DRAFT FOR REVIEW

VOLUME 3

HEALTH AND SAFETY PLAN

SITE WIDE GROUNDWATER (OPERABLE UNIT 03)

WEST LAKE LANDFILL SITE

BRIDGETON, MISSOURI

June 5, 2019

Project #: 63N-001-001

SUBMITTED BY: Trihydro Corporation

1252 Commerce Drive, Laramie, WY 82070

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memorandum

To:	West Lake OU-3 Project-Team Members
From:	Mr. Stephen L Lombardo, P.G.
Date:	June 5, 2019
Re:	Health and Safety Plan (HASP) Orientation

The purpose of this memorandum is to provide project-team members (specifically field team employees) with a Health and Safety Plan (HASP) orientation, including a summary of the project, its common hazards, minimum personal protective equipment (PPE) required, other relevant safety concerns, plus policies and practices unique to the site. Since project history affects information presented to project team members, this orientation is an evergreen document and should be updated as the project progresses. Lessons learned and hazards identified will be documented during daily tailgate safety meetings, recorded on Job Safety Analyses (JSAs) and memorialized in the HASP. This memo must be read in conjunction with the site-specific HASP, which contains detailed site hazard and response information.

INTRODUCTION

The Site was added to the Superfund National Priorities List (NPL) in 1990 and consists of three Operable Units (OUs) including former industrial and municipal waste cells and groundwater. Operable Unit 1 (OU-1) includes former waste disposal areas Radiological Area 1 (Area 1) and Radiological Area 2 (Area 2) where radiological impacted materials (RIM) exist (EPA ID#MOD079900932). Operable Unit 2 (OU-2) has no areas impacted with RIM and includes the closed construction and demolition (C&D) cell, inactive sanitary landfill, and the North and South Quarry Portions of the Bridgeton Landfill. OU-2 is managed by the Missouri Department of Natural Resources (MDNR). OU-3 includes groundwater beneath the entire 212-acre Site and is the focus of this Remedial Investigation/Feasibility Study (RI/FS). The RI/FS portion of the project is anticipated to begin in 2019 and go through 2023.

Currently, the Exclusion Zone at the Site is controlled by Feezor Engineering and Ameriphysics, LLC for OU-1 related activities and routine groundwater and air monitoring. Trihydro will defer to and adhere to the existing health and safety policies/procedures regarding working within the OU-1 Exclusion Zone.

PROJECT/SITE HISTORY

For ease of discussion, the Site is divided into five units:

- Area 1
- Area 2
- Closed Demolition Landfill
- Inactive Sanitary Landfill
- The Bridgeton Landfill

OU-1 comprises Area 1, Area 2, the Buffer Zone, and Crossroads Properties LLC Lot 2A2. The Bridgeton Landfill, the Closed Demolition Landfill, and the Inactive Sanitary Landfill are all part of OU-2.

The West Lake Landfill contains multiple areas of differing past operations. The landfill property was used agriculturally until a limestone quarrying and crushing operation began in 1939. The quarrying operation continued until 1988 and resulted in shallow excavation areas and two quarry pits, the North Quarry Pit and the South Quarry Pit. The South Quarry Pit was excavated to a maximum depth of 240 feet below ground surface (ft bgs) and had a bottom elevation of approximately 240 feet (ft) above mean sea level (msl).

The Site contains several areas where solid wastes have been disposed. The date on which landfilling activities started at the West Lake Landfill is not known with certainty and has been variously cited as beginning in or around the early 1950s, or as starting in 1952 or possibly 1962. The landfill was not officially permitted for use as a sanitary landfill until 1952. EPA has reported that "from 1941 through 1953 it appeared that limestone extraction was the prime activity at the facility; however, as time passed the focus of the activity appeared to shift to waste disposal". EPA has reported that historical aerial photography from 1953 indicates use of a landfill had commenced. Mine spoils from quarrying operations were deposited on adjacent land immediately to the west of the quarry. Portions of the quarried areas and adjacent areas were subsequently used for landfilling municipal refuse, industrial solid wastes, and C&D debris. EPA has reported that liquid wastes and sludges were also disposed of at the landfill. These operations, which predated state and federal laws and regulations governing such operations, occurred in areas that subsequently have been identified as Area 1, Area 2, the Closed Demolition Landfill, and the Inactive Sanitary Landfill.

Due in part to the fact that the disposal of solid and liquid waste at the Site predated state and federal regulations for landfills, there is uncertainty regarding the specific site activities and disposal practices conducted on-site. Specifically, based upon a review of historical aerial photographs as documented in the Aerial Photographic Analysis of the West Lake Landfill Site, "deep" pits, lagoons, and other Site features related to past on-site disposal practices have been identified on several historical aerial photographs for years pre-dating the arrival of radionuclides from the Latty Avenue Site.

This project HASP is specifically geared towards the OU-3 RI/FS field scope of work.

WORK SCOPE

The OU-3 RI/FS is designed to document the nature and extent of releases of any hazardous substance from the Site in groundwater and determine the potential risk posed to human health and the environment. The objective of the RI/FS is to refine the current understanding of the hydrogeologic system, evaluate background water quality near the Site, determine the extent of groundwater impacts occurring at and

near the Site, provide predictive tools/models to evaluate potential future impacts, and based on the information collected, identify potential groundwater remedies that may be implemented at the Site.

The primary hydrogeologic investigation and groundwater characterization tasks will include:

1. Well inventory and repair.
2. Surveying and mapping the existing groundwater monitoring network.
3. Advancing soil borings for geologic logging investigation.
4. Downhole geophysics.
5. New monitoring well installation on-site and off-site.
6. New and existing well development.
7. Groundwater sampling.
8. Install surface water gauges on and off site.

Tasks included in the field investigation may include, but are not limited to, surficial and subsurface geologic investigations and sampling, monitoring well/soil boring drilling and installation, fluid level gauging, aquifer testing, groundwater sampling, surface water sampling, storm water sampling, sediment sampling, surface soil sampling, leachate sampling, methane gas sampling/monitoring, surveying/global positioning system (GPS), vapor intrusion investigations, ecological assessments, and routine site visits.

MINIMUM/ANTICIPATED PERSONAL PROTECTIVE EQUIPMENT (PPE)

The minimum PPE to enter the Site is listed below. However, refer to the HASP and task-specific Job Safety Analysis (JSA) forms for additional anticipated PPE. There are also additional requirements as outlined in the Radiation Safety Plan included with this HASP as Appendix J.

- Safety-toed boots
- Safety glasses
- Hard hat
- Work gloves
- Tyvek (as needed)
- Chemical resistant gloves (as needed)
- Half-face APR (as needed)
- Nitrile gloves, 4-gas meter (as needed)

- H2S monitor (as needed), photo-ionization detector (PID) (as needed)
- Geiger counter (as needed)
- Hearing protection (as needed)
- Pocket dosimeter (as needed)
- High-visibility vest

TRAINING/DRUG SCREENING REQUIREMENTS

- Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response (OSHA HAZWOPER) 40-Hour Training
- Generalized Employee Radiological Training (GERT) Training (as needed)
- Bridgeton Landfill On-Site Orientation

The drug consortium applies to project team members who must be enrolled and screened before site entry. In accordance with the Trihydro Drug and Alcohol Policy described in the HASP Reference Manual, at no time while on duty may employees use or be under the influence of alcohol, narcotics, intoxicants, or similar mind-altering substances to include prescription medications. Employees found under the influence or consumption of substances are to be immediately removed from the jobsite. Trihydro reserves the right to test for substance abuse. As part of implementing Trihydro's program to deter alcohol, drug, and substance abuse, each employee may be requested to submit to urine, blood, or other medical tests at any time, with or without notice. Employees are further subject to "for cause" drug, alcohol, or substances testing. "Cause" is determined if the company has reason to believe that the covered worker has used alcohol or illegal drugs or has misused prescription medication or over-the-counter drugs. Key reasons for testing may include the following: accidents, injuries, near misses, excessive absences, tardiness, altercations, lengthy absences, possession of drugs, or thefts. This policy applies to Trihydro employees and subcontractors.

Drug Testing Facilities

Concentra Medical Center	83 Progress Pkwy	Maryland Heights, MO	(314) 434-8174
Mercy Urgent Care - St Peters	637 Dunn Road Suite 101	Hazelwood, MO	(314) 817-2000

MOBILE PHONE AND ELECTRONIC DEVICES SAFETY

Mobile phone(s) are defined as cellular and other mobile telephones and other similar electronic communication devices which facilitate both simplex (push-to-talk) and duplex (multi-directional simultaneous conversations), to include global positioning devices (GPS), when those devices are being

used for voice communication, text messaging, electronic mail, and other operations requiring active manipulation of the device, including operation of the devices in hands free or hand held modes. For the purposes of this standard, two-way radios that are only capable of simplex communication (push-to-talk) are excluded from the definition of mobile phones.

The following are specifically prohibited:

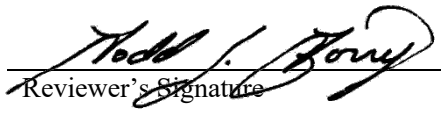
- Use of mobile phones by drivers while operating a company vehicle on public roadways.
- Use of mobile phones by drivers while operating a personal vehicle on company business.
- Use of mobile phones by drivers while operating a motor vehicle on company business, unless allowable areas and circumstances are designated by applicable work site rules and instructions (such as areas restricted from public access inside an operating facility or controlled area).

63N-001-001

HASP REVIEW PROCESS

This document has been developed by the Corporate Health and Safety Team followed by peer review in accordance with the Trihydro Corporation (Trihydro) Writing-Style Manual (WSM) policy by the project management and an authorized final reviewer on behalf of the Health and Safety Team.

Health and Safety:

Todd Forry		May 31, 2019
Reviewer's Name	Reviewer's Signature	Date

Project Manager:

Stephen Lombardo		May 31, 2019
Final Reviewer's Name	Final Reviewer's Signature	Date

PRE-ENTRY BRIEFING ACKNOWLEDGEMENT

Trihydro

I certify that I have read and understand the contents of this Health and Safety Plan (HASP), Environmental Activities, Site wide groundwater (operable unit 03), Bridgeton, Missouri, and reviewed appropriate Job Safety Analysis (JSA) forms, Site wide groundwater (operable unit 03)-specific safety documents, and Trihydro safety policies, procedures, plans, and documents for hazards that may be encountered on this project. Check the reason block if this is for initial entry, because of a change in the HASP, or to recognized hazards as outlined in Section 7 of this HASP.

Name/Signature	Reason	Date
	☐ Initial ☐ HASP Change ☐ Hazard Change	
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Pre-Entry Briefing Acknowledgement (continued)

Name/Signature	Reason	Date
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Table of Contents

Table of Contents (cont.)

Table of Contents (cont.)

Table of Contents (cont.)

Table of Contents (cont.)

List of Tables

List of Figures

List of Appendices

1.0 EMERGENCY RESPONSE PLAN

Because of the near proximity of medical assistance (approximately 3-4 minute response), this site does not assign site personnel to provide first aid.

The following personnel are trained in CPR and first aid:

Stephen Lombardo	Michelle Harper,
Michael Sweetenham	Charles VanHeuvelen
Drew Caschette	

Emergency response will be carried out immediately whenever there is a personal injury, fire, or explosion. Field team members that sight or suspect a fire, explosion, or other potential risk to employee or environmental health will notify the Trihydro Corporation (Trihydro) Project Manager (PM) immediately. A first-aid kit and fire extinguisher will be maintained on site.

Trihydro employees will be familiar with emergency procedures at the job site. Site emergency procedures will be reviewed with team members during the morning kick-off safety meeting. Site workers will be instructed to immediately stop work when a hazard is discovered.

A primary line of communication with emergency services will be established before work commencement. A secondary form is highly encouraged. Forms of communication include, but are not limited to, land line telephone, cellular telephone with verified acceptable signal strength, two-way radios, etc.

The following information is provided in the event of an emergency.

1.1 SITE EVACUATION PROCEDURES

Site Alarms ☒ N/A

Type	*Description*
☐ Fire	
☐ Chemical Release	
☐ Evacuation	
☐ Severe Weather	
☐ All Clear	
☐ Other:	

Site Evacuation Routes

Primary:	Up/crosswind from hazard. Exit site through Entrance #1, as discussed in daily tailgate meeting
Alternate:	Up/crosswind from hazard. Exit Site through Entrance 2, or 4: See attached site map (Figure 3-1) for details

Site Assembly Areas

Primary:	Entrance #1 Primary Muster Point, as discussed in daily tailgate meeting
Alternate:	Second Alternate Muster Point, as discussed in daily tailgate meeting

1.2 EMERGENCY CONTACT LIST

Local Emergency Services

Plant/Work Site Emergency Number ..... (314) 744-8172
Police Emergency/Station 911/ (314) 739-7557
Fire Department Emergency/Station 911/ (314) 291-6670
Ambulance Emergency/Station 911
SSM De Paul Health Center, Hospital ..... (314) 344-6000
MO Highway Patrol ..... (573) 751-3313
Poison Control ..... (800) 222-1222
Call Before You Dig 811
WorkCare™ Incident Intervention (24-hours) ..... (888) 449-7787

Company Contacts

Project Manager (PM), Stephen Lombardo ..... (847) 337-4275
Project Site Health and Safety Officer (PSHSO), TBD .....
Radiation Safety Officer (RSO), Tim Pratt (Ameriphysics) ..... (800) 563-7497
Certified Health Physicist (CHP), Tom Hansen, Jr. PhD, CHP (Ameriphysics) ..... (800) 563-7497
Radiological Control Supervisor (RCS), TBD .....
Safety Response Line (24/7) ..... (307) 755-4888
Safety FAX ..... (307) 460-7428

Client Contacts

Dana Sincox ..... Office: (314) 656-2116
Cell: (314) 313-0838

Federal/Government Contacts

Environmental Protection Agency (EPA) Hotline ..... (800) 621-8431
National Institute of Occupational Safety and Health (NIOSH) Hotline ..... (800) 356-4674
Occupational Safety and Health Administration (OSHA) ..... (202) 219-8148
OSHA Hotline ..... (800) 321-6742
National Response Center (report spills and chemical releases) ..... (800) 424-8802
CHEMTREC (24-hour Hazardous Materials Communications Center) ..... (800) 262-8200
ChemTel (for hazardous materials information) ..... (800) 255-3924
Department of Transportation (DOT) Safety Administration ..... (888) 327-4236

1.3 EMERGENCY MEDICAL CARE

The primary concern during emergencies is the medical treatment of injured or exposed personnel. It is crucial that employees understand the contents of the Emergency Response Plan of the Health and Safety Plan (HASP) to include the location of emergency contact numbers, the route to the nearest hospital, and the process of using WorkCare™, Trihydro's contracted medical intervention provider.

- ***PMs need to print the emergency contact list, page 1-3, and post in a central location on site (if available).***
- ***PMs need to print the hospital routes, page 1-8, and post in a central location on site (if available).***
- Team members need to have their WorkCare™ contact cards available.
- When present, the site PM, or other Trihydro representative, needs to accompany the injured employee to the hospital.
- WorkCare™ needs to be contacted by a project-team member on site to provide the treating facility with the injured employee's medical records and to coordinate medical treatment.

A map showing the location of the nearest (primary) hospital is shown on Figure 1-1, page 1-10.

1.4 NON-EMERGENCY MEDICAL CARE

The health and welfare of the project-team members is a concern, so it is important for employees to understand the procedures for contacting WorkCare™ for medical situations of a non-emergency nature. To provide the best care of staff, employees will contact WorkCare™ to provide information for the nearest Occupational Health Clinic, or use the services provided by the hospital listed in this HASP.

- Team members need to have their WorkCare™ contact cards available.
- When present, the site PM, or other Trihydro representative, needs to accompany the employee to the clinic.
- The employee will contact WorkCare™ to provide the treating facility with the employee's medical records and to coordinate medical treatment.

1.5 INCIDENT AND ACCIDENT REPORTING

Trihydro employees will report verbally and in writing, to Trihydro's PM and Corporate Health and Safety (H&S) Office, incidents or near misses resulting in personal or public injury, environmental impact, or property damage to Site wide groundwater (operable unit 03) operated site, materials, or equipment, including motor vehicles owned by Trihydro, its subcontractors, or Site wide groundwater (operable unit 03). Regarding accident, incidents, or near

misses, verbal reports will be made as soon as possible after the situation is under control followed by written reports to the Site wide groundwater (operable unit 03) PM through the Trihydro PM or Director. A copy of the "Near Miss Report" form can be found as **Appendix A**. A near miss is an event that, given a change in time or position, could have resulted in an incident.

Examples of incidents and near misses which will be reported are as follows:

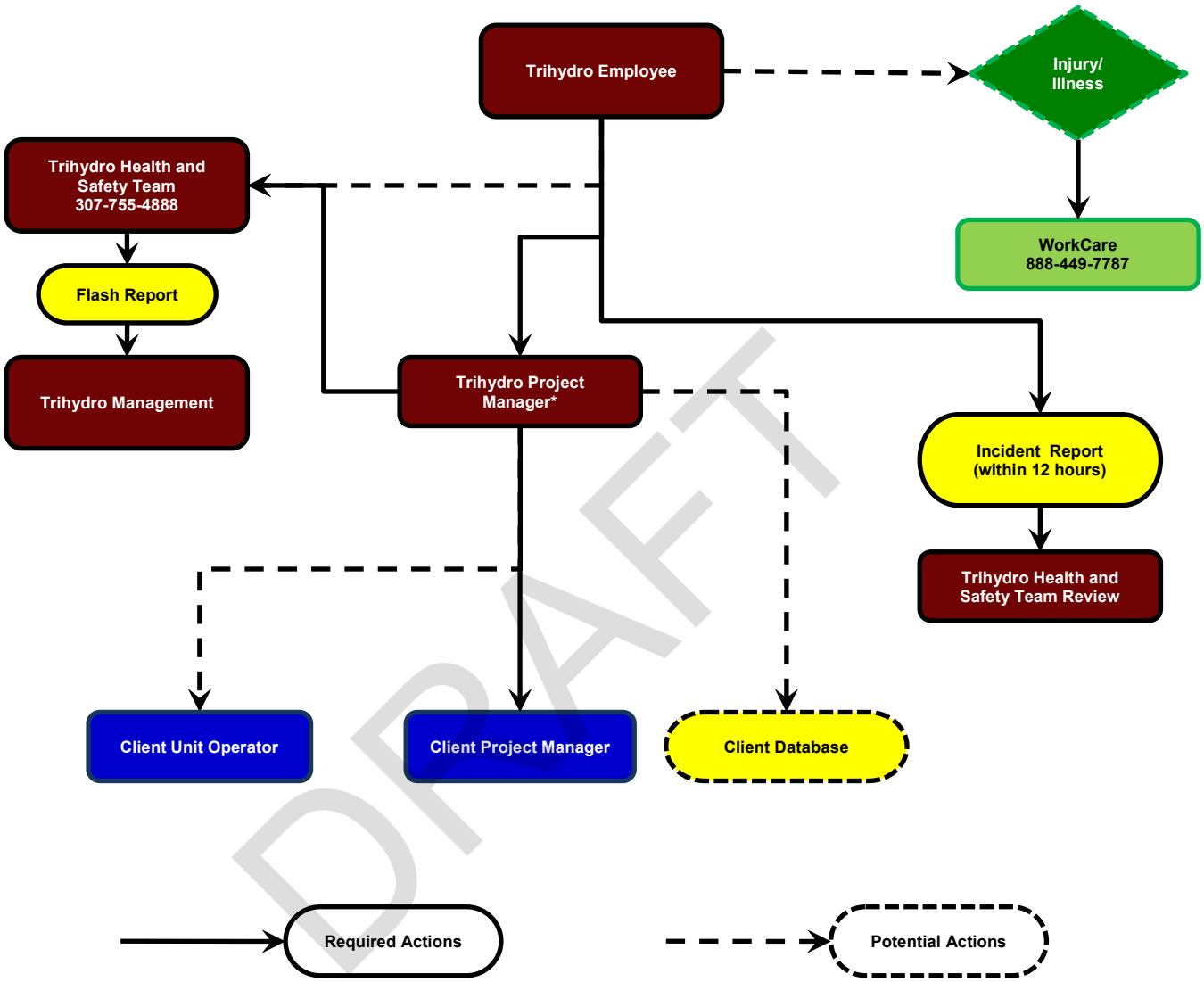
- Environment (e.g., spills, releases, odor complaints, permit exceedances, process upsets)
- Injury/illness (e.g., injuries, illnesses, first aids, recordables, lost workday cases, fatalities, non-injuries – document only, non-occupational)
- Property damage/loss (e.g., fires, explosions, loss of well control, business interruptions, abnormal operations, production loss/reduction)
- Quality (e.g., customer complaints, contaminations, off specification)
- Security (e.g., vandal – damages, burglaries, break and enters, robberies, thefts, public disturbances, trespasses)
- Vehicle (e.g., vehicle accidents, cars/pickups/trucks, barges/boats/ships, aircraft, rail cars, tankers/transports, cranes/fork trucks)

Incident and accident reporting are important for the following reasons:

- Collects information that Trihydro can use to calculate statistics and other information for tracking accident trends
- Helps identify training needs; problems with work procedures; and needs for personal protective, safety, and emergency equipment
- Collects information necessary for completing investigation and insurance reports and complying with regulatory requirements
- Identifies weaknesses in company and site safety programs

Reports of incidents or accidents will be prepared immediately after the event occurs. This is necessary to verify that important evidence is not lost or disturbed, and details are not forgotten by those involved. The "Accident/Incident Investigation Report" form can be found as **Appendix B**.

1.6 INCIDENT REPORTING FLOWCHART



The Trihydro PM is to notify the client representatives.

It is crucial the project team has control of the situation and care for the injured before reporting the incident. Once under control, the notification process is to be initiated.

The goal is for the notification process to be completed within 1 hour.

Notification is to be "person-to-person;" email notification and voicemail is unacceptable. If necessary, contact the next position in the notification tree.

Incidents include: injuries, illnesses, motor vehicle crashes, environmental impacts, Notice of Violation (NOV), security incidents, property damage, OSHA response, or other incidents that could potentially impact Trihydro's reputation.

Version: March 2, 2018

1.7 INCIDENT RESPONSE

1.7.1 VEHICLE ACCIDENT

- The individual discovering the accident is to provide or coordinate immediate care for personnel, safety, and vehicle security.
- The individual discovering the accident is to initiate or coordinate the notification process:
  - Notify police/ambulance (911)
  - Notify the Trihydro H&S Office using the Safety Response Line (307) 755-4888
  - Notify the PM
  - Notify the supervisor
  - Notify the client as directed by the PM
  - Notify the rental car agency as directed by the PM (if applicable)
- If medical treatment is required, notify WorkCare™ (888) 449-7787
- Complete drug and alcohol testing as soon as possible (within 3 hours); coordinate with H&S Team
- Complete and file reports within 12 hours

1.7.2 INCIDENT

- Stop work and provide immediate care for personnel, safety, and site security
- The individual discovering the accident is to initiate or coordinate the notification process:
  - Notify police/ambulance (911), if applicable
  - Notify the Trihydro H&S Office using the Safety Response Line (307) 755-4888
  - Notify the PM
  - Notify the supervisor
  - Notify the client as directed by the PM
  - Notify site managers as directed by the PM
- If medical treatment is required, notify WorkCare™ (888) 449-7787
- Complete and file reports within 12 hours

- Before returning to work, the employee will:
  - Notify the PM and supervisor
  - Assess and analyze the conditions for safety
  - Take applicable corrective actions to prevent recurrence

1.8 HOSPITAL ROUTES

Primary route from the project site to the hospital can be found on Figures 1-1 through 1-6.

FIGURE 1-1. PRIMARY HOSPITAL ROUTE

Directions to Hospital
Hospital Name: **SSM De Paul Health Center**
Address: **12303 De Paul Drive**
Telephone Number: **(314) 344-6000**

SUMMARY
Driving distance: 2.24miles
Trip duration: 6 minutes

Instruction	**For**
Depart 13570 St Charles Rock Rd, Bridgeton, MO, 63044, USA	
Go southeast on **St Charles Rock Rd Saint Charles Rock Rd** toward **Taussig Rd**	1.40 mi
Make sharp right on **Mareschall Ln**	.12 mi
Bear left on **Depaul Ln De Paul Ln**	.21 mi
Turn left at **Depaul Dr** to stay on **Depaul Ln De Paul Ln**	.14 mi
Bear right on **Depaul Dr De Paul Dr**	.37 mi
Arrive Finish at **12303 Depaul Dr, Bridgeton, MO, 63044, USA** on the right	

FIGURE 1-2. PRIMARY HOSPITAL ROUTE START POINT

FIGURE 1-3. PRIMARY HOSPITAL ROUTE DESTINATION POINT

2.0 INTRODUCTION

2.1 REFERENCES

The 29 Code of Federal Regulations (CFR) 1910 General Industry standards, 1910.120, Hazardous Waste Operations and Emergency Response (HAZWOPER), will dictate the primary information contained within this HASP where section 1910.120(b)(1)(ii)(C) states that "a site-specific safety and health plan which need not repeat the employer's standard operating procedures required in paragraph (b)(1)(ii)(F)" and will contain the elements listed under 1910.120(b)(4)(ii).

2.2 APPLICATION

This HASP applies to the site specified and those tasks and operations identified in Section 2.0.

2.3 PURPOSE

The purpose of this HASP is to provide Trihydro employees with emergency response information, high-level hazard analyses, and a summary of safe work requirements. Subcontractors may wish to use Trihydro's plan as a guideline. However, subcontractors will have their own health and safety plan (HASP) developed by their respective companies. The primary responsibility for employee safety lies with each company for its own employees.

2.4 REQUIRED DOCUMENTATION

Project work will comply with applicable sections of the Occupational Safety and Health Administration (OSHA), state, Trihydro, and client standards, policies, procedures, and plans. The more stringent standards will apply. This HASP and supportive documentation will be kept on site in accordance with 29 CFR 1910.120(b)(4)(i).

Trihydro employees and subcontractors that are covered by contractual agreements with Trihydro performing tasks outlined in this HASP need to have a thorough understanding of supportive documentation. The following documents will accompany this HASP as supportive documentation:

- Job Safety Analysis (JSA) oriented to the site tasks and operations outlined in this HASP. See **Appendix C**.
- Site wide groundwater (operable unit 03)-specific health and safety policies, procedures, or plans relevant to the tasks outlined in this HASP. See **Appendix D**.
- Safety Data Sheets (SDSs) / Material Safety Data Sheets (MSDS). See **Appendix E**.
- Radiation Safety Plan. See **Appendix J.**

2.4.1 JOB SAFETY ANALYSIS (JSA)

JSA forms are living documents to assist in hazard awareness and in task preparation. Employees are expected to review JSA forms before work commencement, have the JSA at the task site, and revise the JSA when discrepancies are noted. The following JSA forms are included in **Appendix C**:

☒ Air Knife Borehole Clearance	☐ Forklift Operations	☒ Soil Sub-Sampling
☐ Air/Knife/Vacuum Extraction	☒ Fueling Vehicles	☐ SUMMA Canister Sampling
☐ Asbestos ID and Burial	☐ Geoprobe/Geopunch Sampling	☒ Surface Water Sampling
☐ Asphalt Placement Observation	☒ GPS Surveying	☐ Tank Demolition
☐ Boating	☒ Groundwater Gauging	☐ Vacuum Trailer Operations
☐ Confined Space Entry	☒ Groundwater Sampling	☒ Vehicle Operation
☐ Contaminated Soil Cleanup	☐ Hand Auger Soil Sampling	☐ Voltage and Ground Test
☒ Contractor Oversight	☒ Heavy Equipment Operations	☐ Weed Control
☒ Drilling	☒ Hydraulic Direct Push Sampler	☒ Well Abandonment
☒ Drilling Oversight	☐ Hydroknifing	☒ Well Bailing
☐ Dump Truck Loading	☐ Pump/Motor/Leads Installation	☒ Well Rehabilitation
☐ Dump Truck Operations	☒ Site Visit	☒ Well Replacement
☐ Excavation Observation	☒ Other: Install surface water staff gauges	
☐ Flume Sampling	☐ Other: _____	

2.4.2 MATERIAL SAFETY DATA SHEETS (MSDSs) / SAFETY DATA SHEETS (SDSs)

The following SDSs / MSDSs are included in **Appendix E**:

☐ Acetone	☐ Ethyl Benzene	☒ Methane	☐ Selexol
☐ Acrylonitrile	☐ Fly/Coal Ash	☐ Methane, Compressed	☒ Simple Green
☐ Anhydrous Ammonia	☐ Fuel Oil	☐ Methanol	☐ S-K 105 Solvent
☐ Aniline	☐ Gasoline	☐ Methyl Methacrylate	☐ Sodium Hydroxide
☐ Aromatic 100	☐ Granite Rock Dust	☐ Methyl Propyl Ketone	☐ Sodium Nitrate
☐ Aromatic 150	☐ Grease	☐ Methylene Chloride	☐ Sodium Phosphate Monobasic
☐ Asbestos	☐ Heptane	☐ Methyl Isobutyl Ketone	
☐ Bentonite	☐ Hexane	☐ Mineral Spirits	☐ Sulfuric Acid
☐ Benzene	☐ Hexanone	☐ Motor Oil	☐ Surflan
☐ BTEX Calibration Gas	☐ Hydraulic Oil/Fluid	☐ MTBE	☐ Survey Marker Paint
☐ Cadmium	☐ Hydrocarbons	☐ Natural Gas	☐ Tack
☐ Celtone	☐ Hydrochloric Acid	☐ Nitric Acid	☐ Tetrahydrofurane
☐ Chrome	☐ Hydrofluoric Acid	☐ Nitrogen, Compressed	☐ Toluene
☐ Coal	☐ Hydrogen	☐ Nitrogen, Liquid	☐ Trichloroethane
☐ Coal Fly Ash	☐ Hydrogen, Compressed	☐ Oxygen, Compressed	☐ Triethylamine
☐ Coke	☐ Hydrogen Chloride	☐ Perchloric Acid	☐ Trimethyl Benzene
☐ Condensate	☐ Hydrogen Sulfide	☐ Phosphoric Acid	☐ Used Oil
☐ Crude Oil	☐ Isobutane	☐ Phthalic Anhydride	☐ Vinyl Chloride
☐ Dichloroethane	☒ Isobutylene	☐ Propane	☐ Xylene
☐ Diesel Fuel	☐ Isopropyl Alcohol	☒ Other: Alconox	
☐ Dimethyl Sulfide	☐ Kerosene	☒ Other: 4-Gas Calibration Gas (Precision Gas Mixture)	
☐ DIPE	☐ Lead	☐ Other:	
☐ Ethanol	☐ Lead Acid (Battery)	☐ Other:	

2.5 TRAINING REQUIREMENTS

Trihydro employees and subcontractors that are covered by contractual agreements with Trihydro performing tasks outlined in this HASP need to meet the training requirements outlined in OSHA 29 CFR 1910.120(e)(3). The best solution is for employees and subcontractors to have certification in the 40-hour HAZWOPER course and, if staff will be performing supervisory duties, the 8-hour supervisor's course.

2.6 PHYSICAL QUALIFICATIONS

2.6.1 PERSONAL QUALIFICATIONS

Trihydro employees will be physically, medically, and emotionally qualified to perform the duties to which they are assigned. Some factors to be considered in making work assignments are activity knowledge, strength, endurance, agility, coordination, and visual and hearing acuity. Trihydro employees and subcontractors will be able to read and understand English.

At no time while on duty may employees use or be under the influence of alcohol, narcotics, intoxicants, or similar mind-altering substances. Employees found under the influence or consumption of substances will be immediately removed from the jobsite. Trihydro reserves the right to test for substance abuse. As part of implementing the Company's program to deter alcohol, drug, and substance abuse, each employee may be requested to submit to a urine, blood, or other medical test at any time, with or without notice. All employees are further subject to "for cause" drug, alcohol, or substances testing. "Cause" is determined if the Company has reason to believe that a covered worker has used illegal drugs or has misused alcohol, prescription medication, or over-the-counter drugs. Such reason may be, but is not limited to, the following: accidents, injuries, near misses, excessive absences, tardiness, altercations, lengthy absences, possession of drugs, or thefts. This policy applies to, but is not limited to, Trihydro employees and subcontractors.

Operators of equipment or vehicles will be able to read and understand the signs, signals, and operating instructions in use. Where permits are required to operate specified equipment, the employee will have the permit on hand.

2.6.2 MEDICAL SURVEILLANCE REQUIREMENTS

In accordance with 29 CFR 1910.120(f), Trihydro employees and subcontractors that are covered by contractual agreements with Trihydro performing tasks outlined in this HASP will meet the following medical surveillance requirements with medical examinations and consultations:

- Before assignment.
- Project field-team members at least once every 12 months.
- At termination of employment or reassignment.
- As soon as possible upon notification by an employee that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that the employee has been injured or exposed above the permissible exposure limits or published exposure levels in an emergency situation.

2.6.3 EXPOSURE-ASSESSMENT PLAN

As a component of Trihydro's H&S Management System, the H&S Team coordinates annual exposure sampling events for hazardous environments per the corporate Exposure Assessment Plan. The results are compiled, analyzed, recorded, and reported to management and employees per the plan.

2.7 PRE-ENTRY BRIEFING

In accordance with 29 CFR 1910.120(b)(4)(iii), Trihydro employees and subcontractors that are covered by contractual agreements with Trihydro performing tasks outlined in this HASP will receive a pre-entry briefing:

- Before initiating site activities
- Before work activities if there are changes to this HASP
- Before work activities if there are changes to the recognized hazards (i.e., seasonal changes, new hazardous substance exposure, etc.)

Trihydro employees and subcontractors will complete the ***Pre-Entry Briefing Acknowledgement Form*** portion of this HASP after each pre-entry briefing.

2.8 DAILY SAFETY BRIEFINGS

The site PM, or assigned project supervisor, will conduct a daily site safety briefing covering the scope of work (general type of work), tasks for the shift, PPE, associated chemicals and their hazard controls, site and task associated hazards, permits needed, special equipment/techniques, communications, hospital information, and any special topics. The "Daily Tailgate Safety Meeting" form will be used to document the meeting; see **Appendix F**.

Subcontractors will be included in the daily safety briefings to provide effective coordination between Trihydro and contracted employees.

2.9 EFFECTIVENESS OF THE SITE HEALTH AND SAFETY PLAN (HASP)

In accordance with 29 CFR 1910.120 (4)(iv), inspections should be conducted by the PSHSO as necessary to determine the effectiveness of the site HASP. Deficiencies in the effectiveness of the site HASP will be corrected by the employer.

The "Health and Safety Plan Effectiveness Audit Form," found on the H&S Forms Web page, will be used to annotate and report deficiencies to the Corporate H&S Team.

3.0 SITE TASKS AND OPERATIONS

The following activities are anticipated to be performed at this site:

- Geologic Investigations
- Monitoring Well/Soil Boring Drilling and Installation
- Fluid Level Gauging
- Aquifer Testing
- Groundwater Sampling
- Surface Water Sampling
- Storm Water Sampling
- Sediment Sampling
- Surface Soil Sampling
- Subsurface Soil Sampling
- Leachate Sampling
- Methane Gas Monitoring
- Vapor Intrusion Investigations
- Sampling/Monitoring
- Surveying/GPS
- Routine Site Visits

3.1 SITE MAP

A site map (**Figure 3-1**) is provided for protect-team member orientation. The site map will indicate site entrances, gates, command centers and parking areas. Project-team members and subcontractors need to be familiar with the site map.

3.2 SITE ACCESS

Workers and authorized visitors/guests must access the West Lake Landfill site by signing in at the landfill office after completion of the Site's safety orientation program. Authorized visitors/guests must be accompanied to a work site.

3.3 SITE SECURITY

For client-controlled sites, Trihydro employees and subcontractors will follow the client's security policies and procedures. At any time, a Trihydro employee or subcontractor observes a breach in site security measures or suspicious activities that contradict security protocol, the client specified notification process will be initiated followed by reporting the situation to the Trihydro site PM.

Where Trihydro has responsibilities for security, a daily inspection of security measures will be conducted. Breaches in site security measures or suspicious activities that contradict security protocol, the situation will be reported to the Trihydro site PM.

4.0 PERSONNEL RESPONSIBILITIES

4.1 PROJECT TEAM RESPONSIBILITIES

Project personnel who have responsibility for the oversight of this project are:

Position	***Name***
Project Director:	Garry Risse
Project Manager (PM):	Stephen Lombardo
Project Site Manager:	Michael Sweetenham
Project Site Health and Safety Officer* (PSHSO):	TBD
Trihydro Team Members:	Charles VanHeuvelen

*The PSHSO(s) will be a member who is present at the project site.

The project team responsibilities are listed below. It is the responsibility of the PM to verify that the field team has access to this HASP and supportive documentation and reads the safety procedures. It is the individual's responsibility to bring to the attention of the PM, or Corporate H&S Manager, portions of this HASP and related training that he/she does not fully understand.

Site employees and subcontractors will conduct safety meetings at appropriate intervals to verify that personnel are fully informed of potential hazards. Attendance at safety meetings is to be documented, and attendance sheets signed by personnel in attendance. The attendance sheets will be retained by Trihydro and made available to the appropriate client representative on request. Trihydro's "Daily Tailgate Safety Meeting" form can be found as **Appendix F**.

4.1.1 PROJECT MEMBERS

Trihydro is a strong advocate for Behavior-Based Safety (BBS) where the "one team" approach to safety is highly supported. Project members, to include subcontractors, are expected to perform Work-Site Self-Assessments (WSSA), conduct task observations, exercise the right of Stop Work Authority and to refuse unsafe work, review JSA forms, and report any unsafe conditions; all to promote the highest level of safety.

4.1.2 TRIHYDRO PROJECT DIRECTOR

The responsibilities of the project director with respect to safety are as follows:

- Verify that Trihydro field team personnel have read and understand this HASP
- Make available to the field team personnel the data known to him/her on this project site

4.1.3 TRIHYDRO PROJECT MANAGER (PM)

The responsibilities of the PM with respect to safety are as follows:

- ***Verify acceptable cellular reception at site before work commencement.***
- ***Verify route from site to hospital by driving the published route.***
- Coordinate initial site safety training for project team personnel as described in this document.
- Verify that field team personnel have read and understand this HASP.
- Verify that Trihydro field team personnel have the required materials needed before the start date to meet the requirements of this specific site HASP.
- Make available to the field team personnel and the appropriate client representative H&S information relevant to this project.

