LPS training session. This training session explains the objectives, elements, and requirements of LPS to personnel that will be expected to perform or oversee work on Chevron property or sites. Subcontractor personnel will not be allowed to perform work on Chevron property or sites prior to attending an LPS training session.

Subcontractors must designate individuals to function as the PM, HSO, and HSS. In some firms, it is not uncommon for the duties of the HSO to be carried out by the PM. This is acceptable, provided 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 HSO and the HSS. 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. No photographs are permitted while on site without approval from the client.

2.4 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 this HASP. All on-site personnel shall sign the HASP Acknowledgement Form following their review of this HASP. In addition, all personnel will take and pass (passing is 90%) a written test that documents their understanding of the site-specific risks. Employees who do not pass the test will receive one-on-one retraining and will be given the opportunity to retake the exam. Employees who fail the exam the second time will not be allowed to work that day on site but may come back at a later time to retake the exam. The test can be found in Attachment C.

All on-site personnel that will be performing or overseeing work on this project must attend a Chevron LPS training session. This training session explains the objectives, elements, and requirements of LPS to personnel that will be expected to perform or oversee work on Chevron property or sites. Personnel will not be allowed to perform work on Chevron property or sites prior to attending an LPS training session.

All ARCADIS BBL 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 carry the proper identification badge. Badges must be clearly displayed at all times. All on-site personnel must perform an SPSA prior to beginning each work activity. The SPSA process is presented in Section 4.3.1. This process must be performed prior to beginning each activity and must be performed after any near miss or other incident in order to determine if it is safe to proceed. On-site personnel will immediately report the following to the HSO 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.
- Near misses.

No photographs are permitted while on site without approval from the client.

2.5 Visitors

All visitors to ARCADIS BBL work areas must check in with the HSS. Visitors will be cautioned to avoid skin contact with surfaces, soil, groundwater, or other materials that may impacted or be suspected to be impacted by constituents of concern (COCs). Visitors must complete a Site-Specific Visitors Test prior to being escorted by the HSS. Visitors must remain in contact with the HSS, or HSS-designated individual at all times. The Site-Specific Visitors Test can be found in Attachment C.

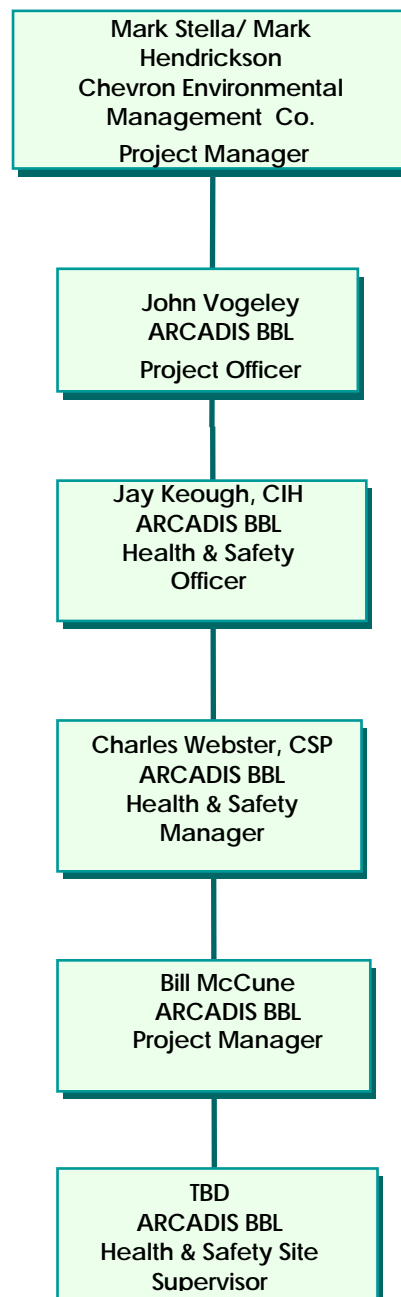
Visitors requesting to observe work at the site must wear appropriate PPE prior to entry to the work area and must have the appropriate training and medical clearances to do so. If respiratory protective devices are necessary, visitors who wish to enter the work area must have been respirator-trained and fit tested for a respirator within the past 12 months. No photographs are permitted while on site without approval from the client.

Table 2-1. Key Personnel and Health and Safety Hierarchy

Chevron Products Co.		
Title/Role	Name	Address
Project Manager	Mark Stella	Chevron Environmental Management Company 4800 Fournace Place E 530C Bellaire, TX 77401 713.432.2643 Fax 925.889.2035 Mobile 281.382.0281
	Mark Hendrickson	713.432.2643

ARCADIS BBL		
Title/Role	Name	Address
Project Officer – Ultimate stewardship responsibility	John Vogeley	2033 North Main Street Suite 340 Walnut Creek, CA 94596-3727 925.274.1100 Fax 925.274.1103
Health and Safety Officer - Overall responsibility for the technical health and safety aspects of the project, including review and approval of this HASP	Jay D. Keough, CIH	8 South River Rd. Cranbury, NJ 08512 609.860.0590
Health and Safety Manager - Responsible for the daily technical health and safety aspects of the project	Charles P. Webster, CSP	6723 Towpath Road Syracuse, NY 13214 315.671.9297
Project Manager - Responsible for verifying that project activities are completed in accordance with the requirements of this HASP	William T. McCune	6723 Towpath Road Syracuse, NY 13214 315.671.9172 Fax 315.446.8053
Health and Safety Site Supervisor - Responsible for implementing and communicating HASP requirements to all on-site personnel	Health and Safety Site Supervisor will be named on Site-Specific/Task Specific JSA located in Attachment E.	
Subcontractors		
Title/Role	Name	Address
TestAmerica	Stephanie Akers	3355 McLemore Drive Pensacola, FL 32514 850.474.1001 ext. 6201
Parratt-Wolff, Inc.	William Morrow	5789 Fisher Road P.O. Box 56 East Syracuse, NY 13057-0056 315.437.1429

Key Personnel and Health and Safety Hierarchy



3. Project Hazards and Control Measures

3.1 Scope of Work

The scope of work at the site includes performing and brush clearing. The scope of work may include the following field activities at this site:

- Mobilization
- Installation of soil borings and groundwater monitoring wells
- Test pit excavation
- Soil sampling
- Groundwater sampling
- Decontamination
- Fence removal and re-installation
- Brush removal
- Demobilization

These major activities were used to develop the hazard analyses in Section 3 of this HASP. A brief description of each major activity is presented in the sections below.

3.1.1 Job Hazard Assessment

A job hazard assessment identifies potential safety, health, and environmental hazards associated with each type of field activity. Because of the complex and changing nature of field projects, supervisors must continually inspect the work site to identify hazards that may harm site personnel, the community, or the environment. The HSS 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 HSS will keep ARCADIS BBL and ARCADIS BBL subcontractor personnel informed of the changing conditions. A member of ARCADIS BBL's Corporate Health and Safety staff will write or approve addendum or revisions to this HASP as

necessary. Task-/site-specific JSAs for field activities are located in Attachment G. The task-/site-specific JSAs will incorporate, at a minimum, the requirements as outlined in Section 3 of the HASP for each activity.

3.2 Field Activities, Hazards, and Control Procedures

The following sections discuss general safety hazards associated with specific field activities outlined in the scope of work for this project. ARCADIS BBL has also specified minimum safety precautions for various field activities. Each ARCADIS BBL subcontracted company must review these activities and safety procedures with respect to their own standard safe operating procedures. Each subcontracted company may utilize their own standard safe operating procedures provided the minimum requirements set forth in this HASP and 29 CFR 1910, 29 CFR 1926, and CCR 5192 are met. Each subcontracted company is responsible for operating in a safe and healthful manner in order to protect their personnel and all site personnel.

3.2.1 Mobilization

Mobilization activities include travel to and from the site. A Journey Management Plan (JMP), including a Traffic Control Plan (TCP) has been prepared and included in Attachment H to provide recommended safe travel routes to and from the site. The JMP also addresses potential hazards that may be encountered during travel.

Site mobilization may include establishing exclusion, contamination reduction, and support zones. A break area will be set up outside the regulated work area. Mobilization may involve clearing or isolating areas for the support and CRZs. 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 HASP.

The hazards of this phase of activity are associated with heavy equipment movement, manual materials handling, installing temporary on-site facilities, 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. Installing temporary field office and support facilities may expose personnel to electrical hazards, underground and overhead utilities, and physical injury due to manually lifting and moving materials. 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.

In the event that work must be conducted in close proximity to a public roadway (within 15 feet of the right-of way), site personnel must isolate the work area with barricades, signs, cones, caution tape, or other appropriate means to alert passing motorists to the presence of an active work area. Also, personnel who are exposed to vehicular traffic must wear an outer layer of orange or yellow warning garments, such as vests, jackets, or shirts. If work is performed in darkness, workers will be outfitted with reflective garments in orange, white (including silver-coated reflective coatings or elements that reflect white light), yellow, fluorescent red-orange, or fluorescent yellow-orange.

Environmental hazards may 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, heat, and cold-related illnesses; and pathogens, such as rabies, Lyme disease, and blood borne pathogens. Control procedures for these hazards are discussed in Section 4.

3.2.2 Installation of Soil Borings

Soil borings will be installed using a portable drill rig. This equipment poses a hazard to personnel if used incorrectly. Hazards and controls associated with the use of drill rigs is outlined below.

3.2.2.1 Drilling Hazards

The primary physical hazards for this activity are associated with the use of the drilling rig. Rig accidents can occur as a result of improperly placing the rig on uneven or unstable terrain, or failing to adequately secure the rig prior to the start of operations. Underground and overhead utility lines can create hazardous conditions if contacted by drilling equipment. Tools such and equipment such as elevators, cat lines, and wire rope have the potential for striking, pinning, or cutting personnel.

Wire Rope – Worn or frayed wire rope presents a laceration hazard if loose wires protrude from the main bundle.

Cat Lines – 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 injure

the operator. Minimal hoisting control causes sudden and erratic load movements, which may result in hand and foot injuries.

Working Surfaces – 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. Rolling stock can shift and/or fall from a pipe rack or truck bed.

3.2.2.2 Drilling Safety Procedures

Drill Crews – All drillers must possess required state or local licenses to perform such work. All members of the drill crew shall receive site specific training prior to beginning work.

The driller is responsible for the safe operation of the drill rig as well as the crew's adherence to the requirements of this HASP. The driller 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 driller, wear all personal protective equipment, and be aware of all hazards and control procedures. The drill crew must participate in the daily safety meeting and be aware of emergency procedures.

Rig Inspection – Each day, prior to the start of work, the drill rig and associated equipment must be inspected by the driller and/or drill crew. Inspections will be documented. The following items must be inspected:

- Vehicle condition
- Proper storage of equipment
- Condition of all wire rope
- Condition of drill rods and interior threads
- Fire extinguisher
- First aid kit

Drill Rig Set Up – The drill rig must be properly blocked and leveled prior to raising the derrick. The wheels which remain on the ground must be chocked. The leveling jacks shall not be raised until the derrick is lowered. The rig shall be moved only after the derrick has been lowered.

All well sites will be inspected by the driller prior to the location of the rig to verify a stable surface exists. This is especially important in areas where soft, unstable terrain is common.

The drill rig must be properly blocked and leveled prior to raising the derrick. 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 that are on the ground shall be chocked.

Site Drilling Rules – Before drilling activities commence, the existence and location of underground pipe, electrical equipment, and gas lines must be determined. The Underground Facility Protection Organization (UFPO) must be contacted at least 1 week, but no more than 2 weeks, prior to subsurface activities. The SS will meet with electrical and natural gas locators on site prior to marking out the underground utilities. During this meeting, the SS will provide the electrical and natural gas locators with a site figure showing the locations where drilling activities will be completed. The SS will conduct a site walkover with the electrical and natural gas locators and other utility owners to visually identify each location where intrusive activities are to be completed during site operations. The Underground/Overhead Utility Checklist (see Attachment G) will be used to document that nearby utilities have been marked on the ground and that excavation and/or drilling areas have been cleared. The completed Underground/Overhead Utility Checklist will be in the possession of the SS prior to commencing any intrusive investigation. Utilities will be cleared by either hand auger or air knife/vacuum to 8 feet below grade for the full diameter of the auger or down-hole drilling apparatus to be used, whichever is greater.

Combustible gas readings of the general work area will be made regularly in areas where, and/or during operations when, the presence of flammable vapors or gases is suspected, such as during intrusive activities (see Section 6). Operations must be suspended and corrective action taken if the airborne flammable concentration reaches

10% of the LEL in the immediate area (a one-foot radius) of the point of drilling, or near any other ignition sources.

Under no circumstances will personnel be permitted to ride the traveling block or elevators, nor will the catline be used as a personnel carrier.

Overhead Electrical Clearances - If drilling is conducted in the vicinity of overhead electric lines, the electric lines must be de-energized, tested de-energized, marked up and guaranteed, or the equipment must be positioned and blocked such that no part, including the excavation boom, can come within the minimum clearances outlined in Table 3-1.

When equipment is in transit, the equipment clearance must be at least 4 feet for voltages less than 50kV, 10 feet for voltages of 50kV to 345kV, and 16 feet for voltages above 345kV.

Table 3-1. Minimum Overhead Electrical Clearances (all equipment)

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

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.

Drill pipe, auger strings or casing should be picked up slowly. Drill pipe should not be hoisted until the driller is sure that the pipe is latched in the elevator, or the derrickman has signaled that he may safely hoist the pipe.

During instances of unusual loading of the derrick or mast, such as when making an unusually hard pull, only the driller should be on the rig floor; no one else should be on the rig or derrick.

The brakes on the drawworks of the drill rig should be tested by the driller each day. The brakes should be thoroughly inspected by a competent individual each week.

A hoisting line with a load imposed should not be permitted to be in direct contact with any derrick member or stationary equipment, unless it has been specifically designed for line contact.

Workers should never stand near the borehole whenever any wire line device is being run.

Hoisting control stations should be kept clean and controls labeled as to their functions.

Catline 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 catline. The cathead area must be kept free of obstructions and entanglements.

The operator should not use more wraps than 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 catline which is under tension.

Employees rigging loads on catlines 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 not depend on shouting to coworkers.
- Make sure the load is properly rigged, since a sudden jerk in the catline will shift or drop the load.

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/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 rolling stock.

Employees should be instructed never to try to stop rolling pipe or casing; they should be instructed to stand clear of rolling pipe.

Slip handles should be used to lift and move slips. Employees are not permitted to kick slips into position.

When pipe is being hoisted, personnel should not stand where the bottom end of the pipe could whip and strike them.

Pipe and augers stored in racks, catwalks or on flatbed trucks should be secured to prevent rolling.

3.2.3 Field Sampling

Numerous field sampling activities will be undertaken. Sampling activities outlined in the work plan include the following:

- Groundwater sampling
- Soil sampling

3.2.3.1 Groundwater Sampling

Groundwater sampling and monitoring (collectively groundwater sampling hereafter) will involve uncapping, purging (pumping water out of the well), and sampling, and/or monitoring, new or existing monitoring wells. A mechanical pump may be used to purge the wells and can be hand-, gas-, or electric-operated. Water samples taken from the wells are then placed in containers and shipped to an analytical laboratory for analysis. The physical hazards of these operations are primarily associated with the collection methods and procedures used.

Hazards – Inhalation and absorption of COCs are the primary routes of entry associated with groundwater sampling, due to the manipulation of sample media and equipment, manual transfer of media into sample containers, and proximity of operations to the breathing zone. During this project, several different groundwater sampling methodologies may be used based on equipment accessibility and the types of materials to be sampled. These sampling methods may include hand or mechanical bailing. The primary hazards associated with these specific sampling procedures are not potentially serious; however, other operations in the area or the conditions under which samples must be collected may present chemical and physical hazards. The hazards directly associated with groundwater sampling procedures are generally

limited to strains or sprains from hand bailing, and potential eye hazards. Exposure to water containing COCs is also possible.

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

Control – To control dermal exposure during groundwater sampling activities, a minimum of Modified Level D protection will be worn. If necessary, based on field observations and site conditions, air monitoring may be conducted during groundwater sampling to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C protection. Section 6.1, Air Monitoring, describes air monitoring requirements and action levels. Each level of personal protection is described in Section 5, Personal Protective Equipment. Control procedures for environmental and general hazards are discussed in Section 4, General Safety Practices.

All tools and equipment that will be used at the site must be intrinsically safe (electronics and electrical equipment) and non-sparking or explosion-proof (hand tools).

3.2.3.2 Soil Sampling

This task involves collecting soil samples for subsequent analysis and evaluation of potential impact by COCs. During the course of this project, the sampling methods may include hand-auger/sampling probes, manual coring devices, and hand trowels. The physical hazards of these operations are primarily associated with the sample collection methods and procedures used.

Hazards – Inhalation and absorption of COCs are the primary routes of entry associated with soil sampling due to the manipulation of sample media and equipment, manual transfer of media into sample containers, and proximity of operations to the breathing zone. The primary hazards associated with this sampling procedure are not potentially serious; however, other operations in the area or the conditions under which samples must be collected may present chemical and physical hazards. The hazards directly associated with soil sampling procedures are generally limited to strains or

sprains, and potential eye hazards. Exposure to soil containing COCs is also possible. Employees may be exposed to sharp edges and blades during the cutting of plastic tubing surrounding core samples. In addition to the safety hazards specific to sampling operations, hazards associated with the operation of vehicles (especially large vehicles with limited operator visibility), is a concern. Of particular concern will be the backing up of trucks, excavation equipment, and other support vehicles.

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

Control – To control dermal exposure during soil sampling activities, a minimum of Modified Level D protection will be worn. Avoid laying tools and equipment on the ground to avoid contact with native poisonous or irritating flora and fauna. If necessary, based on field observations and site conditions, air monitoring may be conducted during soil sampling activities to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C protection. Each level of personal protection is described in Section 5, Personal Protective Equipment. Control procedures for environmental and general hazards are discussed in Section 4, General Safety Practices.

All tools and equipment that will be used at the site must be intrinsically safe (electronics and electrical equipment) and non-sparking or explosion-proof (hand tools).

3.2.3.3 *Sample Processing*

This task involves the splitting of the plastic or metal casing surrounding the core sample and subsequent processing of the sample.

3.2.3.3.1 *Hazards*

Hazards during sample processing include: lacerations from sharp objects used to cut the casing around the core or from sharps that may be contained within the core; slips, trips and, falls from working on potentially wet or slippery ground; dermal contact with soil or water potentially containing COCs; inhalation of COCs contained within the sample; and exposure to viruses, bacteria, and parasites contained within the sample.

3.2.3.3.2 Controls

A stable work platform will be established to which core tubes can be secured prior to cutting. Mats or gravel should be used to minimize slip hazards if the walking surface around the processing area will not drain or is slippery. A battery-powered metal shear should be used for cutting core tubes. PPE will initially be Modified Level D as outlined in Section 5.1.2. A poly-coated Tyvek[®] suit may be required due to the potential for water contact. Leather gloves over nitrile gloves will be worn when directly handling core tubes. Air sampling in the processing area will be performed in accordance with procedures outlined in Section 6.1. The results of air sampling may dictate upgrading to Level C PPE.

3.2.4 Test Pit Excavation

During site activities ARCADIS BBL and ARCADIS BBL subcontractor personnel may be working in areas of active excavation. This task involves excavating at specified locations to obtain sub-surface soil samples from a designated area, thereby creating a man-made cut, trench, or depression in the earth's surface. Excavation activities will be conducted in accordance with this section and all OSHA regulations.

The physical hazards involved in the excavation of soils are related to the excavation itself and the operation of heavy equipment. The presence of overhead utilities such as power lines requires careful positioning of the excavating equipment in order to maintain a safe distance between the lines and the closest part of the equipment. The presence of underground utilities such as gas lines, power lines, water lines, and sewer pipes must be determined prior to beginning the excavation (Appendix I).

Excavations pose significant hazards to employees if they are not carefully controlled. There exists a chance for the excavation to collapse if it is not dug properly, sloped, benched, or shored as required by 29 CFR 1926 Subpart P. Protective systems, as required by 29 CFR 1926 Subpart P, must be utilized if the potential for hazardous cave-ins exist. The excavation also is a fall hazard, and employees must pay careful attention to what they are doing or they risk a fall into the excavation. Fall protection, as required by 29 CFR 1926 Subpart M, will be required.

Activities shall be done remotely whenever feasible.

Noise also may present a hazard. Heavy equipment operation frequently results in noise levels exceeding 85 dBA, requiring the use of hearing protection.

At the end of each workday, open test pit excavations will be backfilled and equipment will be moved to a location away from high-voltage electrical equipment and away from routes necessary to access high-voltage electrical equipment.

Airborne concentrations of COC in the site soil and the dust from the excavation procedure pose the potential for inhalation exposure. PPE for this phase is described in Section 5, Personal Protective Equipment. Airborne particulate generation will be controlled during site excavations. Dry, dusty soil will be wetted with a water spray from a potable water source to control the generation of dust. Soil will not be wetted to a degree that will cause runoff or erosion.

Before excavation activities commence, the existence and location of underground pipe, electrical equipment, and gas lines shall be determined. Dig Safely New York must be contacted at least one week, but no more than two weeks, prior to subsurface activities. ARCADIS BBL's SS will meet with electrical and natural gas locators on site prior to marking out the underground utilities. During this meeting, ARCADIS BBL's SS will provide the electric and natural gas locators with a site figure that shows the locations where excavation activities will be completed. ARCADIS BBL's SS will conduct a site walkover with the electrical and natural gas locators to visually identify each location where excavation activities are to be completed during site operations. The Underground/Overhead Utility Checklist (see Attachment G) shall be used to document that nearby utilities have been marked on the ground, and that the excavation areas have been cleared. The completed Underground/Overhead Utility Checklist will be in the possession of the SS prior to commencement of any intrusive investigation.

All excavation activities shall be conducted in accordance with 29 CFR 1926 Subpart P. If excavation operations are located near underground installations, the exact location of the installations must be determined by safe and acceptable means. While the excavation is open, underground installations must be protected, supported, or removed as necessary to safeguard employees.

3.2.4.1 Inspections by a Competent Person

Daily inspections of excavations, the adjacent areas, and protective systems must be made by the excavation contractor's competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection must be conducted by the competent person prior to the start of work and as needed throughout the shift (see

attached Periodic Excavation Inspection Form in Attachment H). We do not anticipate entering excavations during this sampling program; however, unanticipated circumstances may develop whereby entry will be required (e.g., fixing a ruptured water pipe or other utility). Should entry be required by ARCADIS BBL, the ARCADIS BBL competent person will evaluate the excavation and determine whether ARCADIS BBL employees can enter safely. ARCADIS BBL competent person inspections are solely for the use of ARCADIS BBL employees.

Inspections also must be made after every rainstorm or other hazard-increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated. Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees must be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

Walkways must be provided where employees or equipment are required or permitted to cross over excavations. Guardrails which comply with 1926.502(b) must be provided. Adequate barrier protection must be provided at all remotely located excavations. All wells, pits, shafts, etc., must be barricaded or covered. Upon completion of exploration and other similar operations, temporary wells, pits, shafts, etc., must be backfilled.

3.2.4.2 Soil Classification

29 CFR 1926 Subpart P, Appendix A describes methods of classifying soil and rock deposits based on site and environmental conditions and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils. This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in 1926.652(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with Appendix C to Subpart P of Part 1926, and when aluminum hydraulic shoring is designed in accordance with 29 CFR Subpart P Appendix D. This appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in 1926.652(c), and the use of the data are predicated on the use of the soil classification system set forth in Appendix A of 29 CFR 1926.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H: V). Short-term exposure means a period of time less than or equal to 24 hours that an excavation is open. Soil and rock deposits must be classified in accordance with Appendix A to Subpart P of Part 1926. The maximum allowable slope for a soil or rock deposit must be determined from Table B-1. The actual slope must not be steeper than the maximum allowable slope. The actual slope must be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope must be cut back to an actual slope which is at least horizontal to one vertical (1/2H: 1V) less steep than the maximum allowable slope. When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person must determine the degree to which the actual slope must be reduced below the maximum allowable slope, and must assure that such reduction is achieved. Surcharge loads from adjacent structures must be evaluated in accordance with 1926.651(I). Configurations of sloping and benching systems must be in accordance with 29 CFR 1926 Subpart P Appendix B.

Table 3-1 29 CFR 1926 Subpart P Appendix B, Maximum Allowable Slopes

Soil or Rock Type	Maximum Allowable Slopes (H:V) ¹ for Excavations Less Than 20 Feet Deep ²
Stable Rock	Vertical (90 degrees)
Type A ³	¾:1 (53 degrees)
Type B	1:1 (45 degrees)
Type C	1½:1 (34 degrees)

Notes:

1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
2. Sloping or benching for excavations greater than 20 feet deep must be designed by a registered professional engineer.
3. A short-term maximum allowable slope of 1/2H: 1V (63 degrees) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth must be 3/4H: 1V (53 degrees).

3.2.4.3 Overhead Electrical Clearances

If excavation activities are conducted in the vicinity of overhead power lines, the power to the lines must be de-energized, tested de-energized, marked up/guaranteed, and grounded or the equipment must be positioned such that no part, including excavation boom, 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

3.2.4.4 Excavation Entry Procedure

Persons entering an excavation must do so under controlled conditions. The excavation must be properly sloped, benched, or shored, and ladders or ramps must be available every 25 feet laterally in the excavation. Each entry shall have an attendant who observes the entrant(s) and is prepared to render assistance.

Duties of Workers Entering an Excavation

- Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of exposure to site contaminants.
- 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.
 - The entrant detects a prohibited condition.

- Exit from the excavation as quickly as possible whenever:
 - An order to evacuate is given by the attendant or the supervisor.
 - The entrant recognizes any warning sign or symptom of exposure to a dangers situation.
 - The entrant detects a prohibited condition.

Duties of Attendants

- Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of exposure to site contaminants.
- Continuously maintains a count of entrants in the excavation.
- Remains outside the excavation during entry operations until relieved by another attendant.
- Communicates with authorized entrants as necessary to monitor entrant status to alert entrants of the need to evacuate the excavation under any of the following conditions, if:
 - The attendant detects a prohibited condition.
 - The attendant detects the behavioral effects of hazard exposure in an entrant.
 - The attendant detects a situation outside the excavation that could endanger the entrants.
 - The attendant cannot effectively and safely perform his duties.
- Summon rescue and other emergency services if the attendant determines that entrants may need assistance to evacuate the excavation.

3.2.5 Fence Removal and Repair

Site activities will include fence removal to access portions of the site currently obstructed by the fencing. Activities may include manual materials and heavy

equipment materials handling, as well as subsurface excavation. General site physical hazards are discussed in Section 4 of the HASP and specific safety procedures concerning safety hazards potentially encountered during fence repair activities are discussed below.

Fence repair activities may include a potential for exposure to physical and health hazards. Hazards may be associated with the site and the environmental conditions.

Physical Hazards: The physical hazards involved with this phase of work are primarily associated with the site environment, manual materials handling, hand tools and/or power tools. There exists a potential for incidents involving personnel struck by or struck against objects resulting in fractures, cuts, punctures or abrasions. Walking and working surface during activities may involve slip, trip and fall hazards. Power tools can throw debris and generate noise above 85 db.

The utility clearance procedures for this project incorporate by reference the ARCADIS corporate SOP, which is included in Attachment Z with the utility clearance checklist and Chevron Guidance (Appendix I) . This SOP directs general safety procedures associated with the identification and management of above ground and subsurface utility locations on project sites. In the event that conflicts arise between this SOP and site-specific (e.g., client-driven) requirements, the latter will take precedence. Also refer to Chevron's manual on Hand Safety (Chevron, November 2006) for proper hand tools.

Biological Hazards: The primary environmental hazards are poisonous plants, bees and wasps.

Working Surfaces: Slippery work surfaces can increase the likelihood of back injuries, overexertion 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.

Control: Prior to initiating activity, the site conditions will be discussed with all employees. A JSA will be conducted for each type of power equipment used. Hazards will be identified and protective measures will be explained. Eye and hand protection will be worn while operating all power equipment. Equipment will be inspected per

manufacturer specifications and in proper working condition. Mechanical assistance should be provided for large lifting tasks. Avoidance of biological hazards as discussed in Section 4.0 will be implemented.

3.2.6 Brush Removal

Site maintenance activities will include the periodic cutting of overgrown brush. Activities may include manual materials and heavy equipment materials handling. Machetes will not be used on the site. General site physical hazards are discussed in Section 4 of the HASP and specific safety procedures concerning safety hazards potentially encountered during cutting activities are discussed below.

3.2.6.1 Brush Clearing Activities

Brush clearing activities may include a potential for exposure to physical and health hazards. Hazards may be associated with the site and the environmental conditions.

Physical Hazards: The physical hazards involved with this phase of work are primarily associated with the site environment, manual materials handling, hand tools and/or power tools. There exists a potential for incidents involving personnel struck by or struck against objects resulting in fractures, cuts, punctures or abrasions. Walking and working surface during activities may involve slip, trip and fall hazards. Power tools can throw debris and generate noise above 85 db.

Biological Hazards: The primary environmental hazards are poisonous plants, bees and wasps.

Working Surfaces: Slippery work surfaces can increase the likelihood of back injuries, overexertion 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.

Control: Prior to initiating activity, the site conditions will be discussed with all employees. A JSA will be conducted for each type of power equipment used. Hazards will be identified and protective measures will be explained. Eye and hand protection

will be worn while operating all power equipment. Equipment will be inspected per manufacturer specifications and in proper working condition. Mechanical assistance should be provided for large lifting tasks. Avoidance of biological hazards as discussed in Section 4.0 will be implemented.

Equipment Fueling

No internal combustion engine fuel tank must be refilled with a flammable liquid while the engine is running. Fueling must be done in such a manner that the likelihood of spillage is minimal. If a spill occurs, it must be contained and cleaned, or equivalent action taken to control vapors before restarting the engine. Fuel tank caps must be replaced before starting the engine.

Good metal to metal contact must be kept between fuel supply tank or nozzle of supply hose and the fuel tank. No open lights, welding, or sparking equipment must be used near internal combustion equipment being fueled or near storage tanks. Smoking is not permitted at or near the gasoline storage area or on equipment being fueled. A conspicuous sign must be posted in each fuel storage and fueling area stating: **"No Smoking within 50 Feet."** Class I liquids must not be dispensed by pressure from drums, barrels and similar containers. Approved pumps taking suction through the top of the container or approved self-closing faucets must be used. No repairs must be made to equipment while it is being fueled.

Each fuel storage tank or drum must have the word "flammable" conspicuously marked thereon, and should also have a similarly sized word indicating the contents of the container. A fire extinguisher rated 20:BC or larger must also be in a location accessible to the fueling area. All fuel storage tanks, drums, or safety cans must be properly marked and of the proper type.

3.2.7 Equipment Decontamination

All equipment is decontaminated before leaving the site. In addition, all operations that have the potential to generate or release hazardous material will be conducted in a controlled area using the appropriate engineering controls. Specific decontamination techniques will be established based on site conditions. Decontamination procedures will be reviewed with all personnel on site. A decontamination pad on a suitable surface (concrete or paved area) with polyethylene sheeting or other appropriate containment system will be established. Pressure washing with manual scrub brushing, as needed,

will be used to decontaminate equipment. COC-impacted equipment will be determined “clean” by visually inspecting all equipment.

The decontamination facility will be inspected daily for evidence of leaks or loss of integrity to the containment system. If any deficiencies are noted they will be corrected immediately. All wastewater and waste materials generated on site will be contained in the decontamination system for characterization and proper disposal.

Personnel involved in decontamination activities may be exposed to skin contact with contaminated materials and chemicals brought to the site as part of the project work. All personnel will review the operating procedures and PPE prior to decontamination. Personnel involved in decontamination activities must wear PPE that is appropriate for the task and no more than one level below the level worn by personnel working in the EZ.

3.2.7.1 Pressure Washing

Equipment will be decontaminated before leaving the site. Personnel involved in decontamination activities may be exposed to skin contact with residuals containing site constituents, volatile emissions from heavily soiled equipment, high pressure water spray, and noise.

Hydro blasting is the process of using a stream of water at high pressure to clean or prepare surfaces by removing foreign matter and contaminants. The hazards of high pressure water cleaning are related to the high pressure of the water, which may exceed 10,000 pounds per square inch (psi) at the nozzle. Contact with the water spray may cause severe lacerations, which may then be contaminated with hazardous material. Because of the high pressure involved, the opportunity for slicing or injecting the water stream through soft tissues of the body exists. Hydro blasters will also cut through bone at high enough pressures. A second hazard is repetitive motion, or cumulative trauma disorder. These serious disorders are related to repeatedly squeezing the trigger or constantly fighting the pressure of the spray gun with the forearm or wrist. When pressure washing, steaming, or hydro blasting, the health and safety precautions for hydro blasting outlined below must be observed.

Pressure washing presents a splash hazard. Protection against splash to face and skin is mandatory. The pressure washer is not to be pointed at a person at any time. Steam cleaning presents a thermal burn hazard in addition to the hazards presented by pressure washing. Adequate protection from the hot surfaces must be provided. Only

persons trained in use and maintenance of a hydro blaster may use such equipment. Hydro blasting operations will be conducted only by qualified subcontractor personnel.

The following general requirements are provided for high-pressure water cleaning activities:

- The gun, pressure piping, pressure hose ends, and couplings will have a burst pressure of at least four times the operating pressure.
- No equipment or component of such equipment will be operated beyond the manufacturer's specifications or beyond the rated working pressure.
- The maximum operating pressure will be permanently displayed on the pumping unit.
- Wear safety glasses, face-shield, hearing protection, and safety shoes.
- Alternate hands frequently during long periods of use.
- Rotate personnel periodically.
- Use a washer with a gun which supplies water to the wand in a straight line as opposed to supplying water through the grip. This eliminates the gun's twisting motion.
- Keep the equipment in good condition.
- Check to see that releasing the trigger stops the flow of water. Do not wire back the trigger.
- A hose safety shroud will be placed on hoses whenever operating pressure exceeds 2,000 psi.
- The pressure control will be a "deadman" type to safely reduce the nozzle discharge pressure when control is released.
- The pressure discharge gauge indicating pump pressure will be clearly visible for monitoring pump pressure.

- A pressure relief device set to relieve at 110% of the maximum working pressure of the unit or its components, whichever is lower, will be installed on the pump. The relief will be clearly marked and displayed on the device.
- A strainer or filter should be installed on the water supply system to prevent debris from entering the water blasting units and clogging the gun, control, or other device.

Pay close attention to the water line. It is under pressure, and may whip about if broken. If a water line breaks, relieve the pressure before trying to grab the line.

3.2.8 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.

3.2.8.1 Hazards

Manual materials handling may cause blisters, sore muscles, and joint and skeletal injuries and may present eye, contusion, and laceration hazards. Heavy equipment operation presents noise and vibration hazards and hot surfaces to operators. Personnel in the vicinity of heavy equipment operation may be exposed to physical hazards resulting in fractures, contusions, and lacerations, and may be exposed to high noise levels. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. 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.

3.2.8.2 Control

Control procedures for these hazards are discussed in Section 4.

3.3 Chemical Hazards

The constituents of concern are related to historical site activities dye manufacturing. Attachments O and P provide MSDS and safety guidelines, respectively.

Site COCs may include: aniline, benzene and chlorobenzene.

The potential for inhalation of site COCs is low. The potential for dermal contact with soils and groundwater containing site COCs during excavation, drilling, and sampling operations is moderate. Table 3-2 lists the chemical, physical, and toxicological properties of site COCs. Material Safety Data Sheets (MSDS) for the COCs is included in Attachment A.

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 in a location at the site that is readily available to personnel and all project personnel shall review and sign this HASP 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 shall not be applied in the EZ or CRZ.
- Cell phone use while driving is prohibited.
- 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.
- 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 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 designated receptacles designated for this purpose.

- Do not remove soil containing site COCs from protective clothing or equipment with compressed air, shaking, or 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 appropriately.
- Recognize emergency signals used for evacuation, injury, fire, etc.
- Report all injuries, illnesses, near misses, and unsafe conditions or work practices to the HSS.
- Use the “buddy system” during all operations requiring Level C 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.
- Discard faulty tools.
- 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.
- When passenger vehicles are in motion, all occupants must be seated in designated areas of the passenger vehicle and wear safety belts. Personnel may not occupy the bed of trucks or trailers while the vehicle is in motion.
- 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 indicate they may cause drowsiness or that heavy equipment should not be operated.
- Remain upwind during site activities whenever possible.

4.2 Drug, Alcohol, and Search Policy

Employees will comply with Chevron's Drug, Alcohol, and Search Policy (Exhibit-Safety Regulations, Contract No. 99014516). Subcontractors, by acceptance of ARCADIS BBL Subcontractor Agreement Form and the Schedule "D" Flowdown provisions, must also comply with this policy. According to the Policy:

- CONTRACTOR (ARCADIS BBL) shall have the right to perform controlled substance and alcohol tests based on a reasonable belief by CONTRACTOR or COMPANY (Chevron) that an individual is using alcohol or drugs on the basis of specific physical, behavioral, or performance indicators.
- CONTRACTOR shall have the right to remove any employee from performing work if the individual exhibits unusual job behavior or unacceptable job performance and it is believed by CONTRACTOR or COMPANY that he/she may be using controlled substances or presently under the influence of alcohol.

Work should be stopped immediately if at any time an employee or subcontractor's employee is suspected of being under the influence. The employee's supervisor should be contacted and arrangements made for transportation for the employee from the site. The cut-off level for a positive alcohol test is a blood alcohol concentration of no more than 0.04 percent.

4.3 Loss Prevention System

The 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.
- solving problems from the bottom up while providing direction from the top down.

Prior to assignment on a project in the field, ARCADIS BBL personnel that will be performing or overseeing work on this project must attend an LPS training session. This training session explains the objectives, elements, and requirements of LPS. Elements of the LPS program are briefly outlined below in Sections 4.3.2 and 4.3.2.2

4.3.1 Safe Performance Self Assessment

All on-site personnel are required to perform an SPSA prior to beginning any activity. This three-step process requires each individual to:

- *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 must be performed after any near miss or other incident in order to determine if it is safe to proceed.

4.3.2 Loss Prevention System Reporting

Optimization of LPS depends upon timely reporting both internally and externally of all types of LPS tools (near misses, observations, and incidents). Detailed descriptions of LPS tools are discussed in detail in the sections below.

4.3.2.1 Incident Investigation

An incident is any of the following events: first-aid cases, injuries, illnesses, near misses, spills/leaks, equipment and property damage, motor vehicle accidents, regulatory violations, fires, and business interruptions. All incidents shall be reported to the PM, the PO, the HSM/HSO and the client immediately and investigated within 24 hours. In the event that one of those individuals cannot be contacted, a voice message should be left and the next individual in the chain should be contacted. Follow-up with the absent individual should occur as soon as possible.

The purpose of an II is to prevent the recurrence of a similar hazardous event. An II investigates all incidents in the same manner. Using the information gathered during an II, appropriate measures will be taken to protect personnel from the hazard in question. The II form is included in Attachment R.

The flowchart on the following page outlines steps to be taken in the event of an incident or near miss.

4.3.2.2 Loss Prevention Observation

The HSS or designee will perform the LPO. An LPO form is provided in Attachment S. The purpose of the LPO is to identify and correct potential hazards and to positively reinforce behaviors and practices that are correct. The HSS must identify potential deviations from safe work practices that could possibly result in an incident and take prompt corrective action. A minimum of one observation will be performed per 500 hours for a specific task and one per 200 hours for higher risk tasks. The LPO process steps are:

- Identify tasks that have the greatest potential for hazardous incidents.
- Review the standard procedure for completing the task.