4.1.4 TRIHYDRO FIELD PROJECT MANAGER

The responsibilities of the site PM with respect to safety are as follows:

- ***Verify acceptable cellular reception at site before work commencement***
- ***Verify there are no route obstructions (i.e., construction) from the site to the hospital***
- Conduct the daily safety briefing

- Coordinate efforts and communicate site tasks with other site contractors
- Establish communications between other site contractors via phone or radio to enhance coordination in the event of an emergency

4.1.5 TRIHYDRO PROJECT SITE HEALTH AND SAFETY OFFICER (PSHSO)

The responsibilities of the Trihydro PSHSO with respect to safety are as follows:

- Verify that work performed by Trihydro is conducted in accordance with safe practices outlined in this HASP
- Communicate to workers what is expected of them
- Note weather conditions
- Identify and schedule training
- Calibrate air and personal monitoring equipment
- Identify and remove hazards where possible
- Monitor activities for the proper use of PPE specified in this HASP, such as respirators with appropriate filters and/or canisters, protective coveralls, gloves, safety boots, protective eyewear, ear plugs, and hard hats
- Make PPE equipment available
- Monitor PPE usage, storage, maintenance, and replace when necessary
- Verify that safety equipment to be used by field team personnel is maintained in usable condition
- Use only safe work practices
- Initiate emergency phone calls when an emergency or accident requires medical attention
- Correct unsafe conditions and behaviors immediately
- Conduct additional health and safety meetings deemed necessary
- Report problems to the PM

4.1.6 TRIHYDRO FIELD TEAM MEMBERS

The responsibilities of the Trihydro field-team members with respect to safety are as follows:

- Become thoroughly familiar with this HASP and its supportive documentation
- Actively participate in this project HASP

- Follow safety standards and safe work practices set by Trihydro, the client, and regulatory agencies
- Refuse to perform work when unsafe conditions exist
- Report potential hazards to the PSHSO
- Immediately report potential hazards, accidents, incidents, injuries, and illnesses to the PSHSO
- Inform PM of contact lens use
- Inform the PM if allergic to insect stings/bites or other biological hazards
- Inform the Trihydro Health Insurance Portability and Accountability Act (HIPAA) Officer of the Risk Management Office if on medication that can impair their physical and/or cognitive abilities to perform their duties
- Use PPE when needed
- Inspect PPE and safety equipment before use
- Have required equipment operating permits on person
- Be familiar with the location, type, and operation of site and facility emergency equipment and procedures

4.1.7 SUBCONTRACTOR TEAM MEMBERS

The responsibilities of the subcontractor-team members with respect to safety are as follows:

- Perform work safely
- Read and understand subcontractor HASPs
- Adhere to applicable HASP protocol
- Provide applicable health and safety monitoring
- Report unsafe acts to Trihydro's PSHSO
- Properly inspect and maintain heavy equipment and other machines in compliance with applicable sections of the federal and State Occupational H&S Codes
- Supply and maintain PPE specified in this HASP, such as respirators with appropriate filters and/or canisters, protective coveralls, gloves, safety boots, protective eyewear, ear plugs, and hard hats
- Enforce corrective action in cooperation with the client and Trihydro's PSHSO
- Inform Trihydro's PSHSO of the presence of potential health or safety hazards

- Be aware and alert for signs and symptoms of potential exposure to site contaminants and climatic or acoustic stress
- Inspect PPE and safety equipment before use
- Inform PM of contact lens use
- Inform the PM if allergic to insect stings/bites or other biological hazards
- Inform their company HIPAA Officer if on medication that can impair their physical and/or cognitive abilities to perform their duties
- Have required equipment operating permits on person
- Be familiar with the location, type, and operation of site and facility emergency equipment and procedures

5.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personnel will understand and follow the Trihydro PPE Program. **Tables 5-1 and 5-2** provide more guidelines on PPE selection.

The following is a list of PPE anticipated to be used on this site based on the listed tasks, operations, and provided JSA forms:

Eye and Face Protection

- ☒ Safety Glasses
- ☐ Face Shield
- ☐ Chemical Goggles

Body Protection

- ☐ Fire-Retardant Clothing
- ☒ Tyvek Coveralls
- ☒ Chemical-Resistant Coveralls
- ☐ Chemical-Resistant Apron
- ☒ High-Visibility Safety Vest
- ☐ Cooling Vest
- ☐ Lightning-Strike Indicator

Water Safety

- ☐ Personal Flotation Device
- ☒ Waders

Hand Protection

- ☒ Industrial Work Gloves
- ☒ Chemical-Resistant Gloves
- ☒ Laceration-Resistant Gloves

Fall Protection

- ☐ Barriers/Guard Rails
- ☐ Body Harness w/Lanyards
- ☐ Anchorage Devices

Foot Protection

- ☒ Leather Boots
- ☒ Safety-Toed Boots
- ☒ Chemical-Resistant Boots

Head Protection

- ☒ Hard Hat
- ☐ Hard-Hat Liner

Respiratory Protection*

- ☒ Half-Face Respirator
- ☐ Full-Face Respirator
- ☐ Chemical Cartridge
- ☐ Particulate Filter
- ☒ Cartridge/Filter Combo
- ☐ Ammonia Cartridge
- ☐ H_2S Escape Cartridge
- ☐ Asbestos Filter

Hearing Protection

- ☒ Ear Plugs
- ☐ Ear Muffs

Biological Protection

- ☒ First-Aid Kit
- ☒ Blood-borne Pathogen Spill Kit
- ☒ Insect Repellent
- ☐ Snake Gaiters

☒ ***Other:*** Radiation monitoring equipment, as needed, per the RSP.

☐ ***Other:*** _____

*Assigned Protection Factors (APF) for determining Maximum Use Concentrations (MUC) and for appropriate respirator selection can be found in the **Table 5-3** titled "Respirator Assigned Protection Factor (APF)."

6.0 AIR (AREA) AND PERSONAL MONITORING, AND ENVIRONMENTAL SAMPLING

The following is a list of monitoring/sampling devices expected to be used on this site for the listed tasks and operations:

Air (Area) Monitoring ☐ N/A	***Personal Monitoring*** ☐ N/A	***Environmental Sampling*** ☐ N/A
☒ Photo-Ionization Detector	☒ H_2S Monitor	☒ DO/ORP Meter
☐ Combustible Gas Indicator	☐ Ammonia Monitor	☒ pH Meter
☒ Multi-Gas Detector	☒ Multi-Gas Detector	☒ Turbidity Meter
☐ Flame Ionization Detector	☐ Colorimetric Tube	☒ Conductivity Meter
☐ Colorimetric Tube	☒ Other: Geiger Counter *(Specify)*	☒ Temperature Gauge
☐ Other: *(Specify)*	☒ Other: Pocket Dosimeter *(Specify)*	☒ Photo-Ionization Detector (PID)
		☐ Flame-Ionization Detector (FID)
		☒ Other: Micro R Detector and Dual Phosphor Alpha Beta Scintillator *(Specify)*

6.1 AIR (AREA) MONITORING

To protect employees from hazardous atmospheric conditions, air sampling and monitoring utilizing the appropriate monitoring device, whether single or multiple gas detectors, will be conducted in the work zone if a potential or actual hazardous atmospheric condition is suspected. An assessment of the work zone includes, but is not limited to, the configuration of the surrounding area that could hold hazardous gases, any nearby processes that produce toxic vapors, wind direction, and the possibility of oxygen depletion or enrichment. A hazardous atmosphere is defined as 1) oxygen percentage less than 19.5% and over 23.5%; 2) Lower Explosive Limits (LEL) of 20% or more (10% for confined space and trenching); and 3) exceeding the Permissible Exposure Levels (PEL) of toxic substances.

The preferred air monitoring device will be of an active design using a pump that introduces the air sample to the gas detecting apparatus. The order of air sampling is: 1) oxygen percentage; 2) LELs; and 3) toxic substances. Air

sampling will be conducted in a "tiered" manner where the sampling is conducted at intervals allowing adequate time for the device to make an accurate reading. For example, when vertically sampling a confined space, pause every 2-3 feet long enough for the device to read the atmosphere correctly.

The manufacturer's manual for the specific device will be kept on site for reference.

6.1.1 AIR MONITORING ACTION LEVELS

When using a PID/FID for air monitoring, refer to **Tables 6-1 and 6-2**, for PID and FID Organic Vapor Action Levels and Responses.

6.1.2 FREQUENCY

The frequency of air sampling/monitoring is:

- Upon area entry by the sampler and before team entry
- Continuously (minimum every 15 minutes) if the oxygen level is below 20% or above 23%, LEL is above 15% (5% for confined space and trenching), and/or half of the PEL of toxic substances
- Periodically, such as every 2 hours, if deemed safe, but with a potential hazard

6.1.3 CALIBRATION, BUMP TESTING, AND MAINTENANCE

Each instrument will be bump tested at the beginning of each day with the manufacturer's recommended calibration gas. Calibration will be performed at a minimum quarterly or sooner if exposed to large doses of contaminants. Trihydro equipment will be calibrated and maintained by the Corporate H&S Team unless otherwise dictated by the team. Rental equipment will be calibrated and maintained by the rental company.

6.1.4 DEVICE TYPES

There are various methods for sampling and monitoring atmospheric conditions where the operator will be trained in their use and the appropriate equipment will be utilized so that the device is capable of detecting the specific site hazard. For area monitoring, it is best to use active devices where the detector is pump driven passing the atmospheric sample across the detecting component.

6.1.4.1 PHOTO-IONIZATION DETECTOR (PID)

A type of Organic Vapor Meter (OVM) known as a PID will be used during this project if hydrocarbon-impacted materials are encountered. The PID used for this project will be equipped with a 10.0 eV lamp or greater. Monitoring will be conducted using one PID per work zone. Areas downwind of the work zone will also be monitored, if necessary, to verify organic vapor emissions do not impact off-site areas.

6.1.4.2 MULTI-GAS DETECTOR

A multiple gas detector can be taken into the field to provide site monitoring (one instrument per work zone) to sample and monitor the work zone area. The multi-gas detector will be set up to monitor oxygen levels, LEL, methane, and hydrogen sulfide.

6.1.4.3 MIRCOR DETECTOR AND DUAL PHOSPHOR ALPHA BETA SCINTAILLATOR

Boreholes will be continuous cored during advancement. The recovered cores will be field screened using hand held scintillators.

The MicroR detector is a scintillation meter that is used to measure low levels of gamma radiation that reports all gamma emissions, irrespective of radionuclide. The detector has a speaker that provides an audible measure of the radiation emitted. The rate at which the clicks occur, allows real time monitoring of the strength of the radiation sources. Readout is generally in terms of microroentgens per hour (µR/hr).

A Dual Phosphor alpha/beta scintillation detector will be primarily used to detect alpha/beta emissions. If the instrument has a speaker, the pulses also give an audible click. The readout can be displayed in multiple different units (e.g. roentgens per hour (R/hr), milliroentgens per hour (mR/Hr), rem per hour (rem/hr), millirem per hour (mrem/hr), and counts per minute (cpm)) when the control switch is in the “Ratemeter” position. These probes are commonly used for contamination measurements.

6.2 PERSONAL MONITORING

The methods for monitoring the atmospheric conditions in a worker’s breathing zone are very similar to area sampling and monitoring. Again, the operator will be trained in their use and the appropriate equipment will be utilized so that the device is capable of detecting the specific site hazard. Personal monitoring devices will be worn in the breathing zone of the employee.

The manufacturer’s manual for the specific device will be kept on site for reference.

6.2.1 FREQUENCY

Personal exposure monitoring will be conducted on a continuous basis (minimum every 15 minutes) if there is a potential exposure risk.

6.2.2 CALIBRATION, BUMP TESTING, AND MAINTENANCE

Non-disposable instruments will be bump tested at the beginning of each day with the manufacturer's recommended calibration gas. Calibration will be performed at a minimum quarterly or sooner if exposed to large doses of contaminants. Trihydro equipment will be calibrated and maintained by the Corporate H&S Team unless otherwise dictated by the team. Rental equipment will be calibrated and maintained by the rental company, or by Trihydro employees if calibration equipment is available.

Employees are to perform a daily function test on disposable personal monitors before commencing work on site.

Calibration results are to be recorded on an "Air Monitoring Equipment Calibration Tracking Form."

Bump testing and function test results are to be recorded on a "Personal Detector Bump Check Record."

6.2.3 DEVICE TYPES

The same devices used for air monitoring can be used for personal monitoring. However, typically, personal monitors are smaller in size and are usually passive devices (not pump driven). The devices can be single gas detectors or multiple.

6.2.3.1 HYDROGEN SULFIDE (H_2S) DETECTOR

Project members are to wear a hydrogen sulfide (H_2S) detector when on site. The low-level alarm is to be set at 10 ppm and the high-level at 15 ppm. The action levels are listed in **Table 6-3**.

The manufacturer's manual for the specific device will be kept on site for reference.

6.2.3.2 MULTI-GAS DETECTOR

A multiple gas detector can be taken into the field to provide personal monitoring (one instrument per person or group) to sample and monitor the work atmosphere. The multi-gas detector will be set up to monitor, at a minimum, oxygen (O_2) levels, LEL, and chemical PELs. The multi-gas detector will monitor for potential hazardous atmospheres of:

- <19.5% O_2
- >20% LEL (>10% for permit-confined space operations)
- >PEL
  - H_2S (low alarm set at 10 ppm, high alarm 15 ppm)
  - CO (alarm set at 35 ppm)

The manufacturer's manual for the specific device will be kept on site for reference.

6.2.3.3 POCKET DOSIMETER

The purpose of a dosimeter is to measure a worker's occupational exposure to radiation. The dosimeter must be handled and worn correctly, must only be used by the person to whom it was issued, and must not be exposed to non-occupational sources of radiation.

6.2.3.3.1 PERSONNEL DOSIMETER PLACEMENT ON THE BODY

To ensure the dosimeter accurately records the whole-body radiation dose, the dosimeter must be placed on the front of upper torso, between neck and waist (never clipped onto a pants pocket, belt, or shirt-sleeve). It must be facing outward, with no covering of any kind (wear it on the topmost layer of clothing; if wearing personal protective clothing, wear it on that layer, facing outward).

6.3 ENVIRONMENTAL SAMPLING

Multiple hazards should be considered when preparing for environmental sampling activities. Hazards may include but are not limited to calibration solutions, calibration gases, sample locations, sampling environment, sample media, and sampling activities. Before completing environmental sampling activities, the appropriate JSA form should be completed by the sampling team and reviewed by the PM. JSA forms would cover, but not be limited to, sampling activities, equipment calibration, and sampling equipment maintenance. Environmental sampling and the development of JSA forms may be completed for a variety of media and should be completed in general accordance with site specific Sampling and Analysis Plans (SAP), Quality Assurance Project Plan (QAPP), and or the USEPA Groundwater RCRA groundwater monitoring guidelines.

6.3.1 TECHNIQUES

Environmental sampling techniques should be completed in general accordance with site specific SAPs, QAPPs, and or the USEPA Groundwater Sampling Technical Guidance Document (TGD).

6.3.2 INSTRUMENTATION

The manufacturer's manual for the specific devices used will be kept on site for reference. Caution will be used whenever using chemicals or compressed gases for calibration of monitoring equipment. Use recommended PPE based upon potential hazards as defined in the job specific JSA.

6.3.2.1 DO/ORP METER

A combination Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) meter will be used at the site during groundwater sampling. The DO meter is an electronic device in which oxygen diffuses across a membrane in a submerged probe, to complete an electrical circuit. It records the dissolved oxygen concentration in milligrams per liter or percentage saturation. ORP meters measure the very small voltages generated when the measuring probe is placed in water in the presence of an oxidizing agent. The electrode is made of platinum or gold, which reversibly loses its electrons to the oxidizer. A voltage is generated which is compared to a silver electrode in a silver salt solution, similar to a pH probe. The more oxidizer available, the greater the comparative voltage generated between the two probes.

6.3.2.2 PH METER

A pH meter is a high impedance voltmeter for the measurement of electrode potential.

6.3.2.3 TURBIDITY METER

A turbidity meter will be used at the site during groundwater sampling. Turbidity refers to the concentration of un-dissolved, suspended particles present in a liquid and is a measure of the clarity of a sample. Turbidity measurement is achieved by analyzing the amount of light refracted from suspended particles such as clay, silt, and organic material.

6.3.2.4 CONDUCTIVITY METER

A conductivity meter will be used at the site during groundwater sampling. Conductivity is the ability of a material to conduct electric current and is measured by placing two plates (enclosed in the meter end) in the sample, a potential is applied across the plates, and the current that passes through the solution is measured.

6.3.2.5 TEMPERATURE METER

A temperature meter will be used at the site during groundwater sampling. Temperature refers to the kinetic energy of molecules making up substance, vibrating and bouncing against each other. Temperature meters measure temperature by reading the current across the sensor after a potential is applied across the sensor. The meter then converts the current reading into temperature.

6.3.2.6 PHOTO-IONIZATION DETECTOR (PID)

A type of OVM known as a PID will be used during this project if hydrocarbon-impacted materials are encountered. The PID used for this project will be equipped with a 10.6 eV lamp or greater. Monitoring will be conducted using one PID per work zone. Areas downwind of the work zone will also be monitored, if necessary, to verify organic vapor emissions do not impact off-site areas.

6.3.3 CALIBRATION AND MAINTENANCE

Each instrument will be tested at the beginning of each day in accordance with the manufacturer's recommendations. Calibration will be documented and performed in accordance with the manufacturer's recommendations or sooner if warranted. Trihydro equipment will be calibrated and maintained by field personnel on a daily basis. Rental equipment will be calibrated and maintained at a minimum according to manufacturer's recommendations. Field equipment will be calibrated to the extent practicable before use each sampling day.

7.0 SITE CONTROL PLAN

Project-team members and subcontractor employees need to review the site map, Figure 3-1, to become familiar with the site layout, work zones, and emergency plan components such as evacuation routes and assembly points.

Entry into a hazardous environment requires the "buddy system" of two personnel where each employee is observed by the other to provide rapid assistance in the event of an emergency. If there are no actual or potential exposures to hazards that would incapacitate the individual, then refer to the Lone Worker Safety Procedures.

The following are recognized hazards at the site throughout the project period; personnel will be familiar with the associated health and safety policy, procedure, or plan corresponding to each hazard.

Physical Hazards

- ☐ Machine Guarding
- ☐ High Pressurized/Temperature Process
- ☐ Lock Out / Tag Out
- ☒ Housekeeping
- ☒ Ground Level Slips, Trips, and Falls
- ☐ Falls from Heights
- ☒ Knife Safety
- ☐ Ladder Use

Electrical Hazards

- ☐ Overhead-Power Lines
- ☒ Inclement Weather/Lightning
- ☐ Utilities Clearance
- ☒ Water Hazards
- ☐ Fire/Explosion Hazards
- ☐ Hot Works
- ☒ Chemical Hazards
- ☐ Asbestos Hazards

Natural Disaster

- ☐ Earthquake
- ☒ Tornado

Climate Hazards

- ☒ Heat Stress
- ☒ Cold Stress

Ergonomic Hazards

Acoustical Hazards

- ☒ Radiation Hazards
- ☒ Dust Hazards
- ☒ Excavation Hazards
- ☒ Drilling Activities

Traffic Hazards

- ☒ Driving Safety
- ☒ Vehicular Safety
- ☒ Contaminated Soil Truck Removal/Hauling Operations
- ☒ Powered Industrial Trucks
- ☐ Confined Space Entry

Biological Hazards

- ☒ Blood-borne Pathogens
- ☒ Hantavirus
- ☒ Histoplasmosis
- ☒ Psittacosis
- ☒ Chiggers

Stinging Insects

- ☐ Fire Ants
- ☒ Lyme Disease (Ticks)
- ☒ West Nile Virus
- ☐ Snakes
- ☒ Spiders
- ☐ Scorpions
- ☐ Poison Oak/Ivy/Sumac
- ☐ Rabies
- ☐ Alligators

7.1 HAZARD CONTROL HIERARCHY – ORDER OF PRECEDENCE

Site hazards and hazards resulting from investigation and remediation activities may be controlled using one or more of the control measures listed below. The order of precedence is as follows:

- ***Engineering Controls:*** A major component of the design phase is to select safety features to eliminate a hazard and render it fail-safe or provide redundancy using backup components. Examples of engineering controls include, but are not limited to: mechanical ventilation; sound-proofing; machine guarding; etc.
- ***Administrative Controls:*** Hazards that cannot be totally eliminated by engineering controls can be controlled through administrative controls. Examples of administrative controls include, but not limited to: warning signs; personnel change out; specialized training; established procedures; etc.
- ***Personal Protective Equipment (PPE):*** To protect workers from injury, the last method in the order of precedence is the use of PPE. Employees need to understand that the use of PPE does not remove the risk. PPE such as hard hats, gloves, eye protection, life jackets, and other protective equipment can be bulky, cumbersome, and heavy where often it is discarded or not used, rendering this method ineffective without proper controls.

7.2 SAFE WORK PRACTICES

The following section presents procedures on how to address the hazards expected to be encountered during site activities for this project. During times when site operations are under the observation of a Trihydro representative, Trihydro will notify contractor personnel on site and a client representative if an unsafe condition is observed.

7.2.1 STOP WORK AUTHORITY/RIGHT-TO-REFUSE UNSAFE WORK PROGRAM

Employees not only have the right to refuse unsafe work, they also have the right to stop unsafe practices of others. The stop work authority program gives any employee working onsite the ability to stop all work related to a specific activity being performed in a manner in which there is an imminent danger to personnel, property, or the environment. All employees and contractors are responsible for participating in the stop work authority program.

The stop work order is binding until either the employee who stopped the work or the site PM rescinds the order. The site PM is the only individual who can overrule the employee who initially stopped the work.

NOTE: The requirements and responsibilities identified in the stop work authority program may cross company boundaries. For example, a Trihydro employee may identify a subcontractor performing an unsafe act or creating an unsafe condition and stop the work, or vice versa. Any unsafe act or condition identified must be investigated and corrected by either the employee who stopped the work or the site PM.

Any employee who identifies an unsafe act or condition that warrants a stop work order shall immediately conduct the following:

- Notify affected employees (includes workers in the general area)
- Take the appropriate actions necessary to protect workers, the public, the environment, and the property
- Notify immediate supervisor
- Notify site PM if different from immediate supervisor

Affected employees will immediately comply with the stop work order until either the employee who stopped the work or the site PM rescinds the order.

Every stop work order will be investigated and corrected as soon as possible. Individuals involved in the investigation will be determined by the site PM. The results of the investigation shall be communicated to all affected employees including the employee who initially stopped the work and the site PM.

No employee will receive any kind of reprisal, retribution, or discipline for exercising a stop work authority.

7.2.2 WORK AREA EVALUATION FOR CONFINED SPACES

The project team will evaluate their work areas for confined spaces using the "Work Area Evaluation for Confined Spaces," **Appendix G.** The form is used to determine if there are non-regulated spaces, confined spaces, or permit-required confined spaces in the work area. The project team will use completed forms to communicate the type and location of the spaces to team members. Completed forms will be kept in the project folder.

The project team will re-evaluate their work areas if the space configuration or hazards change.

7.2.3 HAND-INJURY PREVENTION

Employees are expected to assess their tasks for physical, chemical, and thermal hand hazards and implement engineering and administrative controls, and PPE, or a combination of the three.

7.2.3.1 ENGINEERING CONTROLS

Engineering controls prevent the physical placement of the employee's hand in harm's way. An example is machine guarding to protect from hazards such as those created by point of operation (area on a machine where work is actually performed), ingoing nip points, rotating parts, flying chips, and sparks.

7.2.3.2 ADMINISTRATIVE CONTROLS

Administrative controls are designed to make an individual aware of the hazard and, therefore, limit their exposure. Administrative controls may include training, labeling, signs, and safe work practices and procedures.

7.2.3.3 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Gloves can protect against chemical exposure, lacerations, and thermal hazards. However, employees need to understand that one type of glove does not protect against all hazards. Employees need to match the right glove material with each application or task. This includes assessing the job for chemical exposures, pinch points, laceration hazards, thermal risks, abrasion exposure, puncture risks, and then selecting the appropriate glove based on material, thickness, length, and other traits. Clients may have strict guidelines for proper glove selection, so get with your PM for more details.

Table 7-1 provides employees with more glove selection guidance.

Warning: Loose fitting clothing, including loose fitting gloves and unbuttoned sleeve cuffs, must not be worn around rotating or moving equipment such as, but not limited to, power transmission shafts, pulleys, feed rolls, drill presses, power augers, and rotating stock!

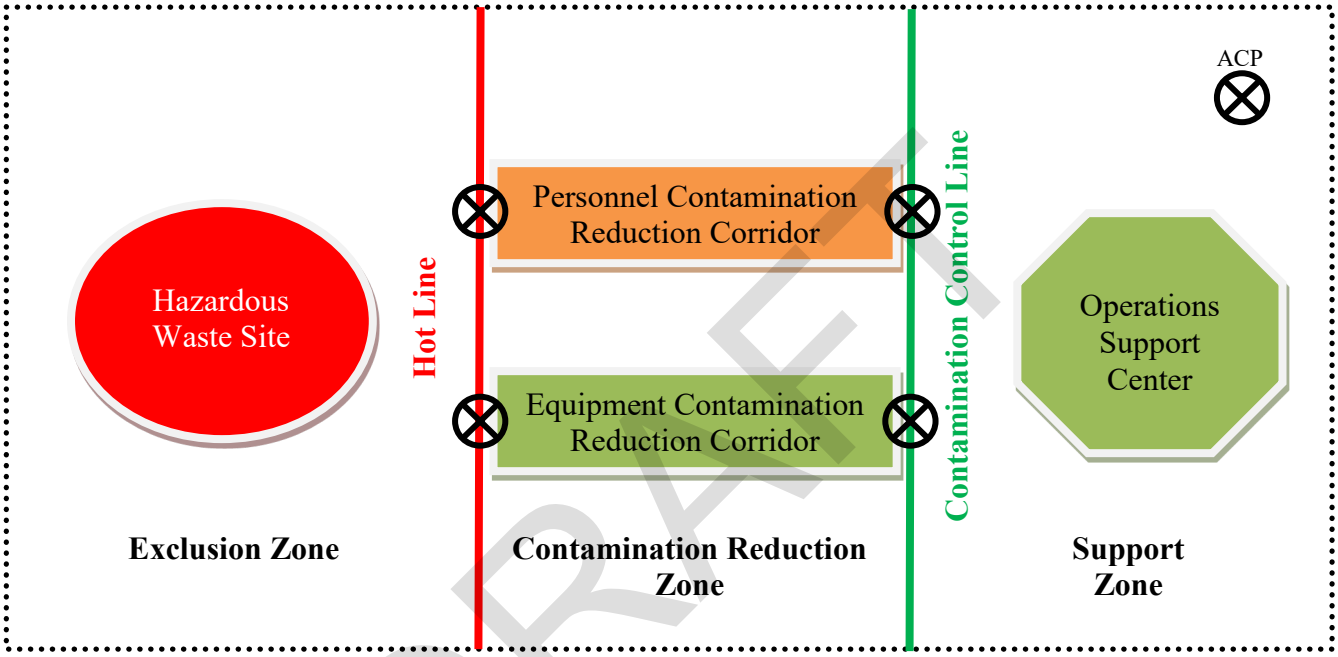
7.3 WORK ZONE ACCESS

Currently the Exclusion Zone at the Site is controlled by Feezor Engineering and Ameriphysics, LLC for OU-1 related activities and routine groundwater and air monitoring. Trihydro will defer to and adhere to the existing health and safety policies/procedures regarding working within the OU-1 Exclusion Zone.

The OU-3 work zone is defined as the area within a 30-foot radius of persons working in the area. Barricades and other entry restricting equipment will be used at the discretion of the PM or PSHSO to prevent the work zone entry of unauthorized personnel. Only authorized personnel will be permitted to enter the work zone. Authorized personnel will include those who have duties requiring their presence in the work zone. The Trihydro PM has the right to require unauthorized personnel to exit the work zone.

Pedestrian and vehicle traffic control plans will be developed and documented as an addendum to the HASP when the potential exists for pedestrian and/or vehicular traffic to pass through or nearby the work zones. The control plans will provide: pedestrian/vehicle diversions around or away from the work zones; clear guidance through the diversion; and prevent pedestrian/vehicle/work zone interaction that would result in incidents. Requirements for submitting traffic control plans with controlling authorities need to be completed in accordance with their guidelines.

7.3.1 HAZWOPER EXCLUSION ZONE ACCESS



During HAZWOPER operations, it may be necessary to set up work zones to control chemical exposures. The Site currently has these areas designated by fencing and signage at OU-1 Areas 1 and 2. The area is controlled by Feezor Engineering and Ameriphysics. Trihydro will adhere to their protocol and procedures when working within the Exclusion Zone.

The Exclusion Zone (or hot zone) is the area with actual or potential contamination and the highest potential for exposure to hazardous substances. Therefore, the Exclusion Zone requires the highest level of PPE determined for the area. If workers are entering the Exclusion Zone under suspected or actual immediately dangerous to life and health conditions, there must be one standby rescuer in the same level of protection for each entrant. Standby rescuers are staged in the Support Zone (or are cold zone ready) to enter the Exclusion Zone at a moment's notice.

Exclusions zones will vary based on the tasks performed on a daily basis. If multiple exclusions zones are established, wind direction and topographical layout need to be considered to prevent exposing workers in other work zones.

Work zones must be well-marked and the boundaries visible. Work zone boundaries are established after evaluating the potential for hazardous substances to migrate through air, soil, or water.

Smoking, eating, drinking, and applying makeup or lotions within the Exclusion or Contamination Reduction Zones is prohibited.

Workers are to enter the Exclusion Zone through the CRZ (or warm zone) via the Access Control Points (ACP). Workers are to exit the Exclusion Zone through the CRZ personnel decontamination stations while equipment is decontaminated at the equipment decontamination stations.

7.3.1.1 BUDDY SYSTEM AND COMMUNICATIONS

Workers in the Exclusion Zone are to use the "buddy system" to facilitate a quicker response in the event of an emergency. Exclusion Zone entrants need to work in groups so as to have effective communication with one another and have visual contact to monitor others for signs and symptoms of exposure and other emergencies. Key responsibilities of buddies are to:

- Provide partners with assistance
- Observe partners for signs of chemical or heat exposure
- Periodically checking partners' PPE
- Notify the PM or other site employees if emergency assistance is needed

The PM needs to establish effective communication with the Exclusion Zone entrants before entry. Various systems can be used to include:

- Radio: including FM and CB (intrinsically safe for explosive atmospheres)
- Noisemakers: such as bells, air horns, megaphones, sirens, whistles
- Visual signals: such as flags, hand signals, lights, signal boards, body movements

7.3.2 WORK PERMITS

Work permits may or may not be required on project sites; however, the client reserves the right to regulate specific areas by the use of work permits such as general work permits, hot work permits, high hazard permits, and permit-required confined space permits. If the client has specific permit requirements, or if hot works or permit-required confined space operations are anticipated, review the Trihydro and client specific procedures before initiating the tasks.

7.3.3 LONE WORKER SAFETY PROCEDURES

To provide an effective means of communication between a single field team member and the project management group, site Lone Worker Safety Procedures will be established by the PM. The primary consideration is the type of activities that will be performed that could result in exposure to an incapacitating situation. ***If there are no expected or potential exposures to hazards that would incapacitate the individual, then Lone Worker Safety Procedures are acceptable.***

The following criteria need to be met before performing tasks at the project site under the Lone Worker Safety Procedures:

- Perform a Work Site Self-Assessment to determine if the task has high risk that would require the buddy system.
- Verify that cellular phone use in the work area does not pose an additional hazard or is not against the client's policy.
- The lone worker needs to possess a cellular phone that is turned on, kept on person, and charged. If working in a noisy environment, set the phone to vibrate.
- Cellular phone reception needs to be verified to be at a sufficient level. If cellular coverage is not sufficient, a booster needs to be issued to the individual.
- Supervisors away from the office will carry a cellular phone, turned on, kept on person, and charged.
- The lone worker needs to carry identification (ID) on their person and in vehicles (company ID badge, driver's license, etc.).
- If the client policies require, company vehicles need to have the company name and office phone number displayed.

The following communication protocol needs to be implemented:

- Field personnel would advise their supervisors of their work schedule.

- The lone worker needs to contact supervision at the start of the day, mid-day, and a final status report call at the end of the day. The client will be notified in accordance with their policies.
- The communication with additional contacts, such as family and friends, is encouraged.
- If a lone worker misses a scheduled communication, they need to be contacted to verify their status within 15 minutes of the scheduled check in time. If the lone worker does not answer after three call attempts, a person will be sent to the work site to check on their status.

7.4 PHYSICAL HAZARDS

PPE is designed to protect field team personnel from some physical hazards expected at the work site. However, the field team personnel will be aware of potential physical hazards and remain alert during field work. The following procedures will be implemented to minimize the potential for injury from physical hazards.

7.4.1 HOUSEKEEPING

The first requirement for safe field operation is that the field team understands and fulfills the responsibility for maintenance and "housekeeping" during site environmental activities.

7.4.1.1 GENERAL HOUSEKEEPING

- Suitable storage locations will be provided for tools, materials, and supplies so that tools, materials, and supplies can be conveniently and safely handled without hitting or falling on a member of the crew or a visitor.
- Work areas, platforms, walkways, scaffolding, and other access ways will be kept free of material, debris, obstructions, and substances such as ice, grease, or oil that could cause a surface to become slick or otherwise hazardous.
- Gasoline will not be stored in portable containers other than a non-sparking, red container with flame arrester in the fill spout and having the word "gasoline" easily visible on the container.
- Store and secure necessary equipment outside the work zone until use is required.
- Mitigate icy conditions within the work zone and along pathways.

7.4.2 GROUND LEVEL SLIPS, TRIPS, AND FALLS

To prevent slips, trips, and falls, take extra precaution if you encounter the following situations:

- Loose, irregular surfaces, such as gravel, shifting floor tiles, and uneven sidewalks can make it difficult to maintain your footing.
- Oil, grease, and other liquids can make walking surfaces extremely slick.
- Obstructed aisles or walkways present tripping hazards or require frequent changes of direction, which can throw you off balance.
- Insufficient light can make it difficult to see obstacles and notice changes in the walking surface.
- Shoes with slick soles provide insufficient traction.
- Carrying items can both obstruct your vision and impair your balance.
- Inattention and distraction interfere with your awareness of these hazards and increase your risk of injury.
- For snow covered terrain, follow already established safe trails.

7.4.3 KNIFE SAFETY

Only self-retracting utility (safety) knives are to be used by Trihydro employees and subcontractors. Self-retracting (safety) knifes add an important safety feature to the design. Like standard utility knives they can adjust quickly to different cutting depths and will let the blade retract completely into the handle when not in use. The difference is that the spring-loaded blades are pushed out of the knife body with finger pressure and then retract automatically when the pressure is released. This added safety feature will help keep our employees safer on the job site.

Here are some safety tips that apply when using utility knives:

- Once the blade is engaged into the material, release the finger pressure to allow blade retraction once material is cut.
- Use a sharp blade.
- Keep your free hand away from the line of cut.
- When making cuts on a surface below you, stand or kneel to one side of the line of the cut.
- Pull the knife toward you when making a cut on a flat surface. Because pulling motions are stronger and more positive than pushing motions, your knife is less likely to slip.
- When using a straight edge to guide a cut, either clamp it down or keep your free hand well away from the cutting path of the knife. Be sure the straight edge is thick enough to prevent the knife from "riding up" over the edge.
- With thicker materials, make several passes, cutting a little deeper into the material with each pass.

- Many tasks require a knife edge, but not a sharp point. For these tasks you can add protection against puncture wounds by using a rounded-tip blade.
- Use "imbedded" blades when possible such as for strapping, shrink wrap, and twine.
- Use scissor-type cutters (pipe cutter) when possible, such as with piping, hosing, and tubing.

Self-retracting Knife

Imbedded Blade

Pipe Cutter

7.5 ELECTRICAL HAZARDS

The potential exists for field team personnel to encounter electrical hazards, particularly during site activities. The following procedures will be implemented to minimize the potential for injury from electrical hazards.

7.5.1 ELECTRICAL-QUALIFIED PERSONS

Only qualified persons are authorized to construct, repair, maintain, and operate electrical equipment and installations where the individual would be within 3 feet of live (energized), exposed components. This does not include removal of an electrical source to machinery/equipment for the purpose of controlling hazardous energy sources (LOTO) under 29 CFR 1910.147.

A qualified person is one who has the skills and knowledge related to the construction and operation of electrical equipment and installations. The qualified person will have undergone safety training to recognize and avoid hazards per the National Fire Protection Association (NFPA) Standard 70E.

7.5.2 GROUND FAULT CIRCUIT INTERRUPTERS (GFCI)

Power tools and extension cords used in construction activities or in damp environments will be outfitted with a GFCI adapter or plugged into a GFCI outlet. The GFCI adapter is to be installed at the outlet before the extension cord or power tool.

If the use of a GFCI can pose a greater threat to employees, such as when using magnetic-mounted power tools, employees are to coordinate with the H&S Team before tool or equipment use.

Employees are to inspect and test the GFCI before use.

7.6 CHEMICAL HAZARDS

Governmental regulations require that Trihydro has one easy reference for important information regarding hazardous substances in the workplace. This information is contained on labels and in SDSs/MSDSs for each substance in the workplace. OSHA has updated the requirements for SDSs (formerly known as MSDSs) but will not fully regulate the new format until June 1, 2015. Also, OSHA has updated the requirements for labeling of hazardous chemicals under its Hazard Communication Standard (HSC). As of June 1, 2015, all labels will be required to have pictograms [consists of a symbol on a white background framed within a red boarder and represents a distinct hazard(s)], a signal word, hazard and precautionary statements, the product identifier, and supplier identification. Until that time, labels can be in the form of the National Fire Protection Agency (NFPA) diamond on buildings or the Hazardous Information System (HIMS) guidelines for containers with the hazards ranging from zero (no risk) to four (highest risk).

If a hazardous material is encountered that the employee is not familiar with, the employee will review the SDS/MSDS for that material. Read labels and the SDS/MSDS carefully, follow warnings and instructions, understand the signs of exposure and first aid response, use the correct protective clothing and equipment when directed, learn emergency procedures, and practice safe work habits. Employees will direct questions about a hazardous material to the PSHSO.

Site-chemical hazards and their associated exposure limits that employees may encounter are listed in **Table 7-4**.

- Hydrocarbon liquids and gases, which may adversely affect human health through injection, skin contact, and inhalation.
- Acidic and caustic solids or liquids, which may adversely affect human health through skin contact and inhalation.

If you have questions regarding chemicals located at the client's site, contact the PM.
The following procedures will be implemented to minimize potential harm from chemicals:

- The Trihydro PM will refer to the National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards for the proper response to hazardous organic chemicals if field team personnel complain of irritation, giddiness, headache, or nausea.
- Copies of SDSs can be found in **Appendix E**.
- If organic vapors are encountered, organic vapor measurement should be taken every 15 minutes in the breathing zone within the site. Employees need to refer to **Tables 6-1 and 6-2** "PID and FID Organic Vapor Action Levels and Responses."

- Trihydro's PSHSO will instruct field team members to stop work and leave the work zone if there are indications of the exposure to acidic or alkaline substances (eye, nose, throat, or skin irritation; holes in clothes).
- Trihydro's PSHSO will instruct the field team members complaining of these symptoms to immediately flush the area of the body exhibiting the symptoms with cool or cold water.
- Trihydro's PSHSO will determine the pH of the apparent offending substance.
- If the pH is less than 1 or greater than 12 standard units, the field team personnel will be required to wear Tyvek coveralls, chemical resistant gloves, chemical resistant boots, splash goggles, and half-mask respirators with acid and particulate cartridges.
- Trihydro's PSHSO will instruct the field team personnel to minimize contact with the acidic or caustic substance.
- Chemicals will be stored with compatible chemicals in an area with secondary containment that will not allow a spill to enter into the environment.
- Chemicals not in their original container will be kept in a container compatible with the chemical and labeled with an HIMS label.

7.6.1 SITE CHEMICALS OF CONCERN

Based on historical environmental sampling data for the site, chemicals of concern at the site include the individual compounds present in petroleum hydrocarbons, including volatile and semi-volatile organic compounds and heavy metals in soil and groundwater. The primary chemicals that were detected at concentrations above cleanup standards include those listed in Table 7-4. This table is used as a reference; defer to the NIOSH Pocket Guide to Chemical Hazards and/or the SDS / MSDS provided in **Appendix E**.