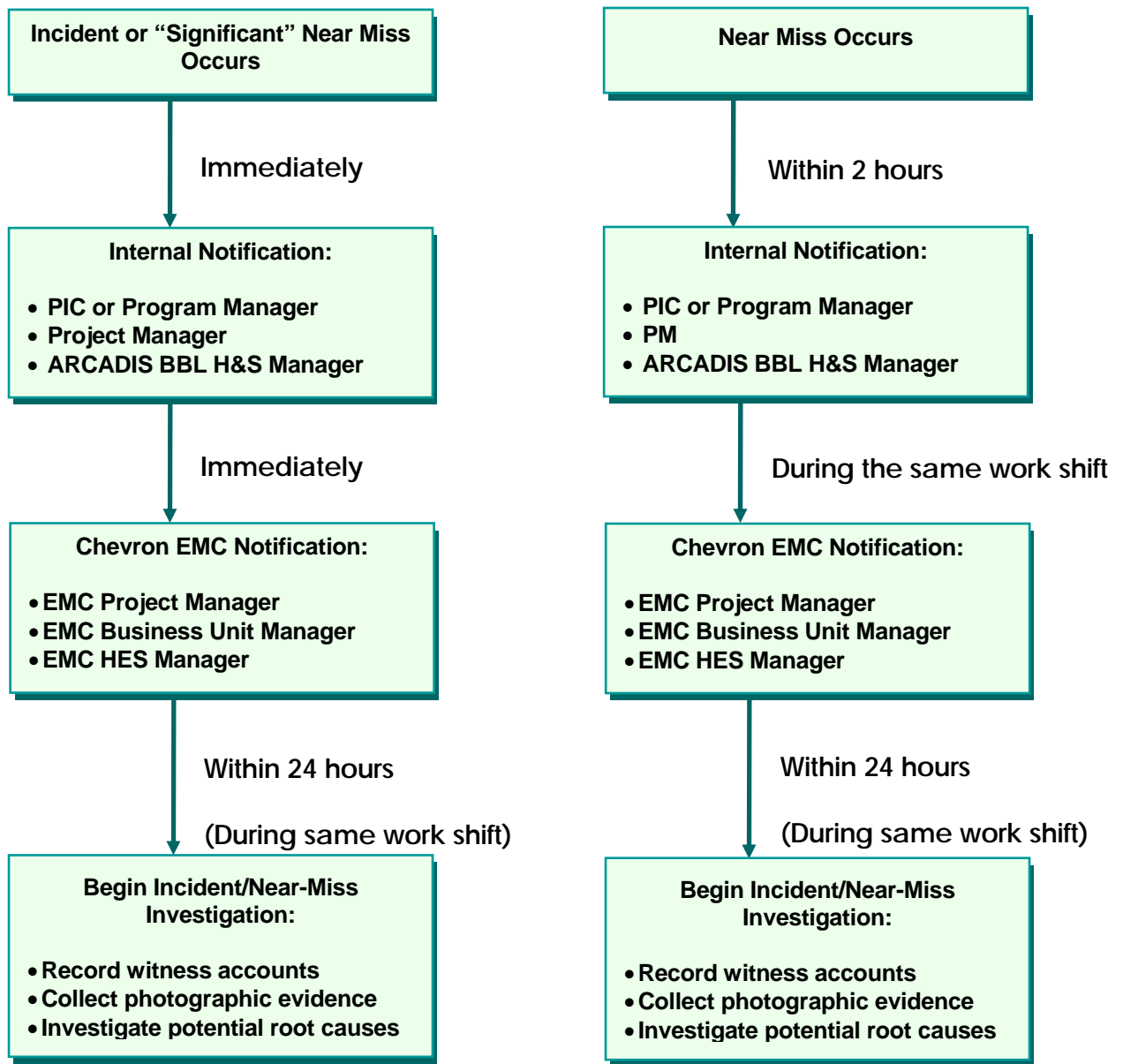
- Discuss with the observed employee the task and the HSS role in observing the task.
- Observe the employee completing the task.
- Reference the LPO form for criteria. Complete the form, documenting positive, as well as areas in need of improvement.
- Discuss the results of the LPO with the employee. Discuss corrective action necessary.
- Implement corrective action.
- Communicate the results of the LPO and corrective action to the PM and the HSO.
- Verify and validate corrective actions are implemented.

4.4 Department of Transportation (DOT) Dangerous Good Shipping Requirements

Hazardous materials and dangerous goods (re: Canadian regulatory term) are those materials that have one or more of the following characteristics: explosives, compressed and liquefied gases, flammable liquids and solids, oxidizing materials, and other substances that are poisonous, infectious, radioactive or corrosive. It is the handling, loading, packing or placing of hazardous materials (dangerous goods) in or from a container or vehicle at any facility for the purpose of transportation (including storing) in the course of transportation. This also includes the packing and transporting for air and ground shipment of laboratory analysis samples.

Regulations governing hazardous materials and dangerous goods exist to protect people, the environment, or property when these goods are being transported by road, rail, sea, or air. Given the increased emphasis of federal (i.e., Federal Aviation Administration and US Department of Transportation, and the Transportation of Dangerous Goods Act) attention to the transport of hazard material-containing goods, it is imperative that all shipments are packaged and transported such that they adhere to all federal requirements. ARCADIS BBL has strict policies in place, whether shipping via ground or air, designed to meet the associated federal requirements. As such, only ARCADIS BBL staff that have been trained in the proper methods to prepare and ship hazardous materials are authorized to do so. If you have not received training on the appropriate preparation and shipping protocols, you are to contact your supervisor or health and safety representative prior to packaging and/or shipping any material that is, or suspected to be, hazardous.

Incident and Near-Miss Reporting Process Flowchart



4.4.1.1 Job Safety Analysis

A JSA is a tool used to identify potential hazards and develop corrective or protective systems to eliminate the hazard. A JSA lists all the potential hazards associated with a task or activity and can include site-specific concerns associated with the task or activity. Hazards may be physical, such as lifting hazards or eye hazards, or environmental, such as weather or biological (e.g., stinging insects, snakes). Following the identification of the hazards associated with an activity, control measures are evaluated and protective measures or procedures are then instituted. JSAs are reviewed daily to confirm that the procedures and protective equipment specified for each task or activity are current and technically correct. Any changes in site conditions and/or the scope of work will require a review 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. At a minimum a JSA will outline the safety requirements for a corresponding specific task as detailed in Section 3 of this HASP.

4.5 Contact Lenses

Based on OSHA's rulemaking record (29 CFR Part 1910, Federal Register # 59:16334-16364), OSHA believes that contact lenses do not pose additional hazards to the wearer and has determined that additional regulation addressing the use of contact lenses is unnecessary. OSHA does want to be clear that contact lenses are not eye protective devices. If eye hazards are present, appropriate eye protection must be worn instead of, or in conjunction with, contact lenses.

According to NIOSH, wearing contact lenses does not appear to require enhanced eye and face protection. For chemical vapor, liquid, or caustic dust hazards, the minimum protection consists of well-fitting non-vented or indirectly vented goggles or full-face piece respirators. Close-fitting safety glasses with side protection provide limited chemical protection but do not prevent chemicals from bypassing the protection. Workers should wear face shields over other eye protection when needed for additional face protection but they should not wear face shields instead of goggles or safety glasses – regardless of contact lens wear.

Routine tasks identified at this site do not contraindicate the use of contact lens when appropriate eye protection is utilized. As a result, all ARCADIS BBL personnel are permitted to wear contact lens at this site when performing routine tasks identified in this HASP.

4.6 Motor Vehicle Safety

ARCADIS BBL's Motor Vehicle Safety Program includes:

- A formal Safe/Defensive Driver Training Course and behind-the-wheel commentary drive.
- A JMP has been prepared for this site. Vehicle operators will be responsible for reviewing and updating the JMP as necessary prior to traveling to the Site.
- Review of a motor vehicle report (MVR) for each employee from ARCADIS BBL's auto insurance provider as a means to monitor driving records. If an employee/potential authorized driver has had three or more incidents in a three year period, work-related driving activities may be restricted or revoked or driving courses may be recommended for the employee. Driving records are monitored on a semi-annual or annual basis for all employees by our auto insurance provider.
- A Travel Safety SOP, JSA for Driving Passenger Vehicle, and Vehicle Pre-Inspection Check List.

4.7 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 C to Level A PPE, and when appropriate, during Level D operations. Crew members 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.
- changes in speech pattern.

Crew members must also be aware of the potential exposure to possible safety hazards, unsafe acts, or non-compliance with safety procedures.

Field personnel must inform their partners or fellow crewmembers of non-visible 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.
- irritation of eyes, skin, or respiratory tract.

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

4.8 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 coworkers.

4.8.1 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 (bumps) 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.

4.8.2 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. Excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a sign of 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 liquid, such as Gatorade is effective in minimizing physiological disturbances during recovery.

4.8.3 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.
- 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.

4.8.4 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:

- hot, dry skin.
- confusion.
- irrational behavior.
- loss of consciousness.
- convulsions.
- a lack of sweating (usually).

- an abnormally high body temperature (e.g., a temperature greater than 104 degrees Fahrenheit [°F]).

If body temperature is too high, it causes 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.

4.8.5 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. Work/Rest Schedule

Adjusted Temperature ^b	Work/Rest Regimen Normal Work Ensemble ^c	Work/Rest Regimen Impermeable Ensemble
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5° - 90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5° - 87.5°F (28.1° - 30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5° - 82.5°F (25.3° - 28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5° - 77.5°F (30.8° - 32.2°C)	After each 150 minutes of work	After each 120 minutes of work

Notes:

- For work levels of 250 kilocalories/hour (Light-Moderate Type of Work).
- Calculate the adjusted air temperature (ta adj) by using this equation: $ta\ adj\ ^\circ F = ta\ ^\circ F + (13 \times \% \text{ sunshine})$. Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)
- A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.
- The information presented above was generated using the information provided in the ACGIH Threshold Limit Values (TLV) Handbook.

Table 4-2. Example Activities within Metabolic Ranges

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 kilometers per hour while carrying 3 kilograms weight load
Heavy	Carpenter sawing by hand
	Shoveling dry sand
	Heavy assembly work on a non-continuous 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: ACGIH, 2004 – page 172

Acclimatization is a set of physiological adaptations that 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 coworkers 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.

4.9 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. Wind 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:

- shivering
- apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95°F
- unconsciousness, glassy stare, slow pulse, and slow respiratory rate
- freezing of the extremities
- 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.

4.9.1 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 a 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, and 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.

4.9.2 Safe Work Practices

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

- Direct contact between bare skin and cold surfaces (less than 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.

4.10 Carbon Monoxide

When working indoors or in an excavation with any type of gasoline, diesel or LP gas powered equipment; carbon monoxide (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 large fans 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 Table 6-1.

4.10.1 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 field work, use the buddy system to keep each other safe.

4.10.2 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.

If there are any changes or modifications to the work or site conditions that present additional hazards not covered by this addendum or the site-specific HASP, the PM and the HSO shall be notified.

4.11 Biological Hazards

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

4.11.1 Tick Borne Diseases

Lyme Disease – The disease commonly occurs in summer and is transmitted by the bite of infected ticks.

Erlchiosis – The disease also commonly occurs in summer and is transmitted by the bite of infected ticks.

These diseases are transmitted primarily by the deer tick, which is smaller and redder than the common wood tick. The disease 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.

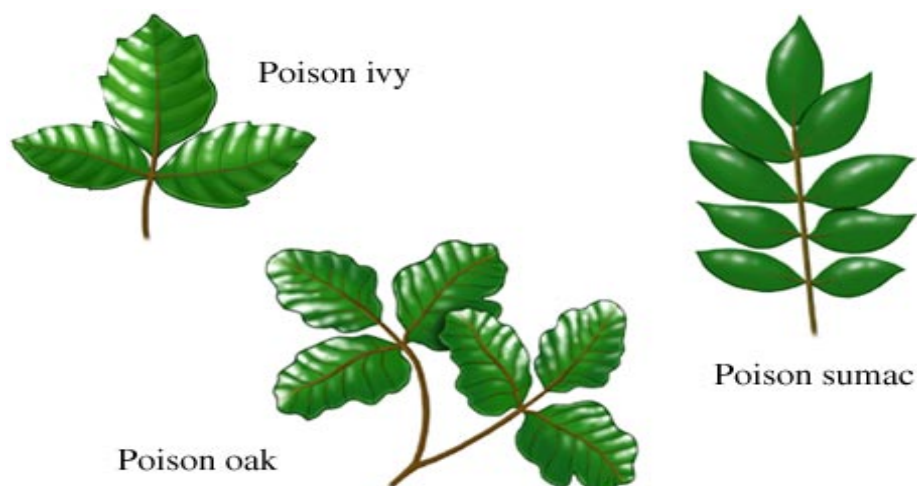
Symptoms of Lyme disease include a rash or a peculiar red spot, like a bull's eye, which expands outward in a circular manner. The victim may have headache, weakness, fever, a stiff neck, and swelling and pain in the joints, and eventually, arthritis. Symptoms of erlichiosis include muscle and joint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

Rocky Mountain Spotted Fever (RMSF) – This disease is transmitted via the bite of an infected tick. The tick must be attached 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.

Control – Tick repellent containing diethyltoluamide (DEET) should be used when working in tick-infested areas, and pant legs should be tucked 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.

4.11.2 Poisonous Plants

Poisonous plants may be present in the work area. Personnel should be alerted to its presence, and instructed on methods to prevent exposure.



Poison oak has leaves that look like oak leaves, usually with three leaflets but sometimes up to seven leaflets per leaf group. It grows as a vine or a shrub. Poison

oak is more common in the western United States, but it is also found in the eastern United States and, rarely, in the Midwest.

Poison sumac has seven to 13 leaflets per leaf stem. All plant parts are poisonous. The leaves have smooth edges and pointed tips. Poison sumac grows as a shrub or small tree. The lack of leaflet glands, “wings” between the leaflets, and 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. It is found in wooded, swampy areas and in wet, wooded areas in the northern United States.



Poison Oak



Poison Sumac

Control – The main control for poisonous plants 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.

Contact with poisonous plants is 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. Seventy-five percent 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 2 to 5 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 5 days and in severe cases as long as 5 to 6 weeks.

If you come in contact with a poisonous plant, or an 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 6 hours before the first symptoms appear, you have a good chance of avoiding an outbreak, and an even better chance of minimizing the effects if you do have one.

4.11.3 Snakes

The possibility of encountering snakes exists, specifically for personnel working in wooded/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).

Control – 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 that might cause encounters. To lower the risk of being bitten:

- Leave snakes alone. Many people are bitten because they try to kill a snake or get a closer look at it.
- Stay out of tall grass unless you wear thick leather boots. Snake gators may be needed for work in swampy and/or heavily wooded areas.
- Keep hands and feet out of areas you can not see. Do not pick things up from tall grass, vegetated areas or debris piles without first disturbing the area with a long implement.
- Observe tree limbs and branches before making contact since many snakes live in trees.

If a snake bite occurs, a quick attempt should be made to identify the snake via size and markings. The victim must be transported to the nearest hospital immediately. First aid consists of washing the area around the wound to remove any unabsorbed venom, immobilizing the wounded area and placing it lower than the heart. If medical attention cannot be given within 30 minutes, a band may be applied directly above the wound to restrict the movement of venom – do not apply a tourniquet. The band should be loose enough for a finger to pass beneath it, and should not restrict the flow of blood to the area.

4.11.4 Spiders

Personnel may encounter spiders during work activities.

Two spiders are of concern: 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--ong, 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.

Control – To minimize the threat of spider bites, all personnel walking through vegetated areas must be aware of the potential for encountering these arachnids. Personnel need to 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.

4.11.5 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 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. There have been confirmed cases of West Nile virus in the Northeast.

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 and to clothing.
- 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 to the local County Health Department. If flu-like symptoms are present, contact your doctor or the HSO for more information.

4.11.6 Other Stinging Insects

Thousands of other insects are capable of stinging and producing a negative reaction in humans. These insects include bees, wasps, hornets, fire ants, scorpions, centipedes, beetles, and flies. Some insects are more likely than others to cause allergic or toxic reactions.

- A bee leaves the stinger behind and then dies after stinging. Africanized honeybees, the so-called killer bees, are more aggressive than common honeybees and often attack together in great numbers.
- Wasps, including hornets and yellow jackets, can sting over and over. Yellow jackets cause the greatest number of allergic reactions.
- A fire ant attaches to a person by biting with its jaws, then, pivoting its head, it stings from its abdomen in a circular pattern at multiple sites.

- The kissing bug (*Triatoma*) will bite humans, often at night, to obtain blood. A typical reaction is generally an intensely itchy, red-raised area that is more severe than a typical insect bite. The kissing bug has a large body, measuring ½ to 1 inch in length. It has a cone-shaped head and is dark brown with yellow or red markings on the abdomen.
- Scorpions do not bite: they sting with their barbed tails. There are 37 species of scorpions in California and toxicity varies with the species. Scorpion's native to Arizona and Mexico are the most dangerous. In California, dangerous scorpions are found only in the areas bordering the Colorado River. A sting from a scorpion in geographic areas other than around the Colorado River is not likely to be dangerous. Most people compare a scorpion sting to a bee sting as they both cause a burning pain. Some people also have some swelling. Unless symptoms of an allergic reaction appear, there is little to be concerned about.

Bites and stings are more serious if you develop one or more of the following conditions after an insect bite or sting. These conditions include:

- a toxic reaction.
- a large skin reaction.
- signs of a skin infection.
- a severe allergic reaction (anaphylaxis).

Anaphylaxis is a sudden, severe allergic reaction. In anaphylactic shock, the most severe form of anaphylaxis, blood pressure drops severely; water rapidly leaves the blood stream, causing severe swelling; and bronchial tissues swell dramatically. This causes the person to choke and collapse. Anaphylactic shock is fatal if not treated immediately.

Anaphylaxis occurs usually within minutes of exposure to the allergen and almost always within 2 hours. The most severe cases may be fatal just 10 minutes after exposure. If administered in time, an injection of epinephrine (adrenaline) may reverse the condition by quickly constricting blood vessels, increasing the heart rate, stopping the swelling around the face and throat, and relaxing smooth muscles in the lungs. Because anaphylaxis can progress so quickly, the first signs of reaction should be

taken seriously. Do not wait to see how serious the reaction may become; call for emergency help immediately.

It is recommended that all site workers with known allergies to insects, such as allergies to bees, inform coworkers of their condition and carry the appropriate medication with them into the field.

Control – To minimize the risk of insect bites, long-sleeves and full-length pants should be worn if possible. All personnel working in vegetated areas and/or around debris piles and monitoring wells must be aware of the potential for encountering stinging insects. 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. First aid for all stings and bites consists of washing the area around the wound to remove any unabsorbed venom and applying ice packs to minimize swelling.

4.12 Noise

Exposure to noise over the OSHA 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 greater the intensity and the longer the duration of exposure to noise. In addition to damaging hearing, noise can impair voice communication, thereby increasing the risk of accidents on site. As a general rule, sound levels that cause speech interference at normal conversation distance probably require the use of hearing protection.

Control – 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 coworker 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 for this project. If the use of noisy equipment is unavoidable, barriers or increased distance will be used to minimize worker exposure to noise, if feasible.

4.13 Spill Control

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

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

4.14 Sanitation

Site sanitation will be maintained according to OSHA requirements.

4.14.1 Break Area

Breaks must be taken 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.

4.14.2 Potable Water

The following rules apply to all field operations:

- 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 shall not be used for any other purpose.

- Disposable drinking cups must be provided. A sanitary container for dispensing cups and a receptacle for disposing used cups is required.

4.14.3 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.

4.14.4 Lavatory

If permanent toilet facilities are not available, an appropriate number of portable chemical toilets will be provided for projects with greater than 5-day duration.

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.

4.15 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 the commencement of 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 and 29 CFR 1910.38 and 1926.156.
- Industrial first-aid kits of adequate size for the number of personnel on site.
- Emergency eyewash and/or shower if required by operations being conducted on site.

4.16 Lockout/Tagout Procedures

Only fully qualified and trained personnel will perform maintenance procedures. Before maintenance begins, lockout/tagout procedures per General Industry Safety Orders, Electrical Safety Orders 23.20.4 and OSHA 29 CFR 1910.147 will be followed.

Lockout is the placement of a device that uses a positive means, such as lock, to hold an energy or material-isolating device, such that the equipment cannot be operated until the lockout device is removed. If a device cannot be locked out, a tagout system shall be used. Tagout is the placement of a warning tag on an energy- or material-isolating device indicating that the equipment controls may not be operated until the tag is removed by the personnel who attached the tag. Attachment T presents logout/tagout equipment specific energy control procedures.

4.17 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, the National Electrical Code, or USCG regulations.
- Portable and semi-portable tools and equipment must be grounded by a multi-conductor cord having an identified grounding conductor and a multi-contact 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.
- 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.

4.18 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 must 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.

4.19 Ladder Safety

When portable ladders are used for access to an upper landing surface, the ladder side rails shall extend at least 3 feet above the upper landing surface to which the ladder is used to gain access, or, when such an extension is not possible because of the ladder's length, then the ladder shall be secured at its top to a rigid support that will not deflect. A grasping device, such as a grab rail, shall be provided to assist employees in mounting and dismounting the ladder. In no case shall the extension be such that ladder deflection under a load would, by itself, cause the ladder to slip off its support.

- Ladders shall be maintained free of oil, grease, and other slipping hazards.
- Ladders shall not be loaded beyond the maximum intended load for which they were built or beyond their manufacturer's rated capacity.
- Ladders shall be used only for the purpose for which they were designed.
- Non self-supporting ladders shall be used at an angle such that the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder (the distance along the ladder between the foot and the top support).
- Wood job-made ladders with spliced side rails shall be used at an angle such that the horizontal distance is one-eighth the working length of the ladder.
- Fixed ladders shall be used at a pitch no greater than 90 degrees from the horizontal, as measured to the back side of the ladder.

- Ladders shall be used only on stable and level surfaces unless secured to prevent accidental displacement.
- Ladders shall not be used on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental displacement. Slip-resistant feet shall not be used as a substitute for care in placing, lashing, or holding a ladder that is used upon slippery surfaces, including, but not limited to, flat metal or concrete surfaces that are constructed so they cannot be prevented from becoming slippery.
- Ladders placed in any location where they can be displaced by workplace activities or traffic, such as in passageways, doorways, or driveways shall be secured to prevent accidental displacement, or a barricade shall be used to keep the activities or traffic away from the ladder.
- The area around the top and bottom of ladders shall be kept clear.
- The top of a non-self-supporting ladder shall be placed with the two rails supported equally unless it is equipped with a single support attachment.
- Ladders shall not be moved, shifted, or extended while occupied.
- Ladders shall have non-conductive side rails if they are used where the employee or the ladder could contact exposed energized electrical equipment.
- The top, top step, or the step labeled that it or any step above it should not be used as a step.
- Cross-bracing on the rear section of stepladders shall not be used for climbing unless the ladders are designed and provided with steps for climbing on both front and rear sections.
- Ladders shall be inspected by the HSS for visible defects on a daily basis and after any occurrence that could affect their safe use.
- Portable ladders with structural defects, such as, but not limited to, broken or missing rungs, cleats, or steps; broken or split rails; corroded components; or other faulty or defective components shall either be immediately marked in a manner that readily identifies them as defective, or be tagged with "Do Not Use" or similar language, and shall be withdrawn from service.

- Fixed ladders with structural defects, such as, but not limited to, broken or missing rungs, cleats, or steps; broken or split rails; or corroded components; shall be withdrawn from service.
- Ladder repairs shall restore the ladder to a condition meeting its original design criteria, before the ladder is returned to use.
- Single-rail ladders shall not be used.
- When ascending or descending a ladder, the user shall face the ladder.
- Each employee shall use at least one hand to grasp the ladder when progressing up and/or down the ladder.
- An employee shall not climb any ladder while carrying items with the hands.

4.20 Confined Space Entry

Confined space entry by ARCADIS BBL employees is not anticipated on this site. In the event that the scope of work changes and confined space entry by ARCADIS BBL employees is required, a HASP addendum will be prepared to address confined space entry requirements. In the case, confined space entry would be performed only by trained personnel using established procedures defined by ARCADIS BBL and included in the appropriate HASP addendum.

4.21 Waste Management

The handling and disposal of investigation-derived waste (IDW) material generated at the site during investigative activities will be managed in accordance with ARCADIS BBL's Standard Operating Procedure (SOP): Handling and Storing Investigation-Derived Waste. This SOP is included as Attachment U. The SOP will be used in accordance with state, local, and Chevron guidelines. Additionally, the site-specific requirement for the COCs will be taken into account for the handling of the IDW at this facility.

4.22 Lightning

Outdoors is the most dangerous place to be during a lightning storm. When lightning is seen or thunder is heard, or when dark clouds are observed, quickly move indoors or

into a hard-topped vehicle and remain there until well after the lightning storm ends. Listen to forecasts and warnings through NOAA Weather Radio or your TV and radio stations. If lightning is forecast, plan an alternate work activity or know where you can take cover quickly. Check on client/site specific procedures regarding lightning prior to starting work.

4.22.1 Hazards

Burns, nervous system damage, broken bones, loss of hearing or eyesight, electrocution and/or death from contact with lightning.

4.22.2 Control

1. **Postpone activities promptly. Don't wait for rain.** Many people take shelter from the rain, but most people struck by lightning are not in the rain! Go quickly inside a completely enclosed building, not a carport, open garage or covered patio. If no enclosed building is convenient, get inside a hard-topped all-metal vehicle. A cave is a good option outside but move as far as possible from the cave entrance.
2. **Be the lowest point. Lightning hits the tallest object.** In the mountains if you are above tree line, you ARE the highest object around. Quickly get below tree line and get into a grove of small trees. Don't be the second tallest object during a lightning storm! Crouch down if you are in an exposed area.
3. **Keep an eye on the sky.** Look for darkening skies, flashes of lightning, or increasing wind, which may be signs of an approaching thunderstorm.
4. **Listen for the sound of thunder.** If you can hear thunder, go to a safe shelter immediately.
5. **If you see or hear a thunderstorm coming or your hair stands on end, immediately suspend work and instruct everyone to go inside a sturdy building or car.** Sturdy buildings are the safest place to be. Avoid sheds, picnic shelters, baseball dugouts, and bleachers. If no sturdy building is nearby, a hard-top vehicle with windows closed will offer some protection. The steel frame of the vehicle provides some protection if you are not touching metal.
6. **Listen to the Weather Radio.** Listen for alerts.

7. **If you can't get to a shelter, stay away from trees.** If there is no shelter, crouch in the open, keeping twice as far away from a tree as it is tall.
8. **Avoid leaning against vehicles.** Get off bicycles and motorcycles.
9. **Get out of the water. It's a great conductor of electricity.** Stay off the beach and out of small boats. If caught in a boat, crouch down in the center of the boat away from metal hardware. Wading and scuba diving are NOT safe. Lightning can strike the water and travel some distance beneath and away from its point of contact. Don't stand in puddles of water, even if wearing rubber boots.
10. **Avoid metal!** Drop metal backpacks, stay away from clothes lines, fences, exposed sheds and electrically conductive elevated objects. Don't hold on to metal items such as golf clubs, fishing rods, tennis rackets or tools. Large metal objects such as drill rigs or excavators can conduct lightning. Small metal objects can cause burns.
11. **Move away from a group of people.** Stay several yards away from other people. Don't share a bleacher bench or huddle in a group.

Make sure you are not the highest object. Lightning will strike the highest object. Crouch down. Do not lie down! What you most want to avoid is lightning going through your heart. Lightning follows the path of least resistance. If lightning strikes the ground near you, a ground current will set up in the area nearby. If you are lying flat your chances of being "hit" by this ground lightning increases. Not only that, the lightning will run through your whole body including your heart. If you are in a crouching position with your heels together, the ground current will enter one foot but it will then return to the ground through your other foot on the ground. The current does not go through your heart.



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 the levels of COCs and the degree of physical hazard. This section presents the various levels of protection and defines the conditions of use for each level. A summary of the levels is presented in Table 5-1 in this section.

5.1.1 Level D Protection

The minimum level of protection that will be required of ARCADIS BBL personnel and subcontractors at the site will be Level D, which will be worn when site conditions or air monitoring indicates no inhalation hazard exists. The following equipment will be used:

- work clothing as prescribed by weather
- steel toe and shanked work boots, meeting American National Standards Institute (ANSI) Z41, and puncture resistant insoles, as required by Site-Specific/Task-Specific JSA
- safety glasses or goggles, meeting ANSI Z87
- outer gloves chosen based on COCs over nitrile surgical gloves (if handling soil or groundwater)
- hard hat, meeting ANSI Z89
- hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used) see Section 6.2

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 an increased potential for skin contact with contaminated materials. Modified Level D consists of:

- nitrile gloves worn over nitrile surgical gloves
- steel toe and shanked work boots, meeting ANSI Z41, and puncture resistant insoles as required by Site-Specific/Task Specific JSA
- safety glasses or goggles, meeting ANSI Z87
- face shield in addition to safety glasses or goggles when projectiles or splash hazards exist as required by Site-Specific/Task Specific JSA
- hard hat, meeting ANSI Z89
- hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used) see Section 6.2
- Tyvek[®] suit (polyethylene coated Tyvek[®] suits for handling liquids) when physical contact with COC-impacted media is anticipated

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, (NIOSH-approved, air-purifying respirator with cartridges selected for the types of COC present on site
- polyethylene-coated Tyvek[®] suit, with ankles and cuffs taped to boots and gloves
- nitrile gloves worn over nitrile surgical gloves
- steel toe work boots, meeting ANSI Z41, as well as with metatarsal guards
- chemical resistant boots with steel toes or latex/polyvinyl chloride overboots over steel toe boots
- hard hat, meeting ANSI Z89

- hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used)

5.2 Selection of Personal Protective Equipment

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 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 HASP 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. Site-specific PPE requirements are discussed in each Site-Specific/Task-Specific JSA.

Table 5-1. PPE Selection Matrix

Task	Anticipated Level of Protection
Mobilization/Demobilization	Level D
Installation of Soil Borings/Monitoring Wells	Modified Level D/ Level C
Soil Sampling	Modified Level D/ Level C
Test Pit Excavation	Modified Level D/ Level C
Groundwater Sampling and Monitoring	Modified Level D/Level C
Brush Clearing	Modified Level D
Decontamination	Level D/Modified 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. Respirator use is not anticipated at this site. The site respiratory protection program will consist of the following (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 commencement of site work.
- Only cleaned, maintained, NIOSH-approved respirators will be used.
- If respirators are used, the respirator cartridge is to be properly disposed at the end of each work shift, or when load-up or breakthrough occurs.
- 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 disinfecting, cleansing wipe. 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 Personal Protective Equipment

Depending upon 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 Level C 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 or Level C 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).
- Put hood or head covering over head and respirator straps and tape hood to face piece (Level C).
- Don remaining PPE, such as safety glasses or goggles and hard hat.

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 or Level C 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). All disposable clothing should be placed in plastic bags, which are labeled 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.

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

6. Air Monitoring

6.1 Air Monitoring

Air monitoring will be conducted continuously at the site during any land-based intrusive work to determine employee exposure to airborne constituents. The monitoring devices to be used are an MIE Mini RAM particulate monitor (or equivalent) and a Rae Systems MultiRAE detector (PID with a 10.6 eV lamp/ oxygen/ LEL/ Hydrogen Sulfide Sensors). 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. In areas where petroleum hydrocarbons are suspected, benzene detector tube readings may be taken if PID readings exceed 1 part per million (ppm), and are sustained for 15 minutes in the breathing zone.

The ARCADIS BBL HSS will be responsible for utilizing the air monitoring results to determine appropriate health and safety precautions for ARCADIS BBL personnel and subcontractors. Air monitoring results will be recorded in the field notebook or on an air monitoring log (see Attachment F).

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 the instrument will be used. Instruments must be calibrated before and after use, noting the reading(s) and any adjustments that are necessary. All 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 documentation/forms must be reviewed and maintained by the HSS.

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 Action Levels

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

6.5 On-Site Monitoring Plan and Response Activities

Soil borings will be completed at locations as part of the field investigation activities. These activities have the potential to generate organic vapors and particulates. As mentioned above, air monitoring will be conducted in the worker breathing zone to determine the level of protection required for personnel observing completion of monitoring well, soil vapor point, and soil boring installations. If action levels in the worker breathing zone are exceeded for organic vapors or particulates, air monitoring will be required at various on-site/perimeter locations to determine appropriate response activities that are protective of personnel on site who are not directly involved with the investigation, personnel at adjacent commercial sites, and the surrounding community. If action levels for the remaining monitoring parameters listed in Table 6-1 are exceeded, work will stop, the HSO/HSM will be contacted, and perimeter monitoring will be performed. Additional monitoring (and appropriate response activities) to be implemented if the total organic vapor and particulate levels in the worker breathing zone exceed action levels as discussed below.

Total Organic Vapors

If the sustained level of total organic vapors in the worker breathing zone exceeds 1 ppm above background, then the level of total organic vapors will be manually recorded at the downwind perimeter of the work area (i.e., exclusion zone) at 15

minute intervals. If the sustained level of total organic vapors at the downwind perimeter of the work area exceeds 1 ppm above background, then work activities will be halted and additional downwind monitoring will be performed. Efforts will be undertaken to mitigate the source of organic vapors. The work area will be enlarged, if necessary, to mitigate the potential for people who are not involved with the investigation from being exposed to organic vapor levels exceeding 1 ppm above background, chlorobenzene or aniline detector tubes may be taken based upon exceeding PID readings as given in Table 6-1.

During the investigation, it is possible that the downwind perimeter of the work area will coincide with the site perimeter. If, at any time, the sustained level of total organic vapors adjacent to the downwind site perimeter reaches 5 ppm above background, then the level of total organic vapors adjacent to the nearest downwind occupied building or property from the work zone will be monitored. If after 30 minutes, the total organic vapor level adjacent to the nearest occupied building or property has not subsided below 1 ppm above background, then the HSS will inform the local emergency response contacts [in addition to project managers from Chevron, the NYSDEC, the New York State Department of Health (NYSDOH), and ARCADIS BBL] listed in Section 11.5 and persons who may be exposed will be notified to evacuate occupied buildings or properties. These persons will not be permitted to return to the properties until after the level of total organic vapors on the properties subsides to below 1 ppm above background.

Particulates

If the level of particulates in the worker breathing zone exceeds 100 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) above background, then the level of particulates will be manually recorded at the downwind perimeter of the work area at 15 minute intervals. If the level of particulates at the downwind perimeter of the work area is $150 \mu\text{g}/\text{m}^3$ or greater, then work activities will cease and dust suppression techniques must be employed to maintain particulate levels below $150 \mu\text{g}/\text{m}^3$. In addition, the work area will be enlarged if necessary to keep the public from being exposed to particulate levels greater than $150 \mu\text{g}/\text{m}^3$.

6.6 Odor Control

If any odor complaints are received from members of the surrounding community and are related to the field investigation activities described herein, then the potentially odor-causing activity will be suspended, subsurface openings will be covered, and on-

site personnel (in consultation with Chevron and ARCADIS BBL PM) will evaluate an alternative course of action.

Table 6-1. Airborne Constituent Action Levels

Parameter	Reading in Breathing Zone (BZ)	Action
Total Hydrocarbons	0 ppm to ≤ 1 ppm	Normal operations; continue hourly breathing zone monitoring
	> 1 ppm to 5 ppm	Increase monitoring frequency to every 15 minutes and use benzene colorimetric tube to screen for the presence of benzene
	≥ 5 ppm to ≤ 50 ppm	Upgrade to Level C PPE; continue screening for benzene and contact PM
	> 50 ppm	Stop work; investigate cause of reading
Benzene (from colorimetric tube)	≥ 1 ppm to 5 ppm	Upgrade to Level C PPE
	> 5 ppm	Stop work; investigate cause of reading and contact PM
Chlorobenzene (from colorimetric tube)	≥ 10 ppm to 15 ppm	Upgrade to Level C PPE
	> 15 ppm	Stop work; investigate cause of reading and contact PM
Aniline (from colorimetric tube after PID readings 4 ppm)	> 2 ppm	Stop work and contact PM
Flammable Vapors (LEL)	< 10% LEL	Normal operations
	$\geq 10\%$ LEL	Stop work, 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
Particulates	100 $\mu\text{g}/\text{m}^3$	Monitor downwind conditions every 15 minutes
	150 $\mu\text{g}/\text{m}^3$	Stop work and start dust suppression

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 HSS 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 HSS and will consist of a review of this HASP. This review must cover the radiological, 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 HASP. In addition, all personnel entering site work areas will take a written test that documents their understanding of the site-specific risks.

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/cardiopulmonary resuscitation (CPR) certificates, as well as current medical clearances for all project field personnel required to wear respirators, will be maintained within that file. All ARCADIS BBL 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 at the site by the HSS. Personnel must sign in and out on a log sheet as they enter and leave the work area and the HSS 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 ARCADIS BBL 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 HSS. 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 HSS 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. The locations of the Contamination Control Zones will be determined by the HSS based on the specific task or activity to be conducted. Contamination Control Zones will be determined by the HSS based upon the activity being conducted and the location of the activities at sites.

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. The EZ at this site is defined as the building within the fenced area.

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. The decontamination of all

personnel will be performed 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 support area 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, barricades, company vehicles, or a site diagram.

7.1.9 Site Inspections

The HSS 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 W may be used as a guide for daily inspections. LPOs will be completed, input into the One Team Incident Prevention System, and forwarded to the PM for review per the project schedule.

7.2 Decontamination

7.2.1 Personnel Decontamination

All personnel wearing Modified Level D or Level C 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 using a wash solution and brush.
- *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. The most significant potential exposure to Alpha particles is via ingestion, therefore effective hand washing is essential. Respirators will be sanitized and then placed in a clean plastic bag.

7.2.2 Equipment Decontamination

All equipment such as bailers, oil/water probes, transfer containers must be decontaminated prior to leaving the work area. A solution of Alconox (or equivalent) will be used to remove all visible contamination. The decontamination solution and rinsate must be poured into a drum for disposal.

All vehicles that have entered the EZ will be decontaminated at the decontamination pad prior to leaving the zone. If the level of vehicle contamination is low, decontamination may be limited to rinsing of tires and wheel wells with water. If the vehicle is significantly contaminated, steam cleaning or pressure washing of vehicles and equipment may be required.

7.2.3 Personal Protective Equipment 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 in properly labeled containers. Reusable protective clothing will be rinsed at the 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.

7.2.4 Emergency Decontamination

If an injured employee has gross contamination, emergency decontamination may be required prior to transportation to a treatment facility. At this site, the worst case

scenario would be an employee who was covered/soaked with COCs containing fuel and fuel byproducts. Steps for emergency decontamination are:

- Remove the outer protective layer of clothing (if employee has a suspected neck/back injury, carefully cut the clothing off so as to not cause further injury).
- Wipe off any remaining gross contamination with clean clothes/towels.

An ARCADIS BBL employee must accompany the injured person to the hospital to provide information to the examining/treating medical professional. The accompanying ARCADIS BBL employee must bring the MSDSs for the COCs involved with site work. The accompanying employee should be prepared to provide information regarding site conditions, potential exposures, and a description of the incident causing the injury or exposure.

7.3 Traffic Control

A JMP will be generated for each facility and updated in accordance with the JMP guidelines. The JMP incorporates a TCP to be implemented at the subject facility; this includes the designation of pedestrian and motor vehicle areas at the site. The HSS may make modifications to the TCP, as needed, to address potential changes in site conditions. A detailed TCP, including a site map depicting traffic control measures is included with the JMP in Attachment H.

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 HSS must have completed an additional 8 hours of supervisory training, and must have a current first-aid/CPR certificate.

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 (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
- general emergency response procedures

8.1.3 Supervisor Course

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

- general site safety and health procedures
- PPE programs
- air monitoring techniques

8.1.4 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 or HSS on the contents of this HASP before work begins. The review must include a discussion of the radiological, chemical, physical, and biological hazards; the protective equipment and safety procedures; and emergency procedures. In addition, all personnel entering the work areas will take a written test that documents their understanding of the site-specific risks.

8.1.5 Daily Safety Meetings

Twice daily safety meetings will be held to discuss the Task-Specific JSAs and cover the work to be accomplished, the hazards anticipated, the PPE and procedures required to minimize site hazards, client controlled permit requirements, and emergency procedures. The HSS should present these meetings prior to beginning the day's fieldwork and again within approximately 1-hour after lunch. No work will be

performed in an EZ before a safety meeting has been held, the Task-Specific JSA has been discussed, and the Permit-to-Work form has been completed. A safety meeting must also be held prior to new tasks and repeated if new hazards are encountered. The Daily Safety Meeting Log/Permit-to-Work Form is included in Attachment X.

8.1.6 First Aid and CPR

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

8.2 Medical Surveillance

8.2.1 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).

8.2.2 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
- follow-up examinations, at the discretion of the examining physician or the corporate medical director

The examining physician provides the employee with a letter summarizing his 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.

8.2.3 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
- At the discretion of the HSO or occupational physician in anticipation of, or after known or suspected exposure to toxic or hazardous materials

8.2.4 Periodic Exam

Following the placement examination, all employees must undergo a periodic examination, similar in scope to the placement examination. For employees potentially exposed over 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.

8.2.5 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 HSS immediately.

The 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. Refer to Section 9.7 (or Attachment Y) for the hospital route map. In addition, all personnel entering the work areas will take a written test that documents their understanding of the site-specific risks.

9.2 Emergency Response and Evacuation Procedure

If an incident occurs, the following steps will be taken by the HSS:

- 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.
- Take appropriate measures to stabilize the incident scene.

Emergency safety drills will be conducted as directed by the HSS to evaluate the emergency response procedures and the preparedness of the personnel at the site.

If it is determined by the HSS that evacuation is necessary, all personnel will follow evacuation route to a designated off-site meeting point. Refer to Section 9.7 (or Attachment Y) for the hospital route map.

9.2.1 Fire

In the case of a fire at the site, the HSS will assess the situation and direct fire-fighting activities. The 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 the HSS immediately
- Evacuate immediate area of release
- Conduct air monitoring to determine needed level of PPE
- Don required level of PPE and prepare to implement control procedures

The HSS has the authority to commit resources, as needed, to contain and control released material and to prevent its spread to off-site areas. If personnel come into direct contact with the released contaminant, immediate decontamination is required using the decontamination procedures outlined in Section 7.

9.3 Medical Emergency

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/her to a location away from the work area where EMS can gain access.

All employee injuries must be promptly reported to the HSS, 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 an ARCADIS BBL employee, notify Pat Bullock, Workers Comp Administrator at 720.344.3844 as soon as possible after the employee has been safely evacuated from the scene.

9.4 First Aid – General

All persons must report any injury or illness to their immediate supervisor or the HSS. Trained personnel will provide first aid. Injuries and illnesses requiring medical treatment must be documented. The HSS must conduct an II as soon as emergency conditions no longer exist and first aid and/or medical treatment have 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 CRZ. 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/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, 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 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. If it is impractical to move the personnel to the CRZ then emergency decontamination may take place in the EZ at their location by moving the decontamination equipment to their area and conducting decontamination procedures in accordance with Section 7. 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/she shows any sign of skin reddening, irritation, or if he/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 it is impractical to move the personnel to the CRZ, then emergency decontamination may take place in the EZ at their location by moving the decontamination equipment to their area and conducting decontamination procedures in accordance with Section 7. 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 HSS immediately. The HSS will complete an injury report and submit it to the HSM/HSO, client, PO, the PIC, 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 Non-Emergency, Non-Life Threatening Work Related Injury or Illness

For minor illnesses or injuries that may be work-related and are **not** life threatening or emergencies (e.g., you're in your hotel room and your lower back tightens up, earlier in the day you hand-augured 50 borings; you cut your hand in the office, put a band-aid on the cut, and go back to work, but when you get home you realize the cut is deep and is still bleeding; you hit your head on a cabinet while loading paper, and later on that day you suddenly feel dizzy.) employees will take the following steps **before** seeking medical treatment at a medical treatment facility:

As soon as possible, contact WorkCare at 1-800-455-6155 (Once you've spoken with WorkCare, you can let your supervisor know).

- WorkCare will discuss the medical issues with you and provide appropriate medical guidance.
- If WorkCare feels that you should see a physician:
 - They will help you locate a physician/clinic and will contact the clinic to discuss the treatment plan. If they have a concern about the treatment plan, one of the WorkCare physicians will attempt to contact the treating physician to discuss the plan and will keep you advised.
- If WorkCare feels that first-aid/self-treatment is medically appropriate:
 - They will provide the treatment information to you and will follow up with you to determine effectiveness.
 - If the medical issue persists, WorkCare will advise alternative treatment or will refer you to a physician.
 - Keep your supervisor informed on what action you will be taking. If you are seen by a physician, keep them advised as to your work status and upcoming medical appointments.

If an injury or illness is life-threatening or an emergency, please seek medical attention immediately. As soon as possible, notify your supervisor.

9.7 Off-Site Emergencies

Off-site emergencies may include vehicle crashes, off-site fires, medical responses, or security incidences. In the event of an off-site emergency the HSS will determine the need to stop work and evacuate employees to the SZ or other safe area deemed appropriate by the HSS. At the SZ, the HSS will conduct an SPSA and determine if additional action is required.

9.8 Emergency Information

The means to summon local public response agencies such as police, fire, and ambulance will be reviewed in the daily safety meeting.

Table 9-1. Emergency Contacts

Agency/Contact	Telephone Number
Police	911
Fire Department	911
Ambulance	911
Hospital: St. John's Riverside Hospital	914.964.4444
Local Health Department	914.813.5000
State Health Department	866.881.2804
Poison Control Center	1.800.282.3171
Project Emergency Contacts	Telephone No.
State Environmental Agency (NYSDEC)	800.457.7362
USEPA Region 2	800.424.8802
National Response Center (oil/chemical spill)	800.424.8802
Emergency Chevron, Inc. Contact: Mark Stella/Mark Hendrickson	770.984.3145 713.432.2634
ARCADIS BBL Project Manager: Bill McCune	315.671.9172
Site Supervisor	TBD

HOSPITAL:

It is the responsibility of the HSS to verify the directions to the hospital prior to the start of work.

St John's Riverside Hospital
967 US-9
Yonkers, NY

1. Start at **1 RAILROAD AVE, HASTINGS ON HUDSON** - go **0.1** mi
2. **RAILROAD AVE** becomes **SOUTHSIDE AVE** - go **0.2** mi
3. Turn **R** on **CROPSEY LN** - go **< 0.1** mi
4. Turn **R** on **WARBURTON AVE** - go **0.2** mi
5. Turn **L** on **PINECREST DR** - go **0.4** mi
6. Bear **R** on **NEW BROADWAY[US-9]** - go **0.1** mi
7. Continue to follow **US-9 SOUTH** - go **0.9** mi
8. Arrive at **ST JOHN'S RIVERSIDE HOSPITAL**

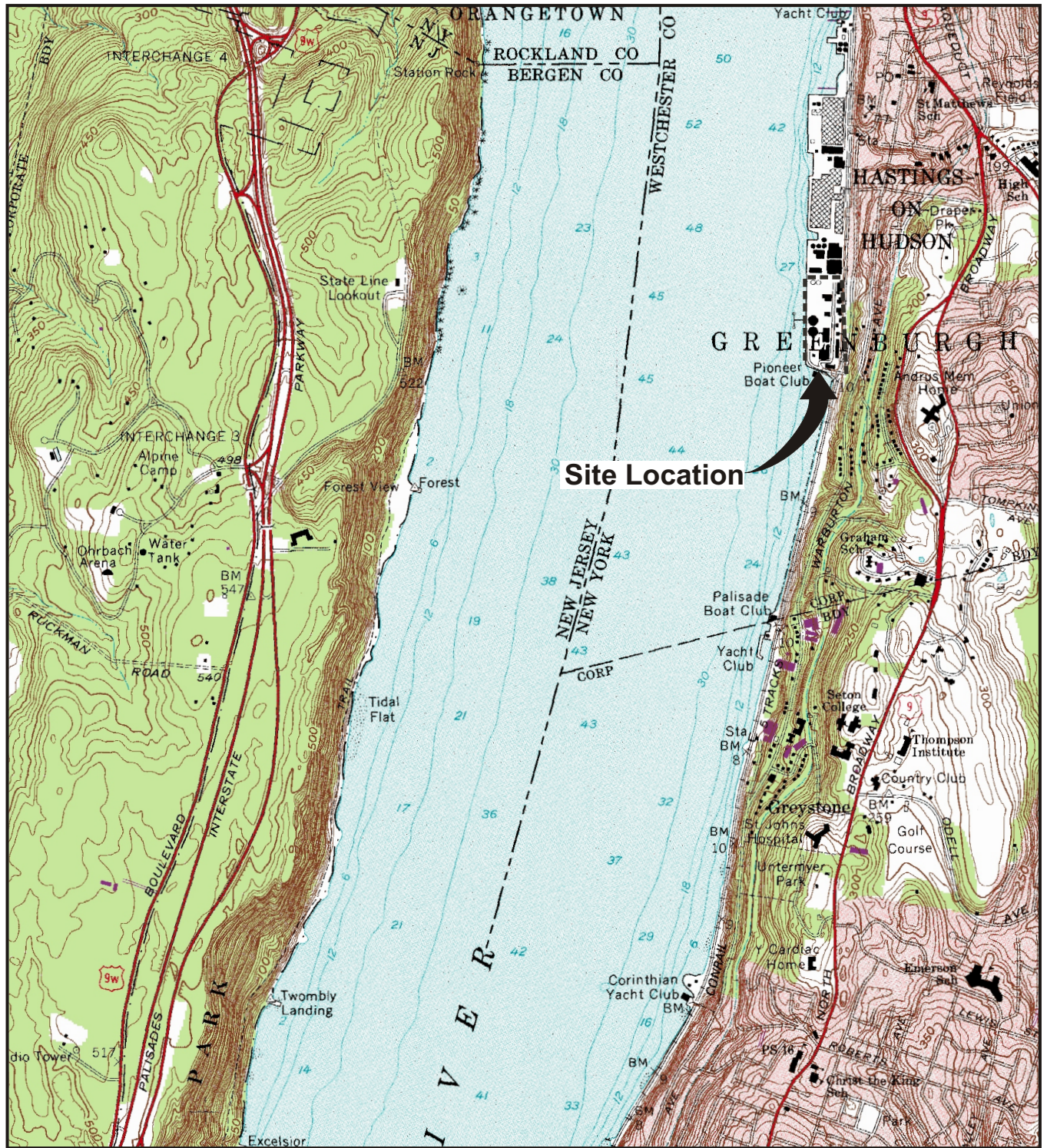
Total Estimated Time: 5 minutes

Total Estimated Distance: 1.9 miles



Attachment A

Site Map

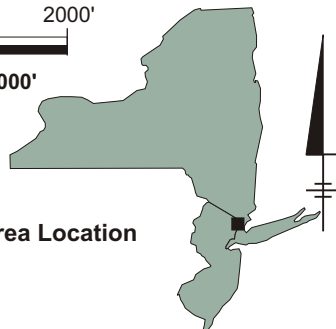


REFERENCE: BASE MAP USGS 7.5 MIN. QUAD., YONKERS, N.Y. - N.J., 1966, PHOTOREVISED 1979.



Approximate Scale: 1" = 2000'

Area Location



TAPPAN TERMINAL SITE
HASTINGS-ON-HUDSON, NEW YORK

SITE LOCATION MAP

Attachment B

Addendums and Changes to HASP
Log

Addendum Page

This form should be used to document any changes required to this HASP. These changes may be a result of changes to the scope of services, changes in field conditions, new hazards identified on the Site, higher or lower hazards than anticipated, etc. Please complete this form prior to the next work day once the changes have been identified. Review the modifications with all Site staff, including subcontractors, during the daily tailgate briefing, and complete the tailgate briefing form as required. Attach a copy of the addendum to all copies of the HASP including the Site copy, and log in the Addendum Log in Section 1.0.

Addendum Number: _____ Project Number: _____
Date of Changed Conditions: _____ Date of Addendum: _____

Description of Change that Results in Modifications to HASP:

Hazard Analysis for Change in Work:

HAZARD		Level of Risk:	
Source of Hazard			
Admin. & Eng. Controls		PPE:	
HAZARD		Level of Risk:	
Source of Hazard			
Admin. & Eng. Controls		PPE:	

Is air monitoring required for this task? <input type="checkbox"/> YES <input type="checkbox"/> NO		If yes, complete the following:	
Monitoring Equipment	Monitoring Frequency	Action Level	Action

Signed: _____
Project Manager

Signed: _____
Site Safety Officer

Signed: _____
H&S Plan Writer

Signed: _____
H&S Plan Reviewer

Attachment C

Site-Specific HASP and Visitors Tests

Name/Company:_____ Date:_____

Health and Safety Plan Written Test
CVX Tappan Terminal Site – Hastings-on-Hudson, New York

Please answer all the following questions.

- 1) What is the address of the site?
- 2) If working conditions or behaviors are considered unsafe, what is your responsibility to do?
- 3) Where is the HASP located?
- 4) Name 3 tools used in the LPS Program.
- 5) In your opinion, what is the biggest hazard at the site, and how would you control it?
- 6) Where is the support zone?
- 7) Where is the exclusion zone?
- 8) Where are the emergency equipment kept (e.g. fire extinguishers, first aid kits, etc)?
- 9) What are the components of the Safe Performance Self Assessment?
- 10) Have you read the Journey Management Plan?
- 11) What section summarizes emergency procedures and presents directions to the nearest hospitals and emergency telephone numbers?
- 12) What LPS tool should you use every time before you perform a new activity?
- 13) If a near miss occurs, who should you notify...and when?
- 14) After leaving the exclusion zone, before eating, drinking, smoking, or using the toilet facilities, what must you do?
- 15) Who is the ARCADIS BBL Site Health and Safety Supervisor?

Name/Company:_____ Date:_____

Please answer the questions relating to the tasks that you will be performing onsite.

Engineering Observation

- 1) Before entering the exclusion zone to observe soil excavation and offsite disposal activities, who should participate in CSX's site orientation program?
- 2) If working near very loud heavy machinery, name 5 pieces of PPE that are required to be worn at all times

Decontamination

- 1) Describe the decontamination procedures for the tasks that you will be performing onsite.

Excavation

- 1) How far must heavy equipment (such as an excavator) be kept from overhead power lines?


Pipeline Removal

- 1) What must be completed before a worker may enter a trench to remove a pipe?

Attachment D

Management of Change Form

Management of Change Form

		Management of Change Report Form Attach additional pages if needed. See ESH 505 for information or suggestions for each section. Note: All date formats are M/DD/YYYY	
INTRODUCTION		Originator:	Affected Location(s) or Operation(s):
MOC #:		Type of Change:	Date Submitted:
Reason for Change:		Operational Excellence	
Describe the Change:			

TASKS		List the work tasks required to complete the Change. List the responsible party and the due date. See ESH 505 Task Section for potential tasks for each type of change. Insert additional lines as needed.		
MOC Tasks:		Responsible	Due Date	Completed

RISKS		Calculate the risk by completing a Risk Assessment. If the risk warrants, complete a PHA. Identify associated risks and how they are to be mitigated. List the responsible party and the due date.		
Is Process Hazard Analysis required? <input type="checkbox"/> Yes If not, uncheck this box. If Yes, attach the completed Risk Assessment Guideline Form (Appendix D). If Yes, add PHA to tasks list and add identified risks and mitigation steps below.				
MOC Risks: See ESH 505 Risk Section for potential risks for each type of change.		Responsible	Due Date	Completed

COMMUNICATION	Who needs to know about the Change and how will you communicate the Change to them? Insert additional lines as needed.
---------------	---

COMMUNICATION	Who needs to know about the Change and how will you communicate the Change to them? Insert additional lines as needed.

APPROVALS	Who needs to approve of the Change at the Local, Area, and Corporate level. Include all departments responsible for, or affected by, the Change. Remember, High Risk or select changes require Area or Departmental Manager approval.					
Initial MOC Plan Authorized by: RTBU Area Manager				Date Authorized:		
	Title	Signature	Title	Signature	Title	Signature
Local:						
Area:						
Corporate:						
MOC Completion: RTBU Area Manager				Date:		

Attachment E

Management of Change Tracking
Log

Management of Change Tracking Form

[illegible]

Attachment F

Short Service Employee (SSE) Form

EMC's Short Service Employee (SSE) Form

Contractor must complete and submit form to the EMC Project Manager for approval at least 24 hours prior to arrival on location. The EMC Project Manager must approve the individual SSE before he/she arrives on location.

Contractor Company Name: _____ Request Date: _____

Chevron Site and Number: _____

Chevron Site Address: _____

SSE Name: _____

Date of Employment: _____ Years Experience: _____

Current Job Title: _____ Experience in Present Position: ____ Yrs ____ Mos

1. Is this employee in compliance with your Substance Abuse Program? ____ Yes ____ No

2. Has EMC and Contractor HES policies been reviewed with SSE? ____ Yes ____ No
By Whom? _____

3. Who has been assigned as the SSE Mentor? _____
Mentor's experience in present position (yrs & mos.): _____

4. List all of the training you provided for the SSE: List previous special training:

SSE(s) is identified by: Hi Vis Orange Hard Hat CVX OPCO Approved Visitor Color Hard Hat
SSE Orange Baseball Cap (Must Comply With EMC SSE Expectation)

SSE Crew Makeup Requirements:

Choose one below:

☐ Single person crew - can not be a SSE

Site/Location Contractor Supervisor

☐ 2 – 4 person crew - no more than 1 SSE per crew

Site/Location Contractor Supervisor

☐ 5 or more person crew - no more than 20% per crew

Site/Location Contractor Supervisor

☐ Exceeding 20% per crew

Site/Location Contractor Supervisor

☐ Approved Variance Form by EMC Business Unit Manager Attached

Date Variance Form approved: _____

SSE Review and Approval:

Contractor's Management Date: _____

EMC Project Manager Date: _____

Attachment G

Task-/Site-Specific Job Safety
Analysis Forms

Job Safety Analysis - JSA004364

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

Date:	7/31/2007
JSA Type:	General Work Activities
Work Type:	Brush/Vegetation Clearing, Grubbing, Mowing
Work Site:	Former Tappan Terminal, Hastings-on-Hudson, NY
EMC Business Unit:	SFPM Operations
Organization:	ARCADIS BBL

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Sandorf, Jennifer		<input checked="" type="checkbox"/>	Elliott, Roger		
			McCune, William		8/24/2007
			Robertson, Jo Ann		8/24/2007

Personal Protective Equipment (PPE) needed

First Aid Kit

Hard Hat

Hearing Protection - ear plugs

Long Pants

Protective Gloves - Leather

Safety Glasses

Work Boots - Steel toe/shank

No	Job Steps	Potential Hazard(s)	Critical Action(s)
1	Conduct SPSA.	Check for potential risks. Identify any potential hazards prior to initiating work.	Always conduct an SPSA prior to start. • Assess the risk. What is the worst that could happen? • Analyze how to reduce the risk. Ask yourself what you could do to make the task safer. If you are uncertain, then ask someone who would know. • Act to ensure safe operations. Use the ideas and tools that make the task safer. All personnel have the right and responsibility to use their Stop Work Authority if conditions or actions make working unsafe.
2	Identify any changes in the existing site conditions that may create a hazardous situation.	Safety / Regulatory compliance	Make any necessary changes to the JSA. Ensure that all employees are trained in the proper operation of equipment and review any pertinent safety information including conducting a daily safety meeting. Make sure that employees are wearing the proper PPE prior to starting work.
3	Inspect and fuel equipment	Check for any damaged equipment. Fuel and re-fuel in a safe environment after equipment has cooled. Improperly trained for safe operation of equipment.	Scope area for suitable areas to park vehicles. Be cautious of muddy and icy surfaces. Close/lock access gates before beginning work and when exiting site for lunch and at the end of the day.
4	Brush clearing and mowing	Excessive noise, rotating blades on mower, risk of cutting injuries, flying debris from mower, biting/stinging insects (mosquitos, ticks, bees, etc.). Uneven terrain, and roll-over hazard from mowing on a slope. Collision with site structures such as groundwater monitoring wells and process piping.	Wear all appropriate PPE, including hearing protection, hard hat, work gloves, safety glasses, and safety shoes. Kepp limbs at safe distance from rotating cutting parts of mower. Use the buddy system and know where your buddy or coworkers are at all times. MOW SLOWLY and be alert for debris in the grass and keep a safe distance from wells and site utility piping. A commercial zero-turn mower with a low center of gravity is recommended to mow sloped areas rather than a low profile tractor with a mower or brush-hog. However, the tractor and mower or brush-hog may be utilized to mow around the site building or on the other flat areas. The slope should be mowed in a up-down direction rather than across the slope to minimize the risk of a roll-over. Be alert for any uneven surfaces including animal burrows (holes) or tire ruts from the previous mowing event that could also present a roll-over hazard. Apply insect repellent if necessary.
5	Demobilize	Slips, trips, falls. Back injury.	See mobilization/ demobilization and driving JSAs. Watch for hazards. Use proper lifting techniques.

JSA004364 - Under Review - In Progress - 08/24/2007 09:45 AM EST

Job Safety Analysis - JSA004365

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

Date:	7/31/2007
JSA Type:	Trucking, Passenger, Motor, Off Road Vehicles and Boats
Work Type:	Driving: Personal, Rental or Company Vehicles
Work Site:	Former Tappan Terminal, Hastings-on-Hudson, NY
EMC Business Unit:	SFPM Operations
Organization:	ARCADIS BBL

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Sandorf, Jennifer		<input checked="" type="checkbox"/>	McCune, William		8/24/2007
			Robertson, Jo Ann		8/9/2007

Personal Protective Equipment (PPE) needed

Other - Seat Belts

No	Job Steps	Potential Hazard(s)	Critical Action(s)
1	PRE-TRIP - Review SPSA Card	Worst case outcome of vehicle operation (blowout, breakdown, collision, injury or death).	Assess the potential hazards. Review weather and road conditions/closures before departing. Plan travel route and select alternate routes in case main roads are closed. Notify someone of your departure time/route/and ETA. Pack emergency supplies. Analyze how to reduce the risk. In icy conditions get into the vehicle slowly and consciously, keep legs close to vehicle and hold on to handle or door. Act to ensure safe operation of the vehicle. Recognize SWA.
2	Perform perimeter walk around vehicle for damage or unusual conditions.	Flat tire, blowout, impaired vision, obstacles, collision, injury or death.	Assure tires are properly inflated and there is sufficient tread. Assure there are no cuts or bulges in the sidewalls. Assure windshield and window glass is clean. Lift wiper arms and check wiper blades for damage or deterioration. Check behind vehicle for obstructions. Check under vehicle engine for evidence of fluid leaks.
3	Check and adjust seat, mirrors, head lamps, turn signals, washer/wipers.	Back or body strain. Blind spots. Inability to signal intentions. Streaking windshield, impaired vision.	Adjust seat so back is fully supported, upper arms close to body, pedals within easy reach. Adjust head restraint so that it is 2 to 6cm from the top of your head. Lower steering wheel so hands are below shoulders and shoulders are relaxed. Check mirror adjustments each time vehicle is re-started. Test operations of front and rear turn signals. Locate and test operation of head lamps, wiper and washer switches.
4	Fasten seat belts.	Increased risk of more serious injury or death in collision.	Assure seat belt is in good condition and fastened. Assure all passenger seat belts are in good condition and fastened.
5	Lock doors.	Ejection from vehicle in collision. Unwanted intrusion.	Lock all doors to vehicle.
6	Start engine.	Unexpected movement.	Assure that transmission is in 'Park' and that parking brake is set.

7	Check gauges and warning lights.	Overheated engine or break-down due to lack of critical fluids. Brake failure. Stranding.	Assure there is sufficient gas, oil and other critical fluids.
8	Pull out of parking space.	Collision with other vehicles, pedestrians, or stationary objects.	Check mirrors and over shoulder in all directions prior to pulling out of parking space. Signal if parallel parked along a street. Use spotter if not pulling forward out of spot.
9	DURING TRIP - Keep your eyes moving, aim high in steering, leave yourself an out, get the big picture, make sure other drivers see you. Pay attention to driving at all times	Collision, injury or death to occupants or other parties.	Move eyes at least every 2 seconds. Scan major and minor intersections before entry (left-right-left). Check mirrors when slowing or stopping vehicle. Scan mirrors frequently, at least one mirror every 5-8 seconds. Avoid staring while evaluating road conditions. No use of cell phones or radios while driving in a vehicle on streets or on site. Maintain 15 second eye lead time (1 1/2 blocks in city traffic, 1/4 mile in highway traffic). Assess condition of traffic lights (fresh vs. stale). Assess information from distant objects. Adjust eye lead distance to speed. Maintain safety cushion around vehicle (front, sides, rear). Adjust vehicle space and speed to avoid unsafe intrusion by other drivers. At signal controlled intersections, stop 10 ft. behind crosswalks or behind other vehicles. At stop sign controlled intersections, approach stop sign cautiously and ascertain if cross traffic has to stop. Stop at or just behind limit line or crosswalk. When stopped, allow vehicle in front to move for 2 seconds before accelerating. Observe approaching merge areas and choose lane of least resistance. Cede right of way and allow other vehicles to merge, change lanes, make turns, etc. Avoid being unnecessarily boxed in. Avoid sudden acceleration and deceleration. Maintain a minimum 4 second following distance, adjust speed to traffic conditions, scan immediate and adjacent lanes before merging. Seek eye contact with other drivers. Cover or use horn when conditions warrant. Before changing lanes, signal well in advance, check mirrors and over shoulder, and allow adequate space before changing lanes. Break early to activate brake lights. Stay out of blind spots. Gently sound horn or flash lights if unsure other driver sees you. Turn on head lamps in high traffic areas, at dusk, and in inclement weather. In inclement weather decrease speed and increase following distance, use low gears to enhance traction and do not use cruise control or overdrive, break gently to avoid skidding. If the wheels begin locking up ease off breaks. Apply steady pressure if ABS is present, do not pump breaks. If your rear wheels skid take foot off accelerator and steer in the direction you want the front wheels to turn. If front wheels skid take foot off the accelerator and shift to neutral, do not steer immediately, as traction returns steer in the direction you want to go and put the transmission in drive. If the vehicle gets stuck turn wheels from side to side moving snow away from tires, use shovel to remove snow from tires, and pour sand, cat litter etc. to wheel path. Always focus on driving. Stop driving if you become distracted. Refrain from conducting involved or emotional discussions while driving - end the conversation or pull over to the side of the road if it becomes difficult to concentrate on driving while conversing with your passengers.
10	Backing up.	Collision, injury or death to occupants or other parties.	Make all backing maneuvers slowly and cautiously. Check mirrors and over shoulders. Use horn to alert nearby persons of your movement. When parking, look for pull-through parking to avoid backing. Use spotter when necessary.
11	Parking.	Collision, injury or death to occupants or other parties.	Park away from other cars. Back into parking spot when possible and safe. Maintain cushion of safety from fixed objects. Set parking brake. If it is safe to do so, park so the first movement is forward. If parking on road, place vehicle as barrier to oncoming traffic and use barricades/warning devices or cones.
12	POST-TRIP - Report maintenance or mechanical problems upon returning vehicle.	Conditions worsen leading to mechanical failure resulting in accident, injury or death.	When exiting vehicle in icy conditions test the surface before putting all of your weight down, keep legs close to vehicle and hold on to handle or door. Report vehicle problems immediately to company representative or rental car agency. Review JSA again to ensure best practices have been followed.

JSA004365 - Closed - Current - 08/24/2007 09:48 AM EST

Job Safety Analysis - JSA004366

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

Date:	7/31/2007
JSA Type:	General Work Activities
Work Type:	Mobilize/Demobilize
Work Site:	Former Tappan Terminal, Hastings-on-Hudson, NY
EMC Business Unit:	SFPM Operations
Organization:	ARCADIS BBL

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Sandorf, Jennifer		<input checked="" type="checkbox"/>	McCune, William		8/24/2007
			Robertson, Jo Ann		8/9/2007

Personal Protective Equipment (PPE) needed

First Aid Kit

Hard Hat

Hearing Protection - ear plugs

Level D

Long Pants

Protective Gloves - leather or as appropriate for task

Safety Glasses

Work Boots - Steel toe/shank

No	Job Steps	Potential Hazard(s)	Critical Action(s)
1	Review project specifications and HASP, emergency contact information	Administrative function. Emergency response not appropriate	Review site requirements and site Emergency phone numbers: Review site specific H&S requirements. Review activity specific JSA's. If this is your first visit to the site you must complete the Site Health and Safety Written Test. All visitors must complete the Visitor Written Test. All onsite personnel must sign the Chevron Daily Safety meeting log. Conduct tailgate safety meetings.
2	Complete all forms and related documentation. Verify all permits, forms and training have been completed.	Safety / Security compliance	Keep all relevant forms and HASP onsite during onsite activities. All employees must have required training: OSHA training and HAZWOPER Activity specific – vehicle operation, excavation.
3	Conduct SPSA and review Stop Work Authority.	NLI/LI	Always conduct an SPSA prior to start. • Assess the risk. What is the worst that could happen? • Analyze how to reduce the risk. Ask yourself what you could do to make the task safer. If you are uncertain, then ask someone who would know. • Act to ensure safe operations. Use the ideas and tools that make the task safer. All personnel have the right and responsibility to use their Stop Work Authority if conditions or actions make working unsafe.
4	Inspect job site for placement/staging of vehicles	Equipment damage, physical contact/moving vehicles.	Scope area for suitable areas to park vehicles. Be cautious of muddy and icy surfaces. Close/lock access gates before beginning work and when exiting site for lunch and at the end of the day.
5	Mobilization of heavy equipment prior to arrival at site	Non-Communication misunderstanding of: roles, responsibilities, H&S expectations, site rules, regulations and permit conditions OE Tenets 4,7,10 Traffic collision with other vehicles and pedestrians OE Tenets 2,4,7	1. Prior to arrival the contractor will contact Health & Safety (H&S) Site Safety Officer (SSO) and operations supervisor to discuss all requirements for work onsite. Prior to arrival the SSO will review basic elements of the following: Loss Prevention System, site-specific health and safety conditions, site emergency response plan, onsite traffic rules, and site regulatory and permits conditions. Prior to work a pre-determined (best route) for accessing the onsite work area will be established between SSO and operations supervisor. 2. Follow all traffic laws including posted speed limits. Follow Vehicle Safety Program (Safe Driving Procedures). A pre-determined (best route) for accessing the site will be sent to the contractor.
6	Mobilization of heavy	Injurious contact with heavy	1. Driver/Operator will walk around vehicle/equipment to be moved prior to backing up

	equipment onsite Transport, equipment to and from site, load and unload at designated staging area(s)	equipment and pinch points OE Tenets 1,2,4 Traffic (narrow roads, onsite & offsite driving) OE Tenets 2,4,7 Non-Communication OE Tenets 4,7,9	to ensure the area is clear of obstacles and/or personnel. Personnel must be instructed on equipment blind spots and pivot points of articulation. Personnel must maintain safe distance from identified pinch points during operation of equipment/vehicle. A designated spotter must be available during backing up trucks, vehicles, heavy equipment. Operators will inspect their vehicles prior to the start of work. 2. Driver's will be escorted by operation supervisor or his representative while onsite. Follow all traffic laws and posted speed limits. Follow site-specific traffic plan during hauling or other heavy traffic periods – Drive on roads and stay in designated areas. Driver will follow site safe driving procedures by using pull forward first policy, walking around vehicle prior to operation, not using cell phone or hands free devices while operation equipment. Follow designated routes in work plan. Operations supervisor or his representative or SSO will inspect vehicles for appropriate lock down, tie-down of equipment prior to transport. Assume ground personnel may be present on the roads at anytime. 3. All personnel must have the one-time Site Orientation. Must have the appropriate OSHA HAZWOPER, refresher and safe driving training. Radio contact will be maintained on site radio frequency. Review the JSA for specific work and comply with JSAP permit to work. Attend the daily onsite H&S Meeting.
7	Setting up equipment and materials	• Slip, trip, and fall • Pinch points/lacerations • Unexpected risks from unknown practices and operations • Property loss • Struck/being struck by traffic	• Check for wet conditions in truck bed before climbing in/out of truck bed. • Wear leather gloves to protect hands/fingers. • Identify/avoid pinch points and sharp edges. • Perform vehicle inspection in support trailer, parking lots or other low traffic areas. • Inspect surrounding conditions and activities. • Only authorized, Defensive-Driving trained personnel can drive. • Look for changes due to construction activities, traffic peaks, servicing, security, and others. • Get site representative advice as to where to place equipment and materials. • Use buddy-system all times. Have a spotter during low visibility activities.
8	Performing tasks.	Other equipment (collision), slopes, ground conditions possible injuries to personnel, and equipment, buried obstacles, underground and overhead utilities, and dust.	Perform SPSA. Know where utilities are located. Be aware of the scope of work to be performed. Know the paths of other equipment or persons entering and leaving your work area. Communicate with Supervisors through out the day with any questions. Stop work immediately and contact a supervisor if you are uncertain of your task, experience equipment failure or personal injury or near loss. Spot trucks when loading/dumping - make sure they are level. Watch for unstable ground. Have communication with driver. Be aware of other equipment in your work area. Never stand between heavy equipment and trucks when loading/dumping material.
9	Stopping at end of day	Slips trips and falls, Fuel splash/spill. Unexpected movement of equipment, or hydraulic leak	Park in designated area. Set brake/control locks. Idle two minutes if engine is hot. Turn equipment off, use three point dismounts

JSA004366 - Closed - Current - 08/24/2007 09:49 AM EST

Attachment H

Journey Management Plan/Traffic
Control Plan

Chevron Product Company

Journey Management Plan

Former Tappan Terminal (Site No. 3-60-015)

November 2007

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Appendices

- A Vehicle Safety Checklist
- B Driving JSA

1. Introduction

This Journey Management Plan has been prepared by ARCADIS BBL (ABBL), on behalf of Chevron Product Company (Chevron), to provide a description of transportation procedures for mobilization of personnel to, from, and around the Former Tappan Terminal (Site No. 3-60-015; the Site) located on Railroad Avenue in Hasting on Hudson, New York. As described in the PDI Work Plan, activities planned at this site include monitoring well installation, soil borings, test pitting, groundwater sampling activities, and well gauging activities; Figure 2 presents a map of the location of the site.

1.1 Purpose

The purpose of this Journey Management Plan is to minimize potential health, safety, and environmental risks when ABBL and contractor personnel mobilize and demobilize to and from the Site, and while navigating onsite during the implementation of PDI investigation activities at the Site. The Journey Management Plan provides procedures for transportation mobilization to and from the Site, how to safely enter and exit the site, and procedures for navigating onsite. This plan will be communicated to all ABBL and contractor personnel.

1.2 Plan Objectives

The objectives of the Journey Management Plan include the following:

- Provide an introduction to the site.
- Provide a summary of investigation activities.
- Provide transportation modes and routes for ABBL and contractor personnel.
- Provide a sequence of site entry/exit procedures when arriving and departing from the Site.

1.3 Plan Organization

The sections of this Journey Management Plan are as follows.

- Section 2 presents background information.
- Section 3 provides a summary of investigation activities.
- Section 4 presents a description of wastes generated.
- Section 5 presents traffic control, transportation and mobilization procedures.
- Section 6 details the contingency plan.
- Section 7 presents references.

2. Background Information

This section presents a site description, history of operations, and regulatory status of the Site.

2.1 Site Description

The Tappan Terminal site is located on 15 acres along the Hudson River waterfront in the Village of Hastings-on-Hudson, Westchester County, New York. The site comprises two properties, the Exxon/Mobil property, which is located adjacent to the Hudson River, and the Uhlich Color Company, which is located along the railroad tracks that define the eastern boundary of the site. The Uhlich property is a former pigment manufacturing facility, and the Exxon/Mobil property was most recently used as a petroleum distribution terminal. The Uhlich Color Company was recently acquired by the Magruder Color Company, and has discontinued operations at the site. A small portion of the southern end of the Exxon/Mobil property is leased to the Pioneer Boat Club for use as a marina.

Limited access to the site is from Railroad Avenue at the southeast corner of the site and over the Zinsser Bridge that crosses the railroad tracks. Both portions of the site are surrounded by a chain link fence that is in good repair. This bridge has fallen into disrepair, and is no longer open to vehicular traffic.

3. Scope of Work Activities

The following site activities will occur during the Work Plan investigation:

- Excavate test trenches.
- Drill soil borings.
- Install monitoring wells.
- Collection of groundwater and soil samples.

Site activities will commence with a health and safety kickoff meeting. Each work day will also start with a site safety meeting.

4. Traffic Control Transportation and Mobilization Procedures

This section includes descriptions of some of the investigation activities, driving/hauling routes, onsite traffic control and loading procedures, record keeping, and health and safety procedures.

4.1 Description of Scope of Work Activities

The investigation activities will include soil and groundwater sampling. The soil samples will be collected using a geoprobe, please refer to the HASP for more detail on drilling safety.

4.1.1 Groundwater Sampling Activities

Groundwater sampling activities will be performed across the site. These activities will occur as the investigation schedule dictates or on an as-need basis. Groundwater investigation activities will include traveling very short distances by vehicle or foot.

4.1.2 Soil Sampling Activities

These activities will occur as the investigation schedule dictates or on an as-need basis. Soil investigation activities will include traveling very short distances by vehicle or foot.

4.1.3 Test Trenching Activities

These activities will occur as the investigation schedule dictates or on an as-need basis. Test trenching activities will include traveling very short distances by vehicle or foot.

4.2 State and Federal Regulations

Material generated during the groundwater and soil sampling activities will be considered non-hazardous or hazardous based on laboratory analytical results. All appropriate state and federal laws and regulations will be followed during the transport and disposal of these materials. All wastes will be transported with documentation as required by applicable state and federal laws and regulations.

4.3 Transportation Modes

The following lists transportation modes for site and contractor mobilization and demobilization during the activities described above in Section 3:

- automobile

4.4 Driving/Hauling Routes

Driving/hauling routes for all personnel anticipated to perform activities associated with remedial actions onsite are presented in Figure 1. Driving/hauling routes will be appended as needed.

4.5 Traffic Control and Loading Procedures

The following procedures for onsite traffic control and loading will be executed upon arrival at the Site:

- Enter the site through Riverside Body Inc. To access the Riverside Body Inc, enter the train station on Railroad Ave and go over the railroad bridge, than make a left. Go to the security office and ask for Lisa. There is a \$120 access fee to the site. Lisa's number is 914-591-7365.

Traffic and mobilization/demobilization procedures will be repeated as necessary.

4.6 Record Keeping

This Journey Management Plan will be transmitted to all ABBL and contractor personnel prior to their mobilization to the Site. A record of transmittal will be stored in project files in Syracuse, NY.

In conjunction with the onsite health and safety kick-off meeting, all ABBL and contractor personnel will sign the acknowledgement sheet located at the front of the onsite copy of the Journey Management Plan. As new personnel are added to the acknowledgement sheet, copies of this form will be stored in the project files in Syracuse, New York.

4.7 Health and Safety Procedures

All ABBL and contractor personnel will be aware of the ABBL Driver Safety Program. All drivers must have a valid driving license and be familiar with the site-specific driving Job Safety Analysis (JSA).

All ABBL and contractor personnel will be aware of the Chevron Policy on Cell Phone Use While Driving. Cell phone use, including use with a hand-free device, by drivers while operating a motor vehicle is prohibited. Drivers should pull off the road to a safe location before using a cell phone. ABBL and contractor personnel will abide by this policy.