7.6.2 HAZARDOUS WASTE

Hazardous waste will be collected in containers compatible with the waste, stored in an area with secondary containment that will not allow a spill to enter into the environment, stored with compatible wastes, and labeled indicating the waste nomenclature and collection start date.

7.7 NATURAL DISASTERS

7.7.1 TORNADOS

If you are under a tornado WARNING, seek shelter immediately!

7.7.1.1 IF INDOORS

- Go to a pre-designated shelter area such as a safe room, basement, storm cellar, or the lowest building level.
- If there is no basement, go to the center of an interior room on the lowest level (closet, interior hallway) away from corners, windows, doors, and outside walls.
- Put as many walls as possible between you and the outside.
- Get under a sturdy table and use your arms to protect your head and neck. Do not open windows.

7.7.1.2 IF IN A VEHICLE, TRAILER, OR MOBILE HOME

- Get out immediately and go to the lowest floor of a sturdy, nearby building or a storm shelter. Mobile homes, even if tied down, offer little protection from tornadoes.

7.7.1.3 IF OUTDOORS WITH NO SHELTER

- Lie flat in a nearby ditch or depression and cover your head with your hands. Be aware of the potential for flooding.
- Do not get under an overpass or bridge; you are safer in a low, flat location.
- Never try to outrun a tornado in urban or congested areas in a car or truck. Instead, leave the vehicle immediately for safe shelter.
- Watch out for flying debris. Flying debris from tornadoes causes most fatalities and injuries.

7.8 CLIMATE HAZARDS

During day-to-day field work, on-site personnel will be alert for the signs and symptoms of climatic stress. Field team members will be observed for the following signs and symptoms of climatic stress:

- Change in body temperature
- Profuse sweating (or absence of sweating when sweating is expected)
- Skin color change
- Shivering
- Disorientation or slurring of speech
- Vision problems
- Muscle cramps or spasms

7.8.1 HEAT STRESS

Heat stress is the increased heart rate, body temperature, respiration, and perspiration that results when the body works to reduce unwanted heat.

7.8.1.1 HEAT STROKE

Heat stroke is the most serious level of heat stress and can be lethal. During heat stroke, moisture from sweat is not available to stimulate evaporative cooling. Some symptoms of heat stroke include:

- Extremely high body temperature
- Red, hot, dry skin (sweating is absent)
- Strong, rapid pulse
- Convulsions or collapse
- Delirium, disorientation, or unconsciousness

The most important emergency measures to take in the event of heat stroke are:

- Call for emergency help.
- Cool the victim rapidly; get the victim to a shaded area until emergency help is available.
- If the victim is conscious, administer liquids, but never give alcoholic beverages or stimulants such as coffee or tea.
- If emergency help is not available, seek medical attention during or immediately following the cooling process.

7.8.1.2 HEAT EXHAUSTION

Heat exhaustion is not as severe as heat stroke but can lead to heat stroke if not treated properly. Some symptoms of heat exhaustion include:

- Body temperature is normal or slightly deviant from normal
- Profuse sweating
- Pale, clammy skin
- Weak pulse
- Fatigue, dizziness or giddiness, fainting
- Muscle cramps
- Nausea or vomiting

The most important emergency measures to take in the event of heat exhaustion to prevent heat stroke are:

- Cool the victim in shade or indoors
- Have the victim lie down with feet slightly elevated
- Loosen clothing
- If conscious, administer an electrolyte solution, such as Gatorade, every 15 minutes unless vomiting occurs
- If symptoms persist or recur, seek medical attention

7.8.1.3 PREVENTION OF HEAT STRESS

The work schedule should be paced based on weather conditions. There should be adequate rest periods when electrolyte solutions are available, as it may be necessary to replace body fluids and electrolytes as often as every 15 minutes. Air thermometers and oral medical thermometers should be available.

Clothing should be light and reflective and a sunscreen with at least a sun protection factor (SPF) of 15 should cover areas of the body that are exposed to direct sunlight. In the case of perspiration, the sunscreen should be re-applied as necessary. It should be remembered that a thin layer of clouds is not a form of protection against sunburn, as ultraviolet rays penetrate thin cloud layers.

The effects of heat and humidity are shown in **Table 7-7**.

7.8.2 COLD STRESS

Cold stress is when the body's core temperature drops below 96.8°F (36°C). Cold stress occurs when the body is unable to compensate for excessive heat loss. Cold stress includes frostbite and hypothermia. Symptoms include pain in the extremities, mental confusion, tripping, and falling. This can occur in temperatures below 50°F, especially in people performing physical labor. Wind chill factor also needs to be taken into consideration (see the Table 7-8).

The most important emergency measures to take in the event of cold stress are:

- Individuals suffering from cold stress should move to a heated area.
- The outer layer of clothing should be removed, and the remainder of clothing loosened.
- Wet clothing should be replaced with dry clothing.

- The individual should be instructed to rest until the symptoms are no longer recognizable.
- If the symptoms appear critical, persist, or get worse, immediate medical attention will be sought.

7.8.2.1 FROSTBITE

Frostbite occurs when body parts freeze. Hands, feet, ears, nose, lips, cheeks, and chin are the most vulnerable to frostbite. There are three stages of frostbite: 1) shallow skin, 2) intermediate skin and underlying tissues, and 3) deep frostbite to the bone. The symptoms include:

- The skin changing from red to pale or waxy
- Tingling, stinging, and cold sensations
- Gradual numbness
- Deep frostbite has a cold, solid feel with pale color

First aid for frostbite includes:

- Move the person to a warm area. Put affected body parts in warm water (105 - 110 degrees F) until skin becomes flushed. No hotter or additional damage will result.
- After warming, the injured area should be wrapped in sterile gauze, keeping affected fingers and toes separated.
- If you cannot guarantee that the tissue will stay warm, do not warm the tissue until it can be kept warm.
- If normal sensations haven't returned within 30 minutes, seek medical attention.
- ***DO NOT RUB OR MASSAGE!*** (Have the person move or exercise the affected areas as soon as possible).

7.8.2.2 HYPOTHERMIA

Hypothermia occurs when heat loss causes the body temperature to lower. Rapid warming is urgently needed to prevent death. The symptoms include:

- Severe shivering (shivering decreases as body temperature lowers)
- Disorientation
- An uncaring attitude
- Slower breathing
- Slow speech

- Forgetfulness
- Loss of manual dexterity
- Pupil dilation at 86°F body temperature
- Eventual unconsciousness and death at body temperatures of 80°F and lower

First aid for hypothermia includes:

- Rest in a warm, sheltered area
- If hypothermia advances beyond shivering, get immediate medical help
- Remove wet clothing and apply heat to the body
- Drink warm water and eat warm food if conscious

7.8.2.3 PREVENTION OF COLD STRESS

To prevent cold stress, wear layers of clothing to keep warm and dry and protect the head, hands, and feet from cold. The work rate should not be so high as to cause heavy sweating that will result in wet clothing. Cooling power of the wind is shown in **Table 7-8.**

7.9 ERGONOMIC HAZARDS

The interaction of personnel with their working environment at this site may present potential hazards, such as incorrect lifting of heavy loads, equipment vibrations, improper twisting, or improper body positioning. The aforementioned conditions are potential factors during site activities. Personnel should position themselves properly, lift with the legs when lifting equipment or heavy objects, and rely on the buddy system for assistance in lifting loads that are awkward or too heavy for one person. Back strain, the most common ergonomic hazard in the field, may be avoided if site workers ask for assistance when needed. It is expected that employees will seek assistance when lifting loads exceeding 50 pounds.

7.9.1 LIFTING PROCEDURES

Back injuries can happen as quickly as one wrong move. Lifting and carrying objects can be safer if:

- Plan the route before lifting the load and remove obstacles.
- When lifting items from below arm level, bend your knees, not your back, to lower your body to the object.

- Bring the load as close as possible to the body before lifting.
- Grip firmly with your hands (not just fingers) and keep your arms and elbows tucked in for more strength.
- Lift by letting your legs push you up, not your back.
- Check that you can see where you are going and move slowly enough to avoid bumping into other objects.
- Do not twist your body while carrying heavy objects; twisting is a major cause of injury. If you need to change directions, move your feet in that direction first.
- Lifting is safest when you keep your back straight and your stomach muscles tight. Staying in good physical condition and getting proper exercise are also important.

Loads should be broken down to movable weights, routes planned, and legs used to do the work. Help should be obtained, or a handcart or other device used if an object is too heavy.

7.10 ACOUSTICAL HAZARDS

When working around site equipment, the potential exists for team members to be exposed to noise levels above the OSHA exposure limit of 85 decibels on an 8-hour TWA. Trihydro and OSHA require the use of hearing protection when working in areas where the exposure limit is equal to or greater than 85 decibels on an 8-hour TWA. To provide adequate hearing protection, Trihydro team members should wear hearing protection while working around mechanical equipment on site. Field team personnel will not use headphones during work.

7.11 RADIATION HAZARDS

Site workers should refer to Trihydro's Ionizing Radiation Program and the Radiation Safety Plan included in Appendix J to this Health and Safety Plan (HASP) that presents the specific radiological requirements that will be met while potentially contacting soil that may contain elevated levels of radioactive materials during this project, in addition to identifying site-specific hazard controls and procedures designed to protect employees, the public, and the environment from hazards associated with this project.

Workers working in or frequenting any portion of a radiation area shall be informed of the occurrence of radioactive materials, shall be instructed in the safety problems associated with exposure, precautions, and devised to minimize exposure including but not limited to time, distance, shielding, and keeping exposure limits as low as possible.

7.11.1 RADIATION HAZARDS PERSONAL PROTECTIVE EQUIPMENT

Appropriate personnel monitoring equipment shall be required and supplied (e.g., film badges, pocket chambers, pocket dosimeters, or film rings) by the RSO to each individual with the potential for ionizing radiation exposure.

7.11.2 WARNING SIGNS

Radiation symbols shall use the conventional radiation caution colors (magenta or purple on yellow background). The symbol is the conventional three-bladed design.

Each radiation area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol with the words: "Caution – Radiation Area."

7.12 DUST HAZARDS

The generation of dust and fugitive emissions will be prevented when possible and controlled when necessary. Work practices may be adjusted in a manner to minimize dust generation. Personnel will avoid working in dust by positioning themselves upwind of intrusive activities. Hazardous dust will be controlled by suppression with water where it poses a risk to workers or community. Throughout site activities, dust areas should be watered, as needed, to minimize dust.

7.13 DRILLING ACTIVITIES

Before any subsurface activities, Trihydro employees involved will complete Trihydro's Subsurface Utility Location and Excavation best practices training. When performing hollow stem auger, flight auger, air rotary, casing hammer, mud rotary, sonic, or direct push drilling operations, the following applies:

7.13.1 GENERAL SAFETY AND EMERGENCY RESPONSE

- Before work is begun, including rig set up, a tailgate safety meeting, review of site specific health and safety plan, and job hazard review must be conducted at the site.
- The job hazard analysis must be specific to the rig to be utilized.
- A first-aid kit must be available in an easily accessible area away from the drilling operation. Its location must be reviewed during the tailgate safety meeting.
- Work cannot be performed if lightning strikes are observed in the area.

7.13.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)

- Minimum required PPE for drilling jobs includes hard hat, safety shoes with steel toes, safety glasses or goggles, gloves and hearing protection.
- Appropriate PPE must be worn to prevent irritation or contamination of the skin when handling potentially contaminated articles and spoils.
- Hearing protection must be worn in the Exclusion Zone or when working within 20 feet of the operating rig.
- Secure loose clothing, hair wraps, strings on jackets and hoods, and shoelaces. Jewelry is not allowed to be worn. Eliminate protruding tools from tool belts.

7.13.3 EQUIPMENT SAFETY

- The drilling contractor will complete a checklist daily to verify equipment is in safe and operable condition. The checklist must be available on site for review.
- Rig controls and levers, including emergency shut-off, should be legibly labeled. Wherever possible, pinch points will be identified and labeled.
- Adequate cribbing must be in place under the leveling jacks and outriggers to prevent tip-over or sinking into unstable soil.
- Secure the rig when it is in position; set brakes and/or locks, chock wheels or tracks as conditions require.
- The Exclusion Zone must be marked with a continuous barrier where the potential for site visitation by the public or other pedestrians exists.
- The Exclusion Zone(s) should be large enough to safely accommodate workers and drilling equipment.
- Check for adequate overhead clearance before raising the mast. Work in proximity to overhead power lines must address risk of contact with lines.
- Travel with the mast of the drill rig in the raised or partially raised position is unauthorized.
- The drilling rig must be equipped with an operable emergency shut-off or “kill” switch. Persons working within the Exclusion Zone must know the location and operation of the emergency shut-off switch. The functionality of emergency shut-off switches must be tested at the start of each work day.
- Whip checks or anti-whip devices must be in place on pressurized hose lines.

- Augers, drill rods, or down-hole equipment must be cleaned when the drill rig is in neutral, the engine is idle, and the machinery has stopped rotating.
- Repair to rigs must be done by a person trained and qualified to perform the repair.
- Do not perform maintenance or refueling while the equipment is operating.
- Work must cease if cables or cable clamps become damaged or frayed.
- No body part is allowed within 12 inches of a turning auger.
- Broken or substandard equipment must not be brought to the site. Equipment that becomes broken must be tagged as such and must not be used.
- Equipment must not be used if guards are not in place.
- Work areas must be kept in a clean and orderly condition. Tools and equipment must be stored properly when not in use.
- A worker must not attempt to move a load unassisted if the weight and bulk exceeds the capability of the worker. Loads greater than 50 pounds must not be repeatedly moved by a single person.
- Vertical storage of drill rods and augers is not allowed unless the rig is specifically designed to accommodate this practice.
- Drilling rods and augers may not be removed in multiple sections. Drilling rods and augers must be broken down at each joint as they are removed from the hole. Manual tools must not be used in combination with powered rotation.

7.13.4 DRILL-SITE CLEARANCE

To protect buried utilities and exposing employees to the hazards associated with utility strikes, a summary of Trihydro's drill-site clearance procedure is listed below. Trihydro's *Excavation, Drilling and Utility Locating Checklist* will be used prior to drilling and/or geoprobing activities. Before any subsurface activities, Trihydro employees involved will complete Trihydro's Subsurface Utility Location and Excavation best practices training. Procedures may vary based on the Clients expectations, PM's assessment of the area, tasks, and geological makeup.

- The drilling contractor will contact the appropriate "Call Before You Dig" one-call notification center at least 2 business days before excavation and/or drilling work is scheduled to begin.
- Contractor will verify that "Call Before You Dig" locators mark their facilities in the designated drill site area or provide notification that they do not have facilities near the proposed drill area.

- Locations of known utility lines will be clearly marked (using electronic locating methods) at each proposed drill site.
- Trihydro will conduct a thorough review of available subsurface utility-location maps for each proposed drill site.
- If drilling activities are within the "tolerance zone" and/or areas outside the "tolerance zone" when required by the client, each location will be potholed to a depth below the utility zone using minimally intrusive potholing methods such as hand auger, air or hydro vacuum techniques. Each of the proposed drill sites will be potholed to a minimum diameter no less than that of the proposed borehole to be drilled.
- If environmental soil-quality samples are required within the "utility window," air vacuum to the desired sample depth and use a hand auger to retrieve the sample.
- Visually confirm that no buried utilities or other subsurface obstructions are present in each pothole to the maximum depth of the "utility window."
- If no buried utilities or other obstructions are encountered, the proposed drill site is "cleared" for drilling.
- Before raising the mast on the drilling rig at each location, look for overhead lines. A 20-feet minimum clearance shall be maintained from overhead power lines, or per the client's requirements, whichever is greater. If the appropriate clearance cannot be maintained, the power lines shall be de-energized. If impracticable, or infeasible, contact the Corporate H&S Team for guidance.
- During drilling activities, proceed slowly for the first 5 feet.
- Stop drilling activities if resistance is encountered.
- A copy of the Trihydro Standard Operation Procedure – Excavation Site Clearance can be obtained on the Trihydro Internal Webpage.

7.13.5 HOUSEKEEPING DURING DRILLING OPERATIONS

- Do not store or transport tools, materials, or supplies within or on the mast (derrick) of the drill rig.
- Pipe, drill rods, casing, augers, and similar drilling tools will be stacked on racks or sills in an orderly fashion to prevent spreading, rolling, or sliding.
- Penetration, or other driving hammers, will be placed at a safe location on the ground or secured to prevent movement when not in use.
- Controls, control linkages, warning and operation lights, and lenses should be stored free of oil, grease, and/or ice.
- Keep support vehicles, unnecessary equipment, and unnecessary personnel outside of the work zone.

7.14 TRAFFIC HAZARDS

7.14.1 DRIVING SAFETY

Driving safety is required to protect the field team personnel from work-related injuries and accidents. Compliance with site, local, state, and federal traffic laws is required. Workers should drive defensively by continually watching for hazardous conditions, understanding how to defend against them, and taking action in time to avoid problems. Keep eyes and attention on the road and others and adjust speed and driving to changing weather and traffic conditions.

- Trihydro employees who, as a part of their duties, operate vehicles on public roads will hold a valid, properly classed driver's license and possess an acceptable driving record.
- Only vehicles designed for off-road operations will be allowed to leave improved roads and then only within the manufacturer's guidelines and the vehicle's capabilities and limitations. When operating off trail, the use of a spotter will be used. If a spotter is not available, then a ground recon of the intended route will be conducted by the driver before driving the area.
- Vehicles will be parked to allow the driver to pull forward to preventing the need for backing. If the vehicle needs to be backed, the driver will use a spotter or, in the absence of a spotter, perform a ground recon for obstacles before entering the vehicle and backing.
- Trihydro employees who, as a part of their duties drive corporate, rental vehicles, or personal vehicles for Trihydro business, will be 3-D Driving (defensive driving) certified before driving on corporate business. Refresher training is required every 2 years.
- Employees are expected to complete a Journey Assessment Form found on the Trihydro H&S Web site before departure when leaving their local area.
- Employees operating a vehicle, personal, rental, or fleet, on company business will not use a cell phone, Blackberry, or other electronic device while operating the vehicle.
- Site workers are required to wear seat belts when operating or riding in vehicles.
- It is a violation of Trihydro's safety policy for employees to operate a vehicle with illegal drugs in his/her system or while impaired by alcohol, prescription drugs, or over-the-counter medications.
- Vehicles and other mobile equipment will operate within posted speed limits, and only in areas necessary to perform work, and will observe roadblocks and caution signs.
- Vehicles may be left running only for the purposes of operating auxiliary equipment or lights or for diesel engine warming, and then only when the driver can verify the vehicle is secure with the transmission in park or neutral, wheels chocked, and the parking brake set.

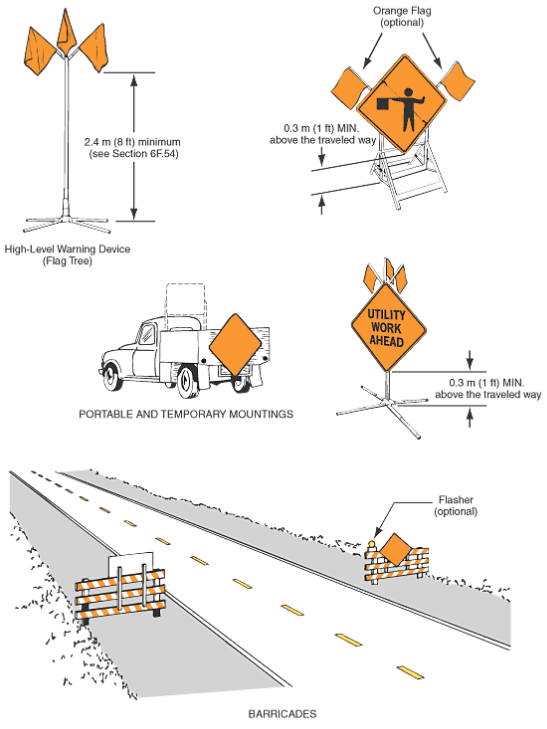
- Vehicles parked on sloped surfaces will have the transmission in park, or placed in first gear for manual transmissions, wheels chocked, and the parking brake set.
- When parking heavy equipment, such as front loaders and other excavation equipment, the driver will lower the buckets, blades, or other hydraulically driven attachments to the ground, place the vehicle in park, and set the parking brakes.
- Vehicle operators will not drive over unprotected hoses or exposed piping.
- Employees will enter and exit through the gates or pathway provided and designated for this use.
- Keys to unattended vehicles and equipment will be left in the ignition so the vehicles and equipment can be moved as necessary (on unsecured sites, this is at the discretion of the PM). Where applicable, vehicles and/or equipment are described as unattended anytime the driver is not at the controls of the vehicle.
- Upon notification of a release of flammable vapors, fire, or other immediate dangers, the operator will immediately shut down sources of ignition under his/her control. No attempt to start or move vehicles in the area will be made until conditions are safe for re-entry.

7.14.2 VEHICULAR SAFETY

The protection of project-team members from vehicular hazards while on site is crucial. The following actions should take place to provide a high level of protection from injuries caused by contact with vehicles and heavy equipment.

- Activities conducted in or near roadways will be barricaded and guarded.
    - Backed up trucks and work vehicles can provide an effective barrier for worker protection in the work zone. Trucks should be positioned between the working area and the flow of traffic. Be sure to allow enough space between the vehicle and the closest workers to prevent the vehicle from being pushed into workers if it is hit.
- Traffic control devices will be installed before work begins in accordance with the U.S. Department of Transportation (USDOT) Manual on Uniform Traffic Control Devices

Figure 6F-2. Methods of Mounting Signs Other Than on Posts



(MUTCD), Chapter 6F, Temporary Traffic Control Zone Devices (http://mutcd.fhwa.dot.gov/htm/2003r1r2/part6/part6f1.htm).

- The MUTCD defines traffic control devices as signs, signals, markings, and other devices used to regulate, warn, or guide road users, placed on, over, or adjacent to a street, highway, pedestrian facility, or bikeway.
- Traffic control devices used on street and highway construction, maintenance, utility, or incident management operations will conform to the MUTCD.
- Work site warning signs will be placed far enough from the work zone so that drivers will have time to read the messages and react before they reach the work area (see **Table 7-9**). On urban streets, the effective placement of the first warning sign should range from 4 to 8 times the speed limit with the high end of the range being used when speeds are relatively high. When a single advance warning sign is used (in cases such as low-speed residential streets), the advance warning area can be as short as 100 feet. When two or more advance warning signs are used on higher-speed streets, such as major arterials, the advance warning area should extend a greater distance. The distance from the work zone to the first sign is listed in column A. The distance from the first sign to the second is listed in column B. The distance from the second sign to the third is listed in column C (The third sign is the first one in a three-sign series encountered by a driver approaching a TTC zone).
- Signs mounted on barricades, or other portable supports, will be no less than 1 foot above the traveled way (See MUTCD Figure 6F-2).
- Traffic cones can be used to guide and direct traffic around or through the work areas during daylight hours. The devices will be installed before the work begins. At least one advance warning sign will be used to explain the cones. Flags inserted in the top of the cones increase their visibility.
- Backed up and stationery vehicles and trucks can also serve as warning devices when equipped with flashing high intensity emergency lights (a revolving light or strobe light above the cab).

- During sampling activities, one person should function as a flagger to divert traffic while another collects the samples.
- Flaggers and work crew will wear high visibility vests.
- Site heavy equipment will have backup warning devices.

7.14.3 POWERED INDUSTRIAL TRUCKS (FORKLIFTS, ETC.)

Powered industrial trucks includes fork trucks, tractors, platform lift trucks, motorized hand trucks, and other specialized industrial trucks powered by electric motors or internal combustion engines.

In accordance with OSHA CFR 1910.178(l), no employee is allowed to operate a powered industrial truck without receiving the proper training and certification. Refresher training is required every 3 years, when an employee is observed operating a powered industrial truck unsafely, an employee is operating a powered industrial truck and involved in an accident, the operator has received an evaluation that reveals that the operator is not operating the truck safely, the operator is assigned to drive a different type of truck, or a condition in the workplace changes in a manner that could affect safe operation of the truck.

7.15 CONTAMINATED SOIL REMOVAL/HAULING OPERATIONS

During contaminated soil removal operations, a *Contaminated Soil Removal Plan* will be developed, where relevant, to address the following issues and submitted to the client PM before work commencement:

- Dust/vapor control
- Excavation hazards
- Hazardous atmospheres
- Chemical hazards
- Traffic control
- Truck routing
- Utility clearance
- Asbestos hazards

7.16 BIOLOGICAL HAZARDS

7.16.1 BLOOD-BORNE PATHOGENS

Workers may be at risk of developing various types of illnesses, such as the human immunodeficiency (HIV) and hepatitis B (HBV) and C (HCV) viruses, due to their exposure to blood-borne pathogens and other potentially infectious materials in the workplace.

Universal precautions, engineering, and work practice controls will be used to eliminate or minimize employee exposure. Universal precaution is the practice of treating bodily fluids as contaminated. Where occupational exposure remains after institution of these controls, PPE will also be used.

Trihydro will provide hand-washing facilities accessible to employees where feasible. When provision of hand-washing facilities is not feasible, Trihydro will provide an appropriate hand cleanser in conjunction with clean

cloth/paper towels or antiseptic towelettes. When antiseptic cleansers or towelettes are used, hands will be washed with soap and running water as soon as feasible. Employees will wash their hands and other skin with soap and water, or flush mucous membranes with water immediately or as soon as feasible following contact of such body areas with blood or other potentially infectious materials.

Project sites will have on hand a blood-borne pathogen clean up kit and personnel should be trained before its use.

If field team members are exposed to body fluids, they will report the incident immediately to Trihydro's PM, who will fill out Trihydro's "Exposure Incident Report" found in Appendix I.

7.16.2 HANTAVIRUS

Hantavirus pulmonary syndrome (HPS) is a rare but serious, and often deadly, lung infection. Hantaviruses are found in rodents in different parts of the world where the Sin Nombre virus is carried by the deer mouse, the cotton rat, and perhaps other rodents common throughout North America. The Sin Nombre virus is passed to humans by saliva, urine, and droppings of infected rodents.

The best way to prevent HPS is to:

- Avoid contact with rodents and avoid inhaling dust that might be contaminated with rodent saliva, urine, or droppings.
- Use safety precautions when cleaning indoor or outdoor areas that might be contaminated with rodent saliva, urine, or droppings. Do not stir up and breathe dust. Before cleaning, wet down potentially contaminated areas with a disinfectant (such as bleach or alcohol). While cleaning, wear rubber gloves and disinfect them after use. Dust masks that cover the nose and mouth can also help.
- When participating in outside activities, stay clear of rodents and their burrows and nests. Open up and air out outbuildings before entering or cleaning. Remove garbage and trash before leaving.

7.16.3 HISTOPLASMOSIS

Although histoplasmosis is usually associated with bird and bat droppings, it actually is caused by a fungus. You can only get it by inhaling dust from decayed droppings or contaminated soil. Anyplace where bird or bat droppings have collected is a likely source of the "Histo" fungus. Prevention is the best solution for exposure.

- Avoid creating dust that will put the fungus in the air where it can be inhaled.

- Try not to disturb soil rich in bird droppings.
- When work requires the removal of contaminated soils, do so with wet sweeping and vacuuming with a high efficiency particulate air (HEPA) filter.
- Soil should be placed in heavy-duty plastic bags or other secure containers for disposal.

7.16.4 PSITTACOSIS

Psittacosis is an infectious disease in humans that has mild, non-specific, flu-like symptoms. Psittacosis refers to infections or diseases caused by Chlamydia psittaci, one of several microorganisms in the genus Chlamydia. This disease can be transmitted from infected birds, either wild or domestic birds or poultry, to humans.
Sick birds show signs of:

- Sleepiness
- Weight loss
- Diarrhea
- Shivering
- Breathing difficulties

Humans can become infected with Chlamydia psittaci by breathing in the organism when the urine, respiratory secretion, or dried feces of infected birds is aerosolized (i.e., dispersed in the air as very fine droplets or dust particles). Other sources of exposure include mouth-to-beak contact, a bite from an infected bird, and handling the plumage and tissues of infected birds.

7.16.5 CHIGGERS

Chiggers are most often found in low, damp areas where vegetation is heavy, although some species prefer dry areas. Chiggers seem to be most abundant in areas covered with shrubs and small trees where rodents are numerous. Chiggers occur in pockets or islands because a female will lay all her eggs in one spot. Chiggers may be a problem when working in grassy areas at project locations. The application of DEET can help prevent bites from these insects.

WARNING: Do not apply DEET on flame-resistant clothing (FRC); it makes the clothing flammable. Use Pyrethrin on FRC.

If a chigger bite is experienced, the bite should be washed with soap and water and then a commercial preparation of medication for chigger bites should be applied. The clothes that were worn when the bite(s) occurred should be placed in a plastic bag for temporary storage until they can be laundered.

7.16.6 STINGING INSECTS

Stinging insects are limited to the order Hymenoptera, which includes wasps, bees, and ants where only females can sting. Social hymenopterans, including yellow jackets, bumble bees, honey bees, and fire ants have individuals in the colony whose task it is to defend the nest. If the nest is disturbed, these individuals will defend it vigorously. In addition, foraging members of the colony will also sting if they are disturbed or injured as they go about their activities. Some, such as the yellow jacket, are much more liable to attack than others.

7.16.6.1 SINGLE STINGS

The body responds to the venom of stings with redness and swelling at the sting site. The area is quite likely to itch. Oral and topical antihistamines should help prevent or reduce the itching and swelling. Try not to rub or scratch the sting site, because microbes from the surface of the skin could be introduced into the wound and result in an infection. If the stinger remains in the skin, remove it as quickly as possible, because venom continues to enter the skin from the stinger for 45 to 60 seconds following a sting. If removed within 15 seconds of the sting, the severity of the sting is reduced. After the stinger is removed, wash the wound and treat it with an over-the-counter product or simply a cold compress to alleviate the pain. Aerosol or cream antihistamine preparations that contain a skin coolant can also help. If the sting is followed by severe symptoms, or if it occurs on the neck or mouth, seek medical attention immediately because swelling in these areas of the body can cause suffocation.

7.16.6.2 MULTIPLE STINGS

Occasionally, a person becomes involved in a situation where he or she is stung many times before being able to flee. Humans can be killed if stung enough times in a single incident. Honeybees' toxic dose is estimated to be 8.6 stings per pound of body weight.

7.16.6.3 RENAL INSUFFICIENCY

A potentially life-threatening result of multiple stings may occur days after the incident where the kidneys become clogged and the patient is in danger of dying from kidney failure. It is important for persons who have received many stings at one time to discuss this secondary effect with their doctors. Patients should be monitored for a week or two following an incident involving multiple wasp or bee stings.

7.16.6.4 ANAPHYLAXIS

A small percentage of the population is allergic to wasp or bee stings. Allergic reactions to bee and wasp stings can develop anywhere on the body and may include non-life-threatening reactions such as hives, swelling, nausea,

vomiting, abdominal cramps, and headaches. Life-threatening reactions such as shock, dizziness, unconsciousness, difficulty in breathing, and laryngeal blockage resulting from swelling in the throat require immediate medical care. Symptoms can begin immediately following the sting or up to 30 minutes later and may last for hours.

Anaphylaxis, if treated in time, usually can be reversed by the effects of epinephrine (adrenaline) injected into the body. Individuals who are aware that they are allergic to stings should notify the PM and carry epinephrine in either a normal syringe (sting kit) or in an auto-injector (Epi-Pen®) whenever they think they may encounter stinging insects.

7.16.7 LYME DISEASE (TICKS)

Tick-borne pathogens present a significant field hazard and in some areas account for many serious field incidents. These procedures should be applied during field activities – even in areas that are predominantly paved but with bordering vegetation.

7.16.7.1 HAZARD CONTROL

The methods for controlling exposure to ticks include, in order of most preferred to least:

- Avoiding tick habitats and ceasing operations in heavily infested areas.
- Reducing tick abundance through habitat disruption or application of acaricide.
- Personal protection through use of repellants and protective clothing.
- Frequent tick inspections and proper hygiene.

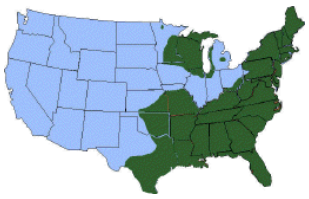
7.16.7.2 FIRST AID AND MEDICAL TREATMENT

Tick bites should be treated with first aid. Clean and wash hands and disinfect the bite site after removing embedded tick by use of tweezers. Consult a healthcare professional if infection or symptoms and effects of tick-borne illnesses develop (“target” or “bull’s eye rash”).

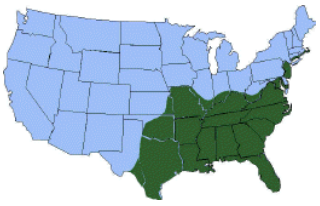
7.16.7.3 TICK IDENTIFICATION

There are four varieties of hard-bodied ticks that have been associated with tick-borne pathogens. These tick varieties include: Deer (Black-Legged) Tick; Lone Star Tick; Dog Tick; and Rocky Mountain Wood Tick.

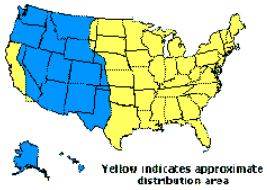
The following ticks can be considered a hazard at the project site:



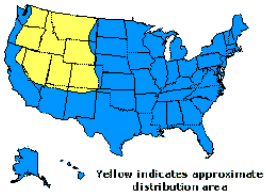
☒ Deer Tick (Range in Green)



☒ Lone Star Tick (Range in Green)



☒ Dog Tick (Range in Yellow)



☐ Rocky Mountain Wood Tick (Range in Yellow)

7.16.8 WEST NILE VIRUS

The West Nile virus (WNV) is a virus transmitted by mosquitoes to other animals normally through a mosquito bite. The most likely route of WNV infection to humans is through the bite of an infected mosquito. It is recommended that workers use standard infection control precautions when working with humans or animals suspected or known to be infected with WNV. Also follow standard infection control procedures when handling sick or dead animals.
Most human WNV infections cause either no symptoms or a mild, flu-like illness. The most severely affected patients may develop an inflammation of the brain called encephalitis. These severe cases are very rare in humans. Persons over age 50 are at higher risk of severe illness following infection.

7.16.9 SPIDERS

Only a few spiders are dangerous to humans with the two problematic spiders in the United States being the Brown Recluse and Black Widow spiders. Bites from spiders may feel like a pinprick and may not even be noticed, but within hours, swelling at the site and breathing problems may occur. Emergency help should be immediately sought. A cloth dampened with cold water or filled with ice may be applied to the bite while awaiting help.

7.16.9.1 BROWN RECLUSE (LOXOSCELES RECLUSA)

It is usually between ¼" and ¾" but may grow larger. It is brown and sometimes an almost deep yellow color and usually has markings on the dorsal side of its cephalothorax, with a black line coming from it that looks like a violin

with the neck of the violin pointing to the rear of the spider, resulting in the nickname "fiddleback spider" or "violin spider". Coloring varies from light tan to brown and the violin marking may not be visible.



Most bites are minor with no necrosis (tissue damage). However, a small number of bites produce severe dermonecrotic lesions (skin tissue damage), and, sometimes, severe systemic symptoms, including organ damage. Rarely, the bite may also produce a systemic condition with occasional fatalities. A minority of brown recluse spider bites form a necrotizing ulcer that destroys soft tissue and may take months to heal, leaving deep scars.

First aid involves the application of an ice pack to control inflammation, the application of aloe vera to soothe and help control the pain, and prompt medical care.

7.16.9.2 BLACK WIDOW (LATRODECTUS SPP)

Adult female black widow spiders are gloss black with an hourglass shaped marking on the underside of its abdomen which is red and male black widow spiders' hourglass color is yellow to white to various shades of orange and red. A large female black widow spider can grow to about 1.5 inches, counting leg span. Male black widow spiders are half the size of the female or smaller (third picture from left). They have longer legs and a smaller abdomen in relation to their body size. They are also usually dark brown with varying colors of stripes/dots, with no hourglass mark. Adult males can be distinguished from juvenile females by their more-slender body, longer legs, and large pedipalps (second pair of appendages) typical of most other male spiders.


Female Black Widow


Female Black Widow


Male Black Widow


Black Widow Nest

Although their venom is extremely potent, (15 times more potent than that of the rattlesnakes), these spiders are not especially large. When the venom is diffused throughout the body of a healthy, mature human, it usually does not amount to a fatal dose, though it can produce the very unpleasant symptoms of latrodectism (abdominal muscle pain and spasms). Deaths in healthy adults from Latrodectus bites are relatively rare.

8.0 CONFINED SPACE ENTRY PROCEDURES

Confined spaces ("non-permit confined space") are defined as meeting ***all of the following***:

- Is large enough and so configured that an employee can bodily enter and perform assigned work.
- Has limited or restricted means for entry or exit.
- Is not designed for continuous employee occupancy.

Some Site wide groundwater (operable unit 03) sites may view certain boating operations as confined spaces; coordinate with a client site representative before conducting boating activities.

A Permit Required Confined Space ("permit space") is defined as a confined space that has one or more of the following characteristics:

- Contains or has a potential to contain a hazardous atmosphere that is defined as:
  - Having flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL).
  - An airborne combustible dust at a concentration that meets or exceeds its LFL.
  - An atmospheric oxygen concentration below 19.5 percent or above 23.5 percent.
  - An atmospheric concentration of substances for which could result in employee exposure in excess of its dose or permissible exposure limit.
  - Other atmospheric condition that is immediately dangerous to life or health.
- Contains a material that has the potential for engulfing an entrant.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.
- Contains other recognized serious safety or health hazard.

Any project work requiring confined space activities performed by Trihydro or a Trihydro sub will get preapproval from the project Business Unit Leader and Trihydro Health & Safety Manager. Confined spaces are initially considered "permit required" until an evaluation is conducted using the Trihydro "Work-Area Evaluation for Confined Spaces **(Appendix G)**." No individual is allowed to enter a confined space, serve as an attendant outside of a confined space, or other confined space duties without proper training. Workers planning on entering or overseeing confined space activities must first determine if the activity being conducted falls under the OSHA General Industry or

Construction industry regulations and determine what regulatory requirements apply. Construction activities 20 CFR 1926 includes new construction, repair to existing facility, and replacement of an existing structure or any of its components. (Maintenance is generally not considered construction). Monitoring and taking samples would generally fall under the general industry standard 20 CFR 1910.146. Training requirements can be found in the Occupational Safety and Health Administrative CFR 1910.146(g) for OSHA General Industry and Occupational Safety and Health Administrative CFR 1926.1207 for Construction.

8.1 CONFINED SPACE OPERATIONS

Confined space operations require:

- Initial evaluation to determine if the space is a permit-required confined space
- Barricades to prevent unauthorized entry and to eliminate fall hazards
- Objects will be kept away from the opening edge to prevent falling object hazards

8.2 PERMIT-REQUIRED CONFINED SPACE OPERATIONS

In addition, permit-required confined space operations require:

- Coordination with the client site administrative and emergency response personnel.
- Identify and evaluate hazards.
- Develop and implement the means, procedures, and practices necessary for safe permit space entry operations.
- Verify appropriate training for those conducting permit-required confined space operations.
- Complete line-breaking, blanking, or lockout/tag out.
- Complete a permit and maintain required documentation at the permit space to include authorized entrant logs. The client's permit has precedence over the Trihydro permit.
- Perform atmospheric testing.
- Purging, inerting, flushing, or ventilating the permit space as necessary to eliminate or control atmospheric hazards.
- Provide the attendant with air monitoring equipment.
- Provide pedestrian, vehicle, or other barriers as necessary to protect entrants from external hazards.
- Verify conditions in the permit space are acceptable for entry throughout the duration of an authorized entry.