In accordance with the HASP dated September 2007 (ABBL, 2007b), no person will be allowed in the work area during site operations without first receiving a site orientation and hazard briefing. This orientation will be presented by the Site Supervisor, and will consist of a review of the HASP. Following this initial meeting, daily safety meetings will be held each day before work begins. Daily safety meetings will be held to cover the work to be accomplished that day, the hazards anticipated, protective equipment and procedures required to minimize site hazards, and emergency procedures. The Site Supervisor will present these meetings prior to beginning the day's fieldwork. No personnel will mobilize to any work area or perform any work task before the daily safety meeting has been held. The safety meeting will also be held prior to starting new tasks and repeated if new hazards are encountered. All people entering site work areas, including visitors, must document their attendance at the site orientation and hazard briefing, as well as the daily safety meeting.

All business-related visitors to the work areas must check in with the ABBL Site Supervisor when arriving onsite. ABBL personnel will transport visitors to and from work areas and/or review this Journey Management Plan with visitors. Visitors will not be allowed to enter the "Restricted Work Zone" unless they have had all required training and possess the proper personnel protective equipment.

All persons authorized to enter the "Restricted Work Zone" as workers and/or visitors must have the appropriate medical clearance and safety training, including OSHA 40 hour training. The ABBL Site Supervisor will maintain a log of those individuals entering the "Restricted Work Zone." In the event of an onsite release, emergency procedures will be executed in accordance with the HASP. 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 Site Supervisor immediately.

The ABBL and/or Site Supervisor will establish evacuation routes and assembly areas for the Site. All ABBL and contractor personnel entering the Site will be informed of these routes and the assembly areas.

5. Contingency Plan

In the event of an emergency, the means to summon local public response agencies such as police, fire, and ambulance are identified in Table 5-1.

Table 5-1. Emergency Contacts

LOCAL EMERGENCY CONTACTS	PHONE NUMBER
Fire Department	911
Local Police	911
Ambulance	911
PROJECT EMERGENCY CONTACTS	PHONE NUMBER
Emergency Client Contact: Mark Stella	(713) 432-2643, if not available 281-382-0281 (cell)
ABBL Project Manager: Bill McCune	(315) 446-9120 ext. 172, if not available (315) 420-4348 (cell)
ABBL Site Supervisor: TBA	TBA

For emergencies requiring response from the fire department, police or an ambulance, dial 911. Calmly explain the situation to the security operator, and they will coordinate with the appropriate emergency services.

6. References

ARCADIS BBL (ABBL). 2007a. *Pre-design Investigation Work Plans, Former Tappan Terminal Site, Hastings on Hudson, New York*

ABBL. 2007b. *Health and Safety Plan, Chevron Environmental Management Company, Hastings on Hudson, New York, September 2007.*

Figure 1
Driving Routes

Figure 1-1
Driving Route
BBL Syracuse, NY to the Project Site

1. From the office parking lot, take a right onto Towpath Rd.
2. At the first stop sign, take a right onto Widewaters Parkway.
3. Turn right onto Bridge St.
4. Merge onto I-690 E via the ramp on the left.
5. Merge onto I-481 S via the exit on the right.
6. Merge onto I-81 S towards BINGHAMTON via exit on the left.
7. Take left fork onto Rt. 17 E towards NEW YORK.
8. Rt. 17 E becomes US-6 E.
9. US-6 E becomes Rt. 17 E.
10. Merge onto I-87 S
11. Take exit #9/US-9 towards TARRY TOWN
12. Turn left on BROADWAY (US-9).
13. Turn right on Warburton Ave.
14. Turn right on Cropsey Ln.
15. Turn left on Southside Ave.
16. Southside Ave becomes Railroad Ave.

The distance from Syracuse, NY to the Site is roughly 249 miles and the estimated travel time is four hours.

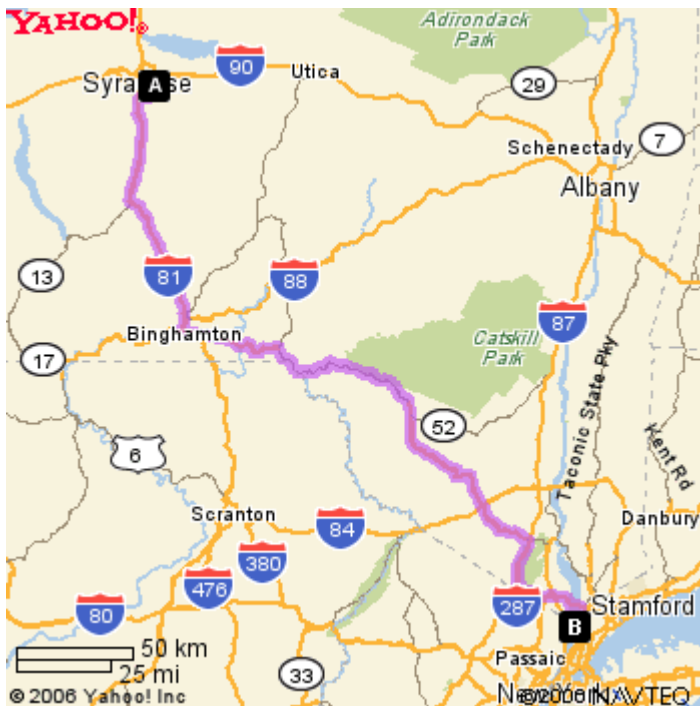


Figure 1-2
Driving Route
BBL Beverly, MA to the Project Site

1. Turn left on Balch St.
2. Turn right on New Balch St.
3. Turn left to Cabot St. (Rt.-1A).
4. Bear right to follow Rt.-1A.
5. Bear right onto Rt.-128 S towards PEABODY/BOSTON.
6. Take exit # 25 onto I-90 W towards WORCESTER.
7. Take exit # 9 onto I-84 W toward HARTFORD/STURBRIDGE.
8. Take left exit # 57 onto CT-15 S towards N.Y. CITY/CHAPTER OAK BR.
9. Ct-15 S becomes US-5 S.
10. Take exit # 87 onto I-90 S.
11. Take exit # 18 onto I-691 W towards WATERBURY/MERIDEN.
12. Take left exit # 1 onto I-84 W towards DANSBURY/WATERBURY.
13. Take exit # 20 onto I-684 S towards NEW YORK CITY/WHITE PLAINS.
14. Take the I-287 W exit towards WHITE PLAINS.
15. Take the I-87 exit S exit towards NEW YORK CITY.
16. Take exit # 7A/SAW MILL RIVER PKWY S onto SAW MILL PKY S.
17. Take exit # 17 onto Allen St. towards DOBBS FERRY/ARDSLEY/ASHFORD Ave.
18. Ashford Ave becomes Broadway (US-9)
19. Turn right on Warburton Ave.
20. Turn right on Cropsey Ln.
21. Turn left on Southside Ave.
22. Southside becomes Railroad.

The distance from Beverly, Ma to the Site is roughly 231 miles and the estimated travel time is three hours and forty five minutes.



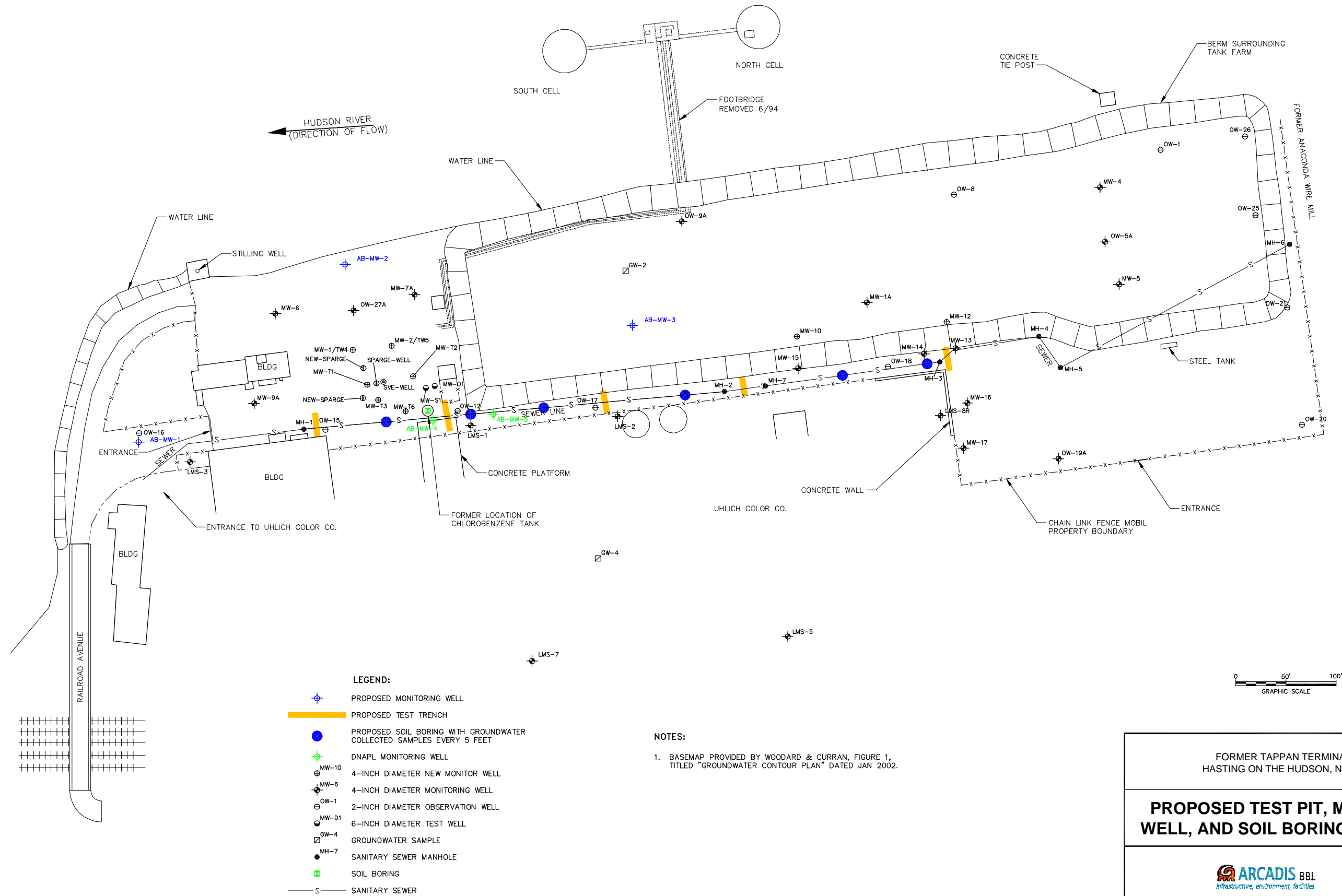
Figure 1-3
Driving Route
The Project Site to St. John's Riverside Hospital, Yonkers NY

1. Railroad Ave becomes Southside Ave.
2. Turn right on Cropsey Ln.
3. Turn right on Warburton Ave.
4. Turn left on Pinecrest. Dr.
5. Bear right on New Broadway (US-9)

The distance from the Site to the hospital is roughly 2 miles and the estimated travel time is six minutes.



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Attachment A

Vehicle Safety Checklist

VEHICLE PRE-TRIP CHECK

Date: _____

Unit: _____

Operator: _____

CHECK BEFORE OPERATING	OK	NR	COMMENTS
Driver's License on hand?			
Insurance card in car?			
Back-up Alarm Operational?			
Tires (tread greater than top of Lincolns head on a penny)			
Taillights Operational			
Turn Signals Operational			
Brake Lights Operational			
Back-up Lights Operational			
Headlights Operational			
Parking Lights Operational			
Mirrors Adjusted to Minimize Blind Spots			
Under the Vehicle - nothing hanging, no leaks			
Windshield Wipers and Fluid all Functional			
Heavy items secured down low or in trunk			
Make Sure All Doors are Fully Closed and Locked			
Adjust Your Seat if Needed			
Adjust Your Head Restraint to Match Height of Head			
Fasten Your Safety Belt and Make Sure Passengers do too			
Start the Engine			
Scan the Gauges to Make Sure Everything is Normal			
Adjust the Vents, Windows, and Heater or Air Conditioner for Comfort			
Make Sure You are Mentally and Physically Ready to Drive			

NR = Needs Repair

This checklist should be completed before operating a vehicle on BBL/BBLES business.

When multiple stops are planned, the driver should walk around the vehicle after each stop to validate tire inflation and vehicle integrity.

Attachment B

Driving JSA

Job Safety Analysis

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements and notification to required contacts (e.g., site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day and then again after lunch. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

Date:	10/9/2006
JSA Type:	Driving and Motor Vehicles
Work Type:	Driving
Project No.:	

Development Team	Position/Title	PC	Reviewed By	Position/Title	Date
Robertson, Jo Ann		<input checked="" type="checkbox"/>	Mccune, William T.		

Personal Protective Equipment (PPE) needed

Job Steps	Potential Hazard(s)	Critical Action(s)
PRE-TRIP - Review SPSA Card	Worst case outcome of vehicle operation (blowout, breakdown, collision, injury or death).	Assess the potential hazards. Review weather and road conditions/closures before departing. Plan travel route and select alternate routes in case main roads are closed. Notify someone of your departure time/route/and ETA. Pack emergency supplies. Analyze how to reduce the risk. Act to ensure safe operation of the vehicle. Recognize SWA.
Inspect vehicle.	Unfamiliar Vehicle and controls.	Familiarize yourself with the vehicle controls before moving. Properly adjust the mirrors and seats. Assure tires are properly inflated and there is sufficient tread. Assure there are no cuts or bulges in the sidewalls. Assure windshield and window glass is clean. Lift wiper arms and check wiper blades for damage or deterioration. Check behind vehicle for obstructions.
Fasten seat belts.	Increased risk of more serious injury or death in collision.	Assure seat belt is in good condition and fastened. Assure all passenger seat belts are in good condition and fastened.
Lock doors.	Ejection from vehicle in collision. Unwanted intrusion.	Lock all doors to vehicle.
Start engine.	Unexpected movement.	Assure that transmission is in 'Park' and that parking brake is set.
Check gauges and warning lights.	Overheated engine or break-down due to lack of critical fluids.	Assure there is sufficient gas, oil and other critical fluids.
Pull out of parking space.	Collision with other vehicles, pedestrians, or stationary objects.	Check mirrors and over shoulder in all directions prior to pulling out of parking space. Signal if parallel parked along a street. Use spotter if not pulling forward out of spot.
Obey Road Rules.	Speed.	Obey all posted limits. Reduce speed during hazardous conditions (fog, rain, etc.)
Check Mirrors	Accidents due to following too close and spacing	Continually check mirrors. Use the 3 second rule for proper spacing. Regularly scan the area you will be entering in the next 10-12 seconds. Always leave yourself an out during travel. When stopping leave adequate

		space between you and the vehicle ahead of you. Do not tailgate.
Sliding and/or skidding	Skids-sliding of the road	If the vehicle has begun to skid out of control, turn the wheel in the direction of the skid. Reduce speed during hazardous conditions. Use 4 wheel drive, if available, when driving in mud.
Situational Awareness	Automobile accidents due to blind spots	Be familiar with your vehicles blind spots. Adjust mirrors to give maximum viewing area. Use turn signals when changing lanes. Avoid other driver's blind spots.
Avoid distractions	Distractions	Do not use cell phone while driving. Do not read maps while driving.
Backing up.	Collision, injury or death to occupants or other parties.	Make all backing maneuvers slowly and cautiously. Check mirrors and over shoulders. When parking, look for pull-through parking to avoid backing. Use spotter when necessary.
Parking.	Collision, injury or death to occupants or other parties.	Park away from other cars. Back into parking spot when possible and safe. Maintain cushion of safety from fixed objects. Set parking brake. If it is safe to do so, park so the first movement is forward. If parking on road place vehicle as barrier to oncoming traffic and use barricades/warning devices or cones.
POST-TRIP - Report maintenance or mechanical problems upon returning vehicle.	Conditions worsen leading to mechanical failure resulting in accident, injury or death.	Report vehicle problems immediately to company representative or rental car agency. Review JSA again to ensure best practices have been followed.

Initial - In Progress - 10/09/2006 09:32 AM EST

Attachment I

Underground/Overhead Utilities
Checklist and Chevron Guidance
Document

Procedures for Identification of Underground Utilities at ChevronTexaco Facilities



ChevronTexaco

November 2002

Procedures for Identification of Underground Utilities at ChevronTexaco Facilities

Utility Mark-out Strategy for Drilling Operations at ChevronTexaco Facilities – LPS Program Action Item

I. Introduction

The accurate identification of underground utilities at all ChevronTexaco facilities prior to intrusive operations (e.g., drilling or excavating) is of paramount importance to protect the health and safety of employees, subcontracted personnel, the general public, and the integrity of the property and infrastructures of the site undergoing investigation. The following procedures provide a strategy for the identification and mark-out of underground utilities, as well as guidance for intrusive activities at high-risk sites.

The overall goal of this document is to provide a procedural outline for utility clearance that can be applied to all facility investigations, and to minimize, if not eliminate, potential for damage caused by hitting utilities during intrusive operations. The following sections present the Planning Procedures and Field Utility Clearance Activities that will be performed prior to all intrusive investigations.

II. Planning Procedures

Prior to the commencement of intrusive activities, the locations will be cleared for underground utilities by contacting the appropriate statewide organization (e.g., Underground Facility Protection Organization (UFPO) for New York) to have appropriate utilities representatives mark the location of underground lines. Most states have a central organization established for marking utilities that can be reached by calling a toll-free number. Table 1 provides a list of states, contact numbers, and requirements for calling in a utility mark-out. If possible, the responsibility of arranging a utility mark-out should be the subcontractor performing the drilling program. The verification of the utility mark-out will be performed on-site by the ChevronTexaco project representative.

Private utilities may be delineated by field personnel using appropriate devices (e.g., ground penetrating radar) and/or by a private utility locating contractor (if necessary). This contractor/site representative will survey the project area to determine the presence of known, as well as unknown, utilities/underground piping at the project area, especially in proposed drilling areas.

An underground/overhead utility checklist (Attachment 1) will be performed at each facility prior to beginning the drilling program. The checklist will be approved by the facility supervisor and the BBL site supervisor.

III. Field Procedures

Do not begin drilling or excavating until you have confirmed that all notified utilities have either responded to or cleared the worksite. The presence of some utility markings does NOT mean that all of the underground lines have been located, as there may be more than one telephone company (i.e. long distance and fiber carriers, etc.), the locator may not have finished marking, or someone may have arbitrarily painted something with that color. Always be certain that these utilities have all responded to (or cleared) your worksite before you begin. If an underground facility has been staked, marked, or otherwise designated within a proposed work area, and if the area of an underground facility overlaps with any part of the work area, or the projected line of a bore/directional drill intersects the path of an underground facility, the site supervisor will identify the precise location, type, size, direction of run and depth of such

underground utility. Verification may be completed before the drilling program is commenced or may be performed as the work progresses.

The verification of underground utilities shall be accomplished by exposing the underground facility or its encasement to view by means of hand dug test holes at one or more points where the work area and tolerance zone overlap, or more points as designated by the operators of such facilities. Hand-dug or hand-augered borings will be spaced to overlap the largest outer dimensions of the auger being used for the drilling operation. Powered or mechanized equipment may be used for removal of pavement or masonry, but only to the depth of such pavement or masonry.

If available, additional methods may be used instead, or in combination with hand digging or hand augering test holes to expose an underground utility. These methods may include surface geophysical methods (e.g., ground penetrating radar), utility tracing equipment (radio frequency detection), or soil vacuum methods (e.g., air knife). Descriptions of the use and limitations of these methods are provided below.

Ground penetrating Radar (GPR)

The GPR system transmits high frequency electromagnetic waves into the ground and detects the energy reflected back to the surface. Energy is reflected along boundaries that possess different electrical properties. Reflections typically occur at lithologic contacts or where subsurface materials have high electrical contrasts, including metal objects such as USTs, drums and utility pipes. These reflections are detected by the antenna and are processed into an electrical signal that can be used to image the subsurface feature. The GPR data will be reviewed in the field to assist in the delineation of potential piping.

The detection of piping located at the site will depend on the electrical properties of the soil and the pipe's depth, diameter and composition. GPR is limited the detection of smaller diameter pipes with depth. Generally, a pipe must increase in diameter by one inch for each foot in depth to be seen using GPR. Also, plastic piping is more difficult to detect than metal piping using GPR, and caution should be used if plastic utility lines are suspected.

Radio Frequency Detection (RFD)

This instrument operates on the principle of radio frequency transmission and detection. The transmitter applies a known frequency to the pipe and the receiver is able to detect this frequency along the length of the pipe. The success of RFD in tracing underground utilities is based on the composition of the pipe (metal or plastic) and the ability to accurately position the transmitter unit so that it can be attached to, or placed directly over the pipe. RFD should only be used to verify the location of utility mark-outs, and not as the primary method of utility identification.

Soil Vacuum Excavation

This method uses nondestructive vacuum excavation methods to create a visual test hole allowing the confirmation of buried utilities. This method is very accurate and can be performed prior to or during the drilling program. The limiting factors for this method are cost and availability. The cost of an appropriate soil vacuum truck and crew can be up to \$1,500/day. As with specialty drilling methods, a limited number of firms have the equipment to perform vacuum excavation.

Consider the location to be cleared relative to the source and depth of impacted soil or groundwater. If the zone to be cleared is known not to contain hazardous vapors or petroleum hydrocarbons via previous testing, implement continuous air monitoring using a lower explosive level (LEL)/O₂ meter and PID or

FID to the depth of the boring. Also consistent with the HASP, air monitoring should be conducted continuously with the LEL/O₂ meter during any activity if flammable or explosive vapors are suspected to be present. Prior to any subsurface investigation activities, air monitoring should be conducted to establish background levels for total organic vapors using a PID or FID. All work activity must STOP where tests indicate the concentration of flammable vapors exceeds 10% of the LEL, and the source of vapors must be investigated.

Caution:

Some vacuum systems commonly used for utility clearance are considered unsuitable for use for environmental investigation sites. The manufacturers' catalogs for some vacuum assisted units have a disclaimer stating, "Not for use with Hydrocarbons, Explosives, Corrosive or Toxic Material," and are not intrinsically safe. On these units, potential petroleum vapors would pass through a hot blower into a tank where sparks or static electricity could be generated.

Given the disclaimer and that some units and associated tanking are not explosion proof. The following steps will be considered prior to using vacuum assisted utility clearance units where soils could be impacted with petroleum hydrocarbons or flammable vapors.

- 1) Request from the manufacturer and/or the contractor doing the work to supply manufacturers' documentation and specifications for use of the unit at environmental sites.
- 2) Request documentation that the unit is intrinsically safe and may be used in areas where petroleum hydrocarbon may be present.
- 3) Obtain details on how the unit deals with vapors through the system and complies with American Society of Civil Engineering guidelines for vacuum assisted utility clearance document number C-38-02.
- 4) Obtain the procedures for grounding portable units to discharge potential static electricity during operation.
- 5) If none of the above are available, then hand auger instead, and do not use vacuum assisted methods.

IV. Review of Utility Mark-Out Strategy

The following strategy for identifying and clearing underground utilities at ChevronTexaco sites is provided for review.

At all sites the following steps must be performed prior to initiating any intrusive work:

1. Contacting the appropriate states One-Call utility mark-out organization (see Table 1), and follow specific notification requirements for the geographic area.
2. Complete the underground/overhead utility checklist (Attachment 1), and meet on-site with utility representatives to verify utility mark-outs.
3. Based on the above, determine the need to perform supplemental utility identification by either exposing the utility via hand digging / hand augering, or using soil vacuum excavation. If any utility

mark-outs are in question, then the location of the utility must be confirmed by hand digging/hand augering methods or using a soil vacuum method prior to drilling.

4. GPR and RFD methods may be used to help located marked-out utilities, but should not be considered a substitute for hand digging or soil vacuum methods, especially if the location of the utility is unknown.
5. The identification of utilities will be performed to overlap the largest outer dimensions of the auger being used for the drilling operation by exposing the utility via hand digging/hand augering, or by using soil vacuum excavation.

Attachment J

Daily/Periodic Excavation Inspection
Form



Daily / Periodic Excavation Inspection Checklist

Project Name:	Date / Time:		
Project Number:	Location:		
Prepared By:	Project Manager:		
This checklist must be completed for all excavations. It documents that daily and post-event / periodic inspections are conducted.			
Soil Classified As:	Stable Rock	Type A	Type B Type C
Soil Classified On:	By:		
Type of Protective System in Use:	Sloping	Shoring	Other _____
Description:			
Inspection Item	YES	NO	Comments
Is the underground / overhead utilities checklist completed?			
Are underground installations protected from damage?			
Are adequate means of entry / exit available in the excavation?			
If exposed to traffic, are personnel wearing reflective vests?			
Do barriers exist to prevent equipment from rolling into the excavation?			
Was air monitoring conducted prior to and during excavation entry?			
Was the stability of adjacent structures reviewed by a registered P.E.?			
Are spoil piles at least 2 feet from the excavation edge?			
Is fall protection in use near excavations deeper than 6 feet?			
Are work tasks completed remotely if feasible?			
Is a protective system in place and in good repair?			
Is emergency rescue (lifeline / body harness) equipment used due to potential atmospheric hazard?			
Is excavation exposed to vibration?			
Are employees protected from falling / elevated material?			
Is soil classification adequate for current environmental / weather conditions?			
Do portable ladders extend at least 4 feet above the excavation?			
Are portable ladders or ramps secured in place?			
Have all personnel attended safety meeting on excavation hazards?			
Are support systems for adjacent structures in place?			
Is the excavation free from standing water?			
Is water control and diversion of surface runoff adequate?			
Are employees wearing required protective equipment?			
BBL Excavation Competent Person:			Date/Time:

Attachment K


Excavation and Trenching Policy and
Procedure Memo

Approval Signatures

Prepared by: Greg Ertel Date: June 2004



Reviewed by: Charles F. White Date: July 2005
(Technical Expert)

Reviewed by:  Date: 11/30/05
(Health and Safety Officer)

Standard Operating Procedure: Excavation and Trenching

I. Scope and Application

The Firm is committed to operate in a manner which protects the health and safety of its personnel. Employees of the Firm must abide by applicable local, state, and federal regulations while conducting activities for the Firm. To maintain a safe and healthful workplace, employees of the Firm must utilize the procedures outlined in this SOP for any excavation or trenching activity conducted as part of the Firm's business.

This SOP sets forth standard procedures to be utilized by employees of the Firm when working with open excavations made in the earth's surface. This procedure also establishes administrative roles and responsibilities to meet the requirements and definitions of 29 CFR 1926 Subpart P.

To reduce the potential for injury, personnel must avoid entering excavations and trenches whenever feasible alternatives exist. If entry into an excavation cannot be avoided, the safety and engineering controls outlined in this procedure must be implemented by authorized personnel under direct supervision of personnel competent with respect to potential hazards present and regulatory requirements of 29 CFR 1926 Subpart P.

II. Personnel Qualifications

The following outlines the responsibilities of various personnel:

Officers/Division Heads/Project Managers

1. Verify that all excavation activities are properly identified and addressed within a project work plan, site health and safety plan (HASP) and/or other project documents.
2. Verify that employees designated as "competent person" for excavation activities have experience, training, and authority to fulfill the requirements of the position.
3. Verify that proper excavation and personal protective equipment (PPE) is available for use by affected employees.

Corporate Health and Safety (CHS)

1. Review and revise this procedure as required to meet regulatory requirements.
2. Provide technical assistance regarding excavation procedures, hazard identification, "competent person" designation, and personal protective systems.
3. Audit project-specific excavation activities for compliance with this procedure.
4. Review and revise, as appropriate, site-specific HASPs to include requirements for excavation activities.

5. Verify that all employees assigned as a "competent person" for excavation activities meet the OSHA definition as such with respect to training and authority.
6. Provide initial competent person training and retraining, or recommend qualified training provider, for affected employees.

Site Designated "Competent Person"

1. Must be capable of identifying existing or predictable hazards in surroundings and/or working conditions associated with excavation and trenching activities.
2. Must be authorized to take prompt corrective measures to eliminate hazardous conditions associated with excavation activities, including, but not limited to stopping work.
3. Verify that the safety procedures identified in this SOP, the site specific HASP and 29 CFR 1926 Subpart P are utilized when required to protect employees during excavation activities.
4. Conduct and document daily inspections of all excavations and protective systems (see attached Daily Periodic Excavation Inspection Checklist).
5. Conduct and document inspections of all excavations after any event (e.g., thunderstorm, freeze/thaw cycle, vibration, etc) that may affect excavation stability.
6. Attend "Competent Person" training for excavation and trenching activities.
7. Attend 8-Hour Supervisory training.
8. Attend Confined Space Entry training.

Employees Required to Work Around or In Excavations

1. Must be capable of recognizing existing or predictable hazards in surroundings and/or working conditions associated with excavation activities.
2. Understand all safety requirements outlined in this SOP and 29 CFR 1926 Subpart P to be utilized to protect employees during excavation activities
3. Attend annual OSHA refresher training.
4. Attend Excavation Safety training.

III. Equipment List

Excavation and trenching activities require a variety of equipment including, but not limited to the following:

- Signs, barricades or other devices to control access to the excavation and direct traffic a safe distance from the work zone;
- Energy control devices as specified by the Lockout / Tagout (LOTO) Control of Hazardous Energy SOP;

- Entry/Exit Equipment – ladder or approved temporary stairs to allow for safe entry and exit out of the excavation, soil benches can not be used for entry or exit;
- Safety Equipment – fire extinguishers, lights, cooling vests;
- Ventilation Equipment – fans, blowers or other methods to maintain safe atmospheric conditions within the excavation or trench;
- Air Monitoring – instruments to measure the air quality, at a minimum four-gas meters that are able to measure oxygen, lower explosive limit (LEL), hydrogen sulfide (H₂S), and Carbon monoxide (CO) will be used; and
- Personal protective Equipment – as specified by the site-specific HASP and the PPE SOP.

All equipment must be appropriate for the activities of the entry and be approved or certified as specified by regulatory requirements.

IV. Cautions

Excavation and trenching is an extremely hazardous task; only trained, qualified employees will work in excavations according to the procedures of this SOP.

V. Health and Safety Considerations

All policies, procedures, and regulatory requirements as specified in this SOP, the site-specific HASP and applicable standards must be followed by employees of the Firm.

Any employee of the firm or subcontractor at an excavation site, is expected to and has the authority to, stop work if an imminent hazard exists.

VI. Procedure

1. OSHA Definitions for Excavation Activities

- A. Aluminum hydraulic shoring means a pre-engineered shoring system comprised of aluminum hydraulic cylinders (cross-braces) used in conjunction with vertical rails (uprights) or horizontal rails (wailers). Such system is designed to support the sidewalls of an excavation and prevent cave-ins.
- B. Benching (benching system) means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.
- C. Cave-in means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.
- D. Competent person means one who, through education, training, and/or experience, is capable of identifying existing and predictable hazards or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

- E. Excavation means any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.
- F. Failure means the breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.
- G. Hazardous atmosphere means an atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause illness, injury, or death.
- H. Protective system means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide protection.
- I. Ramp means an inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.
- J. Registered Professional Engineer means a person who is registered as a Professional Engineer in the state where the work is to be performed. However, a Professional Engineer, registered in any state, is deemed to be a "Registered Professional Engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.
- K. Sheet piling means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.
- L. Shield (Shield system) means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shield can be either pre-manufactured or job-built in accordance with 1926.652 (c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."
- M. Shoring (shoring system) means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.
- N. Sloping (sloping system) means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.
- O. Stable rock means natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a Registered Professional Engineer.
- P. Support system means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

- Q. Trench means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 meters). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 meters) or less (measured at the bottom of the excavation), the excavation is considered to be a trench.

2. General Safety Requirements for All Excavations

- A. All surface obstructions must be moved or supported so as to protect employees and equipment.
- B. Prior to excavation, all underground installations (water, electric, telephone, gas, etc.) must be located and documented. Proper procedures for locating underground objects may include interviews with utility or facility personnel, contacting locator services (e.g., Dig Safe), reviewing site drawings, and/or using geomagnetic sensing instrumentation. (See attached Underground / Overhead Utility Clearance Checklist.)
- C. When excavating in areas near underground installations, proper precautions must be taken to determine the exact location of the installations and to adequately protect and support them. While an excavation is open, underground installations shall be protected, supported or removed as necessary to protect employees.
- D. Structural ramps used as a means of access and egress to/from excavations must be designed by a "competent person", constructed of uniform materials, securely attached, and treated to prevent slipping. Ladders must extend at least 36 inches (3 feet) above the landing surface.
- E. If personnel are working in a location exposed to vehicular traffic they must be provided with and be required to wear reflective safety vests. Adequate, signs, barriers, or other equivalent traffic controls must be used to protect employees.
- F. Personnel are not permitted to be beneath elevated loads handled by equipment or be in excavations when heavy equipment is digging.
- G. Mobile equipment located near open excavations must be adequately protected from falling or rolling into excavations by the use of barricades or warning devices.
- H. All excavations over 4 feet in depth must be tested for hazardous atmospheres whenever personnel are required to enter and a potential exists for the existence of hazardous contaminants or oxygen deficiency. Excavations less than 4 feet in depth must be evaluated by the competent person and, at the competent person's discretion, tested for hazardous atmospheres whenever personnel are required to enter and a potential exists for the existence of hazardous contaminants or oxygen deficiency.
- I. Means of rescue including a lifeline and body harness must be used by personnel entering excavations with a potential for air hazards. A standby person must be stationed outside the excavation to tend the lifeline(s).

- J. Water must not be allowed to accumulate in open excavations where employees are working. When necessary, means such as diverting natural drainage around the excavation or actively pumping water must be used to prevent or control water accumulation.
- K. All structures adjacent to an open excavation must be supported, or a Registered Professional Engineer must determine that the structure will not be affected by the excavation activities.
- L. Excavated materials (spoil) must be placed no closer than 2 feet from the edge of an open excavation, and otherwise retained to prevent loose material from falling into the excavation.
- M. Protection such as guardrails, barricades, or covers must be in place to protect personnel from possible falls into open excavations, pits, wells, and shafts.
- N. Work tasks will be designed to limit the number of personnel required to enter any excavation. All tasks that can be completed remotely from outside the excavation (such as soil sampling) will be conducted in such a manner.
- O. Personnel will not be allowed to enter any excavation unless adequate protective systems and procedures are utilized to prevent accidents and injury.
- P. All excavations over 4 feet in depth shall be provided with a stairway, ladder, ramp, or other safe means of egress so as to require no more than 25 feet of lateral travel. As deemed necessary by the competent person, excavations less than 4 feet in depth will be provided with a stairway, ladder, ramp, or other safe means of egress so as to require no more than 25 feet of lateral travel.

3. Excavations Requiring Protective Systems

- A. The following excavations require protective systems:
 - 1) All excavations into which employees will enter, regardless of depth, where the potential for cave-in exists.
 - 2) Any excavation over 5 feet in depth into which employees will enter that is not entirely in stable rock as defined in this procedure.
 - 3) Any excavation near a structure (e.g., foundations, piers, footers, walls, sidewalks, tanks, roadways, etc.), as required by the Registered Professional Engineer reviewing the stability of the excavation and the structure.
- B. All excavations over 20 feet in depth must be designed by a Registered Professional Engineer regardless of whether personnel will enter it or not.
- C. All excavations with adjacent structures which are located a distance less than 4 to 6 times the depth of the excavation away shall be reviewed by a Registered Professional Engineer to determine if the stability of the structure will be affected by the excavation.
- D. Support systems for an adjacent structure must be designed by a Registered Professional Engineer.

4. Selection and Use of Protective Systems

A. Shoring or Shielding

- 1) If shoring or shielding is selected as the protective system for an excavation, soil classification in accordance with 1926 Subpart P Appendix A (see Section 9 of this procedure) is required; and
- 2) One of the following options must be utilized for all excavations which will be shored or shielded:
 - a. Timber shoring as specified in 1926 Subpart P Appendix C must be utilized;
 - b. Hydraulic shoring, trench jacks, air shores, or shields as required in 1926.652 (c)(2) must be utilized following the system manufacturer's data;
 - c. A system which follows other tabulated data (approved by a Registered Professional Engineer) must be utilized; or
 - d. The excavation must be designed by a Registered Professional Engineer.

B. Sloping

- 1) If sloping is selected as the protective system for an excavation, the excavation sides must be sloped at a maximum of 34° (1-1/2 Horizontal: 1 Vertical), unless the procedure in #2 is followed; and
- 2) Soil classification in accordance with Section 10 of this procedure) is required for all excavations with sides which will be sloped greater than 34° (1-1/2 Horizontal: 1 Vertical).
 - a. Sloping, based on soil classification, as specified in 1926 Subpart P Appendix B must be utilized;
 - b. A sloping system which follows other tabulated data (approved by a Registered Professional Engineer) must be utilized; or
 - c. The excavation must be designed by a Registered Professional Engineer.

5. Atmospheric Testing for Entry

- A. Any excavation over 4 feet in depth with a potential for hazardous contaminants or oxygen deficiency must be tested for hazardous atmospheres prior to and during activities involving entry.
- B. The site designated "competent person" will document initial and periodic air monitoring results for all activities requiring entry into the excavation.
- C. All atmospheric testing of excavations must be conducted in the following sequence and meet the following air quality criteria:

- 1) Oxygen content must be 19.5 to 23.5%;
 - 2) Combustible gas or vapor must not exceed 10% of its lower explosive limit (LEL);
 - 3) Toxic air contaminant levels must not exceed 50% of the permissible exposure limit for the specific contaminant;
 - 4) Carbon monoxide must not exceed 20 ppm; and
 - 5) Hydrogen sulfide must not exceed 5 ppm.
6. Location of Underground / Overhead Utilities
- A. The competent person and the project manager shall both verify that local underground facilities location/protection agencies are notified within the required time frame prior to the initiation of excavation activities.
 - B. Prior to initiation of excavation or trenching operations the competent person shall verify that all utilities have been located.
 - C. The competent person shall verify that the Overhead/Underground Utilities Checklist (attached) is completed and authorized prior to the commencement of excavation and trenching activities.
7. Daily/Periodic Inspections
- A. Prior to initiation of daily excavation or trenching operations the competent person shall verify that a daily inspection of the excavation has been conducted.
 - B. During excavation or trenching operations the competent person shall verify that periodic inspections of all excavations are conducted after any event (e.g., thunderstorm) that may affect excavation stability.
 - C. The competent person shall verify that a daily/periodic inspection checklist (attached) is completed for each inspection of excavation and trenching activities.
8. Training
- A. "Competent Person" Training
- In order to be assigned duties as a competent person with respect to excavation and trenching personnel must complete the firm's training course or an equivalent course approved by Corporate Health and Safety including but not limited to the following topics:
- 1) Soil classification techniques;
 - 2) Excavation hazard recognition;
 - 3) Protective systems;
 - 4) Requirements of 1926 subpart P and appendices; and
 - 5) Procedures for addressing safety hazards.

B. General Hazard Awareness Training

- 1) New Employees
 - a. Provided general orientation training with respect to this procedure at time of hire.
- 2) Existing Employees will be provided with excavation and trenching awareness training:
 - a. Through CHS during initiation of this procedure.
 - b. As part of other safety training (i.e., 8-Hour Refresher, Confined Space, and 8-Hour Supervisory).

C. Project - Specific Training

- 1) Site orientation on excavation projects shall include a discussion of:
 - a. Site excavation hazards and procedures;
 - b. Requirements for conducting activities remotely whenever possible;
 - c. Client requirements and procedures for excavation activities; and
 - d. This SOP.
- 2) Daily Safety Meetings on projects involving excavation activities shall include a discussion of:
 - a. Site excavation hazards and procedures;
 - b. requirements for conducting activities remotely whenever possible;
 - c. Client requirements and procedures for excavation activities; and
 - d. This SOP.