- Verify rescue services are available and current on annual training. If rescue services respond to another site, the permit-required confined space operations will cease until rescue services has been re-established.
- Establish adequate communications with rescue services and entrants.
- Provide emergency rescue equipment if not provided by rescue services.
- Providing appropriate PPE.
- Provide adequate illumination.
- Provide equipment for safe entry and egress.

Upon completion of permit-required confined space operations, staff will be accounted for, permit space entrances will be properly closed, the client and rescue services notified, and the permit and associated documentation completed and kept on file for 1 year.

9.0 DECONTAMINATION PROCEDURES

As a tenant on the Site wide groundwater (operable unit 03), an evaluation was conducted to determine the potential for hazardous substance contamination during Trihydro tasks at this site. That evaluation indicates that ***there is a potential*** of contamination of a sufficient quantity to require decontamination planning, equipment, and procedures.

In compliance with 29 CFR 1910.120(b)(4)(ii)(G) and 1910.120(k), the decontamination chapter of the HASP describes how personnel and equipment are decontaminated when they leave the Exclusion Zone. This chapter also describes how residual waste from decontamination processes is disposed. Decontamination procedures are designed to achieve an orderly, controlled removal or neutralization of contaminants that may accumulate on personnel or equipment. These procedures minimize worker contact with contaminants and protect against the transfer of contaminants outside designated work zones. They also extend the useful life of PPE by reducing the amount of time that contaminants contact and permeate PPE surfaces. The decontamination procedures described below are designed to meet the requirements of 1910.120(k) and include project-specific information about:

- The location and type of project decontamination facilities
- General and specific decontamination procedures for personnel and PPE
- General and specific decontamination procedures for equipment
- Disposal of residual waste from decontamination
- The monitoring procedures used to evaluate the effectiveness of decontamination

The PSHSO is responsible for the oversight and implementation of project decontamination procedures and is responsible for validating their effectiveness.

9.1 EFFECTIVENESS OF DECONTAMINATION

The PSHSO is responsible for monitoring the effectiveness of decontamination procedures either through swipe testing, lab analysis, or both.

9.2 DECONTAMINATION FACILITIES

Decontamination is conducted in the CRZ. The CRZ acts as a buffer between the Exclusion Zone and the Support Zone. The location and design of decontamination stations minimize the spread of contamination beyond these stations. Separate facilities are used for personnel and for equipment. A decontamination location will be established

in a geographical area that will minimize the exposure of uncontaminated employees or equipment to contaminated employees or equipment. It is recommended to establish a primary and secondary decontamination area based on terrain, site facilities, and environmental factors such as wind. The location of these designated facilities is marked on the site map, **Figure 3-1** in the Figures Section.

In general, items entering the Exclusion Zone on the site will either be decontaminated or properly discarded upon exit from the Exclusion Zone. Personnel will enter and exit the Exclusion Zone through the decontamination area. Before demobilization, contaminated equipment will be decontaminated and inspected by the Trihydro PM, or designate, before it is moved into the Support Zone. Materials that are generated by decontaminated procedures will be stored in a designated area in the Exclusion Zone until disposal arrangements are made.

9.3 PERSONNEL DECONTAMINATION

The Trihydro PSHSO will monitor decontamination procedures to determine their effectiveness, will verify the appropriate use of PPE, and staff have been sufficiently trained in decontamination procedures.

Based on the nature of the hazards and/or duration of work, showers, and change rooms consistent with the requirements of 29 CFR 1910.141 ***are provided for workers.***

The following are general decontamination procedures established and implemented during this project:

- Decontamination is required for workers exiting a contaminated area. Personnel may re-enter the Support Zone only after undergoing the decontamination procedures described in the next section.
- Used protective clothing is decontaminated, cleaned, laundered, maintained, and/or replaced as needed to verify its effectiveness.
- PPE that requires maintenance or parts replacement is decontaminated before repairs or service.
- PPE is decontaminated or prepared for disposal on the premises. Personnel who handle contaminated equipment have been trained in the proper means to do so to avoid hazardous exposure.
- Workers are required and trained to immediately exit the work zone, perform applicable decontamination procedures, shower, and change into uncontaminated clothing if their permeable clothing is splashed or becomes wetted with a hazardous substance.
- Procedures for decontamination waste disposal meet applicable local, state, and federal regulations.

9.3.1 STEPS FOR DECONTAMINATION

Station 1 Equipment Drop

Deposit equipment used on-site on plastic drop cloths. These items will be decontaminated or discarded as waste before removal from the Exclusion Zone.

Station 2 Outer Boot and Outer Glove Wash and Rinse

Scrub outer boots (if utilized) and outer gloves with decontamination solution or detergent water. Rinse off using water.

Station 3 Outer Boot and Glove Removal

Remove outer boots (or boot covers) and gloves. If disposable, deposit in a container with plastic liner. If non-disposable, place in a clean dry place.

Station 4 Respiratory Protection Removal

Remove hard hat and respirator face-piece and deposit on a clean surface. Air purifying cartridges will be discarded daily, if appropriate. Wash and rinse respirator at least daily. Wipe off and store respiratory gear in a clean dry location.

Station 5 Inner Glove Removal

Remove inner gloves. Deposit in container for disposal.

Station 6 Protective Clothing Removal

Protective cotton coveralls will be placed in a marked container for cleaning as needed. Tyvek or poly-coated coveralls will be deposited in a container with a plastic liner that is properly marked.

Station 7 Field Wash

- Thoroughly wash hands, forearms and face with biodegradable soap and water.
- Eating, drinking or practices that increase the probability of hand to mouth transfer and/or ingestion of materials is prohibited in areas where the possibility of contamination exists and is permitted only in the designated break area. Personnel will not wear or bring dirty/contaminated clothing into the clean support area.

9.4 EQUIPMENT DECONTAMINATION

Tools, equipment, and machinery from the Exclusion Zone or CRZ are decontaminated in the CRZ before removal to the Support Zone. Equipment decontamination procedures are designed to minimize the potential for hazardous skin or inhalation exposure, cross-contamination, and chemical incompatibilities.

The following are general equipment decontamination procedures established and implemented during this project.

9.4.1 GENERAL EQUIPMENT DECONTAMINATION PROCEDURES

- Equipment in the Exclusion Zone that can be used again, that is still operable, and that will not pose an increased exposure hazard during re-use is left in Exclusion Zone until it is no longer needed. This eliminates unnecessary decontamination and reduces the potential for physical transfer of contaminants outside the Exclusion Zone.
- Decontamination is required for equipment exiting a contaminated area. Equipment may re-enter the Support Zone only after undergoing equipment decontamination procedures.
- Equipment that is transported regularly between the contaminated and clean areas of the facility (e.g., monitoring equipment) is carefully decontaminated each time it is removed from the Exclusion Zone and the effectiveness of decontamination is monitored to reduce the likelihood that contamination will be spread outside designated work zones.
- Equipment that cannot be successfully decontaminated is disposed of as hazardous waste.

9.5 DISPOSITION OF DECONTAMINATION WASTES

Equipment used for decontamination will be decontaminated or disposed of with the established waste streams. Established waste streams are those specified in the work plan. Discarded clothing (PPE) will be disposed of along with the waste streams.

9.6 EMERGENCY DECONTAMINATION

Site personnel who are contaminated and need medical treatment will be decontaminated before being transported to a medical facility if decontamination does not delay life-saving treatment or aggravate the injury.

When emergency decontamination is performed, contaminated protective clothing and equipment is washed, rinsed, and/or cut off. If an emergency victim is grossly contaminated with extremely toxic or corrosive material, the victim will be wrapped in blankets, plastic, or rubber to reduce potential exposure to other personnel.

Offsite medical treatment personnel will be alerted to the chemicals and hazards to which a victim has been potentially exposed. This will be done by sending relevant SDSs / MSDSs and other applicable hazard data with the victim or by having the victim accompanied by personnel who are familiar with the incident and the hazards.

10.0 SPILL CONTAINMENT PROGRAM

10.1 RESULTS OF EVALUATION FOR POTENTIAL SPILLS

As a tenant on the client site, an evaluation was conducted to determine there is a potential for hazardous substance spills of Trihydro hazardous materials at this site. That evaluation indicates that there is a potential for a hazardous substance spill of a sufficient quantity to require containment planning, equipment, and procedures. For that reason, a spill containment program is implemented at this site. Employee training on how to respond and take protective measures during incidental releases of hazardous substances are provided consistent with the Hazard Communication Standard, 29 CFR 1910.1200.

10.2 TRIHYDRO OWNED HAZARDOUS MATERIALS SPILL PLAN

In the event Trihydro personnel introduce hazardous materials onto the project site, or obtain responsibility of a hazardous materials inventory through the project, in accordance with OSHA 29 CFR 1910.120(j)(1)(viii), Handling Drums and Containers, a spill control kit, capable of handling the entire anticipated amount of hazardous materials, will be available on-site for use in the event of the uncontrolled release of materials considered potentially hazardous to site personnel, the community, or the environment. The spill control kit is considered a temporary provision to be used by site personnel to control the spread of contamination. The spill kit should be used by personnel only if they are properly protected from exposure to the spill constituents and trained on the use of the kit.

During project planning, the nearby populace exposure needs to be taken into consideration. Depending on the daily influences, such as wind direction and speed, community activities such as parades or school activities, the daily tasks need to be evaluated for possible community exposure in the event of a spill. These issues, with corrective actions, will be discussed in the daily safety briefing before work commencement.

TABLES

TABLE 5-1. CRITERIA FOR SELECTION OF PERSONAL PROTECTION LEVEL

Protection Level	Equipment	Protection Provided	Should Be Used When	Limiting Criteria
A*	***RECOMMENDED:*** ▪ Pressure demand, full facepiece SCBA or pressure demand supplied air respirator with escape SCBA ▪ Fully encapsulating chemical-resistant suit ▪ Inner chemical-resistant gloves ▪ Chemical resistant safety boots/shoes ▪ Two way radio communications ***OPTIONAL:*** ▪ Cooling unit ▪ Coveralls ▪ Long cotton underwear ▪ Hard hat ▪ Disposable gloves and boot covers	The highest available level of respiratory, skin, and eye protection.	The chemical substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either: 1. Measured (or potential for) high concentration of atmospheric vapors, gases, or particles Or 2. Site operations and work functions involving a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin. Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible. Operations must be conducted in confined, poorly ventilated areas until the absence of conditions requiring Level A protection is determined.	Fully encapsulating suit material must be compatible with the substances involved.

*Level A and B Protection Levels require prior approval by Trihydro's President before conducting Level A and B work activities.

TABLE 5-1. CRITERIA FOR SELECTION OF PERSONAL PROTECTION LEVEL (cont.)

Protection Level	Equipment	Protection Provided	Should Be Used When	Limiting Criteria
B*	***RECOMMENDED:*** ▪ Pressure demand, full facepiece SCBA or pressure demand supplied air respirator with escape SCBA ▪ Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical resistant one piece suit) ▪ Inner and outer chemical resistant gloves ▪ Chemical resistant safety-boots/shoes ▪ Hard hat ▪ Two way radio communication ***OPTIONAL:*** ▪ Coveralls ▪ Disposable boot covers ▪ Face shield ▪ Long cotton underwear	The same level of respiratory protection but less skin protection than Level A. It is the minimum level recommended for initial site entries until the hazards have been further identified.	The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection. This involves atmospheres: 1. With IDLH concentrations of specific substances that do not represent a severe skin hazard Or 2. Do not meet the criteria for use of air-purifying respirators ▪ Atmosphere contains less than 19.5 percent oxygen. ▪ Presence of incompletely identified vapors or gases is indicated by direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin.	Use only when the vapor or gases present are not suspected of containing high concentrations of chemicals that are harmful to skin or capable of being absorbed through the intact skin. Use only when it is highly unlikely that the work being done will generate either high concentrations of vapors, gases, or particulates, or splashes of material that will affect exposed skin.

*Level A and B Protection Levels require prior approval by Trihydro's President before conducting Level A and B work activities.

TABLE 5-1. CRITERIA FOR SELECTION OF PERSONAL PROTECTION LEVEL (cont.)

Protection Level	Equipment	Protection Provided	Should Be Used When	Limiting Criteria
C	***RECOMMENDED:*** ▪ Full facepiece, air purifying, canister-equipped respirator ▪ Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical resistant one piece suit) ▪ Inner and outer chemical resistant gloves ▪ Chemical resistant safety boots/shoes ▪ Hard hat ▪ Two way radio communication ***OPTIONAL:*** ▪ Coveralls ▪ Disposable boot covers ▪ Face shield ▪ Escape mask ▪ Long cotton underwear	The same level of skin protection as Level B, but a lower level of respiratory protection.	The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin. The types of air contaminants have been identified, concentrations measured, and a canister is available that can remove the contaminant. All criteria for the use of air-purifying respirators are met.	Atmospheric concentration of chemicals must not exceed IDLH levels The atmosphere must contain at least 19.5 percent oxygen

TABLE 5-1. CRITERIA FOR SELECTION OF PERSONAL PROTECTION LEVEL (cont.)

Protection Level	Equipment	Protection Provided	Should Be Used When	Limiting Criteria
D	***RECOMMENDED:*** ▪ Coveralls • Safety boot/shoes • Safety glasses or chemical splash goggles • Hard hat ***OPTIONAL:*** ▪ Gloves ▪ Escape mask • Face shield	No respiratory protection Minimal skin protection.	The atmosphere contains no known hazard Work functions preclude splashes, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemicals.	This level should not be used in the exclusive Zone. The atmosphere must contain at least 19.5 percent oxygen.

TABLE 5-2. PERSONAL PROTECTIVE EQUIPMENT (PPE) SELECTION

Task	Personnel	Respirator	Tyvek Coveralls[1]	Protective Gloves	Chemical-Resistant Gloves[2]	Chemical-Resistant Boots[2]	Safety Glasses	Chemical Goggles or Face Shield[3]	Ear Plugs/ Muffs	Hard Hat[4]
Excavation and Drilling Operations in Contaminated Soils	Contractor Crew	Available for use	Yes[5]	Industrial Work Gloves	Yes	Yes	Yes	Available for use	Yes	Yes
	Engineer/ Chemist	Available for use	Available for use	Industrial Work Gloves	Available for use	Yes	Yes	Available for use	Yes	Yes
	Surveyors	Available for use	Available for use	Industrial Work Gloves	Available for use	Yes	Yes	Available for use	Yes	Yes
Decontamination Operations	Sampling Team	Available for use	Available for use	Industrial Work Gloves	Yes	Yes	Yes	Available for use	Yes	Yes
Soil, Gas, and Liquid Sampling	Sampling Team	Available for use	Available for use	Industrial Work Gloves, Laceration-proof	Available for use	Available for use	Yes	Available for use	Available for use	Yes
LDAR	Sampling Team	Available for use	Available for use	Industrial Work Gloves	Available for use	No	Yes	Available for use	Yes	Yes

[1] For chemical splash hazards

[2] Not required if soil or water is not visibly contaminated, if PID measurements of the soil samples are below 1000 ppm, and if pH measurements are between 2 and 12 standard units.

[3] For chemical splash hazards or flying debris. Face shield over safety glasses may be used in lieu of chemical goggles; however, safety glasses must be worn in conjunction with the face shield for flying debris.

[4] If falling-objects or head-impact hazards exist.

[5] Coveralls are to be taped to gloves and boots to minimize exposure pathways to contaminants.

TABLE 5-3. RESPIRATOR ASSIGNED PROTECTION FACTOR (APF)

Assigned Protection Factors[5]					
Respirator Type[1,2]	**Quarter Mask**	**Half Mask**	**Full Face**	**Helmet/Hood**	**Loose-Fitting**
Air Purifying	5	10[3]	10/50[4]	----------	----------
PAPR	----------	50[4]	50[4]	25[4]	25[4]
SAR					
• Negative Pressure (Demand)	----------	10	50	----------	----------
• Continuous Flow	----------	50	50	25[4]	----------
• Pressure Demand	----------	1,000	2,000	----------	----------
• Pressure Demand with auxiliary pressure-demand SCBA (Escape Tank)	----------	----------	10,000	----------	----------
SCBA					
• Negative Pressure (Demand)	----------	----------	50	----------	----------
• Pressure Demand	----------	----------	10,000	----------	----------

[1] May use respirators assigned for higher concentrations in lower concentrations or when required use is independent of concentration.

[2] These APFs are only effective when employer has a continuing, effective respirator program per 1910.134.

[3] This APF category includes filtering face pieces and elastomeric face pieces.

[4] With appropriate gas/vapor cartridge and N-100, R-110, or P-100 filters.

[5] These APFs do not apply to escape-only respirators.

Negative Pressure Respirator: A tight-fitting respirator in which the air pressure inside the face piece is negative during inhalation with respect to the ambient air pressure outside the respirator.

Demand Respirator: A respirator in which the pressure inside the face piece in relation to the immediate environment is positive during exhalation and negative during inhalation.

Pressure Demand Respirator: A respirator in which the pressure inside the face piece in relation to the immediate environment is positive during both inhalation and exhalation.

Continuous Flow: A respirator that maintains air flow at all times, rather than only on demand. However, it may not maintain positive pressure within the mask at all times. Negative pressure conditions may occur during inhalation involving strenuous activity.

TABLE 6-1. PID ORGANIC VAPOR ACTION LEVELS AND RESPONSES

Purpose

This table lists air monitoring action levels to be used in the field during direct measurement of total organic vapors (TOV) in the breathing zone using a photo ionization detector (PID) to determine Permissible Exposure Limits (PEL), and describes the responses required when action levels are exceeded. PID action levels for Trihydro projects fall under two categories: petroleum hydrocarbon sites, or chlorinated hydrocarbon sites. Separate action level tables are available for each of these site categories. The table for petroleum hydrocarbon sites lists action levels based on benzene exposure limits, and the table for chlorinated hydrocarbon sites lists action levels based on vinyl chloride exposure limits.

For reference, the occupational exposure limits used in establishing action levels in the tables below include Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PEL), OSHA Short Term Exposure Limits (STEL) or ceiling limits, and National Institute of Occupational Safety and Health (NIOSH) Immediate Danger to Life and Health (IDLH) concentrations. In addition, OSHA's 1910.1017, vinyl chloride standard, was referenced for the chlorinated hydrocarbon graph and table. Correction factors used to calculate action levels were taken from RAE Systems Technical Note TN-106, rev 13d, wh.01-05.

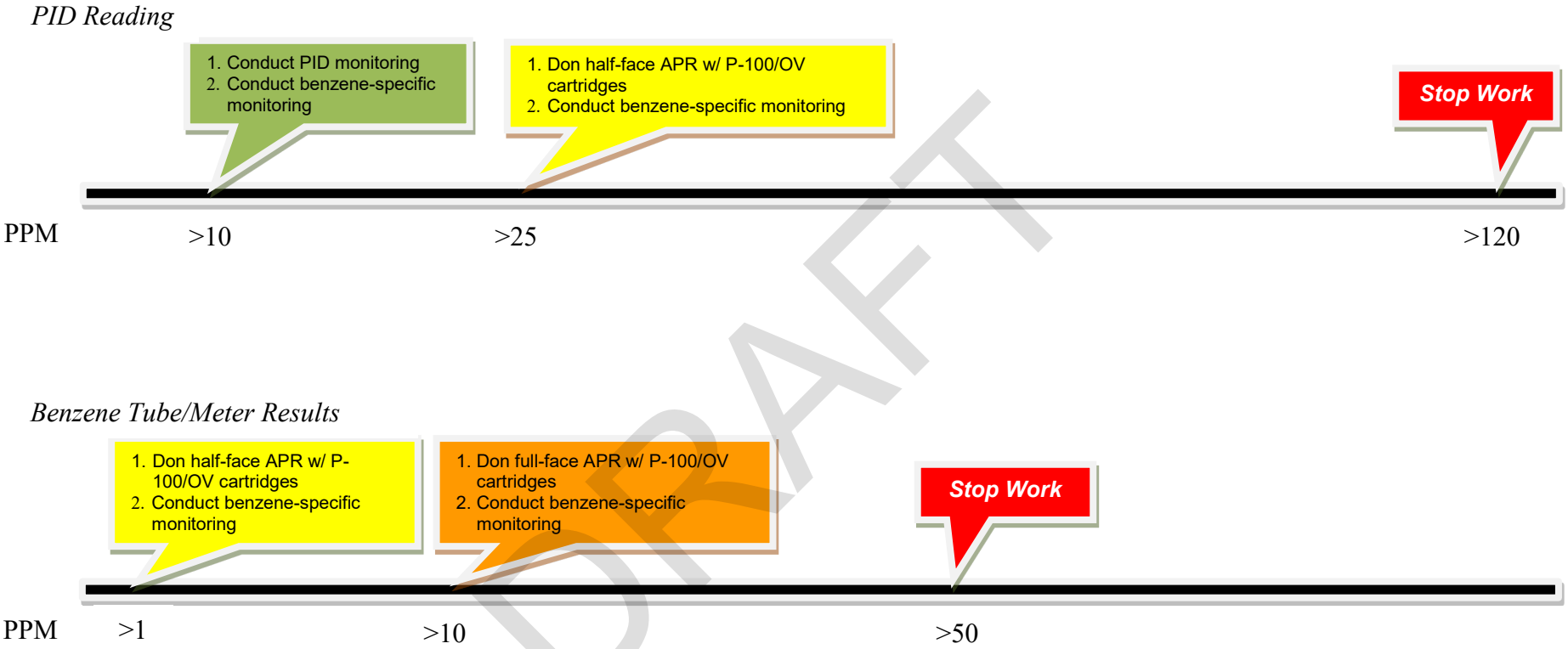
If both tables apply to a particular site, the lower of the two exposure limits will be used.

Notes for tables:

1. PID = Photo ionization detector
2. Benzene to be measured using colorimetric detector tubes or benzene-specific direct reading instrument (such as UltraRAE), vinyl chloride to be measured using colorimetric detector tubes
3. APR = Air purifying respirator
4. P-100/OV = Particulate rated filter P-100/organic vapor combination respirator cartridges

Summary Graph, PID Action Levels, Petroleum Hydrocarbon Sites (10.6 eV Lamp calibrated with 100 ppm isobutylene)

Based on benzene PEL of 1 ppm, STEL of 5 ppm, IDLH of 500 ppm, and correction factor of 0.53.



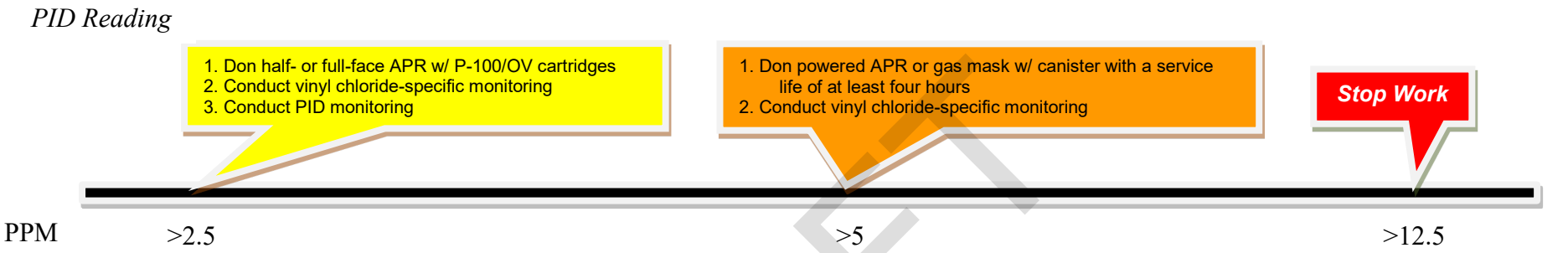
PID Action Levels, Petroleum Hydrocarbon Sites (10.6 eV Lamp calibrated with 100 ppm isobutylene)

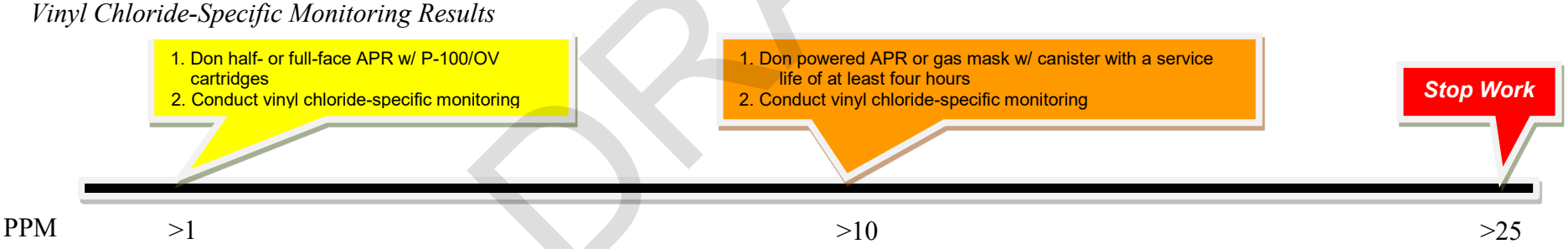
10.6 eV Lamp calibrated with 100 ppm isobutylene span gas
Reference: Benzene STEL of 5 ppm, IDLH of 500 ppm, and correction factor of 0.53

PID[1] Reading (ppm)	Duration of Reading	Action(s)
0 to 10	5 minutes sustained	Conduct PID monitoring
>10 to 25	5 minutes sustained	1. Conduct PID monitoring 2. Conduct periodic benzene-specific monitoring[2] a. Benzene >1 to 10 ppm – don ½ face APR[3] with P-100/OV cartridges[4]
>25 to 120	5 minutes sustained	1. Don ½ face APR with P-100/OV cartridges 2. Conduct PID monitoring 3. Conduct periodic benzene-specific monitoring[2] a. Benzene below 1 ppm – doff APR b. Benzene >1 to 10 ppm – maintain ½ face APR with P-100/OV cartridges c. Benzene >10 to 50 ppm – don full face APR with P-100/OV cartridges d. Benzene >50 ppm – stop work and evacuate area; notify Trihydro H&S Team to discuss engineering controls, atmosphere-supplied respirators, and/or additional monitoring
>120	1 minute sustained	1. Stop work and evacuate area 2. Notify Trihydro H&S Team to discuss engineering controls, atmosphere-supplied respirators, and/or additional monitoring

Summary Graph, PID Action Levels, Chlorinated Hydrocarbon (10.6 eV Lamp calibrated with 100 ppm isobutylene)

Based on vinyl chloride Ceiling of 5 ppm and PID correction factor of 2.0.





PID Action Levels and Responses: Chlorinated Hydrocarbon Sites

10.6 eV Lamp calibrated with 100 ppm isobutylene span gas

Reference: Vinyl chloride Ceiling of 5 ppm, and correction factor of 2.0.

PID[1] Reading (ppm)	Duration of Reading	Action(s)
0 to 0.5	5 minutes sustained	Conduct PID monitoring
>0.5 to 2.5	5 min sustained	1. Conduct PID monitoring 2. Conduct periodic vinyl chloride-specific monitoring[2] a. Vinyl chloride >1 to 10 ppm – don half- or full-face APR[3] with P-100/OV cartridges[4]
>2.5 to 5	5 min sustained	1. Don half- or full-face APR with P-100/OV cartridges 2. Conduct PID monitoring 3. Conduct periodic vinyl chloride-specific monitoring[2] a. Vinyl chloride below 1 ppm – doff APR b. Vinyl chloride >1 to 10 ppm – maintain half- or full-face APR with P-100/OV cartridges c. Vinyl chloride >10 to 25 ppm – don a powered air-purifying respirator (APAPR) having a hood, helmet, or full- or half-face piece, or a gas mask with a front-or back-mounted canister with a service life of at least four hours. d. Vinyl chloride >25 ppm – stop work and evacuate area; notify Trihydro H&S Team to discuss engineering controls, atmosphere-supplied respirators, and/or additional monitoring
>5 to 12.5	5 min sustained	1. Don a powered air-purifying respirator (PAPR) having a hood, helmet, or full- or half-face piece, or a gas mask with a front-or back-mounted canister with a service life of at least four hours. 2. Conduct PID monitoring 3. Conduct periodic vinyl chloride-specific monitoring[2] a. Vinyl chloride below 1 ppm – doff APR b. Vinyl chloride >1 to 10 ppm – maintain half- or full-face APR with P-100/OV cartridges c. Vinyl chloride >10 to 25 ppm – maintain a powered air-purifying respirator (PAPR) having a hood, helmet, or full- or half-face piece, or a gas mask with a front-or back-mounted canister with a service life of at least four hours. d. Vinyl chloride >25 ppm – stop work and evacuate area; notify Trihydro H&S Team to discuss engineering controls, atmosphere-supplied respirators, and/or additional monitoring
>12.5	1 minute sustained	1. Stop work and evacuate area 2. Notify Trihydro H&S Team to discuss engineering controls, atmosphere-supplied respirators, and/or additional monitoring

TABLE 6-2. FID ORGANIC VAPOR ACTION LEVELS AND RESPONSES

Purpose

This table lists air monitoring action levels to be used in the field during direct measurement of total organic vapors (TOV) in the breathing zone using a flame ionization detector (FID) to determine Permissible Exposure Limits (PEL), and describes the responses required when action levels are exceeded. FID action levels for Trihydro projects fall under two categories: petroleum hydrocarbon sites, or chlorinated hydrocarbon sites. Separate action level tables are available for each of these site categories. The table for petroleum hydrocarbon sites lists action levels based on benzene exposure limits, and the table for chlorinated hydrocarbon sites lists action levels based on vinyl chloride exposure limits.

For reference, the occupational exposure limits used in establishing action levels in the tables below include Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PEL), OSHA Short Term Exposure Limits (STEL) or ceiling limits, and National Institute of Occupational Safety and Health (NIOSH) Immediate Danger to Life and Health (IDLH) concentrations. In addition, OSHA's 1910.1017, vinyl chloride standard, was referenced for the chlorinated hydrocarbon graph and table. FID response factors used to calculate action levels were taken from Thermo Environmental Instruments Inc., TVA Response Factors, P/N 50039, 8-23-00.

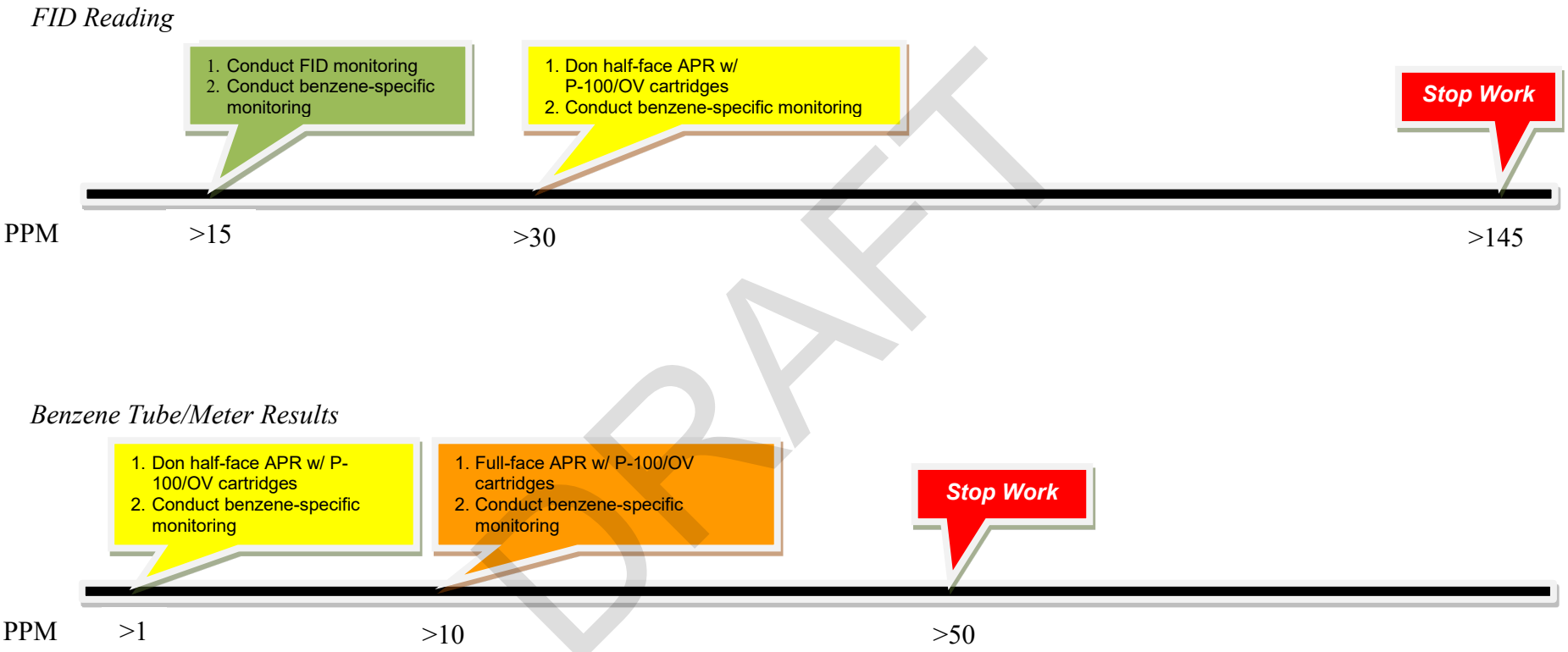
If both tables apply to a particular site, the lower of the two exposure limits will be used.

Notes for the tables:

1. FID = Flame ionization detector
2. Benzene to be measured using colorimetric detector tubes or benzene-specific direct reading instrument (such as UltraRAE), vinyl chloride to be measured using colorimetric detector tubes
3. APR = Air purifying respirator
4. P-100/OV = Particulate rated filter P-100/organic vapor combination respirator cartridges

Summary Graph, FID Action Levels, Petroleum Hydrocarbon Sites (Thermo Electron TVA-1000B FID calibrated with 100 ppm methane)

Based on benzene PEL of 1 ppm, STEL of 5 ppm, IDLH of 500 ppm, and correction factor of 0.35.



FID Action Levels and Responses: Petroleum Hydrocarbon Sites

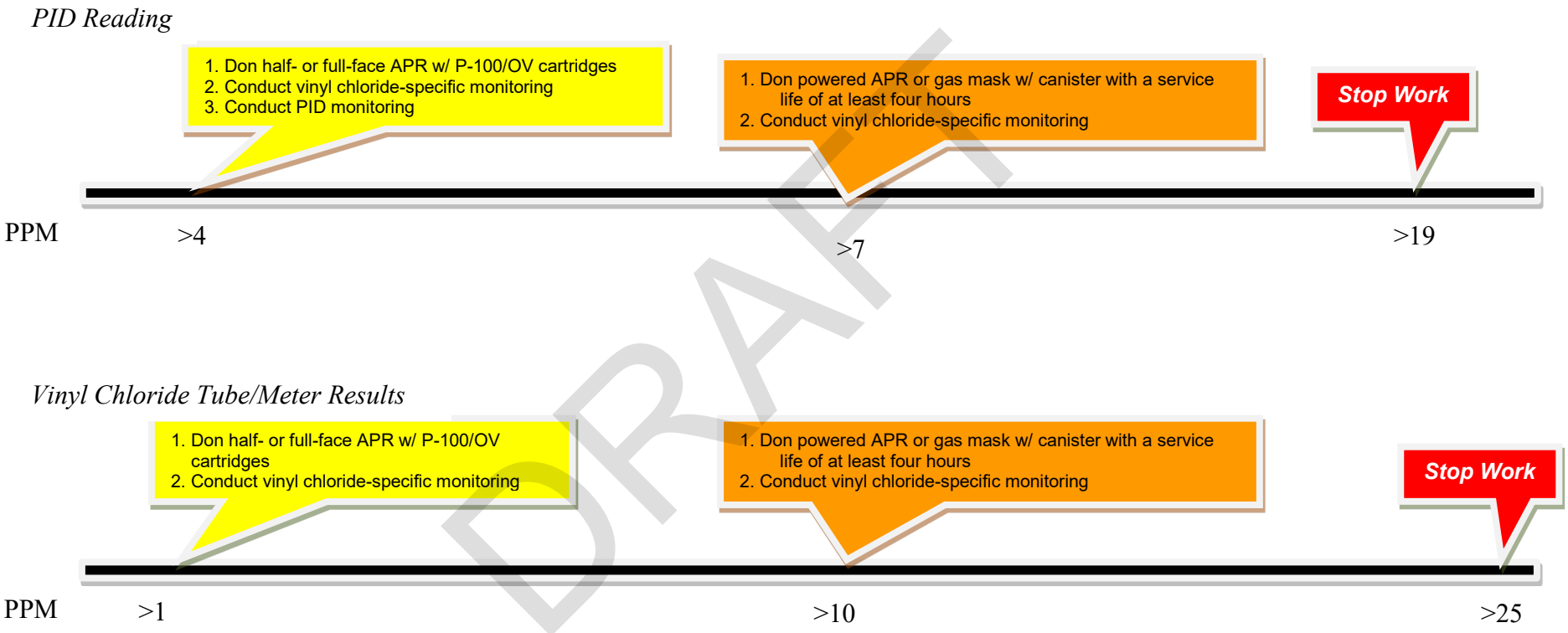
Thermo Electron TVA-1000B FID calibrated with 100 ppm methane span gas

Reference: Benzene STEL of 5 ppm, IDLH of 500 ppm, and correction factor of 0.35

FID[1] Reading (ppm)	Duration of Reading	Action(s)
0 to 15	5 minutes sustained	Conduct periodic FID monitoring
>15 to 30	5 minutes sustained	1. Conduct FID monitoring 2. Conduct periodic benzene-specific monitoring[2] a. Benzene detected >1 to 10 ppm – don ½ face APR[3] with P-100/OV cartridges[4]
>30 to 145	5 minutes sustained	1. Don ½ face APR with P-100/OV cartridges 2. Conduct FID monitoring 3. Conduct periodic benzene-specific monitoring[2] a. Benzene below 1 ppm – doff APR b. Benzene >1 to 10 ppm – maintain ½ face APR with P-100/OV cartridges c. Benzene >10 to 50 ppm – don full face APR with P-100/OV cartridges d. Benzene >50 ppm – stop work and evacuate area; notify Trihydro H&S Team to discuss engineering controls and/or additional monitoring e. Trihydro H&S Department to discuss engineering controls, atmosphere-supplied respirators, and/or additional monitoring
>145	1 minute sustained	1. Stop work and evacuate area 2. Notify Trihydro H&S Team to discuss engineering controls, atmosphere-supplied respirators, and/or additional monitoring

Summary Graph, FID Action Levels, Chlorinated Hydrocarbon (Thermo Electron TVA-1000B FID calibrated with 100 ppm methane)

Based on vinyl chloride Ceiling of 5 ppm and FID correction factor of 1.3.



FID Action Levels and Responses: Chlorinated Hydrocarbon Sites

Thermo Electron TVA-1000B FID calibrated with 100 ppm methane span gas

Reference: Vinyl chloride Ceiling of 5 ppm, and correction factor of 1.3.

PID[1] Reading (ppm)	Duration of Reading	Action(s)
1 to 2.5	5 min sustained	3. Conduct continuous PID monitoring 4. Conduct vinyl chloride-specific monitoring[2] – every 15 minutes 5. Don half- or full-face APR[3] with P-100/OV cartridges[4] if vinyl chloride detected at >1 to 10 ppm
2.6 to 5	5 min sustained	4. Don half- or full-face APR with P-100/OV cartridges 5. Conduct continuous PID monitoring 6. Conduct vinyl chloride-specific monitoring[2] – every 15 minutes a. Vinyl chloride below 1 ppm – doff APR b. Vinyl chloride >1 to 10 ppm – maintain half- or full-face APR with P-100/OV cartridges c. Vinyl chloride >10 to 25 ppm – don a powered air-purifying respirator (APAPR) having a hood, helmet, or full- or half-face piece, or a gas mask with a front-or back-mounted canister with a service life of at least four hours. d. Vinyl chloride >25 ppm – stop work and evacuate area; notify Trihydro H&S Team to discuss engineering controls, atmosphere-supplied respirators, and/or additional monitoring
6 to 12.5	5 min sustained	4. Don a powered air-purifying respirator (PAPR) having a hood, helmet, or full- or half-face piece, or a gas mask with a front-or back-mounted canister with a service life of at least four hours. 5. Conduct continuous PID monitoring 6. Conduct vinyl chloride-specific monitoring[2] – every 15 minutes a. Vinyl chloride >10 to 25 ppm – maintain a powered air-purifying respirator (PAPR) having a hood, helmet, or full- or half-face piece, or a gas mask with a front-or back-mounted canister with a service life of at least four hours. b. Vinyl chloride >25 ppm – stop work and evacuate area; notify Trihydro H&S Team to discuss engineering controls, atmosphere-supplied respirators, and/or additional monitoring
>12.5	1 minute sustained	3. Stop work and evacuate area 4. Notify Trihydro H&S Team to discuss engineering controls, atmosphere-supplied respirators, and/or additional monitoring

FID[1] Reading (ppm)	Duration of Reading	Action(s)
0 to 0.75	5 minutes sustained	Conduct FID monitoring

>0.75 to 4	5 min sustained	1. Conduct FID monitoring 2. Conduct vinyl chloride-specific monitoring(2) a. Vinyl chloride detected >1 to 10 ppm – don half- or full-face APR(3) with P-100/OV cartridges(4)
>4 to 7	5 min sustained	1. Don half- or full-face APR with P-100/OV cartridges 2. Conduct FID monitoring 3. Conduct periodic vinyl chloride-specific monitoring(2 a. Vinyl chloride below 1 ppm – doff APR b. Vinyl chloride >1 to 10 ppm – maintain half- or full-face APR with P-100/OV cartridges c. Vinyl chloride >10 to 25 ppm – don a powered air-purifying respirator (APAPR) having a hood, helmet, or full- or half-face piece, or a gas mask with a front-or back-mounted canister with a service life of at least four hours. d. Vinyl chloride >25 ppm – stop work and evacuate area; notify Trihydro H&S Team to discuss engineering controls, atmosphere-supplied respirators, and/or additional monitoring
>7 to 19	5 min sustained	1. Don a powered air-purifying respirator (PAPR) having a hood, helmet, or full- or half-face piece, or a gas mask with a front-or back-mounted canister with a service life of at least four hours. 2. Conduct FID monitoring 3. Conduct periodic vinyl chloride-specific monitoring(2) a. Vinyl chloride >10 to 25 ppm – maintain a powered air-purifying respirator (PAPR) having a hood, helmet, or full- or half-face piece, or a gas mask with a front-or back-mounted canister with a service life of at least four hours. b. Vinyl chloride >25 ppm – stop work and evacuate area; notify Trihydro H&S Team to discuss engineering controls, atmosphere-supplied respirators, and/or additional monitoring
>19	1 minute sustained	1. Stop work and evacuate area 2. Notify Trihydro H&S Team to discuss engineering controls, atmosphere-supplied respirators, and/or additional monitoring

TABLE 6-3. HYDROGEN SULFIDE ACTION LEVELS

Hydrogen Sulfide Detector Reading	Action
10 ppm	Investigate the source and attempt to eliminate
15 ppm	Evacuate the area, determine the source, attempt to eliminate
20 ppm	Do not enter

TABLE 7-1. PROTECTIVE GLOVE GUIDE

Protection	Glove Material	Applications
Lacerations	Dyneema®, Kevlar®, fiber-metal blends, metal mesh, SuperFabric®, steel core, and Vectran	Cut-resistance: designed to protect hands from direct or indirect contact with sharp edges such as glass, metal, ceramics, and other materials. Many cut resistant gloves are manufactured to provide protection from a *SLASH* from sharp items like knives/blades. However, they may provide very little, if any, puncture-resistance from a pointed item like a needle, unless specifically designed for puncture resistance.
Needle Stick	HEX ARMOR®, DAMASCUS V-Force™ X4	Puncture protection. Ideal for correctional facility pat-downs/searches, customs officers, federal/state/city/municipal/university employees, luggage searches, hospital laundry and sharps handling.
Vibrations	DECADE® Gelfom™, AirGlove™	Provides padding at the palm, fingers and thumb to help neutralize the force of heavy impacts, reducing the chance of injury.
Extreme high temperatures	Best® CharGuard™, ZETEX®, Kevlar®, Nomex®, Crusader Flex®, thermal knit, Terry Cloth, heavy weight cotton	For intermittent handling of hot objects. Ideal for hot castings for intermittent heat, lab sampling with hot glassware or moldings, plastic molding manufacturing, plant maintenance controls. Temperature protection ranges vary.
Extreme low temperatures	Best® Snow Man™, thermal knit, Terry Cloth, heavy weight cotton	For intermittent handling of hot objects.
Awareness	High visibility	Protective gloves made of a high visibility color help enhance hand position awareness; the color of the gloves is rotated on a quarterly basis. This prevents complacency for a particular color and can improve attentiveness.
Chemical	Butyl	A synthetic rubber material that offers the highest permeation resistance to gas and water vapors. Especially suited for use with esters and ketones.
	Neoprene	A synthetic rubber material that provides excellent tensile strength and heat resistance. Neoprene is compatible with some acids and caustics. It has moderate abrasion resistance.
	Nitrile	A synthetic rubber material that offers chemical and abrasion resistance—a very good general-duty glove. Nitrile also provides protection from oils, greases, petroleum products and some acids and caustics.
	PVC (Polyvinyl chloride)	A synthetic thermoplastic polymer that provides excellent resistance to most acids, fats, and petroleum hydrocarbons. Good abrasion resistance.
	PVA (Polyvinyl alcohol)	A water-soluble synthetic material that is highly impermeable to gases. Excellent chemical resistance to aromatic and chlorinated solvents. This glove cannot be used in water or water-based solutions.

TABLE 7-1. PROTECTIVE GLOVE GUIDE (cont.)

Protection	Glove Material	Applications
	Viton®	A fluoroelastomer material that provides exceptional chemical resistance to chlorinated and aromatic solvents. Viton is very flexible, but has minimal resistance to cuts and abrasions.
	SilverShield®/4H	A lightweight, flexible laminated material that resists permeation from a wide range of toxic and hazardous chemicals. It offers the highest level of overall chemical resistance, but has virtually no cut resistance.

TABLE 7-2. EXTENSION CORD RATINGS

Cord Length (ft.)	Gauge	Max Amps
25	18	10
25	16	13
25	14	15
50	18	5
50	16	10
50	14	15
75	18	5
75	16	10
75	14	15
100	16	5
100	12	15
125	16	5
125	12	15
150	16	5
150	12	13

TABLE 7-3. ENERGIZED POWER LINE CLEARANCE

Task	Minimum Clearance Between Equipment and Energized Lines
Heavy equipment in transit with no load and boom lowered for overhead power lines with voltages less than 50, 000 volts	4’
Heavy equipment in transit with no load and boom lowered for overhead power lines with voltages over 50, 000 volts	10’
Heavy equipment in transit with no load and boom lowered for overhead power lines with for voltages up to and including 750,000 volts	16’
Setup/operations near overhead power lines up to 50,000 volts	10’
Setup/operations near overhead power lines over 50,000 volts	10’ plus 0.4 inches for each additional 1,000 volts over 50,000 volts
Drilling operations	20’

TABLE 7-4. EXPOSURE LIMITS FOR SITE CHEMICALS OF CONCERN

	OSHA Permissible Exposure Levels (PEL)			
Chemical	**TWA[1]**	**STEL[2]**	**Ceiling[3]**	**IDLH[4]**
Benzene (vapor)	1 ppm	5 ppm		500 ppm
Toluene (vapor)	200 ppm	300 ppm		500 ppm
Ethyl benzene (vapor)	100 ppm			800 ppm
Xylene (vapor)	100 ppm			900 ppm
Diesel (vapor)	None			
Gasoline (vapor)	None			

† Considered to be a potential occupational carcinogen.
[1]Time Weighted Average (TWA) concentrations for OSHA PELs must not be exceeded during any 8-hour work shift of a 40-hour workweek.
[2]A Short Term Exposure Limit (STEL) is measured over a 15-minute period unless noted otherwise.
[3]OSHA ceiling concentrations must not be exceeded during any part of the workday.
[4]Immediately Dangerous to Life and Health (IDLH) conditions are those that pose an immediate threat to life or health, or conditions that pose an immediate threat of severe exposure to contaminants, such as radioactive materials, which are likely to have adverse cumulative or delayed effects on health.

TABLE 7-5. CHEMICAL CONTAMINANTS IN REFINERY WASTES AND WASTEWATER

Metals
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Lead
Mercury
Nickel
Selenium
Vanadium

Volatiles
Benzene
Carbon disulfide
Chlorobenzene
Chloroform
1,2-Dichloroethane
1,4-Dioxane
Ethylbenzene
Ethylene dibromide (1,2-Dibromoethane)
methyl ethyl ketone
Styrene
Toluene
Xylene (m, o, and p)

Semi-Volatile Base/Neutral Extractable Compounds
Anthracene
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(a)pyrene
Bis(2-ethylhexyl)phthalate
Butyl benzyl phthalate
Chrysene
Cyclohexane
Dibenz(a,h)acridine
Dibenz(a,h)anthracene
Di(n)butyl phthalate
Dichlorobenzenes
Diethyl phthalate
7,12-Dimethylbenz(a)-anthracene
Dimethyl phthalate
Di(n)octyl phthalate
Fluoranthene
Indene
Methyl chrysene
2-Methylnaphthalene
Naphthalene
Phenanthrene
Pyrene
Pyridine
Quinoline

Semi-Volatile Acid-Extractable Compounds
Benzenethiol
Cresols
2,4-Dimethylphenol
2,4-Dinitrophenol
4-Nitrophenol
Phenol

Acidic/Caustic Compounds
Hydrofluoric acid
Sodium hydroxide
Sulfuric acid

* This list (with the exception of the acidic/alkaline compounds) is commonly referred to as the "Modified Skinner List," and was developed by the U.S. Environmental Protection Agency and American Petroleum Institute

TABLE 7-6. HEAT INDEX CHART

Heat index (HI) is sometimes referred to as the "apparent temperature." The HI, given in degrees F, is a measure of how hot it feels when relative humidity (RH) is added to the actual air temperature.

HEAT INDEX °F													
	RELATIVE HUMIDITY (%)												
Temp.	40	45	50	55	60	65	70	75	80	85	90	95	100
110	136												
108	130	137											
106	124	130	137										
104	119	124	131	137									
102	114	119	124	130	137								
100	109	114	118	124	129	136							
98	105	109	113	117	123	128	134						
96	101	104	108	112	116	121	126	132					
94	97	100	103	106	110	114	119	124	129	135			
92	94	96	99	101	105	108	112	116	121	126	131		
90	91	93	95	97	100	103	106	109	113	117	122	127	132
88	88	89	91	93	95	98	100	103	106	110	113	117	121
86	85	87	88	89	91	93	95	97	100	102	105	108	112
84	83	84	85	86	88	89	90	92	94	96	98	100	103
82	81	82	83	84	84	85	86	88	89	90	91	93	95
80	80	80	81	81	82	82	83	84	84	85	86	86	87

Category	Heat Index	Possible heat disorders for people in high risk groups
Extreme Danger	**130°F or higher**	**Heat stroke or sunstroke likely.**
Danger	105 - 129°F	Sunstroke, muscle cramps, and/or heat exhaustion likely. Heatstroke possible with prolonged exposure and/or physical activity.
Extreme Caution	90 - 105°F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.
Caution	80 - 90°F	Fatigue possible with prolonged exposure and/or physical activity.

Reference: NOAA's National Weather Service, 06/15/2006, http://www.crh.noaa.gov/jkl/?n=heat_index_calculator

TABLE 7-7. WIND CHILL CHART

LOW TEMPERATURE + WIND SPEED + WETNESS = INJURIES AND ILLNESS

Wind Speed	Ambient Temperature (F°)																	
Calm	**40**	**35**	**30**	**25**	**20**	**15**	**10**	**5**	**0**	**-5**	**-10**	**-15**	**-20**	**-25**	**-30**	**-35**	**-40**	**-45**
5	36	31	25	19	13	7	1	-5	-11	-16	**-22**	**-28**	**-34**	**-40**	**-46**	**-52**	**-57**	**-63**
10	34	27	21	15	9	3	-4	-10	-16	**-22**	**-28**	**-35**	**-41**	**-47**	**-53**	**-59**	**-66**	**-72**
15	32	25	19	13	6	0	-7	-13	**-19**	**-26**	**-32**	**-39**	**-45**	**-51**	**-58**	**-64**	**-71**	**-77**
20	30	24	17	11	4	-2	-9	-15	**-22**	**-29**	**-35**	**-42**	**-48**	**-55**	**-61**	**-68**	**-74**	**-81**
25	29	23	16	9	3	-4	-11	-17	**-24**	**-31**	**-37**	**-44**	**-51**	**-58**	**-64**	**-71**	**-78**	**-84**
30	28	22	15	8	1	-5	-12	**-19**	**-26**	**-33**	**-39**	**-46**	**-53**	**-60**	**-67**	**-73**	**-80**	**-87**
35	28	21	14	7	0	-7	-14	**-21**	**-27**	**-34**	**-41**	**-48**	**-55**	**-62**	**-69**	**-76**	**-82**	**-89**
40	27	20	13	6	-1	-8	-15	**-22**	**-29**	**-36**	**-43**	**-50**	**-57**	**-64**	**-71**	**-78**	**-84**	**-91**
45	26	19	12	5	-2	-9	-16	**-23**	**-30**	**-37**	**-44**	**-51**	**-58**	**-65**	**-72**	**-79**	**-86**	**-93**
50	26	19	12	4	-3	-10	-17	**-24**	**-31**	**-38**	**-45**	**-52**	**-60**	**-67**	**-74**	**-81**	**-88**	**-95**
55	25	18	11	4	-3	-11	**-18**	**-25**	**-32**	**-39**	**-46**	**-54**	**-61**	**-68**	**-75**	**-82**	**-89**	**-97**
60	25	17	10	3	-4	-11	**-19**	**-26**	**-33**	**-40**	**-48**	**-55**	**-62**	**-69**	**-76**	**-84**	**-91**	**-98**
							Frostbite occurs in 15 minutes or less											

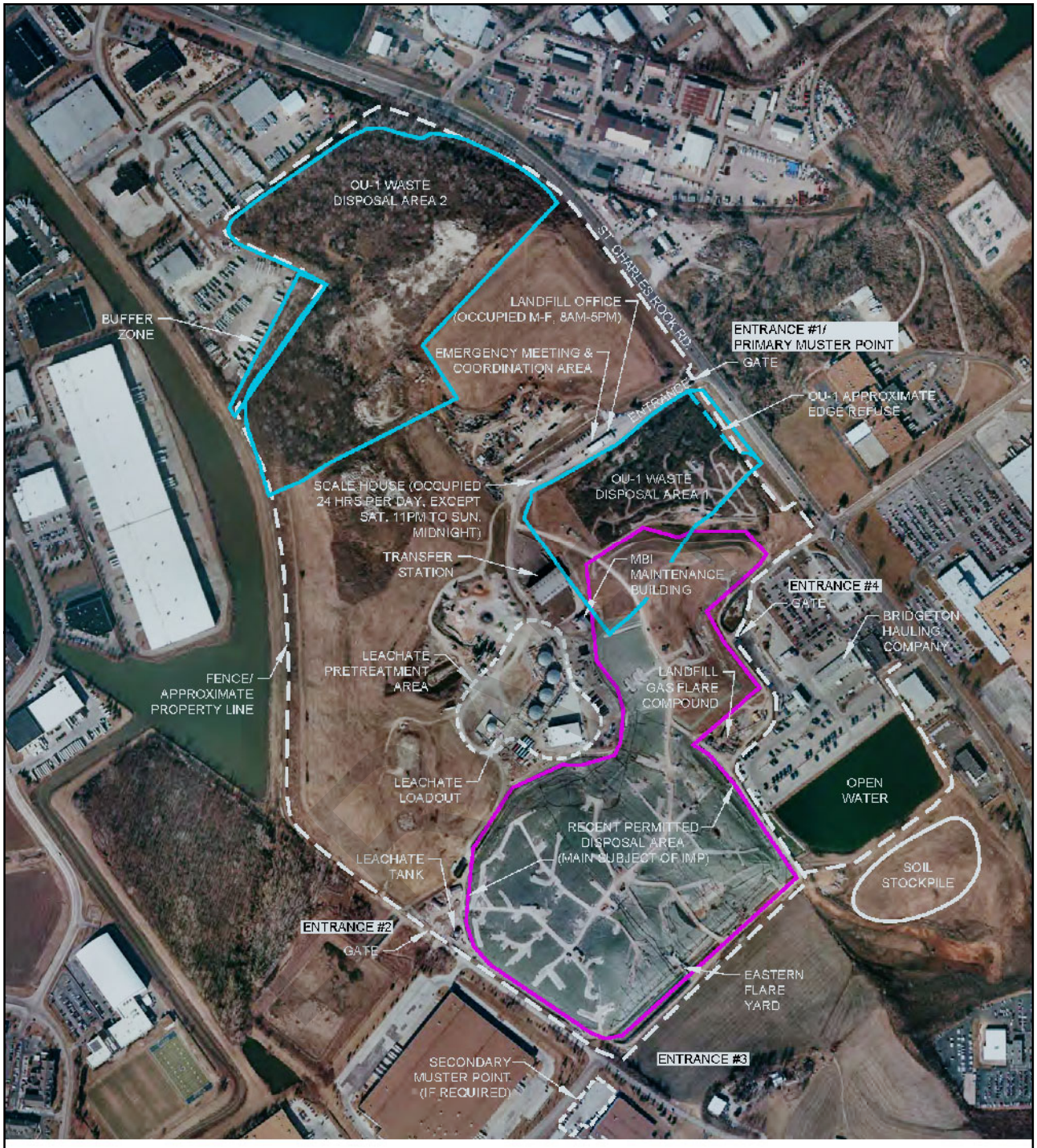
Reference: NOAA's National Weather Service, 01/07/2009, http://www.crh.noaa.gov/ddc/?n=windchill

TABLE 7-8. TRAFFIC-CONTROL SIGN PLACEMENT

Road Type	Distance Between Signs (Feet)		
	A	B	C
Urban (low speed)*	100	100	100
Urban (high speed)*	350	350	350
Rural	500	500	500
Expressway/Freeway	1,000	1,500	2,640

* Speed category to be determined by highway agency

FIGURE



NOTE:

FIGURE SUPPLIED BY ENGINEERING MANAGEMENT SUPPORT, INC. FROM FIGURE 2 FACILITY MAP, BRIDGETON LANDFILL/WEST LAKE LANDFILL INCIDENT MANAGEMENT PLAN (IMP)

N

0 800'

Trihydro CORPORATION

1252 Commerce Drive
Laramie, WY 82070
www.trihydro.com
(P) 307/745.7474 (F) 307/745.7729

FIGURE 3-1

WEST LAKE LANDFILL
HEATH AND SAFETY PLAN

WEST LAKE LANDFILL
BRIDGETON, MO

Drawn By: TE	Checked By: SLL	Scale: 1 " = 800 '	Date: 5/14/19	File: 3-1_WestLakeLF_HASP_Fig3-1.mxd

M:\WTOZ\WESTLAKELANDFILL\GIS\MAPPING\HASP\3-1 WESTLAKELF HASP FIG3-1.MXD

APPENDIX A

NEAR MISS REPORT

NEAR MISS REPORT

Please fill in ***all*** blanks with as much detail as possible. If you have any questions or need assistance, contact Trihydro Corporate Health and Safety at (307) 745-7474. Send completed form via email or FAX to (307) 755-4956.

General Information

Near Miss Date: _____ Time: _____ ☐ AM ☐ PM

Reported Date: _____ Time: _____ ☐ AM ☐ PM

Work Type: _____

Project Client: _____ Project Manager: _____

Project Site: _____ Project Number: _____

Investigation Date: _____ Time: _____ ☐ AM ☐ PM

Supervisor: _____

Supervisor's employer and email if not employed by Trihydro Corporation: _____

Worker: _____ Time at Present Job: _____

Worker's employer and email if not employed by Trihydro Corporation: _____

Employee Status: ☐ Full Time ☐ Part Time

Near Miss Location: _____ _____ _____

Street *City* *State/Zip*

Near Miss Information

Employee's Specific Activities: _____

Equipment, Materials, or Chemicals Used: _____

Near Miss Description: _____

Near Miss Reported to: _____

Weather: ☐ Clear ☐ Cloudy ☐ Cyclonic ☐ Dusty ☐ Partly Cloudy ☐ Ice ☐ Hail ☐ Indoor ☐ Windy
☐ Mist ☐ Lightning ☐ Overcast ☐ Fog ☐ Hazy ☐ Rain ☐ Sleet ☐ Snow ☐ Thunderstorm

Lighting: ☐ Dawn ☐ Day ☐ Dusk ☐ Indoor ☐ Night

Witness #1 ☐ Client Employee ☐ Trihydro Employee ☐ Contractor: *(Company)* _____

Name: _____ Telephone No: _____

Witness #2 ☐ Client Employee ☐ Trihydro Employee ☐ Contractor: *(Company)* _____

Name: _____ Telephone No: _____

Witness #3 ☐ Client Employee ☐ Trihydro Employee ☐ Contractor: *(Company)* _____

Name: _____ Telephone No: _____

Witness #4 ☐ Client Employee ☐ Trihydro Employee ☐ Contractor: *(Company)* _____

Name: _____ Telephone No: _____

Cause Analysis

Root Cause Analysis (RCA) Table			
1	Lack of skill or knowledge	5	Doing the job according to procedures or acceptable practices take more time/effort
2	Lack of or inadequate operational procedures	6	Short-cutting procedures or acceptable practices is 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	8	External factors

CF No.	RCA No.	Contributing Factors (CF) (Any factors that contributed to the near miss, but not the root cause):
1		
2		
3		
4		
5		
6		
7		
8		

**(Refer to RCA table)*

Corrective Actions

Immediate Actions Taken:

CF No.	Solution(s)	Responsible Person	Due Date	Completed
1				☐
2				☐
3				☐
4				☐
5				☐
6				☐
7				☐
8				☐

Validation

Results of Solution, Verification, and Validation:

Investigation Team: _____

Primary Contact: _____ Telephone: _____

Reviewed By: _____ _____ _____

Name *Position/Title* *Date*

APPENDIX B

ACCIDENT/INCIDENT INVESTIGATION REPORT

ACCIDENT/INCIDENT INVESTIGATION REPORT

Trihydro

General Information

Incident Type: ***Incident*** ☐ ***Near Miss*** ☐

Primary Incident Type: ***Injury/Illness*** ☐ ***Motor Vehicle Accident*** ☐ ***Property / Equipment Damage*** ☐

Environmental ☐ ***Exposure*** ☐ ***Other*** ☐

Occurrence Date: _____ Occurrence Time: _____ ☐ AM ☐ PM

Date Reported: _____ Time Reported _____ ☐ AM ☐ PM

Reported By: _____ Telephone: _____

Occurrence Location: _____ On Site: ☐ Off Site: ☐

Stop Work Involved: ***Yes*** ☐ ***No*** ☐ SSE Involved: ***Yes*** ☐ ***No*** ☐

Police Notified: ***N/A*** ☐ ***Yes*** ☐ ***No*** ☐

Transportation to medical facility: ***N/A*** ☐ ***Yes*** ☐ ***No*** ☐

If yes, provide the following Facility Name: _____

Medical treatment received: ***N/A*** ☐ ***Yes*** ☐ ***No*** ☐

Description of Incident: _____

Individuals involved (Company Employee, Subcontractor Employee, Client Employee, Member of the Public, Witnesses)

Name	*Organization*	*Title*	*Telephone*

Vehicle Incident Details:

Check any that apply: ***Company Vehicle Involved*** ☐ ***Non-Company Vehicle Involved*** ☐

Vehicle Information:
Vehicle #: _____ Vehicle VIN: _____
License Plate #: _____ Vehicle Make/Model: _____
Vehicle Year _____ Vehicle Color:
If Rental Vehicle, Rental Company: _____
# of Passengers: _____ Names: _____

Driver Information
First Name: _____ Last Name: _____
Address: _____
City _____ State: _____ Zip Code: _____
Phone # 1: _____ Phone # 2: _____
License Plate #: _____ Vehicle VIN: _____
Vehicle Year _____ Vehicle Make/Model: _____
Vehicle Color: _____ Driver License #: _____
# of Passengers: _____ Names: _____
Insurance Company: _____ Phone: _____
Insurance Agent: _____ Phone: _____
Policy # _____ Exp. Date: _____

Details:
Weather: Clear ☐ Rain ☐ Fog ☐ Wind ☐ Other ☐
Road Condition: Clear ☐ Wet ☐ Icy ☐ Debris ☐ Other ☐
Light Condition: Dawn ☐ Day: ☐ Dusk ☐ Dark ☐
Estimated Speeds _____ _____

Attending Police:
Office Name: _____ Badge #: _____
Division: _____ Phone # _____

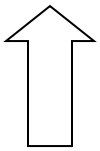
Tow Truck Operator:
Company: _____ Phone #: _____
Drivers Name: _____
Address Towed To: _____

Citation Issued: ***Yes*** ☐ ***No*** ☐

Diagram: include streets, traffic controls, visual obstacles, etc.

1 Vehicle 1

2 Vehicle 2



N

Environmental/Exposure Incident Details:

Agent: Chemical/Substance ☐ Explosion ☐ Noise ☐ Radiation ☐ Vibration ☐

Medium: Air ☐ Soil ☐ Ground Water ☐ Surface Water ☐

Effect On: People ☐ Vegetation ☐ Animals ☐ Structures ☐ Equipment ☐ Materials ☐

Substance Information:

Name of Substance	Amount	Unit of Measure

PPE Worn: ***Yes*** ☐ ***No*** ☐

List PPE: _____

Response Details:

_____

_____

_____

_____

With any incident/accident:

Initial Notifications must be made to:

- Police, Ambulance, 911 (if applicable)
- H&S Team
- Risk Management
- Project Manager (PM)
- Supervisor
- Client (as directed by the PM)
- Site Managers (as directed by the PM)

If medical treatment is needed:

- Contact WorkCare™ at (888) 449-7787

Coordinate drug/alcohol testing within 3 hours

Complete the Accident/Incident Reporting Form and a SPOT report for submittal to the H&S Team.

If after hours, contact the Safety Response number at (307) 755-4888.

APPENDIX C

JOB SAFETY ANALYSIS (JSA) FORMS

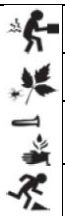
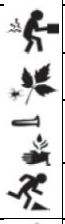
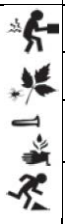
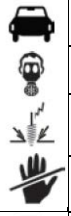
JOB SAFETY ANALYSIS

JSA Version Date: October 2, 2017		
Job Description: AirKnife/HydroVac Borehole Clearance		
Project: Sheridan Production Co.	Site Location: Campbell County, Wyoming	

Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Michelle Harper	Geologist	307-745-7474
2.		
3.		
Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1. Kathy Brown	Project Manager	
2.		/ /
3.		/ /

Personal Protective Equipment (PPE) Needed:

Eye and Face Protection	***Body Protection***	***Fall Protection***
☒ Safety Glasses	☒ Fire Retardant Coveralls	☐ Barriers/Guard Rails
☒ Face Shield	☐ Poly-coated Tyvek Coveralls	☐ Safety Net
☐ Chemical Goggles	☐ Chemical Resistant Coveralls	☐ Personal Fall Arrest System
Head Protection	☐ Chemical Resistant Apron	***Respiratory Protection***
☒ Hard Hat	☒ Reflective Safety Vest	☐ Half-Face Air Purifying Respirator
Hearing Protection	☐ Cooling Vest	☐ Full-Face Air Purifying Respirator
☒ Ear Plugs	☐ Long sleeved shirt	☐ Chemical Cartridge
☐ Ear Muffs	***Biological Protection***	☐ Particulate Filter
Hand Protection	☐ Snake Gaiters	☐ Cartridge/Filter Combo
☒ Industrial Work Gloves	☒ Sunscreen	☐ Ammonia Cartridge
☐ Chemical Resistant Gloves	☒ Insect Repellant	☐ H2S Escape Cartridge
☐ Laceration Resistant Gloves	***Hazardous Atmosphere Protection***	☐ Asbestos Filter (P-100)
Foot Protection	☒ Air Monitoring Equipment (4-gas and H_2S monitors)	☐ Powered Air Purifying Respirator (PAPR) **(contact H&S dept.)**
☐ Leather Boots	☐ Ventilation Fan	
☒ Steel-Toed Boots	☐ Level C	☐ Supplied Air Respirator (SAR) **(contact H&S dept.)**
☐ Chemical Resistant Boots	☐ Level B **(contact H&S dept.)**	
Water Safety	☐ Level A **(contact H&S dept.)**	☐ Self-Contained Breathing Apparatus (SCBA) **(contact H&S dept.)**
☐ Personal Flotation Device	***Decontamination Materials***	
☐ Waders	☐ Equipment Decontamination	
☐ ***Other:***	☐ Personnel Decontamination	☐ ***Other:***
☐ ***Other:***	☐ ***Other:***	☐ ***Other:***

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
Utility Locate					Damage to utilities	Contact One Call (811) at least 48 hours prior to work commencement, notify the site manager or site owner to locate private utilities (One Call does locate private lines)	
Mob to work location		X			Vehicle damage or collisions	Complete site orientation, use spotter if backing, review guidelines for clearance.	
Tailgate Safety Meeting and Equipment Inspection				X	Poor communications, lacerations, pinch points, contact with equipment	Review JSA with project team, wear appropriate gloves, avoid placing body parts in pinch point areas, verify pinch point hazards are labeled, wear hard hat and clothing that covers the body to provide protection, inspect equipment daily.	
Vacuum/compressed air/water operation		X		X	Leakage from hoses, flailing hoses, flying debris, high noise, pinch points, exposure to contaminants, damage to utilities.	Watch for leaks, wear proper face and hearing PPE, inspect for hose damage, verify whip checks are installed, wear appropriate gloves, wear chemical protective PPE if needed, utilities must be located by One Call prior to excavating activities.	
Unload soil from vacuum chamber		X		X	Pinch points from dumping mechanism, dumping soil/rocks on feet	Wear gloves, watch body position, alert others on team that you are dumping, wear proper PPE, keep body clear of falling debris.	
Demob		X		X	Vehicle/property damage	Inspect area for obstacles, notify co-workers of intentions/maneuvers.	

Prior to work, I have read and understand the PPE, safety tools/equipment/instruments, and associated permits needed for this task. I also understand the job steps, potential hazards, and critical actions identified for employee task and hazard awareness. I agree to have this JSA on site and identify daily variances and understand I can make pen and ink changes to meet those variances. JSAs used at the task site that contain pen-and-ink changes ("dirtying up") are to be kept in the project folder for record.

Name (print):	**Signature**	**Date**

END OF DAY

REVISIONS TO JSA
(Any tasks that were "dirtied up")

Date	Job Step #	REVISION	Does JSA need to be updated permanently?		Responsible Person
			Yes	No	

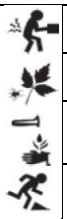
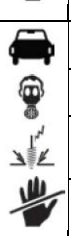
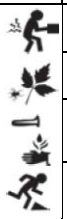
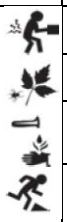
JOB SAFETY ANALYSIS

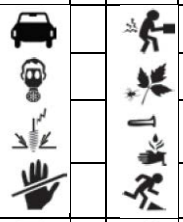
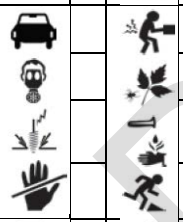
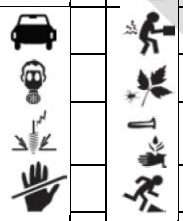
JSA Version Date: October 2, 2017		
Job Description: Contractor Oversight		
Project: Sheridan Production Co.	Site Location: Campbell County, WY	

Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Michelle Harper	Geologist	307/745-7474
2.		
3.		
Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1. Kathy Brown	Project Manager	
2.		/ /
3.		/ /

Personal Protective Equipment (PPE) Needed:

Eye and Face Protection	***Body Protection***	***Fall Protection***
☒ Safety Glasses	☒ Fire Retardant Coveralls	☐ Barriers/Guard Rails
☐ Face Shield	☐ Poly-coated Tyvek Coveralls	☐ Safety Net
☐ Chemical Goggles	☐ Chemical Resistant Coveralls	☐ Personal Fall Arrest System
Head Protection	☐ Chemical Resistant Apron	***Respiratory Protection***
☒ Hard Hat	☒ Reflective Safety Vest	☐ Half-Face Air Purifying Respirator
Hearing Protection	☐ Cooling Vest	☐ Full-Face Air Purifying Respirator
☐ Ear Plugs	☐ Long sleeved shirt	☐ Chemical Cartridge
☐ Ear Muffs	***Biological Protection***	☐ Particulate Filter
Hand Protection	☐ Snake Gaiters	☐ Cartridge/Filter Combo
☐ Industrial Work Gloves	☐ Sunscreen	☐ Ammonia Cartridge
☐ Chemical Resistant Gloves	☐ Insect Repellant	☐ H2S Escape Cartridge
☐ Laceration Resistant Gloves	***Hazardous Atmosphere Protection***	☐ Asbestos Filter (P-100)
Foot Protection	☒ Air Monitoring Equipment	☐ Powered Air Purifying Respirator (PAPR) **(contact H&S dept.)**
☐ Leather Boots	☐ Ventilation Fan	
☒ Steel-Toed Boots	☐ Level C	☐ Supplied Air Respirator (SAR) **(contact H&S dept.)**
☐ Chemical Resistant Boots	☐ Level B **(contact H&S dept.)**	
Water Safety	☐ Level A **(contact H&S dept.)**	☐ Self-Contained Breathing Apparatus (SCBA) **(contact H&S dept.)**
☐ Personal Flotation Device	***Decontamination Materials***	
☐ Waders	☐ Equipment Decontamination	
☐ ***Other:***	☐ Personnel Decontamination	☐ ***Other:***
☐ ***Other:***	☐ ***Other:***	☐ ***Other:***

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
Prior to arriving at Site, Project team will Review HASP. Subcontractor will review and sign the Site Safety (Tailgate Safety Meeting)					Administrative function - no hazards anticipated. Action is to ensure health and safety compliance	Preventative Measures: Employees must have required training: Supervisor Training (Supervisors) OSHA 40-Hour HAZWOPER, Drug screening (as required), and H2S Awareness training.	
Walking around the site		X		X X	1) Slips, Trips, and Falls 2) Temperature stress 3) Biological hazards 4) Vehicle Traffic 5) Heavy / Equipment Hazards 6) Flying Debris/Objects	1A) Watch footing and where you are walking. 1B) Stay alert to holes, debris, and tools. 1C) Be alert. Be aware of location of structures, and operating equipment. 1D) Take extra caution in rainy or muddy conditions; keep boots dry or use rubber boots. 2A) Dress appropriately, but within constraints of HASP. 2B) Drink plenty of water or other hydrating liquids (i.e. not sodas). 3A) Look before you reach or step - watch for small animals, rodents, snakes, insects and spiders. 3B) Try to avoid and do not antagonize. 3C) Use insect repellant and mosquito nets as appropriate. 4A) Watch for and be aware of vehicular traffic related to contractors. 5A) Do not drive in the path of operating equipment. 5B) Make yourself visible. 5C) Yield to heavy/construction equipment until eye contact is made with operator and you are given the signal to proceed. 5D) Stay out of immediate area near heavy equipment. If you need to approach a piece of equipment, do not enter from the blind spots; stay a safe distance away until eye contact is made with the operator. 6A) Be aware of potential falling/flying objects. 6B) Use hard-hat and safety glasses with side shields to keep airborne dust particles and flying debris out of eyes. 6C) Take caution when removing glasses so particles don't fall from glasses into eyes.	
Observe and document activity.		X		X X	1) Noise 2) Heat stress 3) Severe weather 4) Chemical exposure 5) Biological hazards 6) Slips, trips, and falls 7) Struck by equipment	1) Hearing protection required within 25 feet of operating heavy construction equipment. Wear ear-plugs or -muffs if noise is >85-dB. If you have to raise your voice to speak to a person that is at arm's length, noise is probably >85-dB. 2) Take breaks. Drink fluids. Know personnel limits (use buddy system). Know signs and symptoms of heat stress. Wear correct PPE identified in morning meeting. 3) Locate nearest severe weather shelter/strong structure before beginning field work. Suspend fieldwork if lightning within 10 miles	

Job Steps	Hazard(s)	Potential Hazard(s)	Critical Action(s)	Responsible Person
			of site or tornado warning issued. 4) If contaminants are present at the surface -40 hr HAZWOPER and current refresher for workers. 8hr additional supervisor for project engineer, SSHO, and all other on-site supervisors. 5) Inspect area for hazardous plants and organism conditions. Avoid such areas if possible. Wear clothing that covers potentially affected body parts. Seal pant legs against contact with plants and to prevent access by organisms. Use insect/tick repellant whenever possible. 6) Keep path clear. Survey walking path before entering into area. Be aware of ground tripping hazards. Be aware of slick, wet ground surfaces. Utilize caution when walking down slopes. 7) Remain a safe distance away from heavy equipment. Communicate with operator before entering equipment work area and obtain permission.	
				
				
				

Prior to work, I have read and understand the PPE, safety tools/equipment/instruments, and associated permits needed for this task. I also understand the job steps, potential hazards, and critical actions identified for employee task and hazard awareness. I agree to have this JSA on site and identify daily variances and understand I can make pen and ink changes to meet those variances. JSAs used at the task site that contain pen-and-ink changes ("dirtying up") are to be kept in the project folder for record.

Name (print):	**Signature**	**Date**

END OF DAY

REVISIONS TO JSA
(Any tasks that were "dirtied up")

Date	Job Step #	REVISION	Does JSA need to be updated permanently?		Responsible Person
			Yes	No	

JOB SAFETY ANALYSIS

For JSA development procedures, visit the Health &Safety Website at
http://intranet.trihydro.com/HS/default.aspx?Content=JSA&Section=SafetyResources&Title=Safety Resources.