9. Soil Classification for Selection of Protective Systems

A. Soil Classification

- 1) This section describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. This section contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.
- 2) This section applies when a sloping, benching or shoring system is utilized as a method of protection for employees from cave-ins.
- 3) Soil Classification Definitions
 - a. Cemented soil means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand size sample cannot be crushed into powder or individual soil particles by finger pressure.

- b. Cohesive soil means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sides, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.
- c. Dry soil means soil that does not exhibit visible signs of moisture content.
- d. Fissured means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.
- e. Granular soil means gravel, sand, or silt (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.
- f. Layered system means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.
- g. Moist soil means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.
- h. Plastic means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.
- i. Saturated soil means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or shear vane.
- j. Soil classification system means, for the purpose of this procedure, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the characteristics of the deposits and the environmental conditions of exposure.
- k. Submerged soil means soil which is underwater or is free seeping.
- l. Unconfined compressive strength means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.
- m. Wet soil means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

4) Types/Classes of Soil

- a. Type/Class A Soils are cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils, such as caliche and hardpan, are also considered Type A. However, no soil is Type A if:
 - 1. The soil is fissured;
 - 2. The soil is subject to vibration from heavy traffic, pile driving, or similar effects;
 - 3. The soil has been previously disturbed;

4. The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4 Horizontal:1 Vertical) or greater; or
 5. The material is subject to other factors that would require it to be classified as a less stable material.
- b. Type/Class B Soils are:
1. Cohesive soils with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa);
 2. Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam;
 3. Previously disturbed soils, except those which would otherwise be classed as Type C soil;
 4. Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration;
 5. Dry rock that is not stable; or
 6. Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4 Horizontal:1 Vertical), but only if the material would otherwise be classified as Type B.
- c. Type/Class C Soils are:
1. Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less;
 2. Granular soils including gravel, sand, and loamy sand; or
 3. Submerged soil or soil from which water is freely seeping; or
 4. Submerged rock that is not stable; or
 5. Material in a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4 Horizontal:1 Vertical) or steeper.
- 5) Methods for Classifying Soils
- a. Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in this section.
 - b. The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis conducted by a competent person using tests described below, or in other recognized methods of soil classification and testing such as those adopted by the American Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.
 - c. The visual and manual analyses, such as those noted as being acceptable in this section, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.
1. Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the

sides of the open excavation, and the soil taken as samples from excavated material.

- a) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine grained material is cohesive material. Soil composed primarily of coarse grained sand or gravel is granular material.
 - b) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.
 - c) Observe the side of the open excavation and the surface area adjacent to the excavation. Crack like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.
 - d) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.
 - e) Observe the open side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.
 - f) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.
 - g) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.
2. Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.
- a) Plasticity. Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as 1/8 inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a 2-inch (50 mm) length of 1/8-inch thread can be held on one end without tearing, the soil is cohesive.
 - b) Dry strength. If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be

broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

- c) Thumb penetration. The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a minimum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.
- d) Other strength tests. Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand operated shear vane.
- e) Drying test. The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately 1-inch thick (2.54 cm) and 6 inches (15.24 cm) in diameter until it is thoroughly dry:
 - 1. If the sample develops cracks as it dries, significant fissures are indicated.
 - 2. Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as an unfissured cohesive material, and the unconfined compressive strength should be determined by using the thumb penetration or other test.
 - 3. If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

6) Layered System

- a. A layered system shall be classified in accordance with its weakest layer.
- b. Each layer may be classified individually where a more stable layer lies under a less stable layer.

7) Reclassifying Soils

- a. If, after classifying a soil, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person.
- b. The soil shall be reclassified as necessary to reflect the changed circumstances.

10. Excavation Construction Based on Soil Type

- A. The Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V). Short-term exposure means a period of time less than or equal to 24 hours that an excavation is open. Soil and rock deposits must be classified in accordance with Appendix A to Subpart P of Part 1926. The maximum allowable slope for a soil or rock deposit must be determined from the table provided below.. The actual slope must not be steeper than the maximum allowable slope. The actual slope must be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope must be cut back to an actual slope which is at least horizontal to one vertical (1/2H:1V) less steep than the maximum allowable slope. When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person must determine the degree to which the actual slope must be reduced below the maximum allowable slope, and must assure that such reduction is achieved. Surcharge loads from adjacent structures must be evaluated in accordance with 1926.651(I). Configurations of sloping and benching systems must be in accordance with 29 CFR 1926 Subpart P, Appendix B.

EXCAVATION SLOPE TABLE 2
29 CFR 1926 SUBPART P APPENDIX B
MAXIMUM ALLOWABLE SLOPES

Soil or Rock Type	Maximum Allowable Slopes (H:V)¹ for Excavations Less Than 20 Feet Deep²
Stable Rock	Vertical (90 degrees)
Type A ³	¾:1 (53 degrees)
Type B	1:1 (45 degrees)
Type C	1 ½:1 (34 degrees)

1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
2. Sloping or benching for excavations greater than 20 feet deep must be designed by a Registered Professional Engineer.
3. A short-term maximum allowable slope of 1/2H:1V (63 degrees) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth must be 3/4H:1V (53 degrees).

VII. Waste Management

All equipment including disposal PPE must be disposed of according to State, Local and Client requirements. All equipment will be decontaminated before leaving the site.

VIII. Data Recording and Management

1. The completed Daily / Periodic Excavation Inspection Checklist must be posted at the entrance to the excavation and remain posted for the duration of the entry.
2. The completed Utility Clearance Checklist must be at the site available for review prior to any subsurface soil activities.
3. Copies of the completed checklists must be retained within the project file.
4. Information on the excavation health and safety issues (lessons learned, LPOs, etc.) must be forwarded to Corporate Health and Safety for quality assurance checks and record retention.

IX. Quality Assurance

Implementation of this SOP will be monitored through the use of site inspections, quality audits, and document review.


X. References

Code of Federal Regulations 29 CFR 1926 Subpart P – Excavation



Daily / Periodic Excavation Inspection Checklist

Project Name:	Date / Time:		
Project Number:	Location:		
Prepared By:	Project Manager:		
This checklist must be completed for all excavations. It documents that daily and post-event / periodic inspections are conducted.			
Soil Classified As:	Stable Rock	Type A	Type B Type C
Soil Classified On:	By:		
Type of Protective System in Use:	Sloping	Shoring	Other _____
Description:			
Inspection Item	Yes	No	Comments
Is the underground / overhead utilities checklist completed?			
Are underground installations protected from damage?			
Are adequate means of entry / exit available in the excavation?			
If exposed to traffic, are personnel wearing reflective vests?			
Do barriers exist to prevent equipment from rolling into the excavation?			
Was air monitoring conducted prior to and during excavation entry?			
Was the stability of adjacent structures reviewed by a registered P.E.?			
Are spoil piles at least 2 feet from the excavation edge?			
Is fall protection in use near excavations deeper than 6 feet?			
Are work tasks completed remotely if feasible?			
Is a protective system in place and in good repair?			
Is emergency rescue (lifeline / body harness) equipment used due to potential atmospheric hazard?			
Is excavation exposed to vibration?			
Are employees protected from falling / elevated material?			
Is soil classification adequate for current environmental / weather conditions?			
Do portable ladders extend at least 4 feet above the excavation?			
Are portable ladders or ramps secured in place?			
Have all personnel attended safety meeting on excavation hazards?			
Are support systems for adjacent structures in place?			
Is the excavation free from standing water?			
Is water control and diversion of surface runoff adequate?			
Are employees wearing required protective equipment?			
BBL Excavation Competent Person:		Date/Time:	

		Underground / Overhead Utility Checklist	
Project Name:		Date:	
Project Number:		Location:	
Prepared By:		Project Manager:	
<p>This checklist must be completed for any intrusive subsurface work such as excavation or drilling. It documents that overhead and underground utilities in the work area are identified and located. The Project Manager shall request utility markouts before the start of field operations to allow the client and utility companies sufficient time to provide them. If complete information is not available, a magnetometer or other survey shall be performed to locate obstacles prior to intrusive subsurface activities.</p>			
<p>Procedure: A diagram of the work area depicting the proposed location of intrusive subsurface work sites (i.e., boring locations, excavation locations) must be attached to this form. The diagram must clearly indicate the areas checked for underground structures / utilities, and overhead power lines. This form and the diagram must be signed by the BBL Project Manager (if present), the BBL Site Supervisor, and the client representative.</p>			
Type of Structure	Present	Not Present	Method of Markout
Electric Power Line			
Natural Gas Line			
Telephone Line			
Water Line			
Product Line			
Sewer Line			
Steam Line			
Drain Line			
Underground Tank			
Underground Cable			
Overhead Power Line			
Overhead Product Line			
Other (Specify)			
Reviewed By			
Name		Job Title	Date
		Client Representative	
		BBL Project Manager	
		BBL Site Supervisor	

Attachment L

Confined Space Entry Procedure

Approval Signatures

Prepared by: _____ Date: _____

Reviewed by: _____ Date: _____
(Technical Expert)

Reviewed by: _____ Date: _____
(Editorial Reviewer)

Reviewed by: _____ Date: _____
(Quality Assurance Reviewer)

Approved by: _____ Date: _____
(Project Manager)

Standard Operating Procedure: Confined Space Entry

I. Scope and Application

The Firm is committed to operate in a manner that will protect the health and safety of its employees. Employees of the Firm will abide by applicable local, state, and federal regulations while conducting activities for the Firm. Entry into enclosed or confined areas presents unique hazards to employees of the Firm. To reduce the potential for injury, personnel will avoid entering confined spaces whenever feasible. If entry is required into a confined space, the safety and engineering controls outlined in this procedure must be implemented by authorized personnel prior to entry.

To effectively mitigate or eliminate the hazards presented by entry into confined spaces, this procedure sets forth the accepted practice for confined space entry and establishes the requirement for a Confined Space Entry Permit protocol. This procedure, protocol, and Confined Space Entry Permit and Checklist apply to all employees of the Firm. Only trained and authorized personnel are permitted to enter confined spaces, supervise confined space activities, and perform rescues from confined spaces.

II. Personnel Qualifications

The following outlines the responsibilities of various personnel:

Officers/Division Heads/Project Managers

1. Verify that all confined spaces and entry protocols are properly identified and addressed within the project work plan, project health & safety plan, and/or other project-related documents.
2. Verify that their divisional or project team employees have received the proper confined space training provided by Corporate Health & Safety or qualified training source prior to conducting confined space entry activities.
3. Verify that the proper confined space entry equipment, including personal protective equipment (PPE), atmospheric testing equipment, and safety equipment, is available for use by their divisional employees.
4. Verify that copies of the completed and canceled Entry Permits are properly disseminated to Corporate Health and Safety and retained with the project files, as specified in Section VIII – Data Recording and Management.

Corporate Health & Safety

1. Provide the initial confined space entry training and retraining, or recommend qualified training provider, to all Entry Supervisors, entrants, and attendants.
2. Provide technical assistance regarding confined space entry protocol, atmospheric testing equipment, PPE, hazard assessment, and research information on unusual hazards.

3. Audit project-specific confined space entry for compliance with this SOP.
4. Retain a file of cancelled Confined Space Entry Permits for annual review.
5. Conduct an annual review of this SOP and all cancelled permits.

Entry Supervisors (also see Training and Duties of Entry Supervisor)

1. Interface with the client representative to identify hazards associated with the client's confined space.
2. Review existing confined space data (if any) recorded by the client.
3. Review the client's confined space procedure.
4. Review the lockout/tagout and isolation measures implemented by the client.
5. Immediately report any unusual or unforeseen confined space entry hazard to Corporate Health and Safety prior to authorizing entry.
6. Verify that all tests and precautionary measures identified on the Entry Permit have been performed prior to authorizing the Entry Permit.
7. Offer all entrants an opportunity to review the confined space entry testing results and an opportunity to request a reevaluation of the permit space in the presence of the entrant if the entrant has reason to believe that the evaluation of the space may not have been adequate.
8. Issue, authorize, and post the Entry Permit prior to any confined space entry.
9. Upon completion of the entry covered by the permit, and after all entrants have exited the permit space, cancel the Entry Permit.
10. Verify that copies of the completed and canceled Entry Permits are properly disseminated to Corporate Health and Safety and retained with the project files, as specified in Section VIII – Data Recording and Management.

Employees of the Firm

1. Receive the initial training provided by Corporate Health & Safety or qualified training source.
2. Participate in entry operations only if trained and authorized to do so.
3. Never enter a confined space without an authorized attendant, Entry Supervisor, and a completed Entry Permit.
4. Never attempt entry rescue within a confined space unless trained in entry rescue.
5. If unexpected conditions arise during entry, immediately notify other entrants, evacuate the space and inform the Entry Supervisor.

The following outlines the **training and duties** of various personnel:

Entry Supervisor

1. 29 CFR 1910.146-Permit Required Confined Spaces assigns specific responsibilities to the client (client or owner of the confined space). These responsibilities include communicating pertinent information regarding the hazards associated with their identified confined space(s) to contractor employees who will enter those spaces. In order to verify that the required information regarding the confined space is properly communicated to employees of the Firm and the Entry Supervisor must:
 - a. Investigate the client's permit entry protocol, ensuring that any identified hazards and previous experience with the confined space is properly communicated.
 - b. Coordinate rescue assistance with either the client's in-house rescue team and/or the offsite rescue assistance specified by the client. The offsite rescue assistance specified by the client must have direct rescue experience in the client's identified confined space or be provided an opportunity to examine the space and practice a rescue.
 - c. Verify that the client takes the necessary precautions in notifying their employees that our employees will be entering the confined space.
 - d. Coordinate entry operations with the client's employees when both client and employees of the Firm will be working in or near a permit space.
 - e. Inform the client of this permit space program and any additional precautions that will be taken by employees of the Firm during the entry procedure.
2. In addition to acting as the liaison with the client representative, the Entry Supervisor has the following assigned duties:
 - a. Recognize the hazards involved with the entry, as well as the signs and symptoms of exposure to the hazards.
 - b. Verify that both the Entry Permit and Checklist are completed and required equipment is in use prior to entry.
 - c. Monitor entry operations and verify that they remain consistent with the terms of the Entry Permit and that acceptable entry conditions are maintained.
3. The Entry Supervisor may also function as either the attendant and/or as an entrant; therefore, the Entry Supervisor must have the training specified for an attendant and/or an entrant, and will assume the duties listed below for either the attendant and/or the entrant.

Authorized Entrants

1. Entrants must have training and instruction in their duties and responsibilities regarding confined space entry. The following are assigned duties:

- a. Recognize the hazards which may be faced during entry, as well as the signs and symptoms of exposure to the hazard(s).
- b. Maintain visual contact and/or verbal communications with the attendant at all times.
- c. Use the PPE, air monitoring and testing equipment that has been provided.
- d. Maintain an awareness of all external barriers required to protect from external hazards (e.g., blanking, blocking, lockout) and the proper use of those barriers.
- e. Obey evacuation orders given by the attendant, Entry Supervisor, automatic alarm activation, or when self-perceived.

Attendants

1. An attendant must be stationed and remain stationed outside the permit space at all times during entry operations. The attendant may have no other duties besides those listed in this section.
2. All attendants must have training and instruction in their duties and responsibilities regarding confined space entry. The following are assigned duties:
 - a. Maintain an accurate count of all entrants in the confined space.
 - b. Monitor activities both inside and outside the confined space to verify the continued safety of entrants.
 - c. Maintain visual contact or verbal communication with all entrants in the confined space at all times.
 - d. Order evacuation of the confined space if an uncontrolled hazard develops, either within or outside the confined space, or upon observing a behavioral effect of hazard exposure among entrants.
 - e. Warn unauthorized persons away from the confined space.
 - f. Participate in non-entry rescue.
 - g. Summon rescue and other emergency services.
4. Attendants must maintain current certification in basic first aid and cardiopulmonary resuscitation (CPR).
5. Under no circumstances should the attendant attempt rescue of entrants by entering the confined space.

Training Certification

1. Training provided to the Entry Supervisor, attendant, and entrant must be certified by the Firm. Such training certification will be provided by Corporate Health & Safety.
2. Documentation of training certification received by attendance at an outside training course must be provided to Corporate Health & Safety.

III. Equipment List

Confined space entry may require a variety of equipment including, but not limited to the following:

- Signs, barricades or other devices to control access to the confined space
- Energy control devices as specified by the Lockout / Tagout (LOTO) Control of Hazardous Energy SOP
- Entry device – ladder, tripod and winch, harness or other mechanism to allow safe entry and non-entry rescue
- Safety equipment – fire extinguishers, lights, cooling vests
- Ventilation equipment – fans, blowers or other methods to maintain safe atmospheric conditions within the space
- Air monitoring – meters to measure the air quality, at a minimum confined space entry meters will be able to measure oxygen, lower explosive limit (LEL), hydrogen sulfide (H₂S) and Carbon monoxide (CO)
- Personal Protective Equipment – as specified by the permit and the PPE SOP

All equipment must be appropriate for the activities of the entry and be approved or certified as specified by regulatory requirements.

IV. Cautions

Confined space entry is an extremely hazardous task, only trained, qualified employees will work in confined space according to the procedures of this SOP.

V. Health and Safety Considerations

Outside Rescue Assistance

1. For any project involving a confined space entry, the Entry Supervisor must address rescue coordination efforts. Such rescue assistance must be coordinated with either the client's designated confined space rescue team and/or with a local emergency response team. If local confined space rescue services are used they must be offered an opportunity to inspect the confined space prior to initiating the entry. Documentation of this offer must be maintained by the confined space entry supervisor.
2. Confined space entry shall progress only after proper notification of outside rescue assistance prior to the actual entry activity.
3. An adequate means of communication (e.g., cellular telephone for contacting offsite emergency assistance, air horn, or two-way radio for summoning a client's rescue team) must be immediately available to the attendant.

VI. Procedure

Definitions

1. Attendant - a trained authorized individual stationed outside the confined space whose sole duty is to monitor authorized entrants inside the confined space.

2. Confined Space - any enclosed space which is large enough and so configured that an employee can bodily enter and perform work, has limited or restricted means for entry or exit, and is not intended for continuous employee occupancy. Confined spaces include, but are not limited to, storage tanks, vessels, pits, boilers, flues, manholes, ventilation system ductwork, sewers, vaults, pipelines, silos, storage hoppers, diked areas, and wells greater than 4 feet deep.
 - a. Permit-Required Confined Space (Permit Space) - a confined space that has one or more of the following characteristics:
 - 1) Contains or has a known potential to contain a hazardous atmosphere;
 - 2) Contains a material with the potential for engulfment of an entrant;
 - 3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or a floor which slopes downward and tapers to a smaller cross-section; and/or
 - 4) Contains any recognized safety or health hazard capable of causing injury or death.
 - b. Non-Permit Confined Space - a confined space that does not contain or have the potential to contain any hazards capable of causing death or serious physical harm.
3. Entry - the act by which an employee intentionally passes through an opening into a permit-required confined space. Entry is considered to have occurred as soon as any part of the employee's body breaks the plane of the opening into the space.
4. Entry Permit - the document which defines the conditions of confined space entry, the reasons for entering the confined space, the anticipated hazards of the entry, a listing of atmospheric monitoring equipment, and acceptable atmospheric conditions. The Entry Permit identifies the rescue and other contacts which must be summoned in the case of an emergency, provides a listing of authorized attendants and entrants, the date of entry to the confined space, and the expiration of the Entry Permit. For the purposes of this SOP, the Confined Space Entry Permit consists of the Confined Space Entry Permit and the Confined Space Entry Checklist and/or the Confined Space Entry Permit and the Sewer System Manhole Entry Checklist (copies of the Confined Space Entry Permit and Checklist follow this procedure). Entry permits must be re-issued at the beginning of each shift.
5. Entry Supervisor - the trained, authorized employee responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry. The Entry Supervisor may also serve as an authorized attendant.
6. Entrant - an employee who is trained and authorized to enter a confined space.
7. Hazardous Atmosphere - an atmosphere which exposes employees to a risk of death, incapacitation, injury, or acute illness from one or more of the following:
 - a. An atmospheric concentration of any substance in excess of 50% of its established permissible exposure limit (PEL); or in the absence of a PEL, its assigned threshold limit value (TLV) or other value listed on the Material Safety Data Sheet (MSDS) for the chemical constituent;
 - b. A flammable gas, vapor, or mist in excess of 10% of its lower explosive limit (LEL);

- c. An airborne combustible dust at a concentration that obscures vision at a distance of 5 feet or less;
 - d. An atmospheric oxygen concentration below 19.5% (oxygen-deficient atmosphere) or above 23.5% (oxygen-enriched atmosphere); and/or
 - e. An atmosphere which is immediately dangerous to life and health.
8. Immediately Dangerous to Life and Health (IDLH) - any condition which poses an immediate threat to loss of life; may result in irreversible or immediate-severe health effects; may result in eye damage, irritation, or other conditions which could impair escape from the confined space.
9. Isolation - removing equipment/systems in and around the space from service. This includes lockout and tagout, double blanking and bleeding, disconnecting, and securing or restraining equipment.

VII. Waste Management

All equipment including disposal PPE must be disposed of according to State, Local and Client requirements. All equipment will be decontaminated before leaving the site.

VIII. Data Recording and Management

- A. The Entry Permit(s) must be initially posted at the entrance to the confined space and remain posted for the duration of the entry. All permits must be weather-protected to maintain integrity.
- B. The original, canceled Entry Permit(s) must be retained within the project file.
- C. Copies of the canceled Entry Permit(s) and information on the confined space entry (lessons learned, LPOs, etc.) must be forwarded to Corporate Health and Safety for quality assurance checks and record retention.

IX. Quality Assurance

Entry Permit Program

- 1. Prior to authorizing the Entry Permit, the Entry Supervisor must verify that the confined space has been properly isolated, ventilated, and tested, and that the Confined Space Checklist or Sewer System Manhole Entry Checklist is completed. In completing the appropriate Checklist, the following items are required:
 - a. All mechanical apparatus (such as agitators) within or connected to the confined space must be de-energized, locked-out, and tagged as per BBL's LOTO SOP. This specific activity may be performed by the client; therefore, the Entry Supervisor must review the lockout procedure with the client and place a separate lock(s) on all multiple lockout devices. The Entry Supervisor must retain possession of the key(s) during the entire confined space entry.
 - b. All lines connected to the confined space where the nature of the service could present a hazard, such as nitrogen, steam, solvent, acid, or hot water, must be isolated from the confined space. Acceptable isolation methods include removing a valve, spool piece, or expansion joint, and blanking or capping

the opened end; inserting a suitable full-pressure blank in the piping between connecting flanges; and/or closing and locking at least two valves in the pipeline and locking open to atmosphere a chain valve between the two closed and locked valves. As in #1 above, this activity may be performed by the client. The Entry Supervisor must review the isolation/blanking and lockout procedure with the client. The Entry Supervisor must attach separate lock(s) to any lockout device installed. The Entry Supervisor must retain possession of the key(s) during the entire confined space entry.

- c. All electrical equipment in and around the confined space must be de-energized and locked out.
 - d. For confined spaces which have contained a known hazardous chemical (e.g., vessels, storage tanks), the client and entry supervisor must verify that the vessel has been thoroughly cleaned by appropriate means, e.g., overflowing with water, steaming, etc.
 - e. For confined spaces containing known atmospheric hazards, mechanical ventilation may be utilized to maintain atmospheric hazards within permit parameters. Section 11 - Mechanical Ventilation, lists the procedure for confined space ventilation.
 - f. The atmosphere of the confined space must be initially checked to verify that it contains an acceptable level of oxygen (19.5 to 23.5%) and is free of combustible or toxic gases or vapors. The Atmospheric Testing Section, of this procedure lists the air quality specifications which must be met. These specifications are also listed on the Entry Permit. Continuous air monitoring may be required depending on the nature of the confined space, as well as the activity(ies) to be conducted within the confined space.
 - g. Verify that all necessary entry equipment (e.g., retrieval lines, PPE, respiratory protective equipment) are available, in good condition, and functional.
 - h. Verify that all entrants and attendants have received the appropriate confined space entry training.
 - i. Verify that all rescue arrangements are in-place as per Section V - Outside Rescue Assistance, and that an adequate means of communicating with outside assistance is immediately available to the attendant.
2. The Entry Permit must be canceled and all entrants ordered to evacuate the confined space when any one of the following conditions arises:
- a. A change in initial atmospheric conditions which may jeopardize the continued health and safety of entrants is detected.
 - b. The attendant must leave the work station.
 - c. The attendant is called on to perform duties which do not allow him/her to fulfill his/her duties as an attendant.
 - d. Whenever ordered by the attendant due to factors external to the confined space which may jeopardize the continued safety and health of entrants.
 - e. At the end of the work shift and/or whenever a different group of entrants and attendants will take charge of the confined space.

- f. Whenever entrants self-perceive danger and self-initiate evacuation.
- g. At the termination of confined space entry.
- h. At the end of the work shift in which the entry occurs.

Confined Space Entry Permit

1. Prior to entry into any identified confined space, the Entry Supervisor must complete and sign the Entry Permit as defined above.
2. A separate Entry Permit must be generated for each confined space.
3. A single Entry Permit may be generated for entry into multiple sewer system manholes in a continuous sewer system.

The Confined Space Checklist and/or the Sewer System Manhole Entry Checklist must be completed, signed, and attached as part of the Entry Permit. As an example, for entry into several separate manholes for the purpose of collecting effluent samples, recording water depth, flow, etc., one Entry Permit may be generated for entry into all project-specific manholes. The permit must, however, be accompanied by the Sewer System Manhole Entry Checklist which will facilitate entry into as many as 20 manholes per checklist.

4. The completed and signed Entry Permit and Checklist is valid for one shift only. A new completed and signed Entry Permit must be issued for each new crew of entrants and attendants.
5. All entrants must be evacuated and the Entry Permit must be revoked whenever conditions in the space are no longer acceptable as indicated by the direct reading instruments being used to monitor atmospheric conditions in the confined space, or some other circumstance either within or outside the confined space.

Atmospheric Testing

1. All confined spaces will be tested for atmospheric hazards as follows:
 - a. Each confined space will initially be tested prior to the Entry Supervisor authorizing entry.
 - b. Each confined space will also be tested continuously or at intervals as specified by the Entry Supervisor.
2. The Entry Supervisor will select continuous or interval monitoring and specify length of the interval to be implemented during entry. Selection of continuous or interval monitoring will be based on the nature of the confined space hazards present in the permit space, activity during entry, and potential for hazards developing in the confined space.
3. All confined spaces must be tested for atmospheric hazards prior to each entry and as entry proceeds. **The following are the testing sequence and acceptable air quality criteria:**
 - a. Oxygen content for all confined space entry must be 19.5 to 23.5%.

- b. Combustible gas or vapor must not exceed 10% of its LEL.
 - c. Toxic gas or vapor must not exceed 50% of the PEL or other published exposure guideline.
 - d. Carbon monoxide must not exceed 20 ppm.
 - e. Hydrogen sulfide must not exceed 5 ppm.
4. If it is necessary to enter a confined space where any of the following atmospheric conditions exist, all entrants must wear either a NIOSH approved self-contained breathing apparatus (SCBA) of at least 60-minute duration or an air line respirator with emergency SCBA:
- a. Initial atmospheric testing indicates conditions outside the parameters listed on the Entry Permit;
 - b. Initial atmospheric testing indicates conditions within permit parameters, but where the quality of the atmosphere remains questionable; and/or
 - c. Despite initial atmospheric testing results, activities to be performed while in the confined space would endanger entrants by creating a sudden change in atmospheric conditions within the space.
 - d. Mechanical ventilation will not maintain atmospheric hazards within permit limits.
5. Under no circumstances is entry into a confined space having an IDLH condition (less than 19.5% oxygen or >10% LEL) permitted by any employee of the Firm.
6. Results of all atmospheric testing must be recorded on the Confined Space Entry Permit.

Mechanical Ventilation

- 1. Mechanical ventilation may be utilized to maintain confined space atmospheric hazards within entry limits.
- 2. Ventilation can be used to force clean air into a confined space or to remove contaminated air from the confined space.
- 3. Ventilation systems must be set up to adequately ventilate all areas of the confined space.
- 4. Ventilation systems must be locked in the “on” position. The confined space must be evacuated if the system fails.
- 5. Continuous air monitoring must be implemented when ventilation is utilized to maintain atmospheric hazards within entry permit limits.
- 6. Air intake must be positioned to prevent the introduction of air contamination into the confined space (e.g., away from vehicle exhaust, tank vents).

Work Practices

1. All entrants must wear a retrieval line secured on one end to the entrant by a full-body harness, or parachute harness, and the end secured outside the space. For vertical-entry confined spaces, the lifeline must be secured to a lifting or other mechanical retrieval device. Reliance on manually lifting an entrant from a vertical confined space is prohibited. If more than one entrant is entering the space, each line shall be clearly marked to identify the entrant and the mechanical retrieval system must be rated for multiple entrant use.
2. Where mechanical ventilation will be relied on for eliminating an actual or potential hazardous atmosphere, the atmosphere of the space must be continually monitored to verify that the continuous forced air ventilation is preventing the generation or accumulation of a hazardous atmosphere.
3. Whenever a ladder is required for confined space entry, the ladder must be secured and not withdrawn while anyone remains within the confined space, except as necessary to permit extraction during rescue.
4. Adequate illumination must be provided for all confined space entry. An approved type (explosion-proof) lighting device must be used.
5. All electrical equipment used within a confined space must be explosion-proof and must be inspected prior to use to verify good working condition. The equipment must utilize a ground fault interrupt and/or be properly grounded.
6. Whenever the confined space is structured such that visual contact cannot be maintained between entrants and the attendant, intrinsically-safe, two-way radios must be utilized to maintain continuous contact between entrants and attendants.
7. All confined spaces must be isolated prior to entry.
8. Prior to opening or removing lids, covers, access doors, or hatches of a confined space, precautions must be taken to determine if it is safe to do so.
9. Whenever entering manholes or other confined spaces with permanent ladders, all rungs must be inspected to verify they are in safe and useable condition.
10. When working in a vertical confined space, precautions must be taken to prevent equipment and personnel from falling into the confined space opening. Tools should be lowered and removed from the space using a basket or sling to prevent falls and falling objects.

X. References

Code of Federal Regulations 1910.146 – Permit Required Confined Space Entry

Attachment M

Confined Space Entry Checklist



Confined Space Entry Checklist

Permit #: _____ **ALL COPIES OF PERMIT MUST REMAIN AT**

Project: _____ **JOB SITE UNTIL THE ENTRY IS COMPLETE**

Location and Description of Confined Space:

Checklist	YES	NO	N/A	COMMENT
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: _____

Time of Reading	Confined Space Air Monitoring Parameters			
	% Oxygen>19.5%	% LEL <10%	CO <20 ppm	Other
Pre-Entry				

Entry Supervisor _____
Print Name


Signature _____ Date _____ Time _____

Air Monitor _____
Print Name

Signature _____ Date _____ Time _____

Attachment N

Confined Space Entry Permit

		Confined Space Entry Permit	
Project Name:		Date / Time:	
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 ₂ S			
CO			
Other:			
Other:			
Entrants and Attendants			
Number of Entrants:		Number of Attendants:	
Names of Entrants		Names of Attendants	
Entry Supervisor Authorizing Confined Space Entry Permit			
Print:		Date:	Time:
Signature:		Date:	Time:
Entry Supervisor Canceling Confined Space Entry Permit			
Print:		Date:	Time:
Signature:		Date:	Time:

Attachment O

Material Safety Data Sheets

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

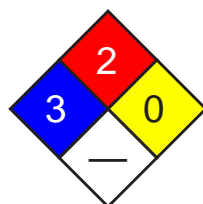
61

Material Name: Aniline **CAS Number:** 62-53-3
Chemical Formula: C₆H₇N
Structural Chemical Formula: C₆H₅NH₂
EINECS Number: 200-539-3
ACX Number: X1001517-5
Synonyms: AMINO BENZENE; AMINOPHEN; ANILIN; ANILINA; ANILINE; ANILINE AND HOMOLOGS; ANILINE OIL; ANILINE OIL, LIQUID; ANYVIM; ARYLAMINE; BENZENAMINE; BENZENE, AMINO; BENZENE, AMINO-; BENZIDAM; BLUE OIL; C.I. 76000; C.I. OXIDATION BASE 1; CYANOL; EPA PESTICIDE CHEMICAL CODE 251400; HUILE D'ANILINE; KRYSTALLIN; KYANOL; PHENYLAMINE
General Use: In the manufacture of dyestuffs and dyestuff intermediates, plastics, resins, photographic developers, pharmaceuticals, antioxidants, varnishes, perfumes, shoe blacks (rubber accelerator and in vulcanizing rubber), isocyanates, explosives, phenolics, herbicides and pesticides.
 A solvent in organic synthesis.

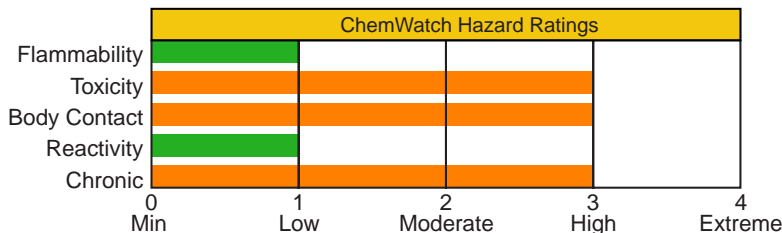
Section 2 - Composition / Information on Ingredients

Name	CAS	%
aniline	62-53-3	>99
OSHA PEL TWA: 5 ppm; 19 mg/m ³ ; skin.	NIOSH REL	DFG (Germany) MAK TWA: 2 ppm; PEAK: 4 ppm; skin.
ACGIH TLV TWA: 2 ppm; skin.	IDLH Level 100 ppm.	

Section 3 - Hazards Identification



Fire Diamond



HMIS	
3	Health
2	Flammability
0	Reactivity

ANSI Signal Word

Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, blue/brownish liquid; amine-like odor. Irritating to eyes/skin/respiratory tract. Toxic. Other Acute Effects: methemoglobinemia, CNS effects, dermatitis. Chronic Effects: anemia, energy loss, headache, digestive disturbances. Combustible.

Potential Health Effects

Target Organs: eyes, skin, blood, liver, kidneys, central nervous system (CNS), cardiovascular system

Primary Entry Routes: eyes, skin contact/absorption, inhalation

Acute Effects

Inhalation: The vapor/mist is highly toxic and inhalation may cause loss of consciousness.

The material presents a hazard from a single acute exposure and from repeated exposures over long periods.

Symptoms of exposure may include coughing, wheezing and laryngitis.

Atmospheric levels of 7 ppm may present a serious hazard. The symptoms of acute exposure include vertigo, headache, mental confusion, weakness, dizziness, nausea and cyanosis (blue lips, nose and earlobes). These effects are due to methemoglobinemia (aniline metabolites react with the red blood cells to reduce oxygen carrying capacity).

Occupational aniline poisoning was at one time relatively common with deaths arising from asphyxiation.

Eye: The liquid is extremely discomforting to the eyes and is capable of causing severe damage with loss of sight.

The vapor is highly discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid is discomforting to the skin, it is rapidly absorbed and is capable of causing allergic skin reactions. Sensitization may result in allergic dermatitis responses including rash, itching, hives or swelling of extremities.

Toxic effects may result from skin absorption.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: The material is toxic and may be fatal if swallowed.

Considered an unlikely route of entry in commercial/industrial environments.

The mean lethal dose may be between 15 and 30 grams. Tissue hypoxia due to methemoglobin formation may produce central nervous system and cardiac effects. Symptoms include severe headache, nausea, vomiting, chest and abdominal pains and dryness of the throat. Central nervous system effects include confusion, irritability, ataxia, vertigo, faintness, tinnitus, weakness, disorientation, lethargy, numbness of the extremities, joint pains, drowsiness, delirium, coma and unconsciousness. Photophobia and weakness of vision and sluggish pupillary reaction may also occur.

Cardiac effects may include heart blocks, slow pulse and shock. Urinary effects and symptoms include painful micturition, hematuria, hemoglobinuria and methemoglobinuria, oliguria, mild renal insufficiency and jaundice.

Death may be due to cardiovascular collapse. Late hemolytic episodes may present up to 8 days after ingestion.

The substance and/or its metabolites may bind to hemoglobin inhibiting normal uptake of oxygen. This condition, known as "methemoglobinemia", is a form of oxygen starvation (anoxia). Symptoms include cyanosis (a bluish discoloration to skin and mucous membranes) and breathing difficulties. Symptoms may not be evident until several hours after exposure. At about 15% concentration of blood methemoglobin there is observable cyanosis of the lips, nose and earlobes. Symptoms may be absent although euphoria, flushed face and headache are commonly experienced. At 25-40%, cyanosis is marked but little disability occurs other than that produced on physical exertion.

At 40-60%, symptoms include weakness, dizziness, lightheadedness, increasingly severe headache, ataxia, rapid shallow respiration, drowsiness, nausea, vomiting, confusion, lethargy and stupor. Above 60% symptoms include dyspnea, respiratory depression, tachycardia or bradycardia, and convulsions. Levels exceeding 70% may be fatal.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Class B, Justifiably suspected of having carcinogenic potential.

Chronic Effects: Chronic exposure may result in anemia, anorexia, weight loss and has been reported to produce red blood cell damage. Kidney and liver damage has been reported in test animals. Chronic poisoning in humans is said to be due to central nervous system symptoms but this observation is contested by some authorities.

Repeated or prolonged contact may cause conjunctivitis and photophobia.

Aniline may also cause a brownish discoloration of the conjunctiva and cornea in the palpebral fissure.

Prolonged exposures to aniline produced hemolysis of red blood cells, and stimulation of bone marrow. Jaundice may also be present. The urine may be dark or wine colored.

beta-Naphthylamine, a contaminant of commercial aniline is a potent carcinogen capable of producing papilloma in the bladder wall.

WARNING! - Avoid exposure of pregnant women to this substance, it may have adverse effects on embryo or fetus.

In male rats several types of mesenchymal tumors, primarily of the spleen have been associated with administration of the compound.

Most arylamines are powerful hemopoietic poisons producing methemoglobinemia in humans. High chronic doses cause splenic congestion and in turn sarcoma formation. Single ring aromatic amines are relatively weak carcinogens requiring large doses to produce any effect in animal experiments. The polycyclic aromatic amines exhibit a wide range of carcinogenic activity which appear, in part, to be dependent on the position on which benzene rings are substituted and the nature of the substituent.

Section 4 - First Aid Measures

Inhalation: Remove quickly from contaminated area. Apply artificial respiration if not breathing.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids. Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately flush body and clothes with large amounts of water, using safety shower if available. Quickly remove all contaminated clothing, including footwear.

Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor.

Ingestion: Contact a Poison Control Center. If more than 15 minutes from a hospital, induce vomiting, preferably using Ipecac Syrup APF. Note: DO NOT INDUCE VOMITING in an unconscious person.

After first aid, get appropriate in-plant, paramedic, or community medical support.

See
DOT
ERG

Note to Physicians: The material may induce methemoglobinemia following exposure.

1. Initial attention should be directed at oxygen delivery and assisted ventilation if necessary. Hyperbaric oxygen has not demonstrated substantial benefits.
2. Hypotension should respond to Trendelenburg's position and intravenous fluids; otherwise dopamine may be needed.
3. Symptomatic patients with methemoglobin levels over 30% should receive methylene blue. (Cyanosis alone is not an indication for treatment).

The usual dose is 1-2 mg/kg of a 1% solution (10 mg/mL) IV over 50 minutes; repeat, using the same dose, if symptoms of hypoxia fail to subside within 1 hour.

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

<u>Determinant</u>	<u>Index</u>	<u>Sampling Time</u>	<u>Comments</u>
Methemoglobin in blood	1.5% of hemoglobin	During or end of shift	B,NS,SQ

B: Background levels occur in specimens collected from subjects NOT exposed

NS: Non-specific determinant; also observed after exposure to other materials

SQ: Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.