Seed JSA Development Information:		
Job Description: Deploying/Retrieving Data Loggers from Wells		
Seed JSA Template Version Date: January 13, 2016 (modified from Gauging Wells JSA Seed)		
Seed JSA Development Team: Brad Pekas		
Project Seed JSA Adaption Review Process (Seed JSA modifications made for the project):		
Project Name: Mattawoman Energy	Site Location: Brandywine, MD	Project Number: 38H-001-002
Project Management Reviewer Name	**Signature**	**Date (MM/DD/YYYY)**
Brad Pekas		1/8/16
Health and Safety Team Reviewer Name	**Signature**	**Date (MM/DD/YYYY)**

Site-specific Information (completed daily, on site, and prior to job start by the task manager):			
Weather conditions:	**Approx. temp:**	**Approx. wind direction/speed:**	/
Site-specific revisions made by:	**Position/Title:**	**Date (MM/DD/YYYY)**	**Primary Contact Number**
			( ) -
Team briefed on: ☐ Daily Safety Briefing	☐ Right to Refuse Unsafe Work	☐ Stop Work Authority	

Personal Protective Equipment (PPE) Anticipated (complete applicable boxes):		
Eye and Face Protection	***Foot Protection***	***Fall Protection***
Safety glasses	Leather Boots/Safety-toes boots	
Head Protection	***Biological Protection***	***Respiratory Protection***
Hard Hat	Snake gaiters, insect repellent	
Hearing Protection	***High Visibility Clothing***	***Protective Clothing***
		Layered clothing for warmth as needed
Hand Protection	***Water Safety Devices***	***Other***
Industrial work gloves, chemical-resistant gloves		Sunscreen

Safety Tools/Equipment/Instruments Anticipated (complete applicable boxes):		
Safety Knives	***Ventilation***	***Barricades or Access Control***
Safety Utility, Acetate Liner Cutter, imbedded blade (hook) knife		
Communications	***Atmospheric Monitoring Devices***	***Other***
Cell phone contact @ enter/exit site		

Specialized/Site-Specific Safety Training Required:

Permits Required:

Job Steps		Potential Hazard(s)	Critical Action(s)
1.	Open well	A. Struck-by traffic B. Slips/Trips/Falls C. Biological hazards (spiders, stinging insects, poisonous snakes, scorpions, etc.) D. Chemical hazards (exposure to H_2S) E. Pinch hazards F. Temperature stress	A. Park vehicle on an angle between well and same-lane of traffic as protection and about 10 – 20' from well, based on traffic speed. Set traffic cone ~50 behind vehicle to alert traffic. Wear a high visibility vest or jacket. B. Survey ground and walking path for trip and slip hazards. C. Survey area for snakes, scorpions, and other hazards while approaching well. Maintain the area around wells clear of vegetation by a 2' radius to prevent harborage of biological hazards. Thoroughly inspect well casing for insects and signs of insect activity. Use an insecticide if insects are present (follow manufacturer's directions). Do not spray DEET on FRCs. Wear work gloves to protect against stings/bites. Wear snake gaiters in areas with poisonous snakes. D. Stand upwind when opening well. Wear chemical PPE, including nitrile gloves and safety glasses. E. Avoid pinch points such as hinges, lids, or caps. Wear work gloves. F. Dress in layers for cold weather or loose-fitting light clothing for hot weather, but within constraints of HASP. Drink plenty of water or other hydrating liquids (i.e., not sodas).
2.	Gauge well	A. Follow JSA for Gauging Wells	A. Follow JSA for Gauging Wells
3.	Program data logger	A. Pinch hazards B. Hand lacerations	A. Connect data logger to the programming device, preloaded with the appropriate software. B. Use the data from gauging the liquid level in the well and the well construction details to complete the data logger deployment form C. Set the recording frequency at the desired interval. Also, synchronize the timing of all data loggers to be deployed at any given site to facilitate subsequent data evaluation and analyses
4.	Deploy data logger	A. Pinch hazards B. Hand lacerations	A. Before placing data logger inside the well, securely connect the cord/line or direct read cable to the data logger and the well cap (or suitable equivalent) B. Lower the data logger into the well to the targeted depth (below the water table for water level recorder; high above the water level for a barometric recorder

Job Steps		Potential Hazard(s)	Critical Action(s)
			C. Gauge well and record data after it has stabilized (5-10 minutes)
5.	Retrieve data logger and download electronic data	A. Pinch hazards B. Hand lacerations	A. Before retrieval, gauge well and record data. B. Slowly lift the data logger from the well to the surface and connect to the programming/downloading device. C. Download the data onto the connected communication devices D. If data monitoring is to continue, repeat deployment steps; otherwise, clean and dry the data logger for storage, and proceed to next step.
6.	Close and lock well	A.	A. Avoid pinch points such as hinges, lids, or caps. Wear work gloves.

Prior to work, I have read and understand the PPE, safety tools/equipment/instruments, and associated permits needed for this task. I also understand the job steps, potential hazards, and critical actions identified for employee task and hazard awareness. I agree to have this JSA on site and identify daily variances and understand I can make pen and ink changes to meet those variances. JSAs used at the task site that contain pen-and-ink changes ("dirtying up") are to be kept in the project folder for record.

Name	**Signature**	**Date**

JOB SAFETY ANALYSIS

For JSA development procedures, visit the Health &Safety Website at
http://intranet.trihydro.com/HS/default.aspx?Content=JSA&Section=SafetyResources&Title=Safety Resources.

Seed JSA Development Information:		
Job Description: Direct Push Sampling		
Seed JSA Template Version Date: February 8, 2011		
Seed JSA Development Team: Jeremy Sell, Joey Waldmann, Justin Simon, Tyson Markham		
Project Seed JSA Adaption Review Process (Seed JSA modifications made for the project):		
Project Name: Laramie Third Street PCE Orphan Site	Site Location: Laramie, WY	Project Number: 021-017-001
Project Management Reviewer Name	**Signature**	**Date (MM/DD/YYYY)**
Christina Hiegel		
Reviewer Name	**Signature**	**Date (MM/DD/YYYY)**
Ryan Athey		3/14/14

Site-specific Information (completed daily, on site, and prior to job start by the task manager):							
Weather conditions:		**Approx. Temp:**		**Approx. wind direction/speed:**	/		
Site-specific revisions made by:	**Position/Title:**	**Date (MM/DD/YYYY)**	**Primary Contact Number**				
			( ) -				
Team briefed on:	☐ Daily Safety Briefing	☐ Right to Refuse Unsafe Work	☐ Stop Work Authority				

Personal Protective Equipment (PPE) Anticipated (complete applicable boxes):		
Eye and Face Protection	***Foot Protection***	***Fall Protection***
Safety glasses, dust-proof safety glasses	Safety-Toed Boots	
Head Protection	***Biological Protection***	***Respiratory Protection***
Hard Hat		
Hearing Protection	***High Visibility Clothing***	***Protective Clothing***
Ear plugs	Vest or Jacket	
Hand Protection	***Water Safety Devices***	***Other***
Industrial work gloves, laceration-resistant gloves, chemical resistant gloves		***Fire Extinguisher, First Aid Kit***

Safety Tools/Equipment/Instruments Anticipated (complete applicable boxes):		
Safety Knives	***Ventilation***	***Barricades or Access Control***
Safety Utility, Acetate Liner Cutter, Imbedded blade (hook) knife		Work Zone Delineation
Communications	***Atmospheric Monitoring Devices***	***Other***
	Personal H_2S monitor, PID	First Aid Kit

Specialized/Site-Specific Safety Training Required:
NA
Permits Required:
NA

Job Steps		Potential Hazard(s)	Critical Action(s)
1.	Utility locates	A. Utility strike B. Biological hazards C. Temperature stress	A. Have the drilling contractor contact One-Call (811) and locate underground utilities at least 48 hours prior to off-site drilling. If a given utility is not registered with One-Call systems, contact a private locates service for utilities located on private property/other suspect utilities. Visually locate overhead utilities and buried utilities and stay clear of these lines. Use a utility checklist to verify potential utilities have been located and marked. B. Survey area for snakes, scorpions, and other hazards while walking site. Maintain the area around equipment/structures/wells clear of vegetation by a 2' radius to prevent harborage of biological hazards. Thoroughly inspect equipment for insects and signs of insect activity. Use an insecticide if insects are present (follow manufacturer's directions). Wear work gloves to protect against stings/bites. Wear snake gaiters in areas with poisonous snakes. C. Dress in layers for cold weather or loose-fitting light clothing for hot weather, but within constraints of HASP. Drink plenty of water or other hydrating liquids (i.e., not sodas).
2.	Drill rig inspection.	A. Inadequate inspection B. Hand lacerations C. Pinch points D. Head struck-against E. Slips/trips/falls	A. Review driller's inspection checklist. Note the locations and verify by testing that drill rig kill switches are in working order. Verify that cathead (if present) and its rope are in good condition. B. Inspect rig for sharp edges and remove, if possible. Wear industrial work gloves. C. Keep hands clear of pinch points. Label pinch points. Wear industrial work gloves. D. Stay alert of equipment proximity. Wear hard hat during inspection. E. Keep work area clear of obstructions and other tripping hazards.
3.	Mobilize to drilling location	D. Vehicular traffic E. Overhead utilities strike F. Other site activities	A. Follow posted speed limits, traffic signs, and restrictions. Become familiarized with the site. Be aware of site activities. Watch for and be aware of vehicular. If needed develop a traffic control plan. Wear high-visibility vest or clothing. B. Equipment needs to remain a minimum of 4 from energized overhead power lines (and other

Job Steps		Potential Hazard(s)	Critical Action(s)
			utilities) while in transport. If required to encroach within the restricted zone, power lines must be de-energized or insulated by the utility company/authorized electrician. C. Familiarize yourself with ongoing and current site activities. Visually check drilling locations prior to setting up. Make sure path to the intended location is stable for a drill rig and has adequate vertical and lateral clearance.
4.	Set up at sample location	A. Overhead utilities strike B. Unstable ground: tipping rig C. Backing rig: struck-by, property damage D. Personal injury: unauthorized entrants E. Moving rig F. Severe weather	A. Walk site location and identify overhead lines. Equipment must remain 10' minimum from energized overhead power lines when erected. If required to encroach within the restricted zone, power lines must be de-energized or insulated by the utility company/authorized electrician. B. Walk site to identify soft or loose soil. Relocate to stable ground or use cribbing for outriggers. C. If it is necessary to back up, survey the area for obstacles prior to backing and use a spotter; verify spotter and driver use standard hand signals. Spotter to wear high-visibility vest and stay in view of driver. D. Establish a work zone large enough to encompass the rig in the event it tips over. Unauthorized personnel and non-essential workers are to remain out of the work zone. E. Set up rig on even ground, if possible. Set parking brake and extend outriggers. Use outrigger cribbing for unstable or previously disturbed ground. Use wheel chocks on slopes. F. Locate nearest severe weather shelter/strong structure before beginning field work. Suspend fieldwork if lightning occurs within 10 miles of site or if a severe weather warning is issued.
5.	Sample collection	A. Injury from drill rig moving and powered parts B. Struck-by: dropping steel samplers C. Slips, trips, and falls D. Lacerations to hands E. Chemical hazards F. Pinch hazards	A. Identify emergency shut-offs and verify functionality of each prior to sampling activities. Review drilling/Geoprobe rig emergency procedures. Keep a safe distance from moving and powered parts. Only authorized and essential personnel are allowed in the work zone. B. Sample over a tailgate to prevent dropped parts from contacting feet. Wear safety-toed boots. C. Keep work area clean and clear of

Job Steps		Potential Hazard(s)	Critical Action(s)
			equipment, tools, spoils, etc. Keep area clear of ice, snow, gravel, etc. that could present a slip/trip hazard. D. Use Geoprobe acetate liner cutter to cut liner. Wear cut-resistant gloves. E. Wear nitrile gloves when handling soil samples. If visual staining is observed, do not directly smell sample to identify odor. Wear H_2S detector for soils high in sulfur. F. Wear leather work gloves when transporting and opening sample equipment.

Prior to work, I have read and understand the PPE, safety tools/equipment/instruments, and associated permits needed for this task. I also understand the job steps, potential hazards, and critical actions identified for employee task and hazard awareness. I agree to have this JSA on site and identify daily variances and understand I can make pen and ink changes to meet those variances. JSAs used at the task site that contain pen-and-ink changes ("dirtying up") are to be kept in the project folder for record.

Name	**Signature**	**Date**

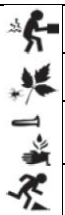
JOB SAFETY ANALYSIS

JSA Version Date: October 2, 2017		
Job Description: Drilling and Pump Installation Oversight		
Project: Sheridan Production Co.	Site Location: Campbell County, WY	

Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Michelle Harper	Geologist	307-745-7474
2.		
3.		
Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1. Kathy Brown	Project Manager	
2.		/ /
3.		/ /

Personal Protective Equipment (PPE) Needed:

Eye and Face Protection	***Body Protection***	***Fall Protection***
☒ Safety Glasses	☒ Fire Retardant Coveralls	☐ Barriers/Guard Rails
☐ Face Shield	☐ Poly-coated Tyvek Coveralls	☐ Safety Net
☐ Chemical Goggles	☐ Chemical Resistant Coveralls	☐ Personal Fall Arrest System
Head Protection	☐ Chemical Resistant Apron	***Respiratory Protection***
☒ Hard Hat	☒ Reflective Safety Vest	☐ Half-Face Air Purifying Respirator
Hearing Protection	☐ Cooling Vest	☐ Full-Face Air Purifying Respirator
☒ Ear Plugs	☐ Long sleeved shirt	☐ Chemical Cartridge
☐ Ear Muffs	***Biological Protection***	☐ Particulate Filter
Hand Protection	☐ Snake Gaiters	☐ Cartridge/Filter Combo
☒ Industrial Work Gloves	☒ Sunscreen	☐ Ammonia Cartridge
☒ Chemical Resistant Gloves	☒ Insect Repellant	☐ H2S Escape Cartridge
☒ Laceration Resistant Gloves	***Hazardous Atmosphere Protection***	☐ Asbestos Filter (P-100)
Foot Protection	☒ Air Monitoring Equipment, PID	☐ Powered Air Purifying Respirator (PAPR) **(contact H&S dept.)**
☐ Leather Boots	☐ Ventilation Fan	
☒ Steel-Toed Boots	☐ Level C	☐ Supplied Air Respirator (SAR) **(contact H&S dept.)**
☐ Chemical Resistant Boots	☐ Level B **(contact H&S dept.)**	
Water Safety	☐ Level A **(contact H&S dept.)**	☐ Self-Contained Breathing Apparatus (SCBA) **(contact H&S dept.)**
☐ Personal Flotation Device	***Decontamination Materials***	
☐ Waders	☐ Equipment Decontamination	
☐ ***Other:***	☐ Personnel Decontamination	☐ ***Other:***
☐ ***Other:***	☐ ***Other:***	☐ ***Other:***

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
1. Utility locates				x	A. Utility strike B. Biological hazards (spiders, stinging insects, etc.) C. Temperature stress	A. Request that driller contact One-Call (811) and locate underground utilities at least 48 hours prior to drilling. Visually locate overhead utilities and buried utilities and stay clear of these lines. Use a utility checklist to verify potential utilities have been located and marked. B. Survey area for hazards while walking site. Maintain the area around equipment/structures/wells clear of vegetation by a 2' radius to prevent harborage of biological hazards. Thoroughly inspect equipment for insects and signs of insect activity. Use an insecticide if insects are present (follow manufacturer's directions). Do not spray DEET on FRCs. Wear work gloves to protect against stings/bites. C. Dress in layers for cold weather or loose-fitting light clothing for hot weather, but within constraints of HASP. Drink plenty of water or other hydrating liquids (i.e., not sodas).	
2. Drill rig inspection		x		x	A. Inadequate inspection B. Hand lacerations C. Pinch points D. Head struck-against E. Slips/trips/falls	A. Review driller's inspection checklist. Note the locations and verify by testing that drill rig kill switches are in working order. Verify safety latches on winch hooks, check for worn cathead rope or frayed cable, check for presence of an adequate number of cable connectors on winch lines. B. Inspect rig for sharp edges and remove, if possible. Wear industrial work gloves. C. Keep hands clear of pinch points. Label pinch points. Wear industrial work gloves. D. Stay alert of equipment proximity. Wear hard hat during inspection. E. Remove debris and slip/trip hazards from work zone. Keep tools organized and out of pathway. Implement good housekeeping practices.	

Job Steps	Hazard(s)	Potential Hazard(s)	Critical Action(s)	Responsible Person
3. Mobilize to sample location	 x x	A. Vehicular traffic B. Overhead utility strikes C. Other site activities	A. Follow posted speed limits, traffic signs, and restrictions. Become familiarized with the site. Be aware of site activities. Watch for and be aware of vehicular traffic related to contractors. Develop a traffic control plan. Wear high visibility vest or clothing. B. Heavy equipment needs to remain a minimum 4' from energized overhead power lines (and other utilities) while in transport. If required to encroach within the restricted zone, power lines must be de-energized or insulated by the utility company/authorized electrician. C. Familiarize yourself with ongoing and current site activities. Visually check drilling locations prior to setting up. Make sure path to the intended location is stable for a drill rig and has adequate vertical and lateral clearance.	
4. Set up at sample location	 x	A. Overhead utilities strike B. Backing rig: struck-by, property damage C. Personal injury: unauthorized entrants D. Moving rig	A. Begin by walking site location and identifying overhead lines. Heavy equipment must remain 10' minimum from energized overhead power lines when erected. If required to encroach within the restricted zone, power lines must be de-energized or insulated by the utility company/authorized electrician. B. If it is necessary to back up, use a spotter; verify spotter and driver use standard hand signals. Spotter to wear high visibility vest and stay in view of driver. Survey the area for obstacles prior to backing. C. Establish a work zone large enough to encompass the rig in the event it tips over. Unauthorized personnel and non-essential workers are to remain out of the work zone. D. Set up rig on even ground, if possible. Set parking brake and extend outriggers. Use outrigger cribbing for unstable or previously disturbed ground. Use wheel chocks on slopes.	

Job Steps	Hazard(s)	Potential Hazard(s)	Critical Action(s)	Responsible Person
5. Observe drilling		A. High noise level B. Flying debris C. Struck-by D. Slip/trips/falls E. Equipment failure F. Severe weather	A. Hearing protection required within 25 feet of operating equipment or when employees cannot maintain a normal conversation at a 2-foot interval. B. Stay away from rotating augers. Verify that "skirt" is in place on air rotary rigs to prevent cuttings from becoming airborne. C. Personnel are not to stand under suspended loads. D. Keep work area clear of tools and equipment. E. Establish the work zone large enough to encompass the rig height in the event of tip-over and to prevent rig or rig components contacting personnel in the event of equipment failure. Prevent entry of non-essential or unauthorized personnel. F. Locate nearest severe weather shelter/strong structure before beginning field work. Suspend fieldwork if lightning occurs within 10 miles of site or severe weather warning issued.	
6. Sample collection		A. Injury from drill rig moving and powered parts B. Struck-by: dropping steel samplers C. Slips, trips, and falls D. Lacerations to hands E. Chemical hazards F. Pinch hazards	A. Identify emergency shut-offs and verify functionality of each prior to sampling activities. Review drilling/Geoprobe rig emergency procedures. Keep a safe distance from moving and powered parts. Only authorized and essential personnel are allowed in the work zone. B. Sample over a tailgate to prevent dropped parts from contacting feet. Wear safety-toed boots. C. Keep work area clean and clear of equipment, tools, spoils, etc. Keep area clear of ice, snow, gravel, etc. that could present a slip/trip hazard. D. Use Geoprobe acetate liner cutter to cut liner. Wear cut-resistant gloves. E. Wear nitrile gloves when handling soil samples. If visual staining is observed, do not directly smell sample to identify odor. Wear H_2S detector for soils high in sulfur.	

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
						F. Wear leather work gloves when transporting and opening sample equipment.	
7. Breakdown at drilling location		x		x	A. Overhead utilities and obstructions B. Slips/trips/falls C. Bystander safety	A. Observe overhead lines and obstructions when lowering mast and tightening winch lines. Use spotter as needed when lowering mast and leaving work area. B. Keep work area clear of tools and equipment. C. Keep bystanders at a safe distance. Remove work area barricades as last item before leaving the work area.	
8. Transfer of impacted drilling waste		x		x	A. Overhead utilities and obstructions B. Slips/trips/falls C. Dropping heavy items	A. When using roll-off containers or dump body trucks, use a spotter to watch for overhead lines and obstructions when containers or dump beds are being lowered or lifted. Stage roll-off containers in an area that is free of overhead obstructions and personnel not working on the project. Use a spotter when utilizing backhoe or similar equipment to transport or dump drums into roll-off containers. Keeps a safe distance from the soil loading/transfer area. Check that the driller uses safe work practices when transferring soils to the roll-off box. B. Maintain the work areas in a neat and orderly manner. Clean up loose or spilled soils. C. Use mechanical lifting methods when handling drums and similar containers. Personnel are not to stand beneath suspended loads including heavy equipment buckets.	
9. Air rotary specific					A. Fluid/splashes from surging borehole B. High pressure air hoses	A. In addition to standard PPE, use additional eye protection such as face-shields and/or goggles. Stay back from the borehole as much as the tasks will allow. B. Check that whip-checks are in place on all high pressure air hose connection including the compressor/hose connection. Do not stand near hose connections while the compressor is being used. Observe (from a safe distance)	

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
						nearby boreholes/wells for the potential ejection of water/solids while compressor is in use. Observe other subsurface structures that have the potential of being damaged for any changes in condition. Stop work in the event that the pressurized air impacts the above discussed items.	
10. Pump Installation		x			A. Electrical connections B. Pinch points C. Overhead objects	A. Check that pump installation procedures are clearly defined for specific pump type. B. Wear steel-toed boots and laceration-resistant gloves. C. Ensure pump is properly secured to lowering device and properly secured in place in well. D. Review electrical hook-up and connectors and check for proper grounding, connections, power limits, etc.	

Prior to work, I have read and understand the PPE, safety tools/equipment/instruments, and associated permits needed for this task. I also understand the job steps, potential hazards, and critical actions identified for employee task and hazard awareness. I agree to have this JSA on site and identify daily variances and understand I can make pen and ink changes to meet those variances. JSAs used at the task site that contain pen-and-ink changes ("dirtying up") are to be kept in the project folder for record.

Name (print):	**Signature**	**Date**

END OF DAY

REVISIONS TO JSA
(Any tasks that were "dirtied up")

Date	Job Step #	REVISION	Does JSA need to be updated permanently?		Responsible Person
			Yes	No	

JOB SAFETY ANALYSIS

JSA Version Date: October 2, 2017		
Job Description: GPS Surveying		
Project: Sheridan Production Co.	Site Location: Campbell County, WY	

Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Michelle Harper	Geologist	307-745-7474
2.		
3.		

Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1. Kathy Brown	Project Manager	
2.		/ /
3.		/ /

Personal Protective Equipment (PPE) Needed:

Eye and Face Protection	***Body Protection***	***Fall Protection***
☒ Safety Glasses	☒ Fire Retardant Coveralls	☐ Barriers/Guard Rails
☐ Face Shield	☐ Poly-coated Tyvek Coveralls	☐ Safety Net
☐ Chemical Goggles	☐ Chemical Resistant Coveralls	☐ Personal Fall Arrest System
Head Protection	☐ Chemical Resistant Apron	***Respiratory Protection***
☒ Hard Hat	☒ Reflective Safety Vest	☐ Half-Face Air Purifying Respirator
Hearing Protection	☐ Cooling Vest	☐ Full-Face Air Purifying Respirator
☐ Ear Plugs	☐ Long sleeved shirt	☐ Chemical Cartridge
☐ Ear Muffs	***Biological Protection***	☐ Particulate Filter
Hand Protection	☐ Snake Gaiters	☐ Cartridge/Filter Combo
☒ Industrial Work Gloves	☒ Sunscreen	☐ Ammonia Cartridge
☐ Chemical Resistant Gloves	☒ Insect Repellant	☐ H2S Escape Cartridge
☐ Laceration Resistant Gloves	***Hazardous Atmosphere Protection***	☐ Asbestos Filter (P-100)
Foot Protection	☒ Air Monitoring Equipment (4-gas and H_2S monitors)	☐ Powered Air Purifying Respirator (PAPR) **(contact H&S dept.)**
☐ Leather Boots	☐ Ventilation Fan	
☒ Steel-Toed Boots	☐ Level C	☐ Supplied Air Respirator (SAR) **(contact H&S dept.)**
☐ Chemical Resistant Boots	☐ Level B **(contact H&S dept.)**	
Water Safety	☐ Level A **(contact H&S dept.)**	☐ Self-Contained Breathing Apparatus (SCBA) **(contact H&S dept.)**
☐ Personal Flotation Device	***Decontamination Materials***	
☐ Waders	☐ Equipment Decontamination	
☐ ***Other:***	☐ Personnel Decontamination	☐ ***Other:***
☐ ***Other:***	☐ ***Other:***	☐ ***Other:***

Job Steps	Hazard(s)	Potential Hazard(s)	Critical Action(s)	Responsible Person
Prior to arriving at Site, project team will review HASP and sign.		Administrative function - no hazards anticipated. Action is to ensure health and safety compliance	Preventative Measures: Employees must have required training: Supervisor Training (Supervisors) OSHA 40-Hour HAZWOPER, Drug screening (as required), and H2S Awareness training.	
Conduct tailgate safety meeting each morning prior to beginning work.	X	Unaware of hazards causing personal injury or equipment/ property damage Weather hazards	Perform site orientation and safety assessment in meeting Observe weather and forecasts, postpone work if extreme weather conditions are expected.	
Site Access	X	Contact with obstructions Slip, Trip, Fall	Observe the area for obstructions or vehicles in the way. Notify site owners at least 24 hours prior to working and have owners move obstacles as necessary. Walk the path before driving and/or taking the vehicle off road.	
Set up at area of survey	X	Slip/trip/fall hazards. Vehicle damage, heavy equipment operations. Damage to equipment/property.	If surveying on foot, park vehicles out of traffic, properly don survey equipment and walk to location. Examine ground for potential hidden hazards such as open pits or debris. Keep eyes on path, proceed slowly and cautiously. Observe site speed limit. Be aware of construction equipment, yield to construction equipment. Avoid obstacles or hazards that could damage property	
Survey and document survey target	X	Slip/trip/fall hazards. Weather factors such as heat stress/fatigue, cold exposure/wind chill, rain, snow, lightning.	Walk and stand on solid ground, and stay clear of open holes, pits or other hazardous terrain. Move slowly and cautiously. Drink plenty of water and take breaks as needed, avoiding long periods of strenuous activity in the heat. Wear proper cold weather clothing and limit exposure due to wind chill. Stop work and seek shelter in the event of lightning or thunderstorm.	
Demobilization	X	Slip/trip/fall hazards. Vehicle damage. Construction/vehicle traffic	Be aware of potential obstructions or hazards in the road, or those hidden by vegetation. Observe safe vehicular speeds and traffic routes. Check that all equipment is secured down properly before movement.	

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Name (print):	**Signature**	**Date**

END OF DAY

REVISIONS TO JSA
(Any tasks that were "dirtied up")

Date	Job Step #	REVISION	Does JSA need to be updated permanently?		Responsible Person
			Yes	No	

JOB SAFETY ANALYSIS

JSA Version Date: October 2, 2017		
Job Description: Groundwater Sampling		
Project: Sheridan Production Co.	Site Location: Campbell County, WY	
Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Michelle Harper	Geologist	307-745-7474
2.		
3.		
Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1. Kathy Brown	Project Manager	
2.		/ /
3.		/ /

Personal Protective Equipment (PPE) Needed:

Eye and Face Protection	***Body Protection***	***Fall Protection***
☒ Safety Glasses	☒ Fire Retardant Coveralls	☐ Barriers/Guard Rails
☐ Face Shield	☐ Poly-coated Tyvek Coveralls	☐ Safety Net
☐ Chemical Goggles	☐ Chemical Resistant Coveralls	☐ Personal Fall Arrest System
Head Protection	☐ Chemical Resistant Apron	***Respiratory Protection***
☒ Hard Hat	☒ Reflective Safety Vest	☐ Half-Face Air Purifying Respirator
Hearing Protection	☐ Cooling Vest	☐ Full-Face Air Purifying Respirator
☐ Ear Plugs	☐ Long sleeved shirt	☐ Chemical Cartridge
☐ Ear Muffs	***Biological Protection***	☐ Particulate Filter
Hand Protection	☐ Snake Gaiters	☐ Cartridge/Filter Combo
☒ Industrial Work Gloves	☒ Sunscreen	☐ Ammonia Cartridge
☒ Chemical Resistant Gloves	☒ Insect Repellant	☐ H2S Escape Cartridge
☒ Laceration Resistant Gloves	***Hazardous Atmosphere Protection***	☐ Asbestos Filter (P-100)
Foot Protection	☒ Air Monitoring Equipment (4-gas and H_2S monitors)	☐ Powered Air Purifying Respirator (PAPR) **(contact H&S dept.)**
☐ Leather Boots	☐ Ventilation Fan	
☒ Steel-Toed Boots	☐ Level C	☐ Supplied Air Respirator (SAR) **(contact H&S dept.)**
☐ Chemical Resistant Boots	☐ Level B **(contact H&S dept.)**	
Water Safety	☐ Level A **(contact H&S dept.)**	☐ Self-Contained Breathing Apparatus (SCBA) **(contact H&S dept.)**
☐ Personal Flotation Device	***Decontamination Materials***	
☐ Waders	☒ Equipment Decontamination	
☐ ***Other:***	☐ Personnel Decontamination	☐ ***Other:***
☐ ***Other:***	☐ ***Other:***	☐ ***Other:***

Job Steps	Hazard(s)	Potential Hazard(s)	Critical Action(s)	Responsible Person
Investigation of work area	 X X	A. Slips, trips, falls. B. Biological hazards. C. Cuts. D. Traffic.	A. Investigate the work area before beginning work. Pay particular attention to inclined surfaces, slick areas, and other terrain concerns. B. Inspect area for spiders or evidence of spiders or other biological hazards such as wasps and snakes. Wear snake gaiters in areas with poisonous snakes. Do not spray DEET on FRCs. C. Pay attention to any sharp objects in the work area, and carefully move them from the work zone if possible. D. Inspect the surroundings for the possibility of traffic hazards. Set up barricades as needed. Wear a reflective vest.	
Open well	 X	A. Biological hazards. B. Hand injury, pinch points. C. Tool hazards.	A. Inspect well casing for spiders or evidence of spiders or other insects such as wasps. Wear work gloves to protect against stings/bites. B. Observe casing for sharp edges or other damage. Wear proper gloves and keep hands clear of pinch points such as hinges, lids, or caps. C. Use the proper tools to remove wells covers.	
Gauge well		A. Refer to Gauging Fluids Levels JSA	A. Refer to Gauging Fluids Levels JSA	

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
Purge water with pump				x X 	A. Splashes from high pumping rates/inadequately secured discharge lines. B. Pinch points on self-actuating pump. C. Lifting hazards associated with moving equipment/water. D. Hazards associated with generator use.	A. Wear chemical resistant gloves. Begin purging well with a low flow rate and increase slowly to desired rate. Secure discharge lines to purge water container prior to pumping. B. Review pump pinch points with field team prior to turning on pump. Communicate with team when pump will be turned on. Stay clear of pinch points. Secure pump to tailgate or well to prevent movement during use. C. Lift heavy equipment/water containers with legs, not back. Use two people if over 50 lbs. Purge water in manageable quantities (<5 gallons). D. Use two people to lift/move generator. Ground generator to prevent shock. Use ear plugs if working near generator.	
Purge water with bailer		X		X X 	A. Lacerations when cutting rope/twine. B. Back Injury from bailing/transferring water. C. Dermal/eye contact with contaminated water or NAPL.	A. Wear cut resistant gloves. Use scissors or hook knife to cut the rope. Do not use a fixed open-blade knife. B. Take frequent breaks to minimize strain. Proper ergonomic techniques such as not twisting while lifting should be utilized during bailing. Lift heavy water containers with legs, not back. Use two people if over 50 lbs. Purge water in manageable quantities (<5 gallons). C. Wear chemical resistant gloves. Lower/raise bailer slowly to prevent splashing. Wear safety glasses with side shields.	
Transfer fluids into drum/poly tank		X		X X 	A. Lifting hazard. B. Contact with contaminated materials. C. Back injuries from lifting/moving drums. D. Injuries from falling drums	A. Don't lift more than 5 gallons at a time. Don't move drums by hand. Avoid twisting while lifting. B. Seal containers prior to moving them. Wear chemical resistant gloves and safety glasses. C. Do not move drums by hand. Use a drum dolly or heavy equipment. Use a tommy gate or heavy equipment to load drums. D. Secure drums to dolly/equipment with tie down prior to moving.	

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
Prepare & label sample bottles				X	A. Cuts from broken sample bottles. B. Contact with chemical preservatives Contact with contaminated water or NAPL.	A. Wear cut resistant gloves under chemical resistant gloves. B. Wear chemical resistant gloves and safety glasses with side shields.	
Collect sample		x		X	A. Contact with contaminated water or NAPL. B. Vapors	A. Wear chemical resistant gloves and safety glasses with side shields. B. Stand upwind of sampling.	
Close and lock well		X			A. Pinch points from well lids or covers.	A. Keep hands clear of pinch points.	

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Name (print):	**Signature**	**Date**

END OF DAY

REVISIONS TO JSA
(Any tasks that were "dirtied up")

Date	Job Step #	REVISION	Does JSA need to be updated permanently?		Responsible Person
			Yes	No	

JOB SAFETY ANALYSIS

JSA Version Date: October 2, 2017		
Job Description: Groundwater Sampling		
Project: Sheridan Production Co.	Site Location: Campbell County, WY	
Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Michelle Harper	Geologist	307-745-7474
2.		
3.		
Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1. Kathy Brown	Project Manager	
2.		/ /
3.		/ /

Personal Protective Equipment (PPE) Needed:

Eye and Face Protection	***Body Protection***	***Fall Protection***
☒ Safety Glasses	☒ Fire Retardant Coveralls	☐ Barriers/Guard Rails
☐ Face Shield	☐ Poly-coated Tyvek Coveralls	☐ Safety Net
☐ Chemical Goggles	☐ Chemical Resistant Coveralls	☐ Personal Fall Arrest System
Head Protection	☐ Chemical Resistant Apron	***Respiratory Protection***
☒ Hard Hat	☒ Reflective Safety Vest	☐ Half-Face Air Purifying Respirator
Hearing Protection	☐ Cooling Vest	☐ Full-Face Air Purifying Respirator
☐ Ear Plugs	☐ Long sleeved shirt	☐ Chemical Cartridge
☐ Ear Muffs	***Biological Protection***	☐ Particulate Filter
Hand Protection	☐ Snake Gaiters	☐ Cartridge/Filter Combo
☒ Industrial Work Gloves	☒ Sunscreen	☐ Ammonia Cartridge
☒ Chemical Resistant Gloves	☒ Insect Repellant	☐ H2S Escape Cartridge
☒ Laceration Resistant Gloves	***Hazardous Atmosphere Protection***	☐ Asbestos Filter (P-100)
Foot Protection	☒ Air Monitoring Equipment (4-gas and H_2S monitors)	☐ Powered Air Purifying Respirator (PAPR) **(contact H&S dept.)**
☐ Leather Boots	☐ Ventilation Fan	
☒ Steel-Toed Boots	☐ Level C	☐ Supplied Air Respirator (SAR) **(contact H&S dept.)**
☐ Chemical Resistant Boots	☐ Level B **(contact H&S dept.)**	
Water Safety	☐ Level A **(contact H&S dept.)**	☐ Self-Contained Breathing Apparatus (SCBA) **(contact H&S dept.)**
☐ Personal Flotation Device	***Decontamination Materials***	
☐ Waders	☒ Equipment Decontamination	
☐ ***Other:***	☐ Personnel Decontamination	☐ ***Other:***
☐ ***Other:***	☐ ***Other:***	☐ ***Other:***

Job Steps	Hazard(s)	Potential Hazard(s)	Critical Action(s)	Responsible Person
Utility locates.	 X X	A. Utility strike B. Biological hazards C. Temperature stress	A. Contact One-Call (811) and locate underground utilities at least 48 hours prior to sampling. If a given utility is not registered with One-Call systems, contact a private locates service for utilities located on private property/other suspect utilities. Before using power equipment, expose the location by hand to a point of no conflict 24" on either side of the utility. Visually locate overhead utilities and buried utilities and stay clear of these lines. Use a utility checklist to verify potential utilities have been located and marked. B. Look before you reach or step; watch for small animals, rodents, snakes, insects, and spiders. Try to avoid and do not antagonize. Use insect repellant and mosquito nets as appropriate. Do not spray DEET on FRCs. C. Dress in layers for cold weather or loose-fitting light clothing for hot weather, but within constraints of HASP. Drink plenty of water or other hydrating liquids (i.e., not sodas).	
Assemble hand auger equipment	 X X	A. Hand injury, pinch points. B. Tool hazards. C. Struck by equipment	A. Keep fingers, hands, and body away from pinch points. Label pinch points for awareness. Wear leather protective gloves. B. Nonessential and unauthorized personnel are to remain out of the work zone. Stay clear of moving equipment. Wear safety-toed boots to protect against dropped tools and equipment. C. For powered augers, keep gasoline in OSHA-approved safety can. Fuel auger when engine is cooled and away from ignition sources.	
Sample collection		A. Electrocution B. Struck-by: dropping heavy equipment C. Slips, trips, falls D. Caught-in: auger E. Flying debris F. Chemical exposure from the	A. Do not work within 10' of energized power lines. B. Maintain two-handed control of equipment until laid down on ground. Sample over a tailgate to prevent dropped parts from contacting feet. Wear safety-toed work boots.	

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
					borehole G. Back injuries from lifting heavy equipment (hand auger, core barrel, etc.) H. Overhead hazards	C. Keep work area clean and clear of equipment, tools, spoils, etc. Keep area clear of ice, snow, gravel, etc. that could present a slip/trip hazard. D. Do not wear loose-fitting clothing, jewelry, or long hair. Remove strings from clothing and verify boots are tied. Do not encroach upon rotating equipment until it has stopped. E. Clear area for loose rocks, gravel etc. that may become a projectile. Establish a work zone to keep nonessential and unauthorized personnel away from the hazards. Wear safety glasses with side shields. F. Wear nitrile gloves when handling soil samples. If visual staining is observed, do not directly smell sample to identify odor. Wear H_2S detector for soils high in sulfur. G. Use proper lifting techniques and request help when available. H. If employees must auger over 6 feet deep, watch for overhead obstructions when tipping auger from hole and while lowering into position.	
Decontamination				X X X X X X	A. Chemical exposure B. Slips, trips, falls	A. Slowly pour decontamination fluids to prevent splashing. Wear chemical-resistant gloves. Wear chemical goggles for splash hazards. B. Area around decontamination bucket could be wet. Adjust method of decontamination to prevent water spillage and use an absorbent to soak up excess moisture to prevent slippage.	

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person

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Name (print):	**Signature**	**Date**

END OF DAY

REVISIONS TO JSA
(Any tasks that were "dirtied up")

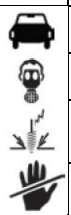
Date	Job Step #	REVISION	Does JSA need to be updated permanently?		Responsible Person
			Yes	No	

JOB SAFETY ANALYSIS

JSA Version Date: July 16, 2014		
Job Description: Site visit / tour		
Project: Linn Operation Due Diligence	Site Location: Approx. 20 miles west of Rawlins	
Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Kenneth Gollon	Senior Environmental Consultant / Project Safety Coordinator	856-325-7939
2.		
3.		
Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1. Lindsey Maybee	Corporate Health & Safety Health and Safety Coordinator	/ /
2.		/ /
3.		/ /

Personal Protective Equipment (PPE) Needed:

Eye and Face Protection	***Body Protection***	***Fall Protection***
☒ Safety Glasses	☒ Fire Retardant - Coveralls (FRC) or Slacks	☐ Barriers/Guard Rails
☐ Face Shield	☐ Poly-coated Tyvek Coveralls	☐ Safety Net
☐ Chemical Goggles	☐ Chemical Resistant Coveralls	☐ Personal Fall Arrest System
Head Protection	☐ Chemical Resistant Apron	***Respiratory Protection***
☒ Hard Hat	☐ Reflective Safety Vest	☐ Half-Face Air Purifying Respirator
Hearing Protection	☐ Cooling Vest	☐ Full-Face Air Purifying Respirator
☒ Ear Plugs (use if necessary)	☒ FRC - Long sleeved shirt	☐ Chemical Cartridge
☐ Ear Muffs	***Biological Protection***	☐ Particulate Filter
Hand Protection	☐ Snake Gaiters	☐ Cartridge/Filter Combo
☒ Industrial Work Gloves	☒ Sunscreen	☐ Ammonia Cartridge
☐ Chemical Resistant Gloves	☒ Insect Repellant	☐ H2S Escape Cartridge
☐ Laceration Resistant Gloves	***Hazardous Atmosphere Protection***	☐ Asbestos Filter (P-100)
Foot Protection	☒ Air Monitoring Equipment (4-gas, personal H2S clip monitor & Geiger Counter	☐ Powered Air Purifying Respirator (PAPR) **(contact H&S dept.)**
☐ Leather Boots	☐ Ventilation Fan	
☒ Steel-Toed Boots	☐ Level C	☐ Supplied Air Respirator (SAR) **(contact H&S dept.)**
☐ Chemical Resistant Boots	☐ Level B **(contact H&S dept.)**	
Water Safety	☐ Level A **(contact H&S dept.)**	☐ Self-Contained Breathing Apparatus (SCBA) **(contact H&S dept.)**
☐ Personal Flotation Device	***Decontamination Materials***	

Job Steps	Hazard(s)	Potential Hazard(s)	Critical Action(s)	Responsible Person
1. Arriving at site	 X X	A. Site emergencies B. Noise C. Slip/Trip/Fall D. Low obstacles E. Loss of phone contact/location with site supervisor	A. Sign in at the client site location (if applicable), take note of emergency evacuation routes and muster area locations. B. Use hearing protection if site equipment is in operation. C. Watch steps for uneven ground; animal burrows / holes, watch for slip and trip hazards. D. Be aware of pipe/conduit in the area. E. Return to the check-in location (if applicable) and regain contact.	
2. Site visit	 X X **X**	A. Traffic hazards B. Slip/Trip/Fall C. Operations hazards / atmospheric dangers D. Biological hazards (spiders, stinging insects, poisonous snakes, etc.) E. Temperature stress	A. Park vehicle defensively for protection from traffic; wear high-visibility clothing. B. Wear safety-toed boots or sturdy footwear and watch for slip and trip hazards; wear traction devices. Keep eyes on path when moving throughout the site. C. Note site hazards and remain clear of ongoing operations, unless otherwise noted. Check working atmosphere via calibrated 4-gas meter and Geiger counter to check safe breathing zone. Exit areas upwind immediately should elevated readings occur. D. Survey area for hazards while walking site. Maintain the area around equipment/structures/wells clear of vegetation by a 2' radius to prevent harborage of biological hazards. Thoroughly inspect equipment for insects and signs of insect activity. Use an insecticide if insects are present (follow manufacturer's directions). Wear work gloves to protect against stings/bites E. Dress in loose-fitting light clothing for hot weather, but within constraints of HASP. Drink plenty of water or other hydrating liquids (i.e., not sodas).	
3. Leaving site	 X **X** **X**	A. Noise B. Slip/Trip/Fall C. Low obstacles D. Observe site traffic / service vehicles E. Loss of phone contact/location with site supervisor F. Site emergencies	A. Use hearing protection if site equipment is in operation. B. Watch for slip and trip hazards, uneven ground, or animal burrows. C. Be aware of pipe/conduit in the area. D. Note site traffic - yield to trucks entering and exiting site. Watch for service vehicles - vacuum trucks or service vehicles that may have operators may exit from vehicles into roadway. Watch for wildlife entering roadway (i.e., Deer, Antelope, etc.).	

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
						E. Return to the check-in location and regain contact. F. Sign out at the client site location to make sure the client is aware of your departure (if applicable). (Not applicable if company representative is with you)	

Prior to work, I have read and understand the PPE, safety tools/equipment/instruments, and associated permits needed for this task. I also understand the job steps, potential hazards, and critical actions identified for employee task and hazard awareness. I agree to have this JSA on site and identify daily variances and understand I can make pen and ink changes to meet those variances. JSAs used at the task site that contain pen-and-ink changes ("dirtying up") are to be kept in the project folder for record.

Name (print):	**Signature**	**Date**

END OF DAY

REVISIONS TO JSA
(Any tasks that were "dirtied up")

Date	Job Step #	REVISION	Does JSA need to be updated permanently?		Responsible Person
			Yes	No	

JOB SAFETY ANALYSIS

JSA Version Date: May 13, 2014		
Job Description: SUMMA Canister Air Sampling		
Project: Laramie PCE Plume Investigation	Site Location: Laramie, WY	

Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Ryan Athey	Project Manager	307-399-4011
2. Matt Jones	Field Personnel	
3.		
Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1. Lindsey Maybee	Health and Safety Coordinator	05/22/2014
2.		/ /
3.		/ /

Personal Protective Equipment (PPE) Needed:

Eye and Face Protection	***Body Protection***	***Fall Protection***
☒ Safety Glasses	☐ Fire Retardant Coveralls	☒ Barriers/Guard Rails
☐ Face Shield	☐ Poly-coated Tyvek Coveralls	☐ Safety Net
☐ Chemical Goggles	☐ Chemical Resistant Coveralls	☐ Personal Fall Arrest System
Head Protection	☐ Chemical Resistant Apron	***Respiratory Protection***
☐ Hard Hat	☒ Reflective Safety Vest	☐ Half-Face Air Purifying Respirator
Hearing Protection	☐ Cooling Vest	☐ Full-Face Air Purifying Respirator
☒ Ear Plugs	☐ Long sleeved shirt	☐ Chemical Cartridge
☐ Ear Muffs	***Biological Protection***	☐ Particulate Filter
Hand Protection	☐ Snake Gaiters	☐ Cartridge/Filter Combo
☒ Industrial Work Gloves	☒ Sunscreen	☐ Ammonia Cartridge
☐ Chemical Resistant Gloves	☐ Insect Repellant	☐ H2S Escape Cartridge
☐ Laceration Resistant Gloves	***Hazardous Atmosphere Protection***	☐ Asbestos Filter (P-100)
Foot Protection	☐ Air Monitoring Equipment	☐ Powered Air Purifying Respirator (PAPR) **(contact H&S dept.)**
☐ Leather Boots	☐ Ventilation Fan	
☐ Steel-Toed Boots	☐ Level C	☐ Supplied Air Respirator (SAR) **(contact H&S dept.)**
☐ Chemical Resistant Boots	☐ Level B **(contact H&S dept.)**	
Water Safety	☐ Level A **(contact H&S dept.)**	☐ Self-Contained Breathing Apparatus (SCBA) **(contact H&S dept.)**
☐ Personal Flotation Device	***Decontamination Materials***	
☐ Waders	☐ Equipment Decontamination	
☐ ***Other:***	☐ Personnel Decontamination	☐ ***Other:***
☐ ***Other:***	☐ ***Other:***	☐ ***Other:***

Job Steps	Hazard(s)	Potential Hazard(s)	Critical Action(s)	Responsible Person
Establish sampling area	 x  x	A. Vehicular traffic B. Moving vehicle C. Slips/Trips/Falls D. Unauthorized entry of personnel and vehicles E. Carbon monoxide exposure F. Temperature stress	A. Park fleet vehicle on angle as a barrier between team members and same-lane traffic. Set up traffic cone 25-50' from vehicle to warn traffic of work zone. Wear high-visibility vests. B. Set steering wheel to the far left or right so if vehicle moves out of park, it will travel away from personnel and traffic. Set parking brake. Chock wheels if parked on a slope. C. Survey area for slip/trip/fall hazards and remove if possible. Choose the safest walk path to sampling area. Implement good housekeeping practices. D. Establish a work zone using caution tape and traffic cones. Non-essential and unauthorized personnel are to remain outside the work zone. E. If vehicle is parked up wind, turn off engine to prevent carbon monoxide exposure. F. Dress in layers for cold weather or loose-fitting light clothing for hot weather, but within constraints of HASP. Drink plenty of water or other hydrating liquids (i.e., not sodas).	
Set up SUMMA canister	 	A. Pinch points B. Hand lacerations C. Hand injuries from hand tools D. Exposure to air contaminants E. Damaged components	A. Keep fingers and hands clear of pinch points when making connections. B. Check equipment and connections for sharp edges; remove if possible. Wear work gloves if sharp edges cannot be removed. C. Inspect hand tools for damage prior to use. Verify the right tool for the task. D. Do not open sampling ports, if applicable, prior to connecting canister. E. Verify connections are made without cross-threading.	
Disconnect SUMMA canister	 x 	A. Hand lacerations B. Exposure to air contaminants	A. Wear work gloves if sharp edges cannot be removed. B. Close sampling ports, if applicable, prior to disconnecting canister.	
	x	A. Vehicular traffic		

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
Deconstruct sampling area				X		A. Maintain a vigilance of traffic while deconstructing sampling area. Wear high-visibility vests. Leave traffic cone to the rear of the vehicle until rest of task is completed.	

Prior to work, I have read and understand the PPE, safety tools/equipment/instruments, and associated permits needed for this task. I also understand the job steps, potential hazards, and critical actions identified for employee task and hazard awareness. I agree to have this JSA on site and identify daily variances and understand I can make pen and ink changes to meet those variances. JSAs used at the task site that contain pen-and-ink changes ("dirtying up") are to be kept in the project folder for record.

Name (print):	**Signature**	**Date**

END OF DAY

REVISIONS TO JSA
(Any tasks that were "dirtied up")

Date	Job Step #	REVISION	Does JSA need to be updated permanently?		Responsible Person
			Yes	No	

JOB SAFETY ANALYSIS

JSA Version Date: 9/26/2013		
Job Description: Surface Water Sampling		
Project: Frontier Refining LLC	Site Location: Cheyenne, Wyoming	

Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Tyson Markham	Project Engineer	(307) 745-7474
2.		( ) -
3.		( ) -
Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1. Todd Forry	Health & Safety Manager	9/26/2013
2.		
3.		

Personal Protective Equipment (PPE) Needed:

Eye and Face Protection	***Body Protection***	***Fall Protection***
☒ Safety Glasses	☒ Fire Retardant Coveralls	☐ Barriers/Guard Rails
☐ Face Shield	☐ Poly-coated Tyvek Coveralls	☐ Safety Net
☐ Chemical Goggles	☐ Chemical Resistant Coveralls	☐ Personal Fall Arrest System
Head Protection	☐ Chemical Resistant Apron	***Respiratory Protection***
☒ Hard Hat	☒ Reflective Safety Vest	☐ Half-Face Air Purifying Respirator
Hearing Protection	☐ Cooling Vest	☐ Full-Face Air Purifying Respirator
☒ Ear Plugs	***Biological Protection***	☐ Chemical Cartridge
☐ Ear Muffs	☐ Snake Gaiters	☐ Particulate Filter
Hand Protection	☒ Sunscreen	☐ Cartridge/Filter Combo
☐ Industrial Work Gloves	☒ Insect Repellant	☐ Ammonia Cartridge
☒ Chemical Resistant Gloves	***Hazardous Atmosphere Protection***	☐ H2S Escape Cartridge
☐ Laceration Resistant Gloves	☒ Air Monitoring Equipment	☐ Asbestos Filter (P-100)
Foot Protection	☐ Ventilation Fan	☐ Powered Air Purifying Respirator (PAPR) **(contact H&S dept.)**
☒ Leather Boots	☐ Level C	
☒ Steel-Toed Boots	☐ Level B **(contact H&S dept.)**	☐ Supplied Air Respirator (SAR) **(contact H&S dept.)**
☐ Chemical Resistant Boots	☐ Level A **(contact H&S dept.)**	
Water Safety	***Decontamination Materials***	☐ Self-Contained Breathing Apparatus (SCBA) **(contact H&S dept.)**
☐ Personal Flotation Device	☐ Equipment Decontamination	
☐ Waders	☐ Personnel Decontamination	
☒ ***Other:*** First Aid Kit	☐ ***Other:***	☐ ***Other:***
☐ ***Other:***	☐ ***Other:***	☐ ***Other:***

Job Steps		Potential Hazard(s)	Critical Action(s)
1.	Mobilize to work area	A. Vehicle damage B. Slips, trips, and falls C. Inhalation or dermal exposure to chemical/botanical hazards	A. Be aware of hazards or potential obstructions in the road or hidden by vegetation. Use a spotter when backing. B. Be aware of hazards hidden by vegetation. Pick up feet and use caution when moving through deep vegetation. C. Wear the necessary PPE to minimize exposure to hazards.
2.	Surface water sample collection	A. Falling/Tripping hazards B. Fatigue, heat stress	A. Proceed cautiously to sample collection area. Ensure that proper footing is kept at all times. B. Stay hydrated; drink water and Gatorade. Use sunscreen when necessary.
3.	Departing work area	A. Vehicle damage B. Slips, trips, and falls C. Inhalation or dermal exposure to chemical/botanical hazards	A. Be aware of hazards or potential obstructions in the road or hidden by vegetation. Use a spotter when backing. B. Be aware of hazards hidden by vegetation. Pick up feet and use caution when moving through deep vegetation. C. Wear the necessary PPE to minimize exposure to hazards.

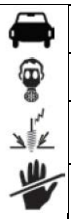
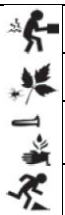
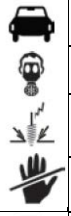
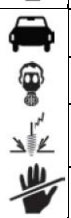
JOB SAFETY ANALYSIS

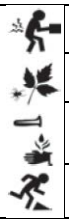
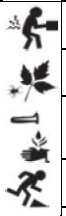
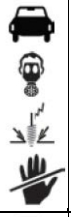
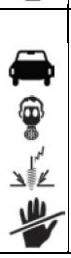
JSA Version Date: October 2, 2017		
Job Description: Vehicle Operation		
Project: Sheridan Production Co.	Site Location: Campbell County, WY	

Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Michelle Harper	Geologist	307-745-7474
2.		
3.		
Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1. Kathy Brown	Project Manager	
2.		/ /
3.		/ /

Personal Protective Equipment (PPE) Needed:

Eye and Face Protection	***Body Protection***	***Fall Protection***
☐ Safety Glasses	☐ Fire Retardant Coveralls	☐ Barriers/Guard Rails
☐ Face Shield	☐ Poly-coated Tyvek Coveralls	☐ Safety Net
☐ Chemical Goggles	☐ Chemical Resistant Coveralls	☐ Personal Fall Arrest System
Head Protection	☐ Chemical Resistant Apron	***Respiratory Protection***
☐ Hard Hat	☐ Reflective Safety Vest	☐ Half-Face Air Purifying Respirator
Hearing Protection	☐ Cooling Vest	☐ Full-Face Air Purifying Respirator
☐ Ear Plugs	☐ Long sleeved shirt	☐ Chemical Cartridge
☐ Ear Muffs	***Biological Protection***	☐ Particulate Filter
Hand Protection	☐ Snake Gaiters	☐ Cartridge/Filter Combo
☐ Industrial Work Gloves	☐ Sunscreen	☐ Ammonia Cartridge
☐ Chemical Resistant Gloves	☐ Insect Repellant	☐ H2S Escape Cartridge
☐ Laceration Resistant Gloves	***Hazardous Atmosphere Protection***	☐ Asbestos Filter (P-100)
Foot Protection	☐ Air Monitoring Equipment	☐ Powered Air Purifying Respirator (PAPR) **(contact H&S dept.)**
☐ Leather Boots	☐ Ventilation Fan	
☐ Steel-Toed Boots	☐ Level C	☐ Supplied Air Respirator (SAR) **(contact H&S dept.)**
☐ Chemical Resistant Boots	☐ Level B **(contact H&S dept.)**	
Water Safety	☐ Level A **(contact H&S dept.)**	☐ Self-Contained Breathing Apparatus (SCBA) **(contact H&S dept.)**
☐ Personal Flotation Device	***Decontamination Materials***	
☐ Waders	☐ Equipment Decontamination	
☒ ***Other:*** First aid kit	☐ Personnel Decontamination	☒ ***Other:*** Sunglasses
☒ ***Other:*** Fire extinguisher	☐ ***Other:***	☐ ***Other:***

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
Vehicle inspection		X **X**		 X 	Pinch hazards Traffic hazards Chemical exposure	Keep hands clear of mechanical parts when conducting inspection. Visually inspect vehicle; if any part requires additional inspection, identify pinch hazards prior to inspection. Leather gloves may be required to inspect vehicle. Conduct inspection in an appropriate area and document. If inspecting under the vehicle, use cones to limit traffic next to vehicle. When inspecting fluids, use a clean shop rag that is large enough to absorb the amount of fluids on the dip sticks.	
Vehicle selection		X 		 	Distraction while operating Vehicle/property damage	Familiarize yourself with the vehicle controls before operating vehicle. Properly adjust mirrors and seat and locate the cruise control before operating. Select a vehicle that is compatible with the driving environment, road conditions, and field activities. Select 4 x 4 vehicles for travel on rough, slick, and unimproved roads.	
Backing vehicle		X 		 	Personal injury and/or vehicle damage	Try to park so the first move is forward. If backing is necessary, visually inspect area prior to entering the vehicle. Use a spotter if backing into an unfamiliar area, an area with many obstacles, or an area with difficult lighting.	
Speed		X 		 	Personal injury and/or vehicle damage Citations	Reduce speed during hazardous conditions (fog, rain, snow, construction, etc.) Obey posted speed limits. Reduce speeds during hazardous conditions (fog, rain, snow, construction, etc.).	
Distance/Spacing		 		 	Personal injury and/or vehicle damage	Maintain safe vehicle spacing. Use the 3-second rule for a car/pickup truck up to 40 mph; add 1 second for over 40 mph. Increase spacing in hazardous weather. Leave yourself maneuvering room when operating a vehicle in traffic.	
Braking		X 		 	Personal injury and/or vehicle damage	Vehicles equipped with anti-lock brakes do not require the brakes to be pumped to prevent locking. Anti-lock brakes may increase braking distance depending on conditions.	

Job Steps	Hazard(s)		Potential Hazard(s)	Critical Action(s)	Responsible Person
Blind Spots			Personal injury and/or vehicle damage	Familiarize yourself with the individual vehicle's blind spots prior to operating the vehicle. Adjust mirrors to minimize blind spots. Load the truck bed so as not to reduce visibility.	
Distractions			Personal injury and/or vehicle damage	Use of electronic devices while operating vehicles is prohibited. Cell phone use while operating vehicles is only allowed in an emergency.	
Equipment failure			Personal injury and/or vehicle damage	Conduct a vehicle inspection prior to operating the vehicle. Immediately repair/service deficiencies when identified. Maintain two hands on the wheel to maintain control if vehicle malfunctions.	
Weather			Personal injury and/or vehicle damage	Research the weather prior to travels. Complete t a Journey Management Plan. If possible, reschedule work during favorable weather. Reduce speed and increase following distance in adverse weather.	
Driver attitude			Personal injury and/or vehicle damage	Evaluate your attitude prior to operating the vehicle. Do not operate a vehicle if you are tired or angry.	
Vehicle load			Personal injury and/or vehicle damage Property/vehicle damage	Load vehicle to maintain balance from side to side and front to back, as this can adversely affect handling during emergency maneuvers. Secure loads in bed of pickups so they do not shift, fall out of bed, or become airborne.	
Parking			Personal injury and/or vehicle damage	Park in designated locations, away from overhead construction, construction debris, or heavily populated work areas.	

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
Jobsite navigation		X			Personal injury and/or vehicle damage	Do not enter the pathway of heavy machinery without acknowledgement from machinery operator. Use primary roads. Do not take shortcuts across fields/untraveled areas. Obey site-specific speed limits.	

Prior to work, I have read and understand the PPE, safety tools/equipment/instruments, and associated permits needed for this task. I also understand the job steps, potential hazards, and critical actions identified for employee task and hazard awareness. I agree to have this JSA on site and identify daily variances and understand I can make pen and ink changes to meet those variances. JSAs used at the task site that contain pen-and-ink changes ("dirtying up") are to be kept in the project folder for record.

Name (print):	**Signature**	**Date**

END OF DAY

REVISIONS TO JSA
(Any tasks that were "dirtied up")

Date	Job Step #	REVISION	Does JSA need to be updated permanently?		Responsible Person
			Yes	No	

JOB SAFETY ANALYSIS

JSA Version Date: 9/26/2013		
Job Description: Well Development		
Project: Frontier Refining LLC	Site Location: Cheyenne, Wyoming	

Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Joey Waldmann	Project Geologist	(307) 745-7474
2. Michelle Harper	Geologist	(307) 745-7474
3.		( ) -

Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1. Justin Simon	Project Engineer	07/27/2010
2. Jeremy Sell	Project Manager	06/28/2010
3. Todd Forry	Health & Safety Manager	9/26/2013

Personal Protective Equipment (PPE) Needed:

Eye and Face Protection	***Body Protection***	***Fall Protection***
☒ Safety Glasses	☒ Fire Retardant Coveralls	☐ Barriers/Guard Rails
☐ Face Shield	☐ Poly-coated Tyvek Coveralls	☐ Safety Net
☐ Chemical Goggles	☐ Chemical Resistant Coveralls	☐ Personal Fall Arrest System
Head Protection	☐ Chemical Resistant Apron	***Respiratory Protection***
☒ Hard Hat	☒ Reflective Safety Vest	☐ Half-Face Air Purifying Respirator
Hearing Protection	☐ Cooling Vest	☐ Full-Face Air Purifying Respirator
☒ Ear Plugs	***Biological Protection***	☐ Chemical Cartridge
☐ Ear Muffs	☐ Snake Gaiters	☐ Particulate Filter
Hand Protection	☐ Sunscreen	☐ Cartridge/Filter Combo
☒ Industrial Work Gloves	☐ Insect Repellant	☐ Ammonia Cartridge
☒ Chemical Resistant Gloves	***Hazardous Atmosphere Protection***	☐ H2S Escape Cartridge
☒ Laceration Resistant Gloves	☐ Air Monitoring Equipment	☐ Asbestos Filter (P-100)
Foot Protection	☐ Ventilation Fan	☐ Powered Air Purifying Respirator (PAPR) **(contact H&S dept.)**
☒ Leather Boots	☐ Level C	
☐ Steel-Toed Boots	☐ Level B **(contact H&S dept.)**	☐ Supplied Air Respirator (SAR) **(contact H&S dept.)**
☐ Chemical Resistant Boots	☐ Level A **(contact H&S dept.)**	
Water Safety	***Decontamination Materials***	☐ Self-Contained Breathing Apparatus (SCBA) **(contact H&S dept.)**
☐ Personal Flotation Device	☒ Equipment Decontamination	
☐ Waders	☒ Personnel Decontamination	
☐ ***Other:***	☐ ***Other:***	☐ ***Other:***
☐ ***Other:***	☐ ***Other:***	☐ ***Other:***

Job Steps		Potential Hazard(s)	Critical Action(s)
1.	Load 100-gallon poly tank into work truck.	A. Back injuries B. Pinch points	A. Don't lift the poly tank alone, get help. Use the truck lift-gate if available. B. Wear heavy-duty work gloves when handling the tank. Don't place your hands beneath the tank.
2.	Lower pump/hose inlet into the well.	A. Back injuries B. Chemical exposure	A. Position your body comfortably. Lift with your knees, not your back. Get help to handle the bulky pump hose. B. Wear nitrile gloves and safety glasses or goggles. Don't put your face near the well opening.
3.	Pump water from well into the poly tank, while surging the hose inlet up and down.	A. Back injuries B. Chemical exposure C. Slips, trips, falls D. Leg injuries	A. Position your body comfortably. Stand; don't bend over, when surging the hose into and out of the well. B. Wear nitrile gloves and safety glasses or goggles. C. Place the extra hose out of the way of your work area. D. Use step-stool to get into and out of the back of the work truck.
4.	Empty water from the poly tank.	A. Chemical exposure	A. Wear nitrile gloves and safety glasses or goggles. Position your body away from the tank's bottom valve. Open the valve slowly.
5.	Unload the poly tank from the work truck.	A. Back injuries B. Pinch points	A. Don't lift the poly tank alone, get help. Use the truck's lift-gate if available. Avoid twisting while lifting. B. Wear heavy duty work gloves. Don't place your hands beneath the tank.

JOB SAFETY ANALYSIS

JSA Version Date: October 2, 2017		
Job Description: Well Gauging		
Project: Sheridan Production Co.	Site Location: Campbell County, WY	

Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Michelle Harper	Geologist	(307) 745-7474
2.		
3.		
Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1. Kathy Brown	Project Manager	
2.		/ /
3.		/ /

Personal Protective Equipment (PPE) Needed:

Eye and Face Protection	***Body Protection***	***Fall Protection***
☒ Safety Glasses	☒ Fire Retardant Coveralls	☐ Barriers/Guard Rails
☐ Face Shield	☐ Poly-coated Tyvek Coveralls	☐ Safety Net
☐ Chemical Goggles	☐ Chemical Resistant Coveralls	☐ Personal Fall Arrest System
Head Protection	☐ Chemical Resistant Apron	***Respiratory Protection***
☒ Hard Hat	☒ Reflective Safety Vest	☐ Half-Face Air Purifying Respirator
Hearing Protection	☐ Cooling Vest	☐ Full-Face Air Purifying Respirator
☐ Ear Plugs	☐ Long sleeved shirt	☐ Chemical Cartridge
☐ Ear Muffs	***Biological Protection***	☐ Particulate Filter
Hand Protection	☐ Snake Gaiters	☐ Cartridge/Filter Combo
☒ Industrial Work Gloves	☒ Sunscreen	☐ Ammonia Cartridge
☒ Chemical Resistant Gloves	☒ Insect Repellant	☐ H2S Escape Cartridge
☐ Laceration Resistant Gloves	***Hazardous Atmosphere Protection***	☐ Asbestos Filter (P-100)
Foot Protection	☒ Air Monitoring Equipment (4-gas and H_2S monitors)	☐ Powered Air Purifying Respirator (PAPR) **(contact H&S dept.)**
☐ Leather Boots	☐ Ventilation Fan	
☒ Steel-Toed Boots	☐ Level C	☐ Supplied Air Respirator (SAR) **(contact H&S dept.)**
☐ Chemical Resistant Boots	☐ Level B **(contact H&S dept.)**	
Water Safety	☐ Level A **(contact H&S dept.)**	☐ Self-Contained Breathing Apparatus (SCBA) **(contact H&S dept.)**
☐ Personal Flotation Device	***Decontamination Materials***	
☐ Waders	☒ Equipment Decontamination	
☐ ***Other:***	☐ Personnel Decontamination	☐ ***Other:***
☐ ***Other:***	☐ ***Other:***	☐ ***Other:***

Job Steps	Hazard(s)	Potential Hazard(s)	Critical Action(s)	Responsible Person
Investigation of work area		A. Slips, trips, falls. B. Biological hazards. C. Cuts. D. Traffic.	A. Investigate the work area before beginning work. Pay particular attention to inclined surfaces, slick areas, and other terrain concerns. B. Inspect area for spiders or evidence of spiders or other biological hazards such as wasps and snakes. C. Pay attention to any sharp objects in the work area, and carefully move them from the work zone if possible. D. Inspect the surroundings for the possibility of traffic hazards. Set up barricades as needed. Wear a reflective vest.	
Open well		A. Biological hazards. B. Hand injury, pinch points. C. Tool hazards.	A. Inspect well casing for spiders or evidence of spiders or other insects such as wasps. B. Observe casing for sharp edges or other damage, wear proper gloves, keep hands clear of pinch points such as hinges, lids or caps. C. Use the proper tools to remove wells covers.	
Gauge well		A. Contact with contaminated water. LNAPL, or vapor exposure. B. Eye injury from liquids.	A. Wear chemical resistant gloves. Lower/raise gauge slowly to prevent splashing. Stand upwind of well. B. Wear safety glasses with side shields.	
Decon probe and tape		A. Dermal contact with contaminated water or NAPL. B. Eye injury from liquids.	A. Wear chemical resistant gloves. Lower/raise gauge slowly to prevent splashing. B. Wear safety glasses with side shields. If deconning in buckets, wash slowly to prevent splashing. If using spray bottles, be aware of the direction you're spraying.	
Close and lock well		A. Pinch points from well lids or covers.	A. Keep hands clear of pinch points.	

Prior to work, I have read and understand the PPE, safety tools/equipment/instruments, and associated permits needed for this task. I also understand the job steps, potential hazards, and critical actions identified for employee task and hazard awareness. I agree to have this JSA on site and identify daily variances and understand I can make pen and ink changes to meet those variances. JSAs used at the task site that contain pen-and-ink changes ("dirtying up") are to be kept in the project folder for record.

Name (print):	**Signature**	**Date**

END OF DAY

REVISIONS TO JSA
(Any tasks that were "dirtied up")

Date	Job Step #	REVISION	Does JSA need to be updated permanently?		Responsible Person
			Yes	No	

APPENDIX D

SITE WIDE GROUNDWATER (OPERABLE UNIT 03)-SPECIFIC HEALTH AND SAFETY POLICIES, PROCEDURES, AND PLANS (BRIDGING DOCUMENT)

Bridging of Trihydro Corporation and Subcontractor Safety Requirements to Site wide groundwater (operable unit 03) Policies and Procedures

The Site-Specific Health and Safety Plan (HASP) for project site work conducted at the Site wide groundwater (operable unit 03) located in Bridgeton, Missouri, includes this attachment for "bridging" the policies and procedures of the site with safe work practices of Trihydro Corporation (Trihydro) and its subcontractors.

Purpose: To verify that Trihydro and its subcontractors understand and comply with written policies and procedures of Site wide groundwater (operable unit 03), as applicable to the work of Trihydro and its subcontractors in the site environment. Where Trihydro, its subcontractors, and Site wide groundwater (operable unit 03) have similar safe work practices and procedures, the more restrictive and protective safe work practices are the only procedures implemented.

Implementation: The included table lists Site wide groundwater (operable unit 03) policies and procedures in existence at the site. Many of these topics are also covered in Trihydro's site and corporate health and safety policies and plans.

The Site wide groundwater (operable unit 03) policies and procedures listed in the table are those that are applicable to the work of Trihydro and its subcontractors. The more restrictive and protective site policies and procedures and safe work practices, whether Site wide groundwater (operable unit 03), Trihydro, or subcontractor, supersede and take precedence over similar practices discussed in Trihydro Site and Corporate Health and Safety Plans or subcontractor safety procedures. Trihydro and Trihydro subcontract personnel who perform field services at the site must read, understand, and comply with these policies and procedures. However, if Trihydro, subcontractor, or Site wide groundwater (operable unit 03) personnel have doubts about the adequacy of the policies and procedures covering safe performance of the work, stop work immediately and contact the Trihydro Project Site Manager and Site Safety Officer. Work will not proceed until the Trihydro PM Manager or Site Safety Officer has discussed the matter with Site wide groundwater (operable unit 03) personnel and provided the affected Trihydro and subcontractor personnel with further instructions about how to proceed.

Contractor Regulations and Safety Manual Content

The following list of safety policies and procedures make up the content of the basic safety policies and procedures and safety manuals at the site. ☒ N/A

The client may add or delete other safety policies and procedures as determined by the specific work a contractor is performing.

Title

APPENDIX E

SAFETY DATA SHEETS (SDSs) / MATERIAL SAFETY DATA SHEETS (MSDSs)

ALCONOX MSDS

Section 1 : MANUFACTURER INFORMATION

Product name: Alconox

Supplier: Same as manufacturer.

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Manufacturer emergency phone number: 800-255-3924.
813-248-0585 (outside of the United States).

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Supplier MSDS date: 2005/03/09

D.O.T. Classification: Not regulated.

Section 2 : HAZARDOUS INGREDIENTS

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
25155-30-0	10-30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL 1330 MG/KG MOUSE ORAL	NOT AVAILABLE
497-19-8	7-13	SODIUM CARBONATE	NOT AVAILABLE	4090 MG/KG RAT ORAL 6600 MG/KG MOUSE ORAL	2300 MG/M3/2H RAT INHALATION 1200 MG/M3/2H MOUSE INHALATION
7722-88-5	10-30	TETRASODIUM PYROPHOSPHATE	5 MG/M3	4000 MG/KG RAT ORAL 2980 MG/KG MOUSE ORAL	NOT AVAILABLE
7758-29-4	10-30	SODIUM PHOSPHATE	NOT AVAILABLE	3120 MG/KG RAT ORAL 3100 MG/KG MOUSE ORAL >4640 MG/KG RABBIT DERMAL	NOT AVAILABLE

Section 2A : ADDITIONAL INGREDIENT INFORMATION

Note: (supplier).
CAS# 497-19-8: LD50 4020 mg/kg - rat oral.
CAS# 7758-29-4: LD50 3100 mg/kg - rat oral.

Section 3 : PHYSICAL / CHEMICAL CHARACTERISTICS

Physical state: Solid

Appearance & odor: Almost odourless.
White granular powder.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): Not applicable.

Vapour density (air=1): Not applicable.

By weight: Not available.

Evaporation rate (butyl acetate = 1): Not applicable.

Boiling point (°C): Not applicable.

Freezing point (°C): Not applicable.

pH: (1% aqueous solution).
9.5

Specific gravity @ 20 °C: (water = 1).
0.85 - 1.10

Solubility in water (%): 100 - > 10% w/w

Coefficient of water\oil dist.: Not available.

VOC: None

Section 4 : FIRE AND EXPLOSION HAZARD DATA

Flammability: Not flammable.

Conditions of flammability: Surrounding fire.

Extinguishing media: Carbon dioxide, dry chemical, foam.
Water
Water fog.

Special procedures: Self-contained breathing apparatus required.
Firefighters should wear the usual protective gear.

Auto-ignition temperature: Not available.

Flash point (°C), method: None

Lower flammability limit (% vol): Not applicable.

Upper flammability limit (% vol): Not applicable.

Not available.

Sensitivity to mechanical impact: Not applicable.

Hazardous combustion products: Oxides of carbon (COx).
Hydrocarbons.

Rate of burning: Not available.

Explosive power: None

Section 5 : REACTIVITY DATA

Chemical stability: Stable under normal conditions.

Conditions of instability: None known.

Hazardous polymerization: Will not occur.

Incompatible substances: Strong acids.
Strong oxidizers.

Hazardous decomposition products: See hazardous combustion products.

Section 6 : HEALTH HAZARD DATA

Route of entry: Skin contact, eye contact, inhalation and ingestion.

Effects of Acute Exposure

Eye contact: May cause irritation.

Skin contact: Prolonged contact may cause irritation.

Inhalation: Airborne particles may cause irritation.

Ingestion: May cause vomiting and diarrhea.
May cause abdominal pain.
May cause gastric distress.

Effects of chronic exposure: Contains an ingredient which may be corrosive.

LD50 of product, species & route: > 5000 mg/kg rat oral.

LC50 of product, species & route: Not available for mixture, see the ingredients section.

Exposure limit of material: Not available for mixture, see the ingredients section.

Sensitization to product: Not available.

Carcinogenic effects: Not listed as a carcinogen.

Reproductive effects: Not available.

Teratogenicity: Not available.

Mutagenicity: Not available.

Synergistic materials: Not available.

Medical conditions aggravated by exposure: Not available.

First Aid

Skin contact: Remove contaminated clothing.
Wash thoroughly with soap and water.
Seek medical attention if irritation persists.

Eye contact: Check for and remove contact lenses.
Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.

Inhalation: Remove victim to fresh air.
Seek medical attention if symptoms persist.

Ingestion: Dilute with two glasses of water.
Never give anything by mouth to an unconscious person.
Do not induce vomiting, seek immediate medical attention.

Section 7 : PRECAUTIONS FOR SAFE HANDLING AND USE

Leak / Spill: Contain the spill.
Recover uncontaminated material for re-use.
Wear appropriate protective equipment.
Contaminated material should be swept or shoveled into appropriate waste container for disposal.

Waste disposal: In accordance with municipal, provincial and federal regulations.

Handling procedures and equipment: Protect against physical damage.
Avoid breathing dust.
Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Launder contaminated clothing prior to reuse.

Storage requirements: Keep containers closed when not in use.
Store away from strong acids or oxidizers.
Store in a cool, dry and well ventilated area.

Section 8 : CONTROL MEASURES

Precautionary Measures

Gloves / Type:

Neoprene or rubber gloves.

Respiratory / Type:

If exposure limit is exceeded, wear a NIOSH approved respirator.

Eye / Type:

Safety glasses with side-shields.

Footwear / Type: Safety shoes per local regulations.

Clothing / Type: As required to prevent skin contact.

Other / Type: Eye wash facility should be in close proximity.
Emergency shower should be in close proximity.

Ventilation requirements: Local exhaust at points of emission.

SAFETY DATA SHEET

Isobutylene

Airgas
an Air Liquide company

Section 1. Identification

GHS product identifier : Isobutylene

Chemical name : 2-methylpropene

Other means of identification : 1-Propene, 2-methyl-; Isobutene; Isobutylene; 1-Propene, 2-methyl- (isobutene); 1, 1-Dimethylethylene; Isopropylidenemethylene; iso-Butene; i-Butene; 2-Methylpropylene; 2-Methyl-2-propene; 2-Methyl-1-propene

Product type : Gas.

Product use : Synthetic/Analytical chemistry.

Synonym : 1-Propene, 2-methyl-; Isobutene; Isobutylene; 1-Propene, 2-methyl- (isobutene); 1, 1-Dimethylethylene; Isopropylidenemethylene; iso-Butene; i-Butene; 2-Methylpropylene; 2-Methyl-2-propene; 2-Methyl-1-propene

SDS # : 001031

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

24-hour telephone : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE GASES - Category 1
GASES UNDER PRESSURE - Liquefied gas

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Extremely flammable gas.
May form explosive mixtures with air.
Contains gas under pressure; may explode if heated.
May displace oxygen and cause rapid suffocation.

Precautionary statements

General : Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Always keep container in upright position. Approach suspected leak area with caution.

Prevention : Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

Response : Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.

Storage : Protect from sunlight. Store in a well-ventilated place.

Disposal : Not applicable.

Hazards not otherwise classified : In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : 2-methylpropene

Other means of identification : 1-Propene, 2-methyl-; Isobutene; Isobutylene; 1-Propene, 2-methyl- (isobutene); 1, 1-Dimethylethylene; Isopropylidenemethylene; iso-Butene; i-Butene; 2-Methylpropylene; 2-Methyl-2-propene; 2-Methyl-1-propene

Product code : 001031

CAS number/other identifiers

CAS number : 115-11-7

Ingredient name	%	CAS number
Isobutylene	100	115-11-7

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : As this product is a gas, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : As this product is a gas, refer to the inhalation section.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

Specific treatments : No specific treatment.