Preplacement and annual medical examinations with emphasis on blood (methemoglobin), kidneys, liver, and cardiovascular system should be undertaken. Medical surveillance of aniline exposed workers should include periodic complete blood analysis.

Section 5 - Fire-Fighting Measures

Flash Point: 70 °C Closed Cup

Autoignition Temperature: 615 °C

LEL: 1.3% v/v

UEL: 25% v/v

Extinguishing Media: Water spray or fog; alcohol stable foam.

Dry chemical powder.

Carbon dioxide.

General Fire Hazards/Hazardous Combustion Products: Combustible liquid. Moderate fire hazard when exposed to heat, flame or oxidizers.

Decomposes on heating and produces toxic fumes of carbon monoxide (CO) and nitrogen oxides (NO_x).

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

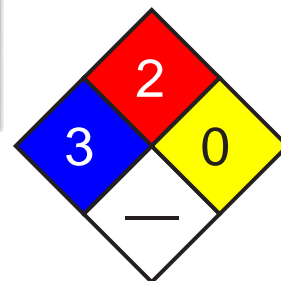
Environmental hazard - contain spillage.

Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Environmental hazard - contain spillage. Clean up all spills immediately.

Wear protective clothing, impervious gloves and safety glasses.

Avoid breathing vapors and contact with skin and eyes.

Wipe up and absorb small quantities with vermiculite or other absorbent material.

Place in suitable containers for disposal.

Large Spills: Pollutant - contain spillage. Advise emergency services.

Clear area of personnel and move upwind.

Increase ventilation.

Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways.

Stop leak if safe to do so.

Contain and absorb spill with sand, earth, inert material or vermiculite.

Collect and seal in labeled drums for disposal.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: Avoid breathing vapors and contact with skin and eyes. Keep containers securely sealed when not in use.

Prevent concentration in hollows and sumps. DO NOT enter confined spaces until atmosphere has been checked.

Avoid contact with incompatible materials.

When handling, DO NOT eat, drink or smoke.

Wash hands with soap and water after handling.

Work clothes should be laundered separately: NOT at home.

Recommended Storage Methods: Check that containers are clearly labeled. Glass container.

Plastic container.

Metal can.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Local exhaust ventilation usually required.

If risk of overexposure exists, wear NIOSH-approved respirator.

Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.

Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment:

Eyes: Chemical goggles. Full face shield.

DO NOT wear contact lenses.

Eyewash unit.

Hands/Feet: Butyl rubber gloves.

Respiratory Protection:

Exposure Range >5 to <100 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face

Exposure Range 100 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Other: Impervious protective clothing/Rubber apron.

Ensure there is ready access to a safety shower.

Glove Selection Index:

BUTYL Best selection

BUTYL/NEOPRENE Best selection

NEOPRENE/NATURAL..... Best selection

NITRILE+PVC Best selection

PE/EVAL/PE Best selection

SARANEX-23 Best selection

VITON/NEOPRENE Best selection

PVA Best selection

TEFLON Best selection

PVC..... Satisfactory; may degrade after 4 hours continuous immersion

NEOPRENE..... Satisfactory; may degrade after 4 hours continuous immersion

NATURAL RUBBER..... Satisfactory; may degrade after 4 hours continuous immersion

NITRILE..... Satisfactory; may degrade after 4 hours continuous immersion

NATURAL+NEOPRENE..... Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: A clear, colorless to light yellow, oily volatile liquid with a characteristic amine odor (unpleasant fishy odor). The liquid darkens on exposure to air and light, becoming dark brown in color. Soluble in alcohol, ether, acetone, benzene, ligroin, chloroform, organic solvents. Viscosity is 44.7 mPa sec at 20 °C.

Physical State: Liquid

pH: Not applicable

Odor Threshold: Recognition 1 ppm

pH (1% Solution): ~8 (2%)

Vapor Pressure (kPa): 2.0 at 25 °C

Boiling Point: 184 °C (363 °F) to 186 °C (367 °F)

Vapor Density (Air=1): 3.2

Freezing/Melting Point: -6.3 °C (20.66 °F)

Formula Weight: 93.13

Volatile Component (% Vol): 100

Specific Gravity (H₂O=1, at 4 °C): 1.02 at 20 °C

Water Solubility: 4% by weight

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Stable under normal storage conditions. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with oxidizers. Avoid reaction with albumin, acids, alkalies, amines, halocarbons and solutions of iron, zinc and aluminum.

Aniline may react violently with acids, boron trichloride, diisopropyl peroxycarbonate, N-haloimide, hexachloromelamine, peroxyformic acid, chloropicrin.
 May react explosively with benzyldiazonium-2-carboxylate, dibenzoyl peroxide, epichlorohydrin, fluorine nitrate, hydrogen peroxide, nitromethane, perchloric acid and formaldehyde, perchloryl fluoride, perchromates, peroxyformic acid peroxysulfuric acid, silver perchlorate, sodium perchlorate.
 May ignite on contact with nitric acid, nitrosyl perchlorate, potassium peroxide, sodium peroxide and water, tetranitromethane.
 Corrodes aluminum and zinc.

Section 11 - Toxicological Information

Toxicity

Oral (rat) LD₅₀: 250 mg/kg
 Oral (human) LD₅₀: 350 mg/kg
 Inhalation (rat) LC₅₀: 250 ppm/4h
 Dermal (rat) LD₅₀: 1400 mg/kg
 Exposure to the material for prolonged periods may cause physical defects in the developing embryo (teratogenesis).

Irritation

Skin (rabbit): 500mg/24 hr-moderate
 Eye (rabbit): 102 mg - SEVERE
 Eye (rabbit): 20 mg/24 hr-moderate

See RTECS BW 6650000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released into water it will primarily be lost due to biodegradation and in surface waters, photooxidation (half-life of the order of days). It will not bioconcentrate in fish. If spilled on land it will be lost by a combination of biodegradation, oxidation and chemical binding to components of soil. If released into air, it will photodegrade (estimated half-life 3.3 hr).

Ecotoxicity: LC₅₀ Daphnia pulex 0.10 mg/l/48 hr. /Conditions of bioassay not specified; LC₅₀ Bass (8 exposure days beyond hatching) 4.4 mg/l in water hardness of CaCO₃ 200 mg/l. /Conditions of bioassay not specified; LC₅₀ Ambystoma mexicanum (mexican axolotl); (3-4 weeks after hatching) 440 mg/l/48 hr. /Conditions of bioassay not specified; LC₅₀ Leuciscus idus melanotus (golden orfe) 51-92 mg/l/48 hr. /Conditions of bioassay not specified; LC₁₀₀ Tetrahymena pyriformis (protozoa: ciliate) 21.5 mmol/l/24 hr. /Conditions of bioassay not specified

Henry's Law Constant: calculated at 1.2×10^{-4}

BCF: fish 0.78

Biochemical Oxygen Demand (BOD): 150%, 5 days

Octanol/Water Partition Coefficient: log K_{ow} = 0.90

Soil Sorption Partition Coefficient: K_{oc} = 130 to 410

Section 13 - Disposal Considerations

Disposal: DO NOT discharge into sewer or waterways. Recycle wherever possible.

Bury or incinerate residue at an approved site.

Follow applicable federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Aniline

ID: UN1547

Hazard Class: 6.1 - Poisonous materials

Packing Group: II - Medium Danger

Symbols: + - Override definitions

Label Codes: 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*

Special Provisions: IB2, T7, TP2

Packaging: Exceptions: None **Non-bulk:** 202 **Bulk:** 243

Quantity Limitations: Passenger aircraft/rail: 5 L **Cargo aircraft only:** 60 L

Vessel Stowage: Location: A **Other:** 40



Section 15 - Regulatory Information**EPA Regulations:****RCRA 40 CFR:** Listed U012 Toxic Waste, Ignitable Waste**CERCLA 40 CFR 302.4:** Listed per CWA Section 311(b)(4), per RCRA Section 3001 5000 lb (2268 kg)**SARA 40 CFR 372.65:** Listed**SARA EHS 40 CFR 355:** Listed**RQ:** 5000 lb**TPQ:** 1000 lb**TSCA:** Listed**Section 16 - Other Information**

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Benzene

CAS Number: 71-43-2

Chemical Formula: C₆H₆

Structural Chemical Formula: C₆H₆

EINECS Number: 200-753-7

ACX Number: X1001488-9

Synonyms: Benzene; BENZENE; (6)ANNULENE; BENZEEN; BENZEN; BENZIN; BENZINE; BENZOL; BENZOL 90; BENZOLE; BENZOLENE; BENZOLO; BICARBURET OF HYDROGEN; CARBON OIL; COAL NAPHTHA; CYCLOHEXATRIENE; EPA PESTICIDE CHEMICAL CODE 008801; FENZEN; MINERAL NAPHTHA; MOTOR BENZOL; NITRATION BENZENE; PHENE; PHENYL HYDRIDE; POLYSTREAM; PYROBENZOL; PYROBENZOLE

General Use: Manufacture of chemicals including styrene, dyes, and many other organic chemicals. Has been used in artificial leather, linoleum, oil cloth, airplane dopes, lacquers; as solvent for waxes, resins, oils etc.

May also be a minor component of gasoline, petrol.

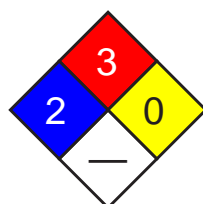
Exposure should be minimized by use in closed systems.

Handling procedures and control measures should be evaluated for exposure before commencement of use in plant operations.

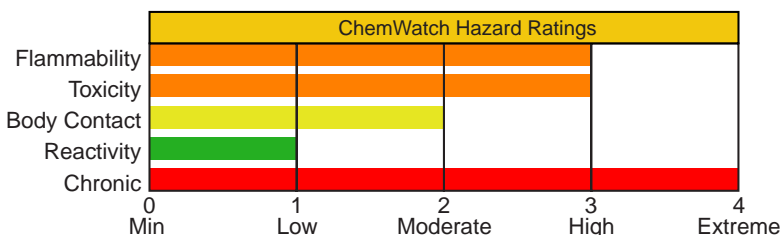
Section 2 - Composition / Information on Ingredients

Name	CAS	%
benzene	71-43-2	99.9
OSHA PEL TWA: 1 ppm; STEL: 5 ppm.	NIOSH REL TWA: 0.1 ppm; STEL: 1 ppm.	DFG (Germany) MAK Skin.
ACGIH TLV TWA: 0.5 ppm; STEL: 2.5 ppm; skin.	IDLH Level 500 ppm.	
EU OEL TWA: 1 ppm.		

Section 3 - Hazards Identification



Fire Diamond



ANSI Signal Word

Danger!

HMIS
③ Health
③ Flammability
① Reactivity



Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sweet odor. Irritating to eyes/skin/respiratory tract. Toxic. Other Acute Effects: headache, dizziness, drowsiness. Absorbed through skin. Chronic Effects: dermatitis, leukemia, bone marrow damage. Carcinogen. Reproductive effects. Flammable.

Potential Health Effects

Target Organs: blood, central nervous system (CNS), bone marrow, eyes, upper respiratory system, skin

Primary Entry Routes: inhalation, skin contact

Acute Effects

Inhalation: The vapor is discomforting to the upper respiratory tract and lungs and may be harmful if inhaled.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

Inhalation hazard is increased at higher temperatures.

The symptoms of acute exposure to high vapor concentrations include confusion, dizziness, tightening of the leg muscles and pressure over the forehead followed by a period of excitement. If exposure continues the casualty quickly becomes stupefied and lapses into a coma with narcosis.

Effects of inhalation may include nausea, vomiting headache, dizziness, drowsiness, weakness, sometimes preceded by brief periods of exhilaration, or euphoria, irritability, malaise, confusion, ataxia, staggering, weak and rapid pulse, chest pain and tightness with breathlessness, pallor, cyanosis of the lips and fingertips and tinnitus. Severe exposures may produce blurred vision, shallow, rapid breathing, delirium, cardiac arrhythmias, unconsciousness, deep anesthesia, paralysis and coma characterized by motor restlessness, tremors and hyperreflexia (occasionally preceded by convulsions). Polyneuritis and persistent nausea, anorexia, muscular weakness, headache, drowsiness, insomnia and agitation may also occur. Two-three weeks after the exposure, nervous irritability, breathlessness and unsteady gait may still persist; cardiac distress and an unusual discoloration of the skin may be evident for up to four weeks.

Hemotoxicity is not normally a feature of acute exposures although anemia, thrombocytopenia, petechial hemorrhage, and spontaneous internal bleeding have been reported. Fatal exposures may result from asphyxia, central nervous system depression, cardiac and respiratory failure and circulatory collapse; sudden ventricular fibrillation may also be fatal.

Death may be sudden or may be delayed for 24 hours. Central nervous system, respiratory or hemorrhagic complications may occur up to five days after the exposure and may be lethal; pathological findings include respiratory inflammation with edema, and lung hemorrhage, renal congestion, cerebral edema and extensive petechial hemorrhage in the brain, pleurae, pericardium, urinary tract, mucous membrane and skin.

Exposure to toxic levels has also produced chromosome damage.

Eye: The liquid is highly discomforting to the eyes, may be harmful following absorption and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is moderately discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid may produce skin discomfort following prolonged contact.

Defatting and/or drying of the skin may lead to dermatitis. Open cuts, abraded or irritated skin should not be exposed to this material.

Toxic effects may result from skin absorption.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: The liquid is discomforting to the gastrointestinal tract and may be harmful if swallowed.

Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Class 1, Known to be a carcinogen; IARC - Group 1, Carcinogenic to humans; OSHA - Listed as a carcinogen; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class A, Human carcinogen; MAK - Class A1, Capable of inducing malignant tumors as shown by experience with humans.

Chronic Effects: Liquid is an irritant and may cause burning and blistering of skin on prolonged exposure.

Chronic exposure may cause headache, fatigue, loss of appetite and lassitude with incipient blood effects including anemia and blood changes.

Benzene is a myelotoxicant known to suppress bone-marrow cell proliferation and to induce hematologic disorders in humans and animals.

Signs of benzene-induced aplastic anemia include suppression of leukocytes (leukopenia), red cells (anemia), platelets (thrombocytopenia) or all three cell types (pancytopenia). Classic symptoms include weakness, purpura, and hemorrhage. The most significant toxic effect is insidious and often irreversible injury to the blood forming tissue. Leukemia may develop.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

See
DOT
ERG

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:

1. Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.
2. Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases ($pO_2 < 50$ mm Hg or $pCO_2 > 50$ mm Hg) should be intubated.
3. Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
4. A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
5. Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.

Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.

6. Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients. Consider complete blood count. Evaluate history of exposure.

Section 5 - Fire-Fighting Measures

Flash Point: -11 °C Closed Cup

Autoignition Temperature: 562 °C

LEL: 1.3% v/v

UEL: 7.1% v/v

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.

Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.

Severe fire hazard when exposed to heat, flame and/or oxidizers.

Vapor forms an explosive mixture with air.

Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.

Heating may cause expansion/decomposition with violent rupture of containers.

On combustion, may emit toxic fumes of carbon monoxide (CO).

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

Fight fire from a safe distance, with adequate cover.

If safe, switch off electrical equipment until vapor fire hazard removed.

Use water delivered as a fine spray to control fire and cool adjacent area.

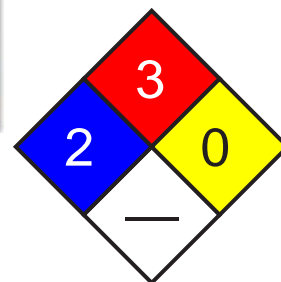
Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.

Equipment should be thoroughly decontaminated after use.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Pollutant - contain spillage. Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

See
DOT
ERG

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
 No smoking, bare lights or ignition sources. Increase ventilation.
 Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
 Use only spark-free shovels and explosion proof equipment.
 Collect recoverable product into labeled containers for recycling.
 Absorb remaining product with sand, earth or vermiculite.
 Collect solid residues and seal in labeled drums for disposal.
 Wash area and prevent runoff into drains.
 If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.
 Wear protective clothing when risk of exposure occurs.
 Use in a well-ventilated area. Prevent concentration in hollows and sumps.
 DO NOT enter confined spaces until atmosphere has been checked.
 Avoid smoking, bare lights, heat or ignition sources.
 When handling, DO NOT eat, drink or smoke.
 Vapor may ignite on pumping or pouring due to static electricity.
 DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
 Avoid contact with incompatible materials.
 Keep containers securely sealed. Avoid physical damage to containers.
 Always wash hands with soap and water after handling.
 Work clothes should be laundered separately.
 Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
 Check all containers are clearly labeled and free from leaks.
Storage Requirements: Store in original containers in approved flame-proof area.
 No smoking, bare lights, heat or ignition sources.
 DO NOT store in pits, depressions, basements or areas where vapors may be trapped. Keep containers securely sealed.
 Store away from incompatible materials in a cool, dry well ventilated area.
 Protect containers against physical damage and check regularly for leaks.
 Observe manufacturer's storing and handling recommendations.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation usually required.
 If risk of overexposure exists, wear NIOSH-approved respirator.
 Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.
 Provide adequate ventilation in warehouse or closed storage area.
Personal Protective Clothing/Equipment:
Eyes: Chemical goggles. Full face shield.
 Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Nitrile gloves; Neoprene gloves.
 Safety footwear.
 Do NOT use this product to clean the skin.
Respiratory Protection:
 Exposure Range >1 to 10 ppm: Air Purifying, Negative Pressure, Half Mask
 Exposure Range >10 to 100 ppm: Air Purifying, Negative Pressure, Full Face
 Exposure Range >100 to 1000 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face
 Exposure Range >1000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
 Cartridge Color: black
Note: must change cartridge at beginning of each shift
Other: Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.
Glove Selection Index:
 PE/EVAL/PE Best selection
 PVA Best selection
 TEFLON Best selection

VITON	Best selection
VITON/NEOPRENE	Best selection
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion
BUTYL	Poor to dangerous choice for other than short-term immersion
NITRILE	Poor to dangerous choice for other than short-term immersion
NEOPRENE.....	Poor to dangerous choice for other than short-term immersion
PVC.....	Poor to dangerous choice for other than short-term immersion
NATURAL RUBBER.....	Poor to dangerous choice for other than short-term immersion
BUTYL/NEOPRENE	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, highly flammable liquid; floats on water. Characteristic aromatic odor. Highly volatile. Mixes with alcohol, chloroform, ether, carbon disulfide, carbon tetrachloride, glacial acetic acid, acetone and oils.

Physical State: Liquid

pH: Not applicable

Odor Threshold: 4.68 ppm

pH (1% Solution): Not applicable.

Vapor Pressure (kPa): 9.95 at 20 °C

Boiling Point: 80.1 °C (176 °F)

Vapor Density (Air=1): 2.77

Freezing/Melting Point: 5.5 °C (41.9 °F)

Formula Weight: 78.12

Volatile Component (% Vol): 100

Specific Gravity (H₂O=1, at 4 °C): 0.879 at 20 °C

Water Solubility: 0.18 g/100 g of water at 25 °C

Evaporation Rate: Fast

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid reaction with oxidizing agents.

Section 11 - Toxicological Information

Toxicity

Oral (man) LD₅₀: 50 mg/kg

Oral (rat) LD₅₀: 930 mg/kg

Inhalation (rat) LC₅₀: 10000 ppm/7h

Inhalation (human) LC₅₀: 2000 ppm/5m

Inhalation (man) TC_{Lo}: 150 ppm/1y - I

Inhalation (human) TC_{Lo}: 100 ppm

Reproductive effector in rats

Irritation

Skin (rabbit): 20 mg/24 hr - mod

Eye (rabbit): 2 mg/24 hr - SEVERE

See RTECS CY 1400000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be subject to rapid volatilization near the surface and that which does not evaporate will be highly to very highly mobile in the soil and may leach to groundwater. It may be subject to biodegradation based on reported biodegradation of 24% and 47% of the initial 20 ppm in a base-rich para-brownish soil in 1 and 10 weeks, respectively. It may be subject to biodegradation in shallow, aerobic groundwaters, but probably not under anaerobic conditions. If released to water, it will be subject to rapid volatilization; the half-life for evaporation in a wind-wave tank with a moderate wind speed of 7.09 m/sec was 5.23 hours; the estimated half-life for volatilization from a model river one meter deep flowing 1 m/sec with a wind velocity of 3 m/sec is estimated to be 2.7 hours at 20 °C. It will not be expected to significantly adsorb to sediment, bioconcentrate in aquatic organisms or hydrolyze. It may be subject to biodegradation based on a reported biodegradation half-life of 16 days in an aerobic river die-away test. In a marine ecosystem biodegradation occurred in 2 days after an acclimation period of 2 days and 2 weeks in the summer and spring, respectively, whereas no degradation occurred in winter. According to one experiment, it has a half-life of 17 days due to photodegradation which could contribute to removal in situations of cold water, poor nutrients, or other conditions less conducive to microbial degradation. If released to the atmosphere, it will exist predominantly in the vapor phase. Gas-phase will not be subject to direct photolysis but it will react with photochemically produced hydroxyl radicals with a half-life of 13.4 days calculated using an experimental rate constant for the reaction. The reaction time in polluted atmospheres which contain nitrogen oxides or sulfur dioxide is accelerated with the half-life being reported as 4-6 hours. Products of photooxidation include phenol, nitrophenols, nitrobenzene, formic acid, and peroxyacetyl nitrate. It is fairly soluble in water and is removed from the atmosphere in rain.

Ecotoxicity: LC₅₀ Clawed toad (3-4 wk after hatching) 190 mg/l/48 hr /Conditions of bioassay not specified; LC₅₀ Morone saxatilis (bass) 5.8 to 10.9 ppm/96 hr /Conditions of bioassay not specified; LC₅₀ Poecilia reticulata (guppy) 63 ppm/14 days /Conditions of bioassay not specified; LC₅₀ Salmo trutta (brown trout yearlings) 12 mg/l/1 hr (static bioassay); LD₅₀ Lepomis macrochirus (bluegill sunfish) 20 mg/l/24 to 48 hr /Conditions of bioassay not specified; LC₁₀₀ Tetrahymena pyriformis (ciliate) 12.8 mmole/l/24 hr /Conditions of bioassay not specified; LC₅₀ Cancer magister (crab larvae) stage 1, 108 ppm/96 hr /Conditions of bioassay not specified; LC₅₀ Crangon franciscorum (shrimp) 20 ppm/96 hr /Conditions of bioassay not specified

Henry's Law Constant: 5.3×10^{-3}

BCF: eels 3.5

Biochemical Oxygen Demand (BOD): 1.2 lb/lb, 10 days

Octanol/Water Partition Coefficient: $\log K_{ow} = 2.13$

Soil Sorption Partition Coefficient: K_{oc} = woodburn silt loam 31 to 143

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.

Follow applicable federal, state, and local regulations.

Incinerate residue at an approved site.

Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Benzene

ID: UN1114

Hazard Class: 3 - Flammable and combustible liquid

Packing Group: II - Medium Danger

Symbols:

Label Codes: 3 - Flammable Liquid

Special Provisions: IB2, T4, TP1

Packaging: Exceptions: 150 **Non-bulk:** 202 **Bulk:** 242

Quantity Limitations: Passenger aircraft/rail: 5 L **Cargo aircraft only:** 60 L

Vessel Stowage: Location: B **Other:** 40



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U019 Toxic Waste, Ignitable Waste

CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a), per CAA Section 112 10 lb (4.535 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Chlorobenzene

CAS Number: 108-90-7

Chemical Formula: C₆H₅Cl

Structural Chemical Formula: C₆H₅Cl

EINECS Number: 203-628-5

ACX Number: X1001545-9

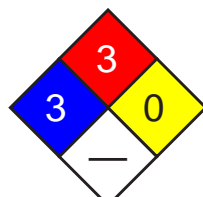
Synonyms: BENZENE CHLORIDE; BENZENE,CHLORO-; CHLOORBENZEEN; CHLORBENZENE; CHLORBENZOL; CHLOROBENZEN; CHLOROBENZENE; CHLOROBENZENU; CHLOROBENZOL; CLOROBENZENE; CP 27; EPA PESTICIDE CHEMICAL CODE 056504; I P CARRIER T 40; MCB; MONOCHLOORBENZEEN; MONOCHLORBENZENE; MONOCHLORBENZOL; MONOCHLOROBENZENE; MONOCLOROBENZENE; PHENYL CHLORIDE; TETROSIN SP

General Use: Used in textile processing as a fiber swelling agent and a dye carrier; as an extractant in the manufacture of diisocyanates, rubber, perfumes and pharmaceuticals; and in the manufacture of phenol, aniline and DDT. Also a tar and grease remover, a solvent for paints and a heat transfer medium.

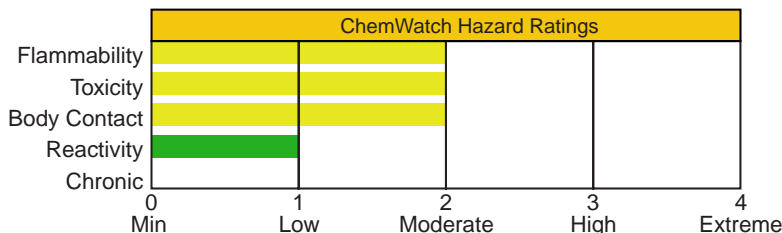
Section 2 - Composition / Information on Ingredients

Name	CAS	%
chlorobenzene	108-90-7	>95
OSHA PEL TWA: 75 ppm; 350 mg/m ³ .	NIOSH REL	DFG (Germany) MAK TWA: 10 ppm; PEAK: 20 ppm.
ACGIH TLV TWA: 10 ppm.	IDLH Level 1000 ppm.	
EU OEL TWA: 23 mg/m ³ (5 ppm); STEL: 70 mg/m ³ (15 ppm).		

Section 3 - Hazards Identification



Fire Diamond



HMIS	
2	Health
3	Flammability
0	Reactivity

ANSI Signal Word

Warning!



Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, volatile liquid; almond-like odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: dizziness, drowsiness, cyanosis, spastic contractions of extremities, unconsciousness. Chronic Effects: skin burns; lung/liver/kidney damage. Flammable.

Potential Health Effects

Target Organs: respiratory system, eyes, skin, central nervous system (CNS), liver

Primary Entry Routes: inhalation, ingestion, eye contact, skin contact

Acute Effects

Inhalation: The vapor is discomforting to the upper respiratory tract and may be harmful if inhaled.

Headaches and upper respiratory tract and eye irritation were reported in a worker exposed to the substance contained in a glue preparation.

Inhalation of 200 ppm may produce mucous membrane irritation and coughing whilst higher concentrations produce central nervous system depression with headache, dizziness, drowsiness, somnolence, transient anesthesia, and incoherence, cyanosis from methemoglobinemia, spastic contractions of the extremities, rapid respiration, weak and irregular pulse, burgundy-red urine, loss of consciousness, coma and respiratory and circulatory collapse.

Central nervous system (CNS) depression may include nonspecific discomfort, symptoms of giddiness, headache, dizziness, nausea, anesthetic effects, slowed reaction time, slurred speech and may progress to unconsciousness. Serious poisonings may result in respiratory depression and may be fatal.

The substance and/or its metabolites may bind to hemoglobin inhibiting normal uptake of oxygen. This condition, known as "methemoglobinemia", is a form of oxygen starvation (anoxia). Symptoms include cyanosis (a bluish discoloration to skin and mucous membranes) and breathing difficulties. Symptoms may not be evident until several hours after exposure. At about 15% concentration of blood methemoglobin there is observable cyanosis of the lips, nose and earlobes. Symptoms may be absent although euphoria, flushed face and headache are commonly experienced. At 25-40%, cyanosis is marked but little disability occurs other than that produced on physical exertion. At 40-60%, symptoms include weakness, dizziness, lightheadedness, increasingly severe headache, ataxia, rapid shallow respiration, drowsiness, nausea, vomiting, confusion, lethargy and stupor.

Above 60% symptoms include dyspnea, respiratory depression, tachycardia or bradycardia, and convulsions. Levels exceeding 70% may be fatal.

Narcosis may also result.

Rats exposed for 2 hours at 1200 ppm showed definite narcosis but 220-660 ppm could be tolerated without obvious clinical signs of sedation. Central nervous system depression was seen at 5850 ppm.

Eye: The vapor is discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

Skin: The liquid may produce skin discomfort following prolonged contact.

Defatting and/or drying of the skin may lead to dermatitis. Toxic effects may result from skin absorption.

Prolonged exposure may cause chemical burns.

Ingestion: The liquid is discomforting to the gastrointestinal tract and may be harmful if swallowed in large quantity. Ingestion may produce nausea, loss of consciousness and possibly coma.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A3, Animal carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Exposure to high levels or prolonged exposure may cause liver damage, chronic respiratory disease and changes to the kidney (urine may be burgundy red).

Workers exposed to chlorobenzene vapors from 1-2 years reported headache, dizziness, somnolence, and dyspeptic disorders. Other symptoms included acroparaesthesia, spastic contractions of the finger muscles, hypesthesia, spastic contractions of the gastrocnemius muscle and vasovegetative instability.

Repeated exposure of rats, rabbits and guinea pigs to chlorobenzene at 1000 ppm, 7 hours/day, 5 days/week over 44 days resulted in lung, liver and kidney changes.

Male rats receiving high doses during chronic gavage studies showed an increase in the occurrence of neoplastic nodules of the liver.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

In case of burns: Quickly immerse affected area in cold running water for 10 to 15 minutes.

Bandage lightly with a sterile dressing. Treat for shock if required.

Lay patient down. Keep warm and rested. Transport to hospital or doctor.

Ingestion: Contact a Poison Control Center. DO NOT induce vomiting. Observe the patient carefully. Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. Give water (or milk) to rinse out mouth. Then provide liquid slowly and as much as casualty can comfortably drink. Transport to hospital or doctor without delay.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.

For ingestion, consider gastric lavage.

Chlorobenzene administered orally is mainly excreted in the urine with 32% appearing in the first 24 hours mostly as metabolites (4-chlorophenylmercapturic acid, chlorophenols, chlorocatechols and mandelic acid) Periodic medical

See
DOT
ERG

examinations are recommended for occupationally exposed workers. Persons with pre-existing skin disorders or impaired liver, kidney or pulmonary function may be more susceptible to the effects of this substance.

Section 5 - Fire-Fighting Measures

Flash Point: 29.2 °C Closed Cup

Autoignition Temperature: 638 °C

LEL: 1.8% v/v

UEL: 9.6% v/v

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.

Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.

Moderate fire hazard when exposed to heat or flame.

Vapor forms an explosive mixture with air.

Moderate explosion hazard when exposed to heat or flame.

Vapor may travel a considerable distance to source of ignition.

Heating may cause expansion or decomposition leading to violent rupture of containers.

On combustion, may emit toxic fumes of carbon monoxide (CO).

Other combustion products include hydrogen chloride and phosgene.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

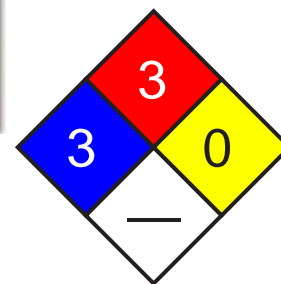
Cool fire-exposed containers with water spray from a protected location.

Do not approach cylinders suspected to be hot.

If safe to do so, switch off electrical equipment until vapor fire hazard is removed.

Fight fire from a safe distance, with adequate cover.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Environmental hazard - contain spillage.

Remove all ignition sources. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Wash spill site with soda solution.

Large Spills: Pollutant - Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent by any means available, spillage from entering drains or watercourse.

No smoking, bare lights or ignition sources. Increase ventilation.

Stop leak if safe to do so.

Water spray or fog may be used to disperse/absorb vapor.

Contain spill with sand, earth or vermiculite.

Use only spark-free shovels and explosion proof equipment.

Collect recoverable product into labeled containers for recycling.

Absorb remaining product with sand, earth or vermiculite.

Collect solid residues and seal in labeled drums for disposal.

Wash area and prevent runoff into drains.

If contamination of drains or waterways occurs, advise emergency services.

After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: Use good occupational work practices.

Avoid breathing vapors and contact with skin and eyes.

Avoid contact with incompatible materials.

Avoid all ignition sources.

Avoid sources of heat.

Avoid physical damage to containers.
 Keep containers securely sealed when not in use.
 Use in a well-ventilated area.
 Ground and secure containers when dispensing or pouring.
 Prevent concentration in hollows and sumps. DO NOT enter confined spaces until atmosphere has been checked.
 Vapor may travel a considerable distance to source of ignition.
 Avoid generation of static electricity.
 Always wash hands with soap and water after handling. Work clothes should be laundered separately.

Recommended Storage Methods: Check that containers are clearly labeled.
 Packaging as recommended by manufacturer.
 Glass container.
 Plastic containers may only be used if approved for flammable liquids.
 Metal drum.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: General exhaust is adequate under normal operating conditions.

Local exhaust ventilation may be required in specific circumstances.

If risk of overexposure exists, wear NIOSH-approved respirator.

Correct fit is essential to obtain adequate protection.

Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment:

Eyes: Chemical goggles. Safety glasses.

Full face shield.

DO NOT wear contact lenses.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Impervious gloves; Viton gloves.

Neoprene gloves.

Protective footwear.

Safety footwear.

Respiratory Protection:

Exposure Range >75 to 750 mg/m³: Air Purifying, Negative Pressure, Half Mask

Exposure Range >750 to <1000 mg/m³: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Exposure Range 1000 to unlimited mg/m³: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Cartridge Color: black

Other: Ensure there is ready access to a safety shower. Eyewash unit.

Impervious apron.

Overalls.

Laboratory coat.

Impervious protective clothing.

If gas concentrations are high, full-face air supplied breathing apparatus.

Barrier cream.

Skin cleansing cream.

Glove Selection Index:

VITON Best selection

TEFLON Best selection

PVA Satisfactory; may degrade after 4 hours continuous immersion

NITRILE Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: A clear, colorless, volatile, flammable liquid with a faint, almond- like, aromatic odor. It is a very refractive liquid (1.528); freely miscible with in alcohol, benzene, chloroform and ether. Environmental pollutant.

Physical State: Liquid

Odor Threshold: 0.98 to 280 mg/m³

Vapor Pressure (kPa): 1.2 at 20 °C

Vapor Density (Air=1): 3.9

Formula Weight: 112.56

Specific Gravity (H₂O=1, at 4 °C): 1.11

pH: Not applicable

pH (1% Solution): Not applicable.

Boiling Point: 132 °C (270 °F)

Freezing/Melting Point: -45.6 °C (-50.08 °F)

Volatile Component (% Vol): approx. 100

Water Solubility: 0.05% by weight

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Hazardous polymerization will not occur. Stable under normal storage conditions.

Storage Incompatibilities: Avoid reaction with oxidizing agents.

Avoid dimethyl sulfoxide and silver perchlorate (forms shock-sensitive solvated salts). Also avoid extreme humidity.

Section 11 - Toxicological Information

Toxicity

Oral (rat) LD₅₀: >2290 mg/kg

Oral (rat) LD₅₀: 1100 mg/kg

Inhalation (rat) LC_{Lo}: 9000 ppm

Mammalian somatic cell mutagen

Irritation

Nil reported

See RTECS CZ 0175000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Once released it will decrease in concentration due to dilution and photooxidation. Releases into water and onto land will decrease in concentration due to vaporization into the atmosphere and slow biodegradation in the soil or water. It would be expected to percolate into the ground water if soil is sandy and poor in organic matter. Little bioconcentration is expected into fish and food products.

Ecotoxicity: LC₅₀ Poecilia reticulata (guppy) 19 ppm/14 days /Conditions of bioassay not specified; LC₅₀ Pimephales promelas (fathead minnow) 16.9 mg/l/96 hr (confidence limit 13.8 - 20.6 mg/l), flow-through bioassay with measured concentrations, 25.7 °C, dissolved oxygen 6.2 mg/l, hardness 43.8 mg/l calcium carbonate, alkalinity 43.4 mg/l calcium carbonate; LD₅₀ Salmo gairdneri (rainbow trout) 1.8 mg/kg/24 hr /Conditions of bioassay not specified

Henry's Law Constant: calculated at 3.56×10^{-3}

BCF: fish 1 to 2

Biochemical Oxygen Demand (BOD): 0.3 lb/lb, 5 days

Octanol/Water Partition Coefficient: log K_{ow} = 2.18 to 2.84

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options.

Follow applicable federal, state, and local regulations.

Bury or incinerate residue at an approved site.

Recycle containers if possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Chlorobenzene

ID: UN1134

Hazard Class: 3 - Flammable and combustible liquid

Packing Group: III - Minor Danger

Symbols:

Label Codes: 3 - Flammable Liquid

Special Provisions: B1, IB3, T2, TP1

Packaging: Exceptions: 150 Non-bulk: 203 Bulk: 242

Quantity Limitations: Passenger aircraft/rail: 60 L Cargo aircraft only: 220 L

Vessel Stowage: Location: A Other:



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U037 Toxic Waste

CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Attachment P

Chemical Hazard Information

Table 3-1. Chemical Hazard Information

Substance [CAS Number]	IP ¹ (eV)	Odor Threshold (ppm)	Route ²	Symptoms of Exposure	Treatment	TWA ³	STEL ⁴	Source ⁵	IDLH (NIOSH) ⁶
Aniline 62-53-3	7.70	1	Inh Abs Con	Irritated eyes, skin, and nose; anemia, energy loss, headache, nausea; CNS depression; dermatitis	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	5 ppm 2 ppm 19 mg/m3 (skin)		PEL TLV REL	100 ppm
Benzene 71-43-2	9.24	1.5-5	Inh Abs Ing Con	Irritated eyes, skin, nose, respiratory system; giddiness; headache, nausea, staggered gait; fatigue, anorexia, lassitude; dermatitis; bone marrow depression; carcinogenic	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	1 ppm 0.5 ppm (skin) 0.1 ppm	5 ppm 2.5 ppm 1 ppm	PEL TLV REL	Ca [500 ppm]
Chlorobenzene 108-90-7	9.07	0.98-280	Inh Ing Con	Irritated eyes, skin, and nose; drowsiness, incoherence; CNS depression	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	75 ppm 10 ppm		PEL TLV REL	1,000 ppm

Notes:

- ¹IP = Ionization potential (electron volts).
²Route = Inh, Inhalation; Abs, Skin absorption; Ing, Ingestion; and Con, Skin and/or eye contact.
³TWA = Time-weighted average. The TWA concentration for a normal workday (usually 8 or 10 hours) and a 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day without adverse effect.
⁴STEL = Short-term exposure limit. A 15-minute TWA exposure that should not be exceeded at any time during a workday, even if the TWA is not exceeded.
⁵PEL = Occupational Safety and Health Administration (OSHA) permissible exposure limit (29 CFR 1910.1000, Table Z).
⁵TLV = American Conference of Governmental Industrial Hygiene (ACGIH) threshold limit value – TWA.
⁵REL = National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit.
⁶IDLH (NIOSH) = Immediately dangerous to life or health (NIOSH). Represents the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.
NE = None established. No evidence could be found for the existence of an IDLH (NIOSH Pocket Guide to Chemical Hazards, Pub. No. 90-117, 1990, 1997).
C = Ceiling limit value which should not be exceeded at any time.
Ca = Carcinogen.
NA = Not applicable.
ND = Not Determined.
LEL = Lower explosive limits.
LC₅₀ = Lethal concentration for 50 percent of population tested.
LD₅₀ = Lethal dose for 50 percent of population tested.
NIC = Notice of intended change (ACGIH).

References:

- American Conference of Governmental Industrial Hygienists Guide to Occupational Exposure Values, 2002, compiled by the American Conference of Governmental Industrial Hygienists.
Amoore, J. and E. Hautula, "Odor as an Aid to Chemical Safety," Journal of Applied Toxicology, 1983.
Clayton, George D. and F.E. Clayton, Patty's Industrial Hygiene and Toxicology, 3rd ed., John Wiley & Sons, New York.

Table 3-1. Chemical Hazard Information

References (Cont'd.):

Documentation of TLVs and BEIs, American Conference of Governmental Industrial Hygienists, 5th ed., 1986.
Fazzuluri, F.A., Compilation of Odor and Taste Threshold Values Data, American Society for Testing and Materials, 1978.
Gemet, L. and J. Van, Compilation of Odor Threshold Values in Air and Water, CIVO, Netherlands, 1977.
Gemet, L. and J. Van, Compilation of Odor Threshold Values in Air and Water, Supplement IV, CIVO, Netherlands, 1977.
Lewis, Richard J., Sr., 1992, Sax's Dangerous Properties of Industrial Materials, 8th ed., Van Nostrand Reinhold, New York.
Micromedex Tomes Plus (R) System, 1992, Micromedex, Inc.
National Institute for Occupational Safety and health Pocket Guide to Chemicals, Pub. 1997, No. 90-117, National Institute for Occupational Safety and Health.
Odor Threshold for Chemicals with Established Occupational Health Standards, American industrial Hygiene Association, 1989.
Respirator Selection Guide, 3M Occupational Health and Safety Division, 1993.
Verschuseren, K., Handbook of Environmental Data on Organic Chemicals, Van Nostrand and Reinhold, 1977.
Warning Properties of Industrial Chemicals – Occupational Health Resource Center, Oregon Lung Association.
Workplace Environmental Exposure Levels, American Industrial Hygiene Association, 1992.

Attachment Q

Site-Related COCs and Maximum
Concentrations

Table 1
Nature and Extent of Contamination

MEDIUM	CATEGORY	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppm)	SCG/ Bkgd. (ppm)
Surface Soils (0-3")	Semivolatile Organic Compounds (SVOCs)	Benzo(a)anthracene	ND (0.027) to 5.4	0.224
		Chrysene	ND (0.030) to 6.2	0.4
		Benzo(b)fluoranthene	ND (0.021) to 7.1	1.1
		Benzo(k)fluoranthene	ND (0.019) to 5.2	1.1
		Benzo(a) pyrene	ND (0.027) to 6.5	0.061
		Dibenzo(a,h) anthracene	ND (0.014) to 1.3	0.014
	Polychlorinated Biphenyls	Total PCBs	ND (0.001) to 5.0	1.0
	Metals	Arsenic	ND (3.0) to 90	7.5
		Barium	ND (1.0) to 8,120	300
		Beryllium	ND (1.0) to 8.1	0.16
		Chromium	ND (1.0) to 97	50
		Copper	ND (1.0) to 1,110	25
		Lead	ND (2.0) to 1,320	400
		Mercury	ND (0.2) to 2.8	0.100
		Nickel	ND (2.0) to 119	13
		Selenium	ND (4.0) to 2.5	2.0
		Vanadium	ND (1.0) to 2,190	150
		Zinc	ND (1.0) to 3,200	20
Near Surface Soils (3"-11")	Semivolatile Organic Compounds (SVOCs)	Benzo(a)anthracene	ND (0.027) to 23	0.224
		Chrysene	ND (0.030) to 25	0.400
		Benzo(b)fluoranthene	ND (0.021) to 23	1.1
		Benzo(k)fluoranthene	ND (0.019) to 25	1.1
		Benzo(a) pyrene	ND (0.027) to 25	0.061
		Indeno (1,2,3-cd) pyrene	ND (0.020) to 12	3.2
		Dibenzo(a,h) anthracene	ND (0.014) to 7.9	0.014
	Polychlorinated Biphenyls	Total PCBs	ND (0.001) to 4.4	1
	Metals	Arsenic	ND (3.0) to 19.8	7.5
		Barium	ND (1.0) to 954	300
		Beryllium	ND (1.0) to 0.39	0.160
		Copper	ND (1.0) to 428	25
		Lead	ND (2.0) to 403	400
		Mercury	ND (0.2) to 2.0	0.100
		Nickel	ND (2.0) to 35.9	13
		Zinc	ND (1.0) to 1,620	20

Table 1
Nature and Extent of Contamination

MEDIUM	CATEGORY	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppm)	SCG/ Bkgd. (ppm)
Subsurface Soils	Volatile Organic Compounds (VOCs)	Chlorobenzene	ND (0.10) to 31	1.7
		Trichloroethylene	ND (0.01) to 15	0.700
		Tetrachloroethylene	ND (0.01) to 50	1.4
		1,2-Dichloroethene	ND (0.01) to 23	0.300
		Vinyl Chloride	ND (0.01) to 1.8	0.2
	Semivolatile Organic Compounds (SVOCs)	Benzo(a)anthracene	ND (0.064) to 2.4	0.224
		Chrysene	ND (0.11) to 2.4	0.400
		Benzo(b)fluoranthene	ND (0.12) to 2.8	1.1
		Benzo(k)fluoranthene	ND (0.11) to 1.9	1.1
		Benzo(a) pyrene	ND (0.060) to 1.7	0.061
		Dibenzo(a,h) anthracene	ND (0.069) to 0.330	0.014
	Metals	Arsenic	ND (3.0) to 14.6	7.5
		Barium	ND (1.0) to 3,650	300
		Beryllium	ND (1.0) to 0.290	0.16
		Cadmium	ND (1.0) to 122	10
		Chromium	ND (1.0) to 120	50
		Copper	ND (1.0) to 28,700	25
		Lead	ND (2.0) to 3,090	400
		Mercury	ND (0.2) to 1.1	0.10
		Nickel	ND (2.0) to 1,120	13
		Selenium	ND (2.0) to 2.7	2
		Zinc	ND (1.0) to 43,500	20
Sediments	Volatile Organic Compounds (VOCs)	1,1,2,2-Tetrachloroethane	ND (1.0) to 5	0.45
	Polychlorinated Biphenyls	Total PCBs	ND (1.0) to 0.140	1
Groundwater	Volatile Organic Compounds (VOCs)	Chlorobenzene	ND (0.1) to 11,000	5.0
		Benzene	ND (0.1) to 170	1.0
		Ethyl Ether	ND (0.1) to 360	¹
		Diisopropyl Ether	ND (0.1) to 410	¹
	Semivolatile Organic Compounds (SVOCs)	2-Chlorophenol	ND (0.1) to 61	1.0
		1,4-Dichlorobenzene	ND (0.1) to 170	3.0
		4-Chloroaniline	ND (0.1) to 25	5.0
		Naphthalene	ND (0.1) to 650	10
	Metals (in filtered samples)	Antimony	ND (4.0) to 47	3.0
		Arsenic	ND (3.0) to 40	25
		Barium	ND (1.0) to 2,180	1,000
		Iron	ND (20) to 261,000	300
		Manganese	ND (4.0) to 8140	300
		Selenium	ND (4.0) to 17	10
		Thallium	ND (5.0) to 8.0	0.5

ND - Not detected at the detection limit listed in parenthesis

¹ - There are no ambient groundwater standards or guidance values for ethyl and diisopropyl ether

Attachment R

Incident/Near-Miss Investigation
Form

2005

Loss Investigation/ Near Loss Investigation Report

ENTACT Job Number/Name:

LOSS TYPE

- ☐ Fatality
☐ Lost Workday
☐ LW Restricted Duty
☐ OSHA Medical or Illness w/o LW

- ☐ First Aid
☐ Industrial Non-Recordable
☐ Non-Industrial
☐ MVA
☐ Business Interruption

- ☐ Fire
☐ Spill/Leak
☐ Product Integrity
☐ Equipment Damage

- ☐ General Liability (e.g. customer loss/carwash)
☐ Criminal Activity
☐ Notice of Violation
☐ Near Loss

Medgate Loss No.:

Control No.:

Date of Loss:

Time:

☐ AM ☐ PM

Every work injury to an employee which causes disability lasting longer than the day of the injury or which requires medical services other than first aid treatment must be reported within three days after the injury. If the loss results in death, a report must be made by phone/fax/mail to the Home Office Incident Reporting Desk no later than 8 hours after the death.

(2) EMPLOYER

Company Name:

Co.:

Dept.:

Div.:

Org. Unit.:

Facility #:

Work Location where loss occurred:

(3) EMPLOYEE

Name:

EPIC ID or SSN:

Employment Status: ☐ Regular ☐ Seasonal ☐ Casual ☐ Part Time

How long in present job?

Gross Wages/Salary: Employee Earns \$ Per ☐ Hour ☐ Day ☐ Week ☐ Every 2 Weeks ☐ Month**(4) INJURY OR ILLNESS INFO**

Where did loss/near loss occur? (number, street, city, state, zip):

County:

On Employer's premises?

☐ Yes☐ No

Specific activity the employee was engaged in when the loss/near loss occurred:

All equipment, materials, or chemicals the employee was using when the loss/near loss occurred (e.g. the machine employee struck against or which struck employees; the vapor inhaled or material swallowed; what the employee was lifting, pulling, etc.):

Describe the specific injury or illness (e.g., cut, strain, fracture, skin rash, etc.):

Body part(s) affected (e.g., back, left wrist, right eye, etc.):

Name and address of Health Care Provider (e.g., physician or clinic):

Phone No.:

If hospitalized, name and address of hospital:

Phone No.:

Date of injury or onset of illness: (MM/DD/YY):

Time of event or exposure:

☐ AM ☐ PMTime employee began work: ☐ AM ☐ PMDid employee lose at least one full shift's work? ☐ No ☐ Yes, 1st date absent: (MM/DD/YY)Has employee returned to work? ☐ Regular work ☐ Restricted work ☐ No, still off work ☐ Yes, date returned: (MM/DD/YY)Did employee die? ☐ No ☐ Yes, date: (MM/DD/YY)

Date employer notified of loss/near loss: (MM/DD/YY)

To whom reported:

To whom reported Social Security Number:

Date employee provided with Workers' Comp Form:

Other workers injured/made ill in this event? ☐ Yes ☐ NoTSCA 8 (c) allegation? ☐ Yes ☐ No

**Chevron Products Company
Marketing**

			Professional Driver? <input type="checkbox"/> Yes <input type="checkbox"/> No			
Total Yrs Driving		Company Vehicle	<input type="checkbox"/> Yes <input type="checkbox"/> No	Operation Type		Accident Situation
Truck Transportation:		Years w/ Carrier:		Vehicle Type:		Equip #:
Accident Location (Street/City/State):						
Haz Material <input type="checkbox"/> Yes <input type="checkbox"/> No		Recordable <input type="checkbox"/> Yes <input type="checkbox"/> No		# Vehicles Towed:	# Injuries:	# Fatalities:
(6) SPILL/LEAK PRODUCT QUALITY						
Product 1 Name:		Quantity:	Product 2 Name:		Quantity:	Product 3 Name: Quantity:
Agency Notifications:						
(7) COST OF LOSS						
(8) THIRD PARTY LOSS						
Name of Owner:		Address:			Telephone:	
Description of Damage:						
Witness Name:		Address:			Telephone:	
Witness Name:		Address:			Telephone:	
(9) DESCRIPTION OF LOSS/NEAR LOSS: (Describe fully the Loss/Near Loss events. Tell what/how it happened)						
(10) CONTRIBUTING FACTORS: Conclusion (Describe in detail why loss/near loss occurred)						
(11) ROOT CAUSE(S) ANALYSIS (RCA):						
1.Lack of skill or knowledge.				5.Correct way takes more time and/or requires more effort.		
2.Lack of or inadequate operational procedures or work standards.				6.Short-cutting standard procedures is positively reinforced or tolerated.		
3.Inadequate communication of expectations regarding procedures or work standards.				7.Person thinks there is no personal benefit to always doing the job according to standards.		
4.Inadequate tools or equipment.				8.Uncontrollable.		
#	RCA#	Solution(s): How to Prevent Loss/Near Loss From Occurring	Person Responsible	Due Date	Completion Date	Date Verified & Validated
(12) INVESTIGATION TEAM MEMBERS:						
Name			Job Title		Date	
(13) RESULTS OF SOLUTION VERIFICATION AND VALIDATION:						
(14) REVIEWED BY:						
Name			Job Title		Date	

Attachment S

Loss Prevention Observation Form



Loss Prevention Observation Multi Task

Loss Prevention Observation	
Date	
Work Type	Multi-Task - General
Organization	
Chevron Project No	Chevron PM

Observer	
Observer's Positive Comments	

Site Location	
Equipment On Site	
Personnel Observed	
Weather Conditions	
Unusual Conditions	

Conclusion (Detail of Why the Questionable Item(s) Occurred).

Explanation of Root Cause(s) Analysis Numbers (RCA No):	
1 Lack of skill or knowledge	5 Doing the job according to procedures or acceptable practices takes more time/effort
2 Lack of or inadequate operational procedures	6 Short-cutting procedures or acceptable practices is positively reinforced or tolerated
3 Inadequate communication of expectations regarding procedures or acceptable practices	7 In the past, did not follow procedures or acceptable practices and no incident occurred (injury, product quality incident, equipment damage, regulatory assessment or production delay)
4 Inadequate tools or equipment (available, operable and safely maintained, proper task and workplace design)	8 External factors

Item No	RCA No	Solution(s): How to Prevent Questionable Behavior From Reoccurring	Person Responsible	Due Date	Completed	Verified/Validated

Results of Solution Verification & Validation

Feedback Conducted By	Date

Reviewed By	Position/Title	Date

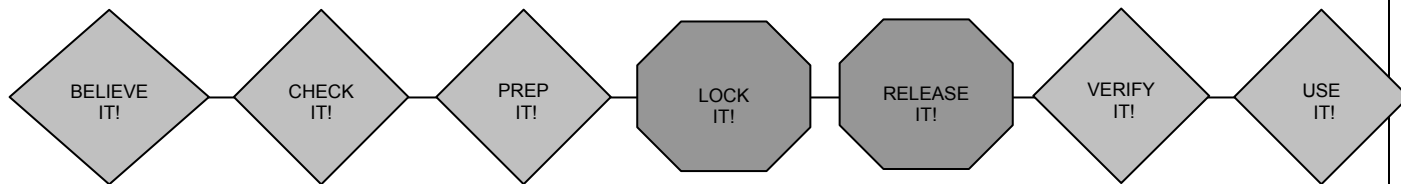
Initial - 04/29/2004 09:43 AM EST

	Pre-Task Preparation	Correct	Questionable	Comments
1	Employee familiar / trained on task			
2	SPSA performed prior to beginning work			
3	Air monitoring equipment on site, calibrated			
4	Air monitoring conducted / action levels understood			
5	Review procedure and/or JSA			
6	Personal protective equipment			
7	Barricades/warning devices/cones			
8	Work zones established and marked			
9	Traffic hazards addressed			
10	Health and Safety Plan / MSDSs on site			
11	Tailgate safety meeting performed			
12	Knowledge of emergency procedures			
13	Select tools/check equipment & tool condition			
14	Communicates intentions to other personnel			
15	First aid kit / fire extinguisher on site			
16	One person trained in first aid / CPR			
17	OSHA-required training / medical surveillance			
18	Short service employees identified and policy followed			
19	Electrical cords inspected / in good condition			
20	Utility mark out / check performed			
21	Other			
	Performing Task			
22	SPSA before beginning new task			
23	Utility clearances / all call completed			
24	Adequate lighting for tasks			
25	Emergency procedures reviewed			
26	Correct body positioning			
27	Uses travel paths/walkways			
28	Proper lifting / pushing / pulling techniques			
29	Keep hands / body away from pinch points			
30	Line of fire (danger)			
31	Digging by hand in questionable areas			
32	Distance between equipment and power lines			
33	Electrical equipment connected through GFCI			
34	Equipment / tools used properly			
35	Walking / working surfaces free of hazards			
36	Follows lockout / tagout procedures			
37	Follows excavation/shoring procedures			
38	Follows safe entry procedures			
39	Crane operation / rigging performed properly			

40	Drill rig located properly / blocked / chocked and moved only with derrick lowered			
41	Procedures / JSA followed			
42	Personnel decon prior to eating/drinking/smoking			
43	Samples properly collected / labeled / preserved			
44	Near losses / losses investigated and reported			
45	Other			
	Post-Task			
46	Procedures / JSA adequate			
47	Housekeeping / storage			
48	Barricades/warning devices/cones			
49	Equipment decontaminated properly			
50	Equipment / tools stored properly			
51	Proper storage of soil / water / waste material			
52	Work area secured			
53	Other			
	Total			

Attachment T

Lockout/Tagout Equipment-Specific
Control Form



Equipment Identification:

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

Attachment U

Investigative-Derived Waste SOP

Standard Operating Procedure: Investigation Derived Waste Handling and Storage For Chevron Projects

I. Scope and Application

The objective of this Standard Operating Procedure (SOP) is to describe the procedures to manage investigation-derived wastes (IDW) generated during drilling, well sampling, and decontamination procedures. IDW may include soil, groundwater, drilling fluids, decontamination liquids, personal protective equipment (PPE), and disposable sampling materials that may have come in contact with potentially impacted materials. All IDW will be collected at the point of generation and taken to a storage area onsite or to a disposal facility. Soil and water will be containerized in DOT-approved drums and analyzed for constituents of concern to evaluate proper disposal methods. PPE and disposable sampling equipment will be placed in DOT-approved drums prior to disposal. This SOP describes the necessary equipment, field procedures, materials, and documentation procedures necessary to do so, as well as the handling of these materials up to the time they are properly disposed. The procedures for handling IDW are based on the United States Environmental Protection Agency's *Guide to Management of Investigation Derived Wastes* (USEPA, 1992). IDW is assumed to be contaminated with the site constituents of concern until analytical evidence indicates otherwise.

IDW will be managed to ensure the protection of human health and the environment and will comply with all local, state, federal, BBL, and Chevron applicable or relevant and appropriate requirements (ARAR). Samples of the waste will be collected in accordance with ARAR and the IDW containers will be labeled and staged on site. If an injured employee has gross contamination, emergency decontamination may be required prior to transportation to a treatment facility. At this site, the worst case scenario would be an employee who was covered/soaked with COCs containing fuel and fuel byproducts. Steps for emergency decontamination are:

- 1) Remove the outer protective layer of clothing (if employee has a suspected neck/back injury, carefully cut the clothing off so as to not cause further injury)
- 2) Wipe off any remaining gross contamination with clean clothes/towels

A BBL employee must accompany the injured person to the hospital to provide information to the examining/treating medical professional. The accompanying BBL employee must bring the MSDSs for the COPCs involved with site work. The accompanying employee should be prepared to provide information regarding site conditions, potential exposures, and a description of the incident causing the injury or exposure.

The onsite waste staging area will be in a secure and controlled area. Pending characterization, IDW will be stored appropriately within each area of contamination (AOC). Waste characterization involves collecting and sending composite samples for each media to a Chevron-approved laboratory for waste characterization analysis.

Wastes judged to potentially meet the criteria for hazardous wastes shall be stored in DOT approved 55 gallon steel drums. Waste material classified as non-hazardous may be handled and disposed of as an industrial waste.

This is a standard (i.e., typically applicable) operating procedure which may be varied or changed as required, dependent upon site conditions, equipment limitations, or limitations imposed by the procedure. The ultimate procedure employed will be documented in the project work plans or reports. If changes to the sampling procedures are required due to unanticipated field conditions, the changes will be discussed with the Chevron project manager as soon as practicable and documented in the report.

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II. Personnel Qualifications

BBL field sampling personnel will have current health and safety training including 40-hour HAZWOPER training, site supervisor training, site-specific training, first aid, and CPR, as needed. In addition, BBL field sampling personnel will be versed in the relevant SOPs and possess the required skills and experience necessary to successfully complete the desired field work.

III. Equipment List

- Appropriate personal protective equipment as specified in the Site Health and Safety Plan;
- 55-gallon steel drums, DOT 1A2 or equivalent;
- ¾-inch socket wrench;
- Hammer;
- Leather gloves;
- Drum dolly;
- Appropriate drum labels (outdoor waterproof self adhesive);
- Polyethylene storage tank;
- Appropriate labeling, packing, chain-of-custody forms, and shipping materials as specified in the *Chain-of-Custody SOP* (No. 1663199) and *Field Sampling Handling, Packing, and Shipping SOP* (No. 1223199);
- Indelible ink and/or permanent marking pens;
- Plastic sheeting;
- Appropriate sample containers, labels, and forms;
- Stainless-steel bucket auger;
- Stainless steel spatula or knife;
- Stainless steel hand spade;
- Stainless steel scoop; and
- Field logbook.

IV. Cautions

- Filled drums can be very heavy, always use appropriate moving techniques and equipment.
- Similar media will be stored in the same drums to aid in sample analysis and disposal.
- Drum lids must be secured to prevent rainwater from entering the drums.
- Drums containing solid material may not contain any free liquids.
- All drums must be DOT approved shipping containers and in good condition to prevent potential leakage and facilitate subsequent disposal. Inspect the drums for dents and rust, and verify the drum has a secure lid prior to use.

V. Health and Safety Considerations

- Appropriate personal protective equipment must be worn by all field personnel within the designated work area.
- Air monitoring may be required during construction activities as required in the Site Health and Safety Plan.

- If excavating in potentially hazardous areas is possible, contingency plans should be developed to address the potential for encountering gross contamination or non-aqueous phase liquids.

VI. Procedures

Waste storage and handling procedures to be used depend upon the type of generated waste. For this reason, IDW will be stored in a secure location onsite in separate 55-gallon storage drums, soil can be stockpiled on poly-sheeting and covered onsite, and purge water may be stored in polyethylene tanks with lids. Waste materials such as broken sample bottles or equipment containers and wrappings will be included in the 55-gallon drums unless they were not in contact with sample media. In the event that the IDW (broken sample bottles or equipment containers and wrappings) does not come in contact with the sample media, the waste may be disposed of with general refuse.

Management of IDW

Minimization of IDW should be considered by the Project Manager during all phases of the project. Site managers may want to consider techniques such as replacing solvent-based cleaners with aqueous-based cleaners for decontamination of equipment, reuse of equipment (where it can be decontaminated), limitation of traffic between exclusion and support zones, and drilling methods and sampling techniques that generate little waste. Alternative drilling and subsurface sampling methods may include the use of small diameter boreholes, as well as borehole testing methods such as a core penetrometer or direct-push technique instead of coring (EPA, 1993).

Drum Labeling

IDW drums will be labeled on both the side and lid of the drum using a permanent marking pen. Old drum labels must be removed to the extent possible, descriptions crossed out should any information remain, and new labels affixed on top of the old labels. IDW drums will be labeled as follows:

- Appropriate Chevron waste characterization label (Testing In Progress, Hazardous, or Non-Hazardous);
- Waste generator's name (e.g., BBL);
- Project name;
- Name and telephone number of BBL/Chevron project manager;
- Composition of contents (e.g., used oil, acetone 40%, toluene 60%);
- Media (e.g., solid, liquid);
- Accumulation start date; and
- Drum number of total drums.

Drilling Soil Cuttings and Muds

Soil cuttings are solid to semi-solid soils generated during trenching activities, subsurface soil sampling, or installation of monitoring wells. Depending on the drilling method, drilling fluids known as "muds" may be used to remove soil cuttings. Drilling fluids flushed from the borehole must be directed into a settling section of a mud pit. This allows reuse of the decanted fluids after removal of the settled sediments. Soil cuttings will be labeled and stored in 55-gallon drums with bolt-sealed lids.

All 55-gallon steel drums will have a containment system that can contain at least 10% of the volume of the largest container, be closed during storage, and be in good condition in accordance with the *Guide to Management of Investigation-Derived Wastes* (USEPA, 1992).

Excavated Soil

Excavated soil may be temporarily stockpiled onsite as long as the soil is a RCRA non-hazardous waste and the soil will be treated onsite pursuant to a certified, authorized, or permitted treatment method. Excavated soil may be stockpiled and maintained in a secure area onsite. At a minimum, the floor of the stockpile area will be covered with a 20-mil high density polyethylene liner that is supported by a foundation or at least a 60-mil high density polyethylene liner that is not supported by a foundation. The excavated material will not contain free liquids. The owner/operator provides controls for windblown dispersion, run-on control, and precipitation runoff. The run-on control system will prevent flow onto the active portion of the pile during peak discharge from at least a 25-year storm and the run-off management system will collect and control at least the water volume resulting from a 24-hour, 25-year storm (EPA, 1992). Additionally, the stockpile area will be inspected on a weekly basis and after storm event. Stockpiled material will be covered with a 6-mil polyvinyl chloride (PVC) liner. Excavated soil may also be placed in roll off containers and covered with a 6-mil PVC liner pending results for waste characterization.

Decontamination Solutions

Decontamination solutions are generated during the decontamination of personal protective equipment and sampling equipment. Decontamination solutions may range from detergents, organic solvents and acids used to decontaminate small field sampling equipment to steam cleaning rinsate used to wash heavy field equipment. These solutions are to be labeled and stored in 55-gallon drums with bolt-sealed lids.

Disposable Equipment

Disposable equipment includes personal protective equipment (tyvek coveralls, gloves, booties and APR cartridges) and disposable sampling equipment such as trowels or disposable bailers. If the media sampled exhibits hazardous characteristics per results of waste characterization sampling, disposable equipment will also be disposed of as a hazardous waste. These materials will be stored onsite in labeled 55-gallon drums pending analytical results for waste characterization.

Purge Water

Purge water includes groundwater generated during well development, groundwater sampling, or aquifer testing. The volume of groundwater generated will dictate the appropriate storage procedure. Monitoring well development and groundwater sampling may generate three well volumes of groundwater or more. This volume will be stored in labeled 55-gallon drums. Aquifer tests may generate significantly greater volumes of groundwater depending on the well yield and the duration of the test. Therefore, large-volume portable polyethylene tanks will be considered for temporary storage pending groundwater-waste characterization.

Purged Water Storage Tank Decontamination and Removal

The following procedures will be used for inspection, cleaning, and offsite removal of purge water in storage tanks. These procedures are intended to be used for rented portable tanks such as Baker Tanks or Rain for Rent containers. Storage tanks will be made of inert polyethylene materials.

The major steps for preparing a rented tank for return to a vendor include characterizing the purge water, disposing of the purge water, decontaminating the tank, final tank inspection, and mobilization. Decontamination and inspection procedures are describe in further detail below.

- **Tank Cleaning:** Most vendors require that tanks be free of any sediment and water before returning, a professional cleaning service may be required. Each specific vendor should be consulted concerning specific requirements for returning tanks.
- **Tank Inspection:** After emptying the tank, purged water storage tanks should be inspected for debris, chemical staining, and physical damage. The vendors require that tanks be returned in the original condition (i.e., free of sediment, staining and no physical damage).

VII. Waste Characterization Sampling

Soil Characterization

Waste characterization will be conducted in accordance with waste hauler, waste handling facility, and state/federal and Chevron requirements.

Composite soil sample will be collected at a frequency of one sample per 10 cubic yard basis for stockpiled soil or one per 55-gallon drum for containerized or as directed under state specific regulatory guidelines. Sample frequencies may be adjusted in accordance with the waste handling facility's requirements. Waste characterization samples will be analyzed for the total concentration of petroleum hydrocarbons, TAL metals, volatile organic compounds, semi-volatile organic compounds, polychlorinated biphenyls, reactivity, corrosivity, and ignitability or as directed under state specific regulatory guidelines. Additional samples may be collected and analyzed by the laboratory on a contingency basis. Typical analytical methods are described below:

- Total Petroleum Hydrocarbons by USEPA Method 8015;
- TAL Metals by USEPA Method 6010A;
- Volatile Organic Compounds by USEPA Method 8260B;
- Semi-Volatile Organic Compounds by USEPA Method 8270C; and
- Polychlorinated Biphenyls by USEPA Method 8082.

Analytical results will be compared to the criteria in the Threshold Limit Concentrations in Table 1. If the total concentration of a compound exceeds 20 times the TCLP threshold, TCLP analyses will be performed. If the TCLP concentration of a compound exceeds the TCLP threshold concentration, the material must be disposed of as a RCRA hazardous waste. This SOP does not address the handling or disposal of hazardous waste.

Wastewater Characterization

Waste characterization will be conducted in accordance with the requirements of the waste hauler, waste handling facility, and state/federal governments. In general, purge water should be analyzed by methods appropriate for the known contaminants, if any, have been historically detected in the monitoring wells. Samples will be collected in accordance with the requirements of the waste disposal facility.

Wastewater characterization samples will be analyzed for the total concentration of petroleum hydrocarbons, TAL metals, volatile organic compounds, semi-volatile organic compounds, polychlorinated biphenyls, reactivity, corrosivity, and ignitability. Additional samples may be collected and analyzed by the laboratory on a contingency basis. Typical analytical methods are described below:

- Total Petroleum Hydrocarbons by USEPA Method 8015;
- TAL Metals by USEPA Method 6010A;
- Volatile Organic Compounds by USEPA Method 8260B;
- Semi-Volatile Organic Compounds by USEPA Method 8270C; and

- Polychlorinated Biphenyls by USEPA Method 8082.

Analytical results will be compared to the criteria in the Threshold Limit Concentrations in Table 1. If the total concentration of a compound exceeds the TCLP threshold, the material must be disposed of as a RCRA hazardous waste. This SOP does not address the handling or disposal of hazardous waste.

All hazardous waste should be containerized, manifested, and transported by a licensed waste hauler to a Chevron-approved permitted treatment, storage, or disposal facility within 90 days of waste generation.

Wastewater with concentrations less than the applicable threshold criteria may be managed as non-hazardous waste.

Sample Handling and Shipping

All samples will be appropriately labeled, packed, and shipped, and the chain-of-custody will be filled out in accordance with the *Chain-of-Custody SOP* (No. 1663199) and *Field Sampling Handling, Packing, and Shipping SOP* (No. 1223199).

VIII. Data Recording and Management

Waste characterization sample handling, packing, and shipping procedures will be documented in accordance with *Quality Assurance Project Plan* (BBL, 2004a). Copies of the chains-of-custody forms will be maintained in the project file.

Following waste characterization, IDW drums will be re-labeled with the appropriate waste hazardous or non-hazardous waste labels and the client will initiate disposal at the appropriate waste disposal facility.

IX. Quality Assurance

The chain-of-custody and sample labels for waste characterization samples will be filled out in accordance with the *Quality Assurance Project Plan* (BBL, 2004a).

X. References

Blasland, Bouck & Lee, Inc. (BBL). 2004. *Health and Safety Plan*. Prepared for Gaylord Container Corporation, Antioch, California (February 2004).

Blasland, Bouck & Lee, Inc. (BBL). 2004a. *Quality Assurance Project Plan*. Prepared for Gaylord Container Corporation, Antioch, California (February 2004).

United States Environmental Protection Agency (USEPA). 1992. *Guide to Management of Investigation-Derived Wastes*. Office of Remedial and Emergency Response. Hazardous Site Control Division. January 1992.

USEPA. 1991. *Guide to Discharging CERCLA Aqueous Wastes to Publicly Owned Treatment Works (POTWs)*. Office of Remedial and Emergency Response. Hazardous Site Control Division 0S-220W.

Table 1**Threshold Limit Concentrations**

Constituent	Soluble Threshold Limit Concentration (STLC) mg/L	Toxicity Characteristic Leaching Procedure (TCLP) mg/L	Total Threshold Limit Concentration (TTLC) mg/kg
Aldrin	0.14	-	1.4
Chlordane	0.25	0.03	2.5
2-4 Dichlorophenoxyacetic Acid	10	-	100
DDT, DDE, DDD	0.1	-	1
Dieldrin	0.8	-	8
Dioxin	0.001	-	0.01
Endrin	0.02	0.02	0.2
Heptachlor	0.47	0.008	4.7
Kepone	2.1	-	21
Lead Compounds, Organic	-	-	13
Lindane	0.4	0.4	4
Methoxychlor	10	10	100
Mirex	2.1	-	21
Pentachlorophenol	1.7	100	17
Polychlorinated Biphenyls	5	-	50
Toxaphene	0.5	0.5	5
Trichloroethene	204	0.5	2,040
2,4,5-Trichlorophenoxypropionic Acid	1	-	10
Antimony	15	-	500
Arsenic	5	5	500
Asbestos	-	-	1.0%
Barium	100	100	10,000
Beryllium	0.75	-	75
Cadmium	1	1	100
Chromium (VI)	5	-	500
Chromium	5	5	2,500
Cobalt	80	-	8,000
Copper	25	-	2,500
Fluoride Salts	180	-	18,000
Lead (inorganic)	5	5	1,000
Mercury	0.2	0.2	20
Molybdenum	350	-	3,500
Nickel	20	-	2,000
Selenium	1	1	100
Silver	5	5	500
Thallium	7	-	700
Vanadium	24	-	2,400
Zinc	250	-	5,000

Notes:

Units are in milligrams per liter (mg/L) or milligrams per kilogram (mg/kg)

Attachment V

Air Monitoring Log



Date:

Activity:

Level of Protection:

[illegible]

Attachment W

Safety Inspection Form

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

	YES	NO	N/A	COMMENTS
EMERGENCY RESPONSES				
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?				

	YES	NO	N/A	COMMENTS
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 X

Daily Safety Meeting Log/Permit-to-
Work Form

DAILY SAFETY MEETING /PERMIT TO WORK

BBL/BBLES

Project Name: _____ Chevron
Facility #: _____
Project Location (Address): _____ Total # On-site Workers: _____
Chevron Project Manager: _____ Project Type: _____
Valid Date: _____ Time Written: _____ Time Closed-out: _____

1. Have necessary work permits been obtained (including those for subcontractors)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
2. Have all sections of the HASP applying to today's tasks been reviewed?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
3. Has the Health & Safety Plan been signed by appropriate on-site personnel?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
4. Has the scope of work or work plan been reviewed and fully understood?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
5. Where will the scope of work or work plan be kept on site?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
6. Are appropriate tools on-site to complete tasks safely and appropriately?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
7. Have Operational Excellence Tenants been discussed and highlighted during the daily health and safety meeting?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
8. Has everyone reviewed the applicable SOPs and JSAs for their assigned work duties?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
9. Where will the HASP be kept on site?	Location: _____		
10. Have the action levels and work zones been identified and reviewed?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
11. What level of PPE is required (See note on following page)?	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C <input type="checkbox"/> D <input type="checkbox"/> Other
12. a. If monitoring is required, what type of monitoring will be performed at the site?	Type: _____ (See 12c.) <input type="checkbox"/> N/A		
b. Is monitoring equipment present and properly calibrated?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
c. Have HASP requirements for air monitoring been reviewed? Complete HASP Appendix T – Air Monitoring Log.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
13. Will work conducted by others in the area affect/conflict your work area?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
14. Have you communicated with others in the work area to understand their tasks?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
15. a. Are lock/out tag/out (LOTO) procedures required?	<input type="checkbox"/> Yes (See 15b.)	<input type="checkbox"/> No	<input type="checkbox"/> N/A
b. Has the LOTO Equipment-Specific Energy Control Procedure form been completed?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
16. Are above-ground utilities identified and clearly visible by equipment operators?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
17. Have underground utilities been clearly marked?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
18. Has the underground/overhead utilities checklist been completed?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
18. Have shutoff switches/valves been located?	<input type="checkbox"/> Electric	<input type="checkbox"/> Gas	<input type="checkbox"/> Water
19. Are proper traffic and/or fire control measures in-place?	<input type="checkbox"/> Traffic	<input type="checkbox"/> Fire Prevention	
20. Who is the designated Site Safety Officer?	Name: _____		
21. Has an on-site emergency response coordinator been determined?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
22. Does everyone know the location, directions, and name of the nearest hospital?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
23. Has the route to the hospital and emergency contact numbers been confirmed?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
24. Has a plan been established to ensure emergency responders can easily locate or be escorted to the work site?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
25. In the event of the emergency, where will personnel meet?	Location: _____		
26. Has an evacuation signal (i.e. emergency alarm, hand signal) been communicated to personnel?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
27. Where is the nearest working phone located (non-cell phone)?	Location: _____		
28. What is the local emergency phone number?	Location: _____		
29. Where is the location of the first aid kit on-site?	Location: _____		
30. Has the location of closest eyewash station been identified?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
31. Has the location of the closest fire extinguisher been identified?	Location: _____		
32. Will a Loss Prevention Observation be conducted today?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
33. Has a tail gate safety meeting been conducted detailing issues relevant to today's planned activities?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
34. Has work area been properly cleaned up after the completion of today's activities?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A

Special Safety Concerns For Today

Personnel having allergies/ailments/illnesses AND list of contact lens wearers: _____

Weather Conditions: _____

(Continue on page 2)

DAILY SAFETY MEETING /PERMIT TO WORK**BBL/BBLES****Personnel Training & Qualifications**

Supervisor's Training	Competent Person	First Aid/CPR	Confined Space

Short Service

Short Service Employees On-Site	Short Service Mentor

Personal Protective Equipment (PPE) Summary

Level A: Positive pressure (pressure demand), self contained breathing apparatus (NIOSH approved), or positive-pressure supplied air respirator with escape SCBA. Fully encapsulating chemical protective suit. Gloves, inner, chemical resistant. Gloves, outer, chemical resistant. Boots, chemical resistant, steel toe and shank; (depending on suit boot construction, worn over or under suit boot.).	Level B: Positive-pressure (pressure-demand), self-contained breathing apparatus (NIOSH approved), or positive-pressure supplied air respirator with escape SCBA. Chemical resistant clothing (coveralls and long-sleeved jacket, coveralls, hooded two-piece chemical splash suit, disposable chemical resistant coveralls.) Gloves, outer, chemical resistant. Boots, outer, chemical resistant, steel toe and shank.	Level C: Full-face or half-mask, air-purifying respirator (NIOSH approved). Chemical resistant clothing (one piece coverall, hooded two piece chemical splash suit, chemical resistant hood and apron, disposable chemical resistant coveralls.) Gloves, outer, chemical resistant. Boots, inner, chemical resistant. Boots, steel toe and shank, chemical resistant.	Level D: Level D is primarily a work uniform and is used for nuisance contamination only. Our standard work uniform consists of safety glasses and boots, steel toe and shank.
--	--	--	---

Additional Comments:

Stop Work Authority – As an employee or contractor for ChevronTexaco, you are responsible and authorized to stop any work that is not safe or does not comply with the OE tenets and there will be NO repercussions to you.

Job Safety Analysis – By signing below, you agree that you have read and fully understand the JSAs applicable to you and your assigned duties.

Name	Company	Before Work (Time)	Signature	Mid Day (Time)	Initial
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					

Call the **BBL Near Miss Hotline** to report all near misses!! : **866-242-4304**

I have assessed the risks posed by work activities planned for today and steps to mitigate those risks (e.g. HASP, JSA, PTW, tailgate meeting, coordination with other parties on site, etc.) have been completed to the best of our ability.

Work is safe to proceed. If site conditions change, Stop Work Authority will be used until reassessment is completed.

Permit Writer/Holder: _____ **date** (__ / __ / __)

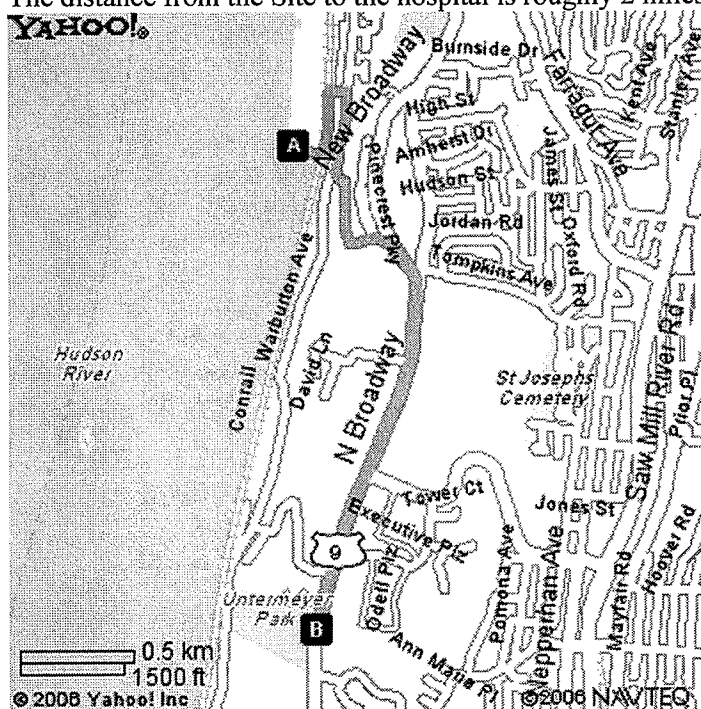
Attachment Y

Map to Hospital and Evacuation
Route Map (See Section 9.7 for
Hospital Route Map)

Figure 2-3
Driving Route
The Project Site to St. John's Riverside Hospital, Yonkers NY

1. Railroad Ave becomes Southside Ave.
2. Turn right on Cropsey Ln.
3. Turn right on Warburton Ave.
4. Turn left on Pinecrest. Dr.
5. Bear right on New Broadway (US-9)

The distance from the Site to the hospital is roughly 2 miles and the estimated travel time is six minutes.



Attachment Z

ARCADIS BBL Utility Clearance
Standard Operating
Procedure/Checklist

Utility Location Policy and Procedure

ARCADIS SOP: ARCHSFS019

Revision #3

Revision Date: 16 April 2007

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Utility Location Policy and Procedure

Approval Signatures

Approved by: 

Michael A. Thomas, CIH, Corporate HS Director

Approved by: 

Patricia A. Vollertsen, Corporate HS Manager

Revision Date	Revision Number	Reason for change
13 December 2007	01	Original document
26 March 2007	02	Put in new company format
15 May 2007	03	Added nation-wide 811 number

1.0 PURPOSE

This procedure directs general safety procedures associated with the identification and management of above ground and subsurface utility locations on project sites.

2.0 SCOPE

2.1 Management Requirements - ARCADIS personnel managing or working on any project requiring subsurface work and/or investigations (SWI) and requiring work in the vicinity of above ground utilities must incorporate this procedure into their project planning and field work activities to ensure that all reasonable means to identify utilities are implemented and that appropriate controls have been put in place to minimize or eliminate damage to these utilities and the hazards associated with these utilities. All applicable procedures described in this document must be completed prior to initiating intrusive field work or field work in the vicinity of above ground utilities, or the work cannot proceed.

2.2 Project Management Requirements - Where SWI are required to be performed by a subcontractor to ARCADIS under its subcontract, project management shall require the subcontractor to adequately incorporate SWI procedures described herein into the subcontractor's scope of work.

3.0 DEFINITIONS

Above Ground Utilities - For the purpose of this procedure, above ground utilities include, but are not limited to: any above ground line, system, or facility used for producing, storing, conveying, transmitting or distributing communication or telecommunications, electricity, gas, petroleum and petroleum products, coal slurry, hazardous liquids or gases, water under pressure, steam, or other hazardous materials.

Subsurface Utilities - For the purposes of this procedure, subsurface utilities include, but are not limited to: any underground line, system, or facility used for producing, storing, conveying, transmitting or distributing communication or telecommunications, electricity, gas, petroleum and petroleum products, coal slurry, hazardous liquids or gases, water under pressure, steam, or sanitary sewage; underground storage tanks; tunnels and cisterns; and septic tanks.

4.0 RESPONSIBILITIES

4.1 Project Manager Responsibilities

To prevent injury to employees, avoid disruption to utility services, and help eliminate damage to subsurface and above ground utilities, project managers have the responsibility for utility identification, location, and marking prior to initiating field activities. Most states, provinces, municipalities, and clients have rules, general statutes, or laws that specify the requirements of subsurface utility location prior to intrusive subsurface field activities (i.e., excavation, trenching, boring, and all forms of drilling operations, etc.). The project manager ensures that these laws are followed, and that the directives outlined in this procedure are met for every project involving SWI and work in the vicinity of above ground utilities.

In addition, if field activities are completed in the vicinity of above ground utilities, the project manager is responsible for working with the client to identify the nature of the utilities, and to determine what control processes need to be implemented to prevent damage to these utilities and to minimize any injury in the event there is damage.

4.2 Field Personnel Responsibilities

Field personnel conducting SWI activities and activities where above ground utilities are in the vicinity of the work have the responsibility to read, understand, and follow this procedure and complete the appropriate checklists during the on-site utility locate process. ARCADIS personnel assisting in the identification of underground utilities have previous related experience of a minimum of 1 year. Those implementing remote sensing technologies have completed training in those techniques and have 6 months experience operating and interpretation results.

If utilities cannot be located to eliminate any reasonable concern, field personnel use their Stop Work authority until utility locations can be identified. Field personnel review this procedure onsite with ARCADIS subcontractors, and ensure they follow the procedures detailed in this document. Any ARCADIS subcontractor not following these procedures are asked to stop work, and the project manager contacted. Any diversion from this procedure by ARCADIS field personnel is approved by the project manager with input from Corporate Health and Safety as necessary.

5.0 POLICY AND PROCEDURES

5.1 Policy

It is the practice of ARCADIS and its affiliated companies to implement appropriate, reasonable and practical procedures within acceptable and customary industry practices to promote the health and safety of its employees, and avoid and mitigate exposure of risk in the performance

of their work. In furtherance of this policy, ARCADIS promotes and encourages compliance by all employees with this policy and procedures relating to SWI and working in the vicinity of above ground utilities.

- This procedure is followed by all responsible ARCADIS personnel. Such procedures are included in the Project Planning processes utilized by ARCADIS personnel.
- Project Management procedural requirements are outlined in Section 5.1. All employees included in SWI and above ground utility work are familiar with these procedures.
- For all SWI, it is required to contact the locality One Call number and/or a privately contracted utility location company, and to conduct a visual inspection of the site for subsurface utility locating. In addition, for non-greenfield sites, ARCADIS obtains from the client, a detailed site utility map. Additional lines of evidence may be required based on field conditions and client requirements for subsurface utility location. The project manager or designated representative in cooperation with the H&S staff and SWI contractor determine when and if additional lines of evidence are required. Additional lines of evidence include but are not limited to the following:
 - Detailed site utility maps, preferably “As-Built” drawings (drawn to scale)
 - Hand augering or digging
 - Hydro-knife
 - Air-knife
 - Radio Frequency Detector (RFD)
 - Ground Penetrating Radar (GPR)
- Contract Terms: In agreements for SWI with a client, prime contractor, or subcontractors, required terms (Exhibit 1) shall be included for the appropriate allocation of risk of damage to subsurface facilities. If such provisions cannot be agreed upon, the reasons are documented and other risk-management actions identified, such as limits of liability, additional physical investigations, additional lines of evidence of utility location, assignment of risk to subcontractors, etc.
- The policy of ARCADIS encourages and empowers all employees to take such action as they deem appropriate to assure compliance with this policy and procedures both in project planning and field site operations. Such authority is delegated to those on the project site to immediately stop any SWI work or work in the vicinity of above ground utilities where the employee believes that injury to persons or damage to property could occur. Such action is taken without regard to costs or schedule. Personnel immediately notify their supervisor of any concerns that they have in observing any SWI work or work in the vicinity of above ground utilities. In all agreements between ARCADIS and SWI subcontractors, (e.g., drilling

subcontractors), provisions shall be included in the subcontract, work authorization or purchase order. These provisions (Exhibit 1) are found on the ARCADIS intranet at the Legal Department team site.

All ARCADIS personnel involved in SWI work or work in the vicinity of above ground utilities are appropriately trained on this procedure and have the appropriate professional experience for oversight of or involvement in SWI work or work in the vicinity of above ground utilities. ARCADIS Corporate Health & Safety can answer further questions about this policy or the hazards associated with and the control procedure for work in the vicinity of subsurface or above ground utilities.

Again, to support the efforts of ensuring the health and safety of its employees and mitigating risk to ARCADIS, ARCADIS requires that these policies and procedures be followed and implemented at all levels of project management and field implementation.

5.2 Procedures

A flow chart/decision tree of these procedures is presented in Exhibit 2 of this document.

5.2.1 Project Management Procedural Requirements

5.2.1.1 Planning and Information Request

Field activities are planned and designed to avoid contact with and damage to, and minimize interference with subsurface and above ground utilities in the vicinity of ARCADIS work activities. During the planning phase of a project the project manager contacts the client and/or property owner to request the following information for the area of the Site where the work will occur:

- A list of known or suspected existing and historical subsurface and above ground utilities present on a subject property;
- An accurate site plan (drawn to scale) illustrating subsurface and above ground utilities; and
- Construction, diameter, volume, depth, contents, and physical properties, etc. of each subsurface and above ground utility.

In the event that the client and/or property owner is not aware of the utilities at the subject property, can only provide a partial list, or cannot provide an otherwise accurate, scaled map, plan or drawing of utilities on the site, then additional resources are utilized to identify utilities at the subject property. This may include but are not limited to:

- Contacting utility provider billing departments directly to inquire if a bill is generated for the property address;
- Utilizing city/county computer-drawn maps, or geographical information systems (GIS) data containing utility information; and/or
- A site walk to visually inspect the subject property for evidence of subsurface and above ground utilities (i.e., manhole covers, meters, warning signs, vent pipes, fill ports, pipe runs, utility lines, etc.).

In the project planning process, the project manager and /or task manager determines the reasonable methods to be used to locate subsurface utilities prior to SWI. It is required to contact the state or province One Call number and/or a private utility locator if on private property as appropriate to the site. Also, an additional two lines of evidence are used for subsurface utility line location at all sites. If scaled and accurate site utility maps are not provided by the client, additional lines of evidence are used (see Section 5.0 for lines of evidence options). Increased flexibility is built into subsurface sampling and/or extraction programs when confidence in utility identification, location, and marking is less than optimal.

5.2.1.2 *Communication and Coordination*

Using list of identified and suspected utilities, the PM or their designated Task Manager:

- Notifies a public one-call service centers and/or private utility contractors prior to initiating intrusive subsurface field activities;
- Provides the list to the site safety officer for inclusion in the site-specific health and safety plan (HASP);
- Communicates potential hazards to field staff prior to mobilization;
- Instructs field staff to be aware of and implement the procedures in the Section 6.2 of this procedure and utilize the appropriate utility location checklists.
- When practical, schedules a joint meeting between the public/private utility locators and field staff to oversee the subsurface utility locating and marking in the field.
- Communicates with and provides utility location documentation to the subcontractors to inform them of the utility locations and discusses methods to be used to protect those utilities.

- Understands the subcontractor's methods for utility location and documenting the process with a clear delineation of responsibilities for utility location.

In general, subsurface utility locations marked by public utility locators are only good for 2 weeks (research your state-specific requirements). If SWI activities are not conducted during this time period, the site is remarked. At no time is SWI conducted based on old markings, hand-drawn maps/sketches, photographs, or by recollection/memory of field staff. If markings are smeared, removed, damaged, or impacted in any way, the site must be remarked before SWI begins. Flag markings are used in addition to paint markings wherever possible.

5.2.1.3 *Utility Request Notifications for Public Property*

Prior to intrusive work on public property (i.e., right-of-ways, easements, etc.), notification of a public one-call service center is completed a minimum of 48-72 hours (states/localities requirements vary, so the PM is responsible for verifying this) prior to initiating field activities (excluding Saturdays, Sundays, and legal holidays). Specific state or local laws related to utility location are evaluated with respect to notification and liability in the event of utility damage. During the call, ARCADIS:

- Provides accurate description of the location of all areas of the SWI;
- Documents the utility locate request to record the time and date of the call, the area to be marked, the list of utility companies and municipalities that the one call service center will notify;
- Records the associated ticket (or dig) number provided by the one call service center;
- Cross references the notification list provided by the one-call service center with the list of known or suspected utilities for the property; and
- Provides accurate contact (PM name and phone numbers) information for the one call service center so they can subsequently communicate potential questions and/or delays related to the utility location and marking.

After receiving a request, the one-call service center sends requests to participating utility operators who have utilities in the area of the intrusive field activities. Each underground utility operator dispatches their own locators to mark their facilities with paint or flags. The project manager attempts to have field staff present during the marking of the utilities by the locator organization to ensure that the area of the SWI is included in the locating activities. It is important to note:

- Not all utility operators and municipalities participate in one call programs. In some instances, one-call programs provide a list of utility providers that participate, and a list of those that do not. The utility providers that do not participate are contacted individually so that they can mark their own lines, and ARCADIS documents this call (date of call, person receiving call, date lines will be marked, etc.);
- Public utility locators are usually only required to mark utilities within the public spaces (i.e., right of ways) or at most up to a meter on private property; and
- Knowledge of existing or suspected, but unmarked utilities are documented and communicated to the site safety officer, field staff, and the client prior to implementing field activities.

If a known or suspected subsurface utility does not participate in the state one-call program, and that provider has not been individually contacted prior to the start of SWI, then the field activities are postponed. If these utility providers are contacted and do not provide utility location services, then SWI are not performed until a private utility locating company is contracted and the locating tasks completed. If utility locates are not completed by public or private utility locating companies, then the subsurface activities are performed with extreme care using hand tools, or other means of utility location are used (air knife/hydro-knife technologies, or GPR), but only upon receiving approval from the ARCADIS Health & Safety department and the client.

5.2.1.4 *Utility Request Notifications for Private Property, Military Installations, or Other Government Facilities*

Prior to intrusive work on private property, military installations, or other government facilities the public one call service center is contacted as previously described, to identify utilities that enter and/or are in the vicinity of the subject property. In addition,

- A private utility contractor may be required to locate and mark utilities that transect the property beyond meters and/or additional utilities that property owner has installed, which may or may not be maintained and serviced by a utility or municipality
- Where appropriate, or at a client's request, a facility or plant engineer familiar with the subsurface utilities is contacted to request marking and location of utilities
- One or more weeks of advanced notice is usually required to subcontract a private contractor or coordinate with a facility or plant engineer to locate and mark utilities

- Verbal or written requests to private contractors or onsite personnel for utility location and marking is documented to record the time and date of the request, the area to be marked, and the list of utilities to be marked
- The project manager attempts to have field staff present during the marking of the utilities by the locator organization to ensure that the area of the SWI is included in the locating activities
- Knowledge of existing or suspected, but unmarked utilities is documented and communicated to the site safety officer, field staff, and the client prior to implementing field activities
- If a known or suspected utility is not located and marked by the private utility company or facility engineer, then sampling and/or excavation activities is performed with extreme care using hand tools, hydro-knife or other method that does not damage the utility; postponed until utilities are clearly marked; or canceled. If work proceeds, it can only be completed with the approval of the ARCADIS Health and Safety department and the client.

5.2.1.5 *New Nation-wide Utility Locate Call Number 811*

Several state and local utility notification centers have launched a new “Call before you Dig” number to help save lives and protect underground infrastructure. This new, national number is: **811**. The number is designed to help prevent professional excavators, drillers, etc. and homeowners, from damaging underground utility lines while digging/drilling and causing injury or service outage. For more information about the 811 services, visit www.call811.com

The number 811 is a new FCC designated national n-11 number created to eliminate confusion of multiple calls before you dig numbers across the country. This quick and efficient one call service will notify the appropriate utilities, who participate in the one call program. **However**, ARCADIS callers must still verify who the one call service contacts, and then determine which utilities may need to be contacted directly (e.g. those utilities not participating in the one call service) by following the requirements outlined in this procedure.

5.2.2 FIELD PROTOCOL

At no time do field activities that involve SWI or work in the vicinity of above ground utilities commence without the field staff having knowledge of the location of subsurface and above ground utilities. In addition, as stated above and in general, subsurface utility locations marked by public utility locators are only good for 2 weeks (research your state-specific requirements). If SWI activities are not conducted during this time period, the site is remarked. At no time is SWI

conducted based on old markings, hand-drawn maps/sketches, photographs, or by recollection/memory of field staff. If markings are smeared, removed, damaged, or impacted in any way, the site must be remarked before SWI begins. Flag markings are used in addition to paint markings wherever possible.

5.2.2.1 *SWI and Subsurface Utilities*

Prior to the start of intrusive activities, all utilities are located and measures instituted to avoid subsurface utility hazards. If intrusive work must take place within close proximity to a utility line, the utility line can also be rendered controlled (i.e. through lockout/tagout procedures).

Prior to mobilizing to the site for SWI work, field staff reviews the task details with the project manager or their designated authorized TM. This may include but is not limited to review of boring logs, excavation permits, etc. Any special site or client requirements are also discussed. Prior to initiation of any intrusive activities, the utilities and structures checklist (Exhibit 3) is reviewed and completed. Generally, the following colors apply for different types of utilities/operations:

- Red – Electric;
- Yellow – Natural gas/oil;
- Orange – Communication/cable television;
- Blue – Water;
- Green – Sewer;
- Pink – Temporary survey marking;
- White – Proposed excavation; and
- Purple – Reclaimed water

In addition, the SWI subcontractor marks (i.e., paint, stakes, etc.) the location of their operations to ensure they fall within the area that has been investigated for utilities.

Once the checklist is completed and all utilities identified, any client/site specific utility location or other utility (subsurface or above ground utilities) protection procedures (i.e. such as hand digging to a specified depth, covering or shielding lines, etc.) is completed at each location where work will be completed. If a known or suspected public subsurface utility has not been marked or the markings are not clear, the state one-call number is contacted to determine if an “emergency” locate can be requested. If so, follow the procedures outlined by the locate service and contact the project manager. If it is a private utility that is not marked, the facility manager and/or the project manager should be contacted.

If uncertainty remains on utility location, and/or more precise locations of utilities are required, and where field staff determine the circumstances warrant it, additional lines of evidence are

implemented including air or hydro knifing, or ground penetrating radar. Descriptions of the use and limitations of these methods are included in Exhibit 4.

If unexpected conditions are encountered (refusal, debris, pea gravel, etc.) while completing the intrusive activity, all work is immediately halted. Note that subsurface utilities at many industrial facilities are often placed in conduits or concrete to prevent damage. If a utility or subsurface structure is compromised, the field staff initiates the Emergency Action Plan Guidelines (Exhibit 5); however, more detailed emergency action procedures should be reviewed with the client and documented in the site specific health and safety plan prior to initiating work.

5.2.2.2 *Work in the Vicinity of Above Ground Utilities*

If activities take place in the vicinity of an above ground utility, the utility line can be rendered controlled (i.e. through lockout/tagout procedures) or protected from damage (i.e. covering overhead power lines). The following table is used to develop acceptable work distances for work involving machinery with high extensions (backhoes, drilling rig masts, etc.) in the vicinity of overhead power lines:

Power Line Voltage Phase to phase (kV)	Minimum Safe Clearance (feet)
50 or below	10
Above 50 to 200	15
Above 200 to 350	20
Above 350 to 500	25
Above 500 to 750	35
Above 750 to 1,000	45

ANSI Standard B30.5-1994, 5-3.4.5

The distance may be lengthened if directed by the client or the electric company, and any specified distances are strictly followed. In addition, work involving machinery, vehicles or equipment that may come in contact with above ground utilities is not completed until those utilities are protected or control processes are in place to avoid damage to those utilities.

If an above ground utility is discovered that has not been previously identified prior to mobilizing to the field, the field staff notifies the project manager who requests the client to assist in the identification of the utility and the implementation of control procedures as appropriate. In addition, if a utility or subsurface structure is compromised, the field staff initiates the Emergency Action Plan Guidelines (Exhibit 5); however, more detailed emergency action procedures should

be reviewed with the client and documented in the site specific health and safety plan prior to initiating work.

6.0 RECORDS

6.1 Checklist Records

Exhibit A - Contract Term Language

INSERT INTO ALL CLIENT CONTRACTS OR WORK ORDERS WHERE DRILLING, EXCAVATION, INTRUSIVE WORK IS TO BE PERFORMED.

Site Conditions: ARCADIS shall not be liable for: (i) damage or injury to any subterranean structures (including, but not limited to, utilities, mains, pipes, tanks, and telephone cables) or any existing subterranean conditions; or the consequences of such damage or injury, if (with respect to this clause (i)) such structures or conditions were unknown and were not identified or shown, or were incorrectly shown, in information or on plans furnished to or obtained by ARCADIS in connection with the Services; (ii) concealed conditions encountered in the performance of the Services; (iii) concealed or unknown conditions in an existing structure at variance with the conditions indicated by the Scope of Services or Work Authorization; or (iv) unknown physical conditions below the surface of the ground that differ materially from those ordinarily encountered and are generally recognized as inherent in work of the character provided under this Agreement.

Client shall provide to ARCADIS all plans, maps, drawing and other documents identifying the location of any subterranean structures on the Site. Prior to location of any drilling or excavation below the ground surface, ARCADIS shall obtain the concurrence of the Client as to the location for such drilling or excavation.

Should: (i) concealed conditions be encountered in the performance of the Services; (ii) concealed or unknown conditions in an existing structure be at variance with the conditions indicated by the Scope of Services or Work Authorization; or (iii) unknown physical conditions below the surface of the ground differ materially from those ordinarily encountered and generally recognized as inherent in work of the character provided under this Agreement; then the amount of this Agreement and/or time for performance shall be equitably adjusted by change order upon timely notice.

INSERT INTO ALL DRILLING, EXCAVATION, INTRUSIVE WORK SUBCONTRACTS.

Site Conditions: SUBCONTRACTOR acknowledges that time is of the essence with respect to the performance and completion of its work under this Contract. SUBCONTRACTOR shall adhere to, commence and complete its work in accordance with any schedule incorporated into this Contract, or any schedule submitted by SUBCONTRACTOR or attached hereto; and with respect to any Changes, out of scope or additional work, SUBCONTRACTOR shall expeditiously perform such work according to any schedule therefore agreed to by the parties. In the event any schedule is incorporated in this Contract or attached to this Contract, SUBCONTRACTOR acknowledges and agrees that such schedule has accounted for all inherent or reasonably anticipated delays, including but not limited to those inherent in obtaining site information, access sufficient labor, supplies, tools, equipment and utilities required for the

project work, and SUBCONTRACTOR waives any claim of extra compensation or damages therefore.

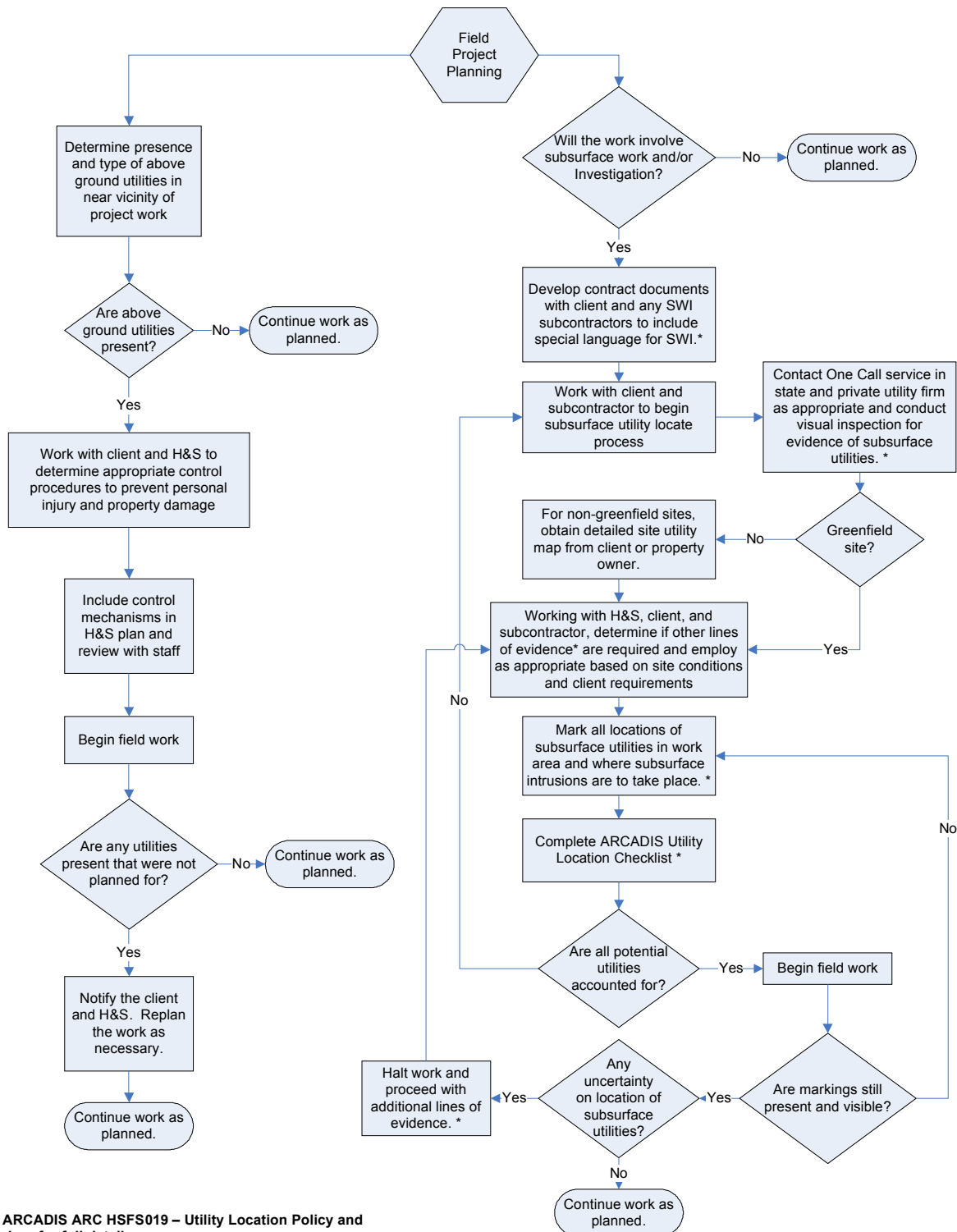
Subcontractor represents and warrants that it has had an opportunity to review and/or has carefully examined all necessary drawings, maps, schematics, specifications, governmental restrictions, permits and license requirements, and all applicable laws, regulations and rules relating to the Work to be done and the Site, its surroundings and local conditions, and has made all investigations based on reasonably available information that are necessary to develop a full understanding of the hazards and difficulties which can be encountered and are likely to impact the cost or schedule to perform the Work. SUBCONTRACTOR is thus familiar with conditions at the Site as are pertinent to or which may affect the Work and has been granted the right to conduct, and has conducted, all investigations it deems appropriate to determine that it can fulfill the requirements of this Contract. Notwithstanding any other provision of this Contract, SUBCONTRACTOR assumes the risk of all conditions, as specified in this Contract, that may affect SUBCONTRACTOR'S ability to perform the Work and will, regardless of such conditions, or the expense or difficulty of performing the Work or the negligence, if any, of ARCADIS, with respect to same, fully complete the Work for the stated price without further recourse to ARCADIS. Information on the Site and local conditions at the Site furnished by ARCADIS are not guaranteed by ARCADIS to be accurate, and is furnished only for the convenience of SUBCONTRACTOR.

The discovery of concealed conditions which could not reasonably have been anticipated by the SUBCONTRACTOR from information available to SUBCONTRACTOR may constitute a changed condition, which, to the extent such condition materially affects the cost or schedule to perform the Work, would entitle the SUBCONTRACTOR to a change and an equitable adjustment of the Contract price or time. SUBCONTRACTOR warrants that it shall conduct appropriate investigations to determine, with reasonable certainty, the location of utility and service lines, underground storage systems, and other subsurface structures of any kind before commencement of any drilling, excavation, or other work that has the potential to disturb these structures. SUBCONTRACTOR further warrants that it shall conduct independent field investigations to confirm the location of subsurface structures before commencement of subsurface work and shall not rely exclusively on plot plans or other drawings provided to SUBCONTRACTOR in conducting these investigations.

Exhibit B – Utility Location Decision Tree

Exhibit B

Exhibit B- Utility Location Decision Tree*
(PMs or TMs are required to follow both sides of flowchart)



* See ARCADIS ARC HSFS019 – Utility Location Policy and Procedure for full details.

Exhibit C - Utilities and Structures Checklist

Project:	Project Number:
Site Location:	Date:

Instructions: This checklist will be used as a safety measure to insure that all underground utility lines, other underground structures as well as above ground utilities are clearly marked out and identified in the area selected for boring or excavation. **DRILLING, EXCAVATION, OR ANY TYPE OF GROUND INTRUSIVE WORK MAY NOT PROCEED UNTIL LINES ARE MARKED AND THIS CHECKLIST HAS BEEN COMPLETED.**

Pre-Field Work Requirements		
Was the state one-call notified with the required advanced notice (usually 48 to 72 hours)	YES	NO
State one-call confirmation number		
What are the 2 lines of evidence used for utility clearance?		
Was a plot plan showing site features and subsurface utilities provided by the PM/TM?	YES	NO
Was the Nation-wide 811 Number called? If no, why not?	YES _____ NO _____	
If yes, what information was provided?		
Subgrade Utility Line Location		
Where is the gas line located?		
Where is the gas meter located on the site building(s)?		
Are the electric lines subsurface or overhead? Where are they located?		
Where is electric meter located on the site building(s)?		
Where are the telephone/cable lines located? Are there any overhead lines?		

Where do these lines enter the site building(s)?	
Where are the water lines located?	
Does the site occupant use water (bathrooms, industrial uses, fire suppression, etc.)? If so where do the water lines enter the building for these purposes?	
Are there small manholes/vault covers indicating water lines? If so, where?	
Was the local municipality contacted to mark sanitary lines?	
Where are the sanitary lines located?	
Where might the sanitary lines enter the building? (i.e. what side of the building are the bathrooms, kitchens, water treatment plant, etc?)	
Where are the storm sewer lines located?	
Are there storm sewer inlets located on the property? Check inlets for direction of subsurface lines.	
Are there any gutters directing storm water to the subsurface? Evaluate for direction of lines.	
Underground Storage Tank Sites	
Where are the USTs located? How many USTs are at the site (very number of USTs by counting fill ports and vent lines)?	
Where do the vent lines run?	
Where does the piping run? (Evaluate the path between USTs to dispenser islands).	
Where are the sub-surface electrical lines located which feed power to the UST system?	
General Underground Utility Location Signs	
Are there any cracks resembling straight lines that may indicate the settling of utility lines?	
Are there any patched areas where subsurface repairs may have been conducted?	

Are there any manhole covers or valve boxes that are not associated with marked lines?	
Above ground Utility Line Location	
Are there overhead power lines? If, so where are they located?	
What is the voltage of the overhead power lines?	
Are there any above ground structures (utilities, piping, etc.) that are used by the client? If so, are they located proximal to the work area?	
Do these lines need controlled (locked out) or protected prior to starting work?	
Interviews: Site Owners/Occupants MUST be interviewed for location of private utility lines at the site (if practicable) before start of work	
Name of Owner/Occupant.	
How is this person affiliated with the Site?	
Who interviewed Owner/Occupant?	
Date of Interview	
Specific comments that should be noted from the interview:	

NOTE: If any subsurface utilities listed above are not located, do not proceed with subsurface activities. Contact PM/TM immediately.

Name and signature of person who conducted utility line checklist



Name (print)

Signature

Date

Exhibit D - Use and Limitations of Utility Locating Methods
Ground Penetrating Radar (GPR)

The GPR system transmits high frequency electromagnetic waves into the ground and detects the energy reflected back to the surface. Energy is reflected along boundaries that possess different electrical properties. Reflections typically occur at lithologic contacts or where subsurface materials have high electrical contrasts, including metal objects such as underground storage tanks (USTs), drums, and utility pipes. These reflections are detected by the antenna and are processed into an electrical signal that can be used to image the subsurface feature. The GPR data will be reviewed in the field to assist in the delineation of potential piping or other subsurface structures.

The detection of subsurface structures located at the site depends on the electrical properties of the soil and the structure's depth, diameter, and composition. GPR is limited to the detection of smaller diameter pipes with depth. Generally, a pipe must increase in diameter by one 1 inch for each foot in depth to be seen using GPR. Also, plastic piping is more difficult to detect than metal piping using GPR, and caution should be used if plastic utility lines are suspected.

Radio Frequency Detection (RFD)

This instrument operates on the principle of radio frequency transmission and detection. The transmitter applies a known frequency to the pipe and the receiver is able to detect this frequency along the length of the structure. The success of RFD in tracing underground utilities is based on the composition of the structure (metal or plastic) and the ability to accurately position the transmitter unit so that it can be attached to, or placed directly over the structure. RFD should only be used to verify the location of utility mark-outs, and not as the primary method of utility identification.

Soil Vacuum Excavation

This method uses nondestructive vacuum excavation methods to create a visual test hole allowing the confirmation of buried utilities. This method is very accurate and relatively fast and can be performed prior to or during the drilling program. The limiting factors for this method are cost and availability. As with specialty drilling methods, a limited number of firms have the equipment to perform vacuum excavation.

The location of the structures to be cleared relative to the source and depth of impacted soil or groundwater is considered. If the zone to be cleared is known not to contain hazardous vapors or petroleum hydrocarbons via previous testing, continuous air monitoring is implemented using a lower explosive level (LEL)/O₂ meter and photoionization detector (PID) or flame ionization

detector (FID) to the depth of the boring. Also consistent with the site health and safety plan (HASP), air monitoring should be conducted continuously with the LEL/O₂ meter during any activity if flammable or explosive vapors are suspected to be present. Prior to any subsurface investigation activities, air monitoring should be conducted to establish background levels for total organic vapors using a PID or FID. All work activity must STOP where tests indicate the concentration of flammable vapors exceeds 10% of the LEL, and the source of vapors must be investigated.

Vacuum-assisted soil excavation utility clearance will not be used in areas known to contain hazardous vapors or petroleum hydrocarbons unless the equipment to be used is suitable for flammable/explosive atmospheres. There is a significantly increased risk of explosion if these materials are encountered while performing this type of utility clearance. Cautions will be performed, as identified below.

Cautions

Many vacuum systems that are commonly used for utility clearance are considered unsuitable for use for environmental investigation sites. Most vacuum units are “Not for use with Hydrocarbons, Explosives, Corrosive or Toxic Material,” and are “Not Intrinsically Safe.”

Given that many units and associated tanking are not explosion-proof, the following steps will be considered prior to using vacuum-assisted utility clearance units where soils could be impacted with petroleum hydrocarbons or flammable vapors.

1. Request from the manufacturer and/or the contractor doing the work to supply manufacturers' documentation and specifications for use of the unit at environmental sites.
2. Request documentation that the unit is intrinsically safe and may be used in areas where petroleum hydrocarbon may be present.
3. Obtain the procedures for grounding portable units to discharge potential static electricity during operation.
4. If none of the above are available, then hand auger instead and do not use vacuum-assisted methods.

Exhibit E - Emergency Action Plan Guidelines

When work activities result in the contact or compromise of a utility line, an appropriate response is critical to prevent injury, death or significant property damage. Although circumstances and response vary depending on site specific conditions, the following guidelines provide information that is factored into emergency action planning associated with utility damage. In any event, emergency planning is coordinated with the entity that owns the utility and the client prior to the start of work. This planning and the appropriate response actions are documented in the project health and safety plan and reviewed with all field staff.

Contact with Above or Underground Electric

Contact with above ground or underground electric lines may result in the equipment being energized. Field personnel do not assume rubber tires on equipment are insulating the equipment from the ground. For underground electric strikes, contact with the line may not be immediately noticeable but indications of a strike include: power outage, smoke, explosion, popping noises, or arching electricity. If contact with an electric line is made or is suspected, the following guidelines are followed:

- Under most circumstances, the equipment operator or any worker on a seat of the equipment should stay on the equipment. These workers should not touch anything, especially metal, on the equipment.
- If it is determined that the equipment should be vacated due to a life threatening circumstance, the worker(s) should jump clear as far as possible from the equipment. When jumping keep both feet together and hop away to a safe distance after landing on the ground. Do not use hand holds or touch any part of the equipment when preparing to jump off.
- Workers on the ground should move away from the equipment.
- Keep others away from the equipment and the area.
- If anyone is injured and in contact with the line or equipment, any attempted rescue should be performed with extreme caution. Only use long, dry, clean, unpainted pieces of wood or fiberglass pole or long dry, clean rope to retrieve the victim. Perform first aid/CPR only after the victim is sufficiently clear from the electrical hazard.
- Notify the electric utility or the client as appropriate for the site. Call 911 or the client's emergency response phone number, as appropriate, for any serious injury or any situation that may result in fire or other hazard that could produce injury or property damage.

Natural Gas

If a natural gas line of any size is compromised, immediately:

- Shut off the equipment and remove any other ignition sources.
- Evacuate the area as quickly as possible.
- DO NOT attempt to turn off any gas valves.
- Call 911 or the designated client emergency response number as appropriate.
- Call the gas utility, if site response is not controlled by the client.
- Do not return to the area until permitted by the utility or by the approved client emergency response personnel, as appropriate.

Water Lines (all types)

Compromised water lines may rapidly become a significant hazard especially if the line is under considerable pressure. Ruptured pressurized water lines may undermine and wash out unconsolidated materials beneath equipment or structures causing them to become unstable. If a pressurized water line is ruptured, the following guidelines should be followed:

- Promptly shut off all equipment.
- Lower masts or other high extension components of the equipment.
- Evacuate area and call the water utility or client emergency response number, as appropriate.
- Turn off the water if the valve location is known and on the site property.
- If potable water lines have been ruptured, attempt to divert any flow away from structures prone to being flooded. Use caution and keep a safe distance from the line break since the ground surface may be compromised.
- For raw process water or other water of unknown quality, do not attempt to divert or contain. Avoid skin contact or accidental ingestion of any water.

- When returning to the area of the break, survey the area for signs of compromised land surface (cracks in asphalt or concrete, depressions in ground, observations of undercutting, etc.) and avoid moving any equipment until these conditions are repaired or resolved.

Sewers (all types)

Use the same general guidelines for water lines when responding to compromised sewers. If a sanitary sewer is compromised additional guidelines should be followed to avoid contracting any bacterial illnesses. These include:

- Promptly evacuate the area.
- Avoid contact with any sewage material.
- If contaminated, promptly wash with soap (antimicrobial) and water and promptly change impacted clothing.
- If sewage is accidentally ingested or infiltrates any breach of the skin or enters the eyes, seek medical attention as a precautionary measure.
- Decontaminate equipment with commercially available disinfectant solutions or a 10% chlorine bleach solution.

Communication Lines

Contact and compromise of communication lines are generally considered more of a financial concern than a concern associated with injury. However, eye damage may occur if looking into the ends of a cut fiber optic line. Do not look into the ends of fiber optic lines or other communication lines of unknown type. Promptly contact the communication company owning the line.

Product Lines and Underground Storage Tanks (all types)

Compromise of a product line or underground storage tank (UST) requires immediate action to mitigate impact to the environment. For gasoline stations and similar facilities the following guidelines should be followed during a line or UST breach:

- Immediately shut down equipment and turn off the emergency shutoff switch for the facility dispensers.

- If there are no injuries, attempt to contain any flowing product using absorbent materials and/or by physically pumping or bailing product out of the breached area.
- If product is flowing on the surface away from the break area, attempt to protect downgradient storm drains, sewer drains, and surface water features from impact of the petroleum product using any readily available materials.
- If the bottom of a UST has been breached, immediately contact a pump truck to remove product from the affected UST.
- For releases involving diesel fuel, care will be taken to avoid any situation where diesel may be injected into the body from impalement by coated nails, wood splinters, etc. If diesel is injected into the body, seek prompt medical attention, even if no apparent symptoms of a problem exist.
- Clear area and arrange for prompt repair.

For industrial sites with lines or USTs containing multiple products with varying hazards, similar guidelines may be followed as above if the material encountered is known and workers have a fundamental understanding of the hazards associated with the material. Upon discovery of a line or UST breach due to work activities at these sites:

- Immediately stop work and notify the client representative or call the client designated emergency number. For abandoned sites call 911.
- If the material is not known, promptly evacuate the area and let HAZMAT teams deal with the release.