Section 4. First aid measures

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : Contains gas under pressure. Extremely flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. If involved in fire, shut off flow immediately if it can be done without risk. If this is impossible, withdraw from area and allow fire to burn. Fight fire from protected location or maximum possible distance. Eliminate all ignition sources if safe to do so.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : Accidental releases pose a serious fire or explosion hazard. No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment.

Large spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid breathing gas. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Use only non-sparking tools. Avoid contact with eyes, skin and clothing. Empty containers retain product residue and can be hazardous. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F). Keep container tightly closed and sealed until ready for use. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Isobutylene	**ACGIH TLV (United States, 3/2017).** TWA: 250 ppm 8 hours.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Section 8. Exposure controls/personal protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Gas. [Compressed gas.]

Color : Colorless.

Odor : Characteristic.

Odor threshold : Not available.

pH : Not available.

Melting point : -140.7°C (-221.3°F)

Boiling point : -6.9°C (19.6°F)

Critical temperature : 144.75°C (292.6°F)

Flash point : Closed cup: -76.1°C (-105°F)

Evaporation rate : Not available.

Flammability (solid, gas) : Extremely flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and oxidizing materials.

Lower and upper explosive (flammable) limits : Lower: 1.8%
Upper: 9.6%

Vapor pressure : 24.3 (psig)

Vapor density : 1.94 (Air = 1)

Specific Volume (ft ^{3}/lb) : 6.6845

Gas Density (lb/ft ^{3}) : 0.1496 (25°C / 77 to °F)

Relative density : Not applicable.

Solubility : Not available.

Solubility in water : 0.26 g/l

Partition coefficient: n-octanol/water : 2.34

Auto-ignition temperature : 465°C (869°F)

Decomposition temperature : Not available.

Viscosity : Not applicable.

Flow time (ISO 2431) : Not available.

Molecular weight : 56.12 g/mole

Aerosol product

Heat of combustion : -45029034 J/kg

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

Incompatible materials : Oxidizers

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Isobutylene	LC50 Inhalation Vapor	Rat	550000 mg/m³	4 hours

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Section 11. Toxicological information

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Isobutylene	2.34	-	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Section 12. Ecological information

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1055	UN1055	UN1055	UN1055	UN1055
UN proper shipping name	ISOBUTYLENE	ISOBUTYLENE	ISOBUTYLENE	ISOBUTYLENE	ISOBUTYLENE
Transport hazard class(es)	2.1 	2.1 	2.1 	2.1 	2.1 
Packing group	-	-	-	-	-
Environmental hazards	No.	No.	No.	No.	No.

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Additional information

DOT Classification : **Limited quantity** Yes.
Quantity limitation Passenger aircraft/rail: Forbidden. Cargo aircraft: 150 kg.
Special provisions 19, T50

TDG Classification : Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.13-2.17 (Class 2).
Explosive Limit and Limited Quantity Index 0.125
ERAP Index 3000
Passenger Carrying Ship Index Forbidden
Passenger Carrying Road or Rail Index Forbidden
Special provisions 29

IATA : **Quantity limitation** Passenger and Cargo Aircraft: Forbidden. Cargo Aircraft Only: 150 kg.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

Clean Air Act (CAA) 112 regulated flammable substances: Isobutylene

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Refer to Section 2: Hazards Identification of this SDS for classification of substance.

State regulations

Massachusetts : This material is listed.

New York : This material is not listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Inventory list

Australia : This material is listed or exempted.

Canada : This material is listed or exempted.

China : This material is listed or exempted.

Europe : This material is listed or exempted.

Japan : **Japan inventory (ENCS)**: This material is listed or exempted.
Japan inventory (ISHL): Not determined.

Malaysia : Not determined.

New Zealand : This material is listed or exempted.

Philippines : This material is listed or exempted.

Republic of Korea : This material is listed or exempted.

Section 15. Regulatory information

Taiwan : This material is listed or exempted.

Thailand : Not determined.

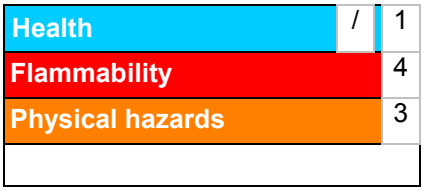
Turkey : Not determined.

United States : This material is listed or exempted.

Viet Nam : Not determined.

Section 16. Other information

Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings and the associated label are not required on SDSs or products leaving a facility under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered trademark and service mark of the American Coatings Association, Inc.

The customer is responsible for determining the PPE code for this material. For more information on HMIS® Personal Protective Equipment (PPE) codes, consult the HMIS® Implementation Manual.

National Fire Protection Association (U.S.A.)

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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Classification	Justification
FLAMMABLE GASES - Category 1 GASES UNDER PRESSURE - Liquefied gas	Expert judgment Expert judgment

History

Date of printing : 5/10/2018

Date of issue/Date of revision : 5/10/2018

Date of previous issue : 7/11/2016

Version : 0.02

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973

Section 16. Other information

as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

References : Not available.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

SAFETY DATA SHEET

Nonflammable Gas Mixture: Carbon Monoxide / Hydrogen Sulfide / Methane / Nitrogen / Oxygen

Section 1. Identification

GHS product identifier : Nonflammable Gas Mixture: Carbon Monoxide / Hydrogen Sulfide / Methane / Nitrogen / Oxygen

Other means of identification : Not available.

Product use : Synthetic/Analytical chemistry.

SDS # : 017447

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

Emergency telephone number (with hours of operation) : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : GASES UNDER PRESSURE - Compressed gas

GHS label elements

Hazard pictograms :

Signal word : Warning

Hazard statements : Contains gas under pressure; may explode if heated.
May displace oxygen and cause rapid suffocation.

Precautionary statements

General : Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Do not depend on odor to detect presence of gas.

Prevention : Not applicable.

Response : Not applicable.

Storage : Protect from sunlight when ambient temperature exceeds 52°C/125°F. Store in a well-ventilated place.

Disposal : Not applicable.

Hazards not otherwise classified : In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.

Section 3. Composition/information on ingredients

Substance/mixture : Mixture

Other means of identification : Not available.

CAS number/other identifiers

CAS number : Not applicable.

Product code : 017447

Ingredient name	%	CAS number
Nitrogen	77 - 99	7727-37-9
oxygen	0.0001 - 19.5	7782-44-7
methane	0.0001 - 3	74-82-8
hydrogen sulfide	0.0001 - 0.2499	7783-06-4
carbon monoxide	0.0001 - 0.0999	630-08-0

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : As this product is a gas, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Contact with rapidly expanding gas may cause burns or frostbite.

Inhalation : No known significant effects or critical hazards.

Skin contact : Contact with rapidly expanding gas may cause burns or frostbite.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : As this product is a gas, refer to the inhalation section.

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Section 4. First aid measures

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
nitrogen oxides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Immediately contact emergency personnel. Stop leak if without risk.

Large spill : Immediately contact emergency personnel. Stop leak if without risk. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid contact with eyes, skin and clothing. Avoid breathing gas. Empty containers retain product residue and can be hazardous. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
hydrogen sulfide	**ACGIH TLV (United States, 3/2015).** STEL: 5 ppm 15 minutes. TWA: 1 ppm 8 hours. **NIOSH REL (United States, 10/2013).** CEIL: 15 mg/m³ 10 minutes. CEIL: 10 ppm 10 minutes. **OSHA PEL 1989 (United States, 3/1989).** STEL: 21 mg/m³ 15 minutes. STEL: 15 ppm 15 minutes. TWA: 14 mg/m³ 8 hours. TWA: 10 ppm 8 hours. **OSHA PEL Z2 (United States, 2/2013).** AMP: 50 ppm 10 minutes. CEIL: 20 ppm
carbon monoxide	**ACGIH TLV (United States, 3/2015).** TWA: 29 mg/m³ 8 hours. TWA: 25 ppm 8 hours. **NIOSH REL (United States, 10/2013).** CEIL: 229 mg/m³ CEIL: 200 ppm TWA: 40 mg/m³ 10 hours. TWA: 35 ppm 10 hours. **OSHA PEL (United States, 2/2013).** TWA: 55 mg/m³ 8 hours. TWA: 50 ppm 8 hours. **OSHA PEL 1989 (United States, 3/1989).** CEIL: 229 mg/m³ CEIL: 200 ppm TWA: 40 mg/m³ 8 hours. TWA: 35 ppm 8 hours.

Section 8. Exposure controls/personal protection

Appropriate engineering controls : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Gas.

Color : Not available.

Melting/freezing point : -187.6°C (-305.7°F) This is based on data for the following ingredient: methane. Weighted average: -210.8°C (-347.4°F)

Critical temperature : Lowest known value: -146.95°C (-232.5°F) (nitrogen).

Odor : Not available.

Odor threshold : Not available.

pH : Not available.

Flash point : Not available.

Burning time : Not applicable.

Burning rate : Not applicable.

Section 9. Physical and chemical properties

Evaporation rate : Not available.

Flammability (solid, gas) : Not available.

Lower and upper explosive (flammable) limits : Not available.

Vapor pressure : Not available.

Vapor density : Highest known value: 1.1 (Air = 1) (oxygen). Weighted average: 0.98 (Air = 1)

Gas Density (lb/ft ^{3}) : Weighted average: 0.08

Relative density : Not applicable.

Solubility : Not available.

Solubility in water : Not available.

Partition coefficient: n-octanol/water : Not available.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

SADT : Not available.

Viscosity : Not applicable.

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatibility with various substances : Extremely reactive or incompatible with the following materials: reducing materials and combustible materials.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
hydrogen sulfide carbon monoxide	LC50 Inhalation Gas. LC50 Inhalation Gas.	Rat Rat	712 ppm 3760 ppm	1 hours 1 hours

Irritation/Corrosion

Not available.

Sensitization

Not available.

Section 11. Toxicological information

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
hydrogen sulfide	Category 3	Not applicable.	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Name	Category	Route of exposure	Target organs
carbon monoxide	Category 1	Not determined	Not determined

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Contact with rapidly expanding gas may cause burns or frostbite.

Inhalation : No known significant effects or critical hazards.

Skin contact : Contact with rapidly expanding gas may cause burns or frostbite.

Ingestion : As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Section 11. Toxicological information

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
hydrogen sulfide	Acute EC50 62 µg/l Fresh water Acute LC50 2 µg/l Fresh water	Crustaceans - Gammarus pseudolimnaeus Fish - Coregonus clupeaformis - Yolk-sac fry	2 days 96 hours

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Nitrogen	0.67	-	low
oxygen	0.65	-	low
methane	1.09	-	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate

Section 13. Disposal considerations

container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1956	UN1956	UN1956	UN1956	UN1956
UN proper shipping name	COMPRESSED GAS, N.O.S. (nitrogen, oxygen)	COMPRESSED GAS, N.O.S. (nitrogen, oxygen)	COMPRESSED GAS, N.O.S. (nitrogen, oxygen)	COMPRESSED GAS, N.O.S. (nitrogen, oxygen)	COMPRESSED GAS, N.O.S. (nitrogen, oxygen)
Transport hazard class(es)	2.2 	2.2 	2.2 	2.2 	2.2 
Packing group	-	-	-	-	-
Environment	No.	No.	No.	No.	No.
Additional information	**Reportable quantity** 40016 lbs / 18167.3 kg Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements.	Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.13-2.17 (Class 2). **Explosive Limit and Limited Quantity Index** 0.125 **Passenger Carrying Road or Rail Index** 75	-	-	-

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

United States inventory (TSCA 8b): All components are listed or exempted.

Clean Water Act (CWA) 311: hydrogen sulfide

Clean Air Act (CAA) 112 regulated flammable substances: methane

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

Section 15. Regulatory information

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

Name	%	EHS	SARA 302 TPQ		SARA 304 RQ	
			(lbs)	(gallons)	(lbs)	(gallons)
hydrogen sulfide	0.0001 - 0.2499	Yes.	500	-	100	-

SARA 304 RQ : 40016 lbs / 18167.3 kg

SARA 311/312

Classification : Sudden release of pressure

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
Nitrogen	77 - 99	No.	Yes.	No.	No.	No.
oxygen	0.0001 - 19.5	No.	Yes.	No.	No.	No.
methane	0.0001 - 3	Yes.	Yes.	No.	No.	No.
hydrogen sulfide	0.0001 - 0.2499	Yes.	Yes.	No.	Yes.	No.
carbon monoxide	0.0001 - 0.0999	Yes.	Yes.	No.	Yes.	Yes.

State regulations

Massachusetts : The following components are listed: NITROGEN; OXYGEN (LIQUID); METHANE

New York : None of the components are listed.

New Jersey : The following components are listed: NITROGEN; OXYGEN; METHANE

Pennsylvania : The following components are listed: NITROGEN; OXYGEN; METHANE

California Prop. 65

WARNING: This product contains less than 1% of a chemical known to the State of California to cause birth defects or other reproductive harm.

Ingredient name	Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
carbon monoxide	No.	Yes.	No.	No.

Canada inventory : All components are listed or exempted.

International regulations

International lists : **Australia inventory (AICS)**: All components are listed or exempted.
China inventory (IECSC): All components are listed or exempted.
Japan inventory: Not determined.
Korea inventory: All components are listed or exempted.
Malaysia Inventory (EHS Register): Not determined.
New Zealand Inventory of Chemicals (NZIoC): All components are listed or exempted.
Philippines inventory (PICCS): All components are listed or exempted.

Section 15. Regulatory information

Taiwan inventory (CSNN): All components are listed or exempted.

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Inform Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Canada

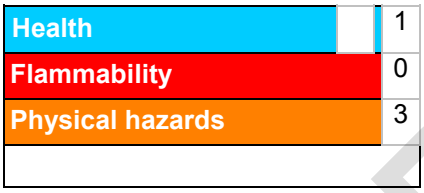
WHMIS (Canada) : Class A: Compressed gas.

CEPA Toxic substances: The following components are listed: Methane
Canadian ARET: None of the components are listed.
Canadian NPRI: The following components are listed: Volatile organic compounds
Alberta Designated Substances: None of the components are listed.
Ontario Designated Substances: None of the components are listed.
Quebec Designated Substances: None of the components are listed.

Section 16. Other information

Canada Label requirements : Class A: Compressed gas.

Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)

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Section 16. Other information

History

Date of printing : 4/1/2016

Date of issue/Date of revision : 4/1/2016

Date of previous issue : 4/1/2016

Version : 2

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United NationsACGIH – American Conference of Governmental Industrial Hygienists
AIHA – American Industrial Hygiene Association
CAS – Chemical Abstract Services
CEPA – Canadian Environmental Protection Act
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA)
CFR – United States Code of Federal Regulations
CPR – Controlled Products Regulations
DSL – Domestic Substances List
GWP – Global Warming Potential
IARC – International Agency for Research on Cancer
ICAO – International Civil Aviation Organisation
Inh – Inhalation
LC – Lethal concentration
LD – Lethal dosage
NDSL – Non-Domestic Substances List
NIOSH – National Institute for Occupational Safety and Health
TDG – Canadian Transportation of Dangerous Goods Act and Regulations
TLV – Threshold Limit Value
TSCA – Toxic Substances Control Act
WEEL – Workplace Environmental Exposure Level
WHMIS – Canadian Workplace Hazardous Material Information System

References : Not available.

Indicates information that has changed from previously issued version.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Safety Data Sheet: **Simple Green® All-Purpose Cleaner** ★

Version No. 13000-18A Issue Date: April 17, 2018 Supersedes Date: September 13, 2014 *OSHA HCS-2012 / GHS*

Section 1: IDENTIFICATION

Product Name: Simple Green® All-Purpose Cleaner
Additional Names:

Manufacturer's Part Number: **Please refer to Section 16*

Recommended Use: Cleaner & Degreaser for water tolerant surfaces.
Restrictions on Use: Do not use on non-rinsable surfaces.

Company: Sunshine Makers, Inc.
15922 Pacific Coast Highway
Huntington Beach, CA 92649 USA

Telephone: 800-228-0709 ● 562-795-6000 *Mon – Fri, 8am – 5pm PST*
Fax: 562-592-3830
Email: info@simplegreen.com

Emergency Phone: Chem-Tel 24-Hour Emergency Service: 800-255-3924

Section 2: HAZARDS IDENTIFICATION

This product is not classified as hazardous under 2012 OSHA Hazard Communication Standards (29 CFR 1910.1200).

OSHA HCS 2012
Label Elements
Signal Word: None **Hazard Symbol(s)/Pictogram(s):** None required

Hazard Statements: None
Precautionary Statements: None
Hazards Not Otherwise Classified (HNOC): None
Other Information: None Known

Section 3: COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient	CAS Number	Percent Range
Water	7732-18-5	> 84.8%*
Ethoxylated Alcohol	68439-46-3	< 5%*
Sodium Citrate	68-04-2	< 5%*
Tetrasodium *N,N*-bis(carboxymethyl)-L-glutamate	51981-21-6	< 1%*
Sodium Carbonate	497-19-8	< 1%*
Citric Acid	77-92-9	< 1%*
Isothiazolinone mixture	55965-84-9	< 0.2%*
Fragrance	Proprietary Mixture	< 1%*
Colorant	Proprietary Mixture	< 1%*

**specific percentages of composition are being withheld as a trade secret*

Section 4: FIRST-AID MEASURES

Inhalation: Not expected to cause respiratory irritation. If adverse effect occurs, move to fresh air.
Skin Contact: Not expected to cause skin irritation. If adverse effect occurs, rinse skin with water.
Eye Contact: Not expected to cause eye irritation. If adverse effect occurs, flush eyes with water.
Ingestion: May cause upset stomach. Drink plenty of water to dilute. See section 11.

Most Important Symptoms/Effects, Acute and Delayed: None known.

Indication of Immediate Medical Attention and Special Treatment Needed, if necessary: Treat symptomatically

Section 5: FIRE-FIGHTING MEASURES

Suitable & Unsuitable Extinguishing Media: Use Dry chemical, CO2, water spray or "alcohol" foam. Avoid high volume jet water.
Specific Hazards Arising from Chemical: In event of fire, fire created carbon oxides may be formed.
Special Protective Actions for Fire-Fighters: Wear positive pressure self-contained breathing apparatus; Wear full protective clothing.

This product is non-flammable. See Section 9 for Physical Properties.

Section 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: *For non-emergency and emergency personnel:* See section 8 – personal protection. Avoid eye contact. Safety goggles suggested.

Environmental Precautions: Do not allow into open waterways and ground water systems.

Methods and Materials for Containment and Clean Up: Dike or soak up with inert absorbent material. See section 13 for disposal considerations.

Section 7: HANDLING AND STORAGE

Precautions for Safe Handling: Ensure adequate ventilation. Keep out of reach of children. Keep away from heat, sparks, open flame and direct sunlight. Do not pierce any part of the container. Do not mix or contaminate with any other chemical. Do not eat, drink or smoke while using this product.

Conditions for Safe Storage including Incompatibilities: Keep container tightly closed. Keep in cool dry area. Avoid prolonged exposure to sunlight. Do not store at temperatures above 109°F (42.7°C). If separation occurs, mix the product for reconstitution.

Section 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Limit Values: No components listed with TWA or STEL values under OSHA or ACGIH.

Appropriate Engineering Controls: Showers, eyewash stations, ventilation systems

Individual Protection Measures / Personal Protective Equipment (PPE)
Eye Contact: Use protective glasses or safety goggles if splashing or spray-back is likely.
Respiratory: Use in well ventilated areas or local exhaust ventilations when cleaning small spaces.
Skin Contact: Use protective gloves (any material) when used for prolonged periods or dermally sensitive.
General Hygiene Considerations: Wash thoroughly after handling and before eating or drinking.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Green Liquid
Odor: Added sassafras odor
Odor Threshold: Not determined
pH ASTM D-1293**:** 8.5 – 9.5
Freezing Point ASTM D-1177**:** 0-3.33°C (32-38°F)
Boiling Point & Range ASTM D-1120**:** 101°C (213.8°F)
Flash Point ASTM D-93**:** > 212°F
Evaporation Rate ASTM D-1901**:** ½ Butyl Acetate @ 25°C
Flammability (solid, gas): Not applicable
Upper/Lower Flammability or Explosive Limits: Not applicable
Vapor Pressure ASTM D-323**:** 0.60 PSI @77°F, 2.05 PSI @100°F
Vapor Density: Not determined

Partition Coefficient: n-octanol/water: Not determined
Autoignition Temperature: Non-flammable
Decomposition Temperature: 109°F
Viscosity: Like water
Specific Gravity ASTM D-891**:** 1.01 – 1.03
VOCs: ***Water & fragrance exemption in calculation*

SCAQMD 304-91 / EPA 24:	0 g/L	0 lb/gal	0%
CARB Method 310**:	2.5 g/L	0.021 lb/gal	0.25%
SCAQMD Method 313:	Not tested		

VOC Composite Partial Pressure: Not determined
Relative Density ASTM D-4017**:** 8.34 – 8.42 lb/gal
Solubility: 100% in water

Section 10: STABILITY AND REACTIVITY

Reactivity: Non-reactive.
Chemical Stability: Stable under normal conditions 70°F (21°C) and 14.7 psig (760 mmHg).
Possibility of Hazardous Reactions: None known.
Conditions to Avoid: Excessive heat or cold.
Incompatible Materials: Do not mix with oxidizers, acids, bathroom cleaners, or disinfecting agents.
Hazardous Decomposition Products: Normal products of combustion - CO, CO2.

Section 11: TOXICOLOGICAL INFORMATION

Likely Routes of Exposure:
Inhalation - Overexposure may cause headache.
Skin Contact - Not expected to cause irritation, repeated contact may cause dry skin.
Eye Contact - Not expected to cause irritation.
Ingestion - May cause upset stomach.

Symptoms related to the physical, chemical and toxicological characteristics: no symptoms expected under typical use conditions.
Delayed and immediate effects and or chronic effects from short term exposure: no symptoms expected under typical use conditions.
Delayed and immediate effects and or chronic effects from long term exposure: headache, dry skin, or skin irritation may occur.
Interactive effects: Not known.

Numerical Measures of Toxicity

Acute Toxicity:
Oral LD_{50} (rat) > 5 g/kg body weight
Dermal LD_{50} (rabbit) > 5 g/kg body weight
Calculated via OSHA HCS 2012 / Globally Harmonized System of Classification and Labelling of Chemicals

Skin Corrosion/Irritation: Non-irritant per Dermal Irritection® assay modeling. No animal testing performed.
Eye Damage/Irritation: Minimal irritant per Ocular Irritection® assay modeling. No animal testing performed.
Germ Cell Mutagenicity: Mixture does not classify under this category.
Carcinogenicity: Mixture does not classify under this category.
Reproductive Toxicity: Mixture does not classify under this category.
STOT-Single Exposure: Mixture does not classify under this category.
STOT-Repeated Exposure: Mixture does not classify under this category.
Aspiration Hazard: Mixture does not classify under this category.

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity: Volume of ingredients used does not trigger toxicity classifications under the Globally Harmonized System of Classification and Labelling of Chemicals.
Aquatic: Aquatic Toxicity - Low, based on OECD 201, 202, 203 + Microtox: EC_{50} & IC_{50} ≥100 mg/L. Volume of ingredients used does not trigger toxicity classifications under the Globally Harmonized System of Classification and Labelling of Chemicals.
Terrestrial: Not tested on finished formulation.

Persistence and Degradability: Readily Biodegradable per OCED 301D, Closed Bottle Test
Bioaccumulative Potential: No data available.
Mobility in Soil: No data available.
Other Adverse Effects: No data available.

Section 13: DISPOSAL CONSIDERATIONS

Unused or Used Liquid: May be considered hazardous in your area depending on usage and tonnage of disposal – check with local, regional, and or national regulations for appropriate methods of disposal.

Empty Containers: May be offered for recycling.

Never dispose of used degreasing rinsates into lakes, streams, and open bodies of water or storm drains.

Section 14: TRANSPORT INFORMATION

U.N. Number:	Not applicable	**U.N. Proper Shipping Name:**	Cleaning Compound, Liquid NOI
Transport Hazard Class(es):	Not applicable	**NMFC Number:**	48580-3
Packing Group:	Not applicable	**Class:**	55
Environmental Hazards:	Marine Pollutant - NO		

Transport in Bulk (according to Annex II of MARPOL 73/78 and IBC Code): Unknown.

Special precautions which user needs to be aware of/comply with, in connection with transport or conveyance either within or outside their premises: None known.

U.S. (DOT) / Canadian TDG:	Not Regulated for shipping.	**ICAO/ IATA:**	Not classified as Hazardous
IMO / IDMG:	Not classified as Hazardous	**ADR/RID:**	Not classified as Hazardous

Section 15: REGULATORY INFORMATION

All components are listed on: TSCA and DSL Inventory.

SARA Title III: Sections 311/312 Hazard Categories – Not applicable.
Sections 313 Superfunds Amendments and Reauthorizations Act of 1986 – Not applicable.
Sections 302 – Not applicable.

Clean Air Act (CAA): Not applicable
Clean Water Act (CWA): Not applicable

State Right To Know Lists: No ingredients listed
California Proposition 65: No ingredients listed
Texas ESL:

Ethoxylated Alcohol	68439-46-3	60 µg/m³ long term	600 µg/m³ short term
Sodium Citrate	68-04-2	5 µg/m³ long term	50 µg/m³ short term
Sodium Carbonate	497-19-8	5 µg/m³ long term	50 µg/m³ short term
Citric Acid	77-92-9	10 µg/m³ long term	100 µg/m³ short term

Section 16: OTHER INFORMATION

Size	UPC	Size	UPC
2 oz. Pump	043318130366	1 Gallon w/ Dilution Bottle	043318000669
2 oz. Pump	043318131035	1 Gallon	043318000799
4 oz. Pump	043318130014	1 Gallon w/ Dilution Bottle	043318001383
16 oz. Trigger	043318130021	1 Gallon w/ Dilution Bottle	043318002021
22 oz. Trigger	043318130229	1 Gallon	043318130052
24 oz. Trigger, 12 per case	043318000034	1 Gallon w/ Dilution Bottle, 112 per case	043318480140
24 oz. Trigger	043318000300	1 Gallon w/ Dilution Bottle, 4 per case	043318480416
24 oz. Trigger	043318130137	1 Gallon w/ Dilution Bottle, 24 per case	043318480492
32 oz. Trigger	043318000652	1 Gallon w/ laundry	043318002052
32 oz. Trigger	043318130335	1 Gallon w/ towel	043318001222
67.6 oz	043318000393	140 oz.	043318001390
67.6 oz.	043318130144	140 oz., 168 per case	043318561405
1 Gallon w/ Dilution Bottle	043318000539	140 oz. w/ Dilution Bottle	043318001468
1 Gallon w/ Dilution Bottle	043318000645	2.5 Gallon	043318004889

USA items listed only. Not all items listed. USA items may not be valid for international sale.

Section 16: OTHER INFORMATION - continued

NFPA:

Health – None
Flammability – Non-flammable
Stability – Stable
Special - None

Acronyms

NTP	National Toxicology Program	IARC	International Agency for Research on Cancer
OSHA	Occupational Safety and Health Administration	CPSC	Consumer Product Safety Commission
TSCA	Toxic Substances Control Act	DSL	Domestic Substances List

Prepared / Revised By: Sunshine Makers, Inc., Regulatory Department.
This SDS has been revised in the following sections: Added UPC to section 16

DISCLAIMER: The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

APPENDIX F

DAILY TAILGATE SAFETY MEETING FORM

DAILY TAILGATE SAFETY MEETING

NOTE: A new tailgate meeting must be conducted if conditions, location, or personnel change.

Date: _____ Time: _____ ☐ a.m. ☐ p.m. Location: _____(city, state)

Project Name: _____ Client: _____

Current Objective/Description: _____

Commitment to Safety

1. I will protect myself for me, my family, Trihydro, clients, and contractors by watching for and mitigating risky behaviors, exercising stop-work authority to prevent incidents and injuries and by complying with Trihydro and client policies, procedures, and JSAs/JLAs
2. I understand that safety is my personal responsibility and that working safely is a key component in providing quality work.
3. I will set an example for my fellow employees, contractors, clients, and family by working safely.
4. I will drive defensively and "Safely for My Family," abiding by Trihydro and client policies and applicable laws and regulations.
5. I will "slow down" appropriately to work at a pace that will allow me and others to complete each task efficiently and safely.
6. I will hold myself accountable for my safety and the safety of those around me. I will think about the safety of me, my coworkers, contractors, and our clients before I conduct each task.

** Stop Work Authority (SWA) – "Everyone has the authority and obligation to immediately stop all unsafe work."*

Identify High-Hazard Work:

- ☐ Hot Work
- ☐ Elevated/overhead work
- ☐ Boat / over-water operations
- ☐ Work involving equipment within 15' of active overhead electrical line or pole supporting an electric line
- ☐ LOTO
- ☐ Excavations - any
- ☐ Demolition, removal of pipelines and buried structures
- ☐ Confined Space Entry
- ☐ Drilling - any

Associated and Identified Hazards:

- ☐ Abrasions, cuts, scrapes
- ☐ Allergies (self & co-workers)
- ☐ Asbestos
- ☐ Biological
- ☐ Buried utilities
- ☐ Burn hazards
- ☐ Chemical exposure
- ☐ Cold stress
- ☐ Compressed gases
- ☐ Crane or lifting equipment
- ☐ Drilling in area?
- ☐ Earthquake
- ☐ Electrical
- ☐ Equipment failure
- ☐ Ergonomic
- ☐ Excavations in area?
- ☐ Falling
- ☐ Fire/explosion
- ☐ H_2S
- ☐ Hand injury
- ☐ Heat stress
- ☐ Heavy equipment
- ☐ High-pressure processes
- ☐ High-temperature processes
- ☐ High wind
- ☐ Laceration
- ☐ Lightning
- ☐ Loud noise
- ☐ Machine guarding
- ☐ Motor vehicle crash
- ☐ No locking/fixed blades
- ☐ Overexertion
- ☐ Overhead utilities
- ☐ Pedestrian
- ☐ Pinch points
- ☐ Power tools
- ☐ Pulled into
- ☐ Radiation/X-ray
- ☐ Security
- ☐ Severe weather
- ☐ Scaffolds
- ☐ Slips, trips, falls
- ☐ Subsurface utilities
- ☐ Traffic
- ☐ Water
- ☐ Other: _____

See it! Identify Current Objective Hazards:

Assess Trihydro's 3 Most Serious Risks

- ☐ Traffic/Heavy Equipment
- ☐ Hazardous Atmosphere
- ☐ Utility Contact

Assess Trihydro's 5 Most Frequent Risks

- ☐ Hand Injuries
- ☐ Lifting
- ☐ Biological Hazards
- ☐ Chemical Exposure
- ☐ Slips, trips, falls

Other Hazards

- ☐ Weather
- ☐ Working at Heights

Personal Protective Equipment (PPE):

- ☐ Hard hat
- ☐ Safety glasses
- ☐ Safety toed boots
- ☐ Ear plugs (as needed)
- ☐ Face shield
- ☐ Fall protection
- ☐ Gloves (as needed)
- ☐ Arm sleeves
- ☐ High visibility vest
- ☐ Rain gear
- ☐ Rubber boots
- ☐ SCBA
- ☐ Snake chaps
- ☐ Sunscreen (as needed)
- ☐ Dust mask
- ☐ Respirator
  Cartridges/filters:
  ☐ VOC/H_2S escape
- ☐ H_2S monitor
  ☐ Bump test
- ☐ FRCs/Nomex
- ☐ Tyvek®
- ☐ Insect repellant
  Do not apply DEET to FRCs

Other special equipment:

- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____

Before Beginning Work:

- ☐ Sign in and out of process unit ☐ N/A
- ☐ HASP reviewed & acknowledged
- ☐ Locate the nearest evacuation point and a secondary location
- ☐ Identify the nearest fire extinguisher, eyewash station, first aid kit, and Material Safety Data Sheets (MSDS)
- ☐ Identify CPR/AED/first aid certified employees
- ☐ If lone worker, implement lone worker procedures ☐ N/A
- ☐ Identify SSE, visitor(s), or guest(s) ☐ N/A
- ☐ Determine and acquire necessary permits ☐ N/A
  Permit required: _____
- ☐ Review the JSA and "dirty up" if necessary
- ☐ Weather forecast: ☐ Hot ☐ Cold ☐ Inclement
  Wind Direction: _____
- ☐ Employee(s) are wearing proper PPE
- ☐ Perform a "self check" on each personal H_2S monitor
- ☐ Perform a Work-Site Self Assessment (WSSA)
- ☐ Review the dashboard emergency flyer for the specific site; place in a visible location inside vehicle
- ☐ Barricade work zone (as needed)
- ☐ Review WorkCare Injury Accident Program cards
- ☐ PPE Action Levels (PID: 10ppm)

Safe Vehicle Use:

- ☐ Pre-inspection complete
- ☐ Seat belt
- ☐ Follow all speed and traffic rules
- ☐ Emergency brake used
- ☐ Keys left in vehicle
- ☐ Trailer Safety Inspection form
- ☐ Mileage sheet filled out
- ☐ No cell phones used while driving
- ☐ Parked in a safe location
- ☐ Orange cone used
- ☐ Chock tires (if needed)
- ☐ Other: _____
- ☐ GOAL sticker in window
- ☐ Spotter used (if available)
- ☐ First move forward, backed in
- ☐ Load secured in vehicle
- ☐ 3D-Driving (every 2 years)
- ☐ Other: _____

Site-Specific Comments:_____

_____

Positive Reinforcement (R+):_____

Signatures:

Meeting Conducted By: _____ (designated project on-site safety responder) Company:

Printed Name	Signature	Company	Attended Mid-Day Safety Focus	Is this worker new on-site?
1.			☐ Yes ☐ No	☐ Yes ☐ No
2.			☐ Yes ☐ No	☐ Yes ☐ No
3.			☐ Yes ☐ No	☐ Yes ☐ No
4.			☐ Yes ☐ No	☐ Yes ☐ No
5.			☐ Yes ☐ No	☐ Yes ☐ No
6.			☐ Yes ☐ No	☐ Yes ☐ No
7.			☐ Yes ☐ No	☐ Yes ☐ No
8.			☐ Yes ☐ No	☐ Yes ☐ No

APPENDIX G

WORK-AREA EVALUATION FOR CONFINED SPACES

WORK-AREA EVALUATION FOR CONFINED SPACES

Trihydro

Date: _____ Project Site: _____

Client: _____ Project Number: _____

SECTION 1: CONFINED SPACE (CS) EVALUATION			TRUE	FALSE
1.	Size	Is the space large enough and so configured that an employee can bodily enter and perform assigned work?	☐	☐
2.	Access/Egress	Are there limited or restricted means of access or egress?	☐	☐
3.	Occupancy	The space is ***not*** designed for continuous human occupancy.	☐	☐

If ***all three*** answers are **"TRUE,"** this is considered a confined space; continue with Sections 2 and 3.

If at least one answer is **"FALSE,"** this is considered a non-regulated space; continue to Section 3.

SECTION 2: PERMIT-REQUIRED CONFINED SPACE (PRCS) EVALUATION			YES	NO
4.	Hazard	A. Is there a potential for or an actual hazardous atmosphere?	☐	☐
		If yes, explain: _____		
		B. Is there a potential for engulfment or entrapment?	☐	☐
		If yes, explain: _____		
		C. Is the internal configuration such that an entrant may be trapped or asphyxiated?	☐	☐
		If yes, explain: _____		
		D. Does the work space contain any other safety or health hazard (e.g., mechanical, chemical, thermal, electrical, etc.)?	☐	☐
		If yes, identify: _____		
		E. Is the work space identified as a permit-required confined space by the client (warning sign, location map, etc.)?	☐	☐*

*If "NO," consider contacting the client and advising them of the unidentified permit-required confined space.

SECTION 3: SPACE DESIGNATION

Based on the answers to the above questions, designate the type of confined space identified:

☐ The work area has been evaluated for confined spaces; none were identified.

☐ The work area has been evaluated for confined spaces; the following confined space(s) was identified:

Confined Space Location: _____ Identification: _____

Confined Space Description: _____

The space is designated:

1. ☐ Non-regulated space ("FALSE" was checked for one or more question in Section 1)
2. ☐ Confined space, no permit required ("TRUE" was checked for ***all*** questions in Section 1)
3. ☐ Permit-required confined space ("TRUE" was checked for ***all*** questions in Section 1 ***and*** "YES" was checked for at least one question in Section 2)

Evaluation performed by: _____ _____

Print Full Name ***Signature***

Instructions

Work-Area Evaluation for Confined Spaces

The project team must evaluate each work area to determine if confined spaces are present.

Section 1: Confined Space Evaluation

If the project team identifies a space that is classified as a confined space, they are to designate which type and communicate the evaluation to the PM.

To classify a space as a *confined space*, ***all three*** of the following criteria must be met:

Size: Is the space large enough and so configured that an employee can bodily enter and perform assigned work?

Access/Egress: Are there limited or restricted means of access or egress? Can the employee easily egress (exit) the space if there is an emergency? Can rescue personnel easily enter the space?

Occupancy: Is the space ***not*** designed for continuous human occupancy? Is the space only designed to house equipment? Are there normal-sized doorways and windows?

If the space is classified as a *confined space*, the next step is to evaluate it as a *permit-required confined space*.

Section 2: Permit-Required Confined Space Evaluation

To classify a *confined space* as a *permit-required confined space*, ***any*** of the following criteria must be met:

1. Contains or has a potential to contain a hazardous atmosphere:
    A. Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);
    B. Airborne combustible dust at a concentration that meets or exceeds its LFL;
    NOTE: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet or less.
    C. Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;
    D. Atmospheric concentration of any toxic substance above its permissible exposure limit (PEL); or
    E. Any other atmospheric condition that is immediately dangerous to life or health.
2. Contains a material that has the potential for engulfing an entrant;
3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section; or
4. Contains any other recognized serious safety or health hazard.

Section 2: Space Designation

If there are no confined spaces identified in the work area, check the box indicating so and file the form.

If there are confined spaces identified in the work area:

1. Check the box indicating so.
2. Give the location, identification, and a description of the confined space (e.g., tank farm 1, MW-01, monitoring well vault).
3. Designate if the space is a non-regulated space, confined space, or permit-required confined space.
4. Communicate the evaluation to the PM and project-team members.
5. File the form in the project filing system.

APPENDIX H

UTILITIES LOCATE ACKNOWLEDGEMENT

UTILITIES LOCATE ACKNOWLEDGEMENT

Trihydro

Utilities Locate Area Map

N

By signing below, I verify that I have located and marked the specified utilities within the boundaries of the project site as indicated on the map above.

Utility Located: ☐ Gas ☐ Electric ☐ Sewer ☐ Communication ☐ Water ☐ Other: ____________

Company ____________ Name ____________ Signature ____________ Date ____________

Utility Located: ☐ Gas ☐ Electric ☐ Sewer ☐ Communication ☐ Water ☐ Other: ____________

Company ____________ Name ____________ Signature ____________ Date ____________

Utility Located: ☐ Gas ☐ Electric ☐ Sewer ☐ Communication ☐ Water ☐ Other: ____________

Company ____________ Name ____________ Signature ____________ Date ____________

Utility Located: ☐ Gas ☐ Electric ☐ Sewer ☐ Communication ☐ Water ☐ Other: ____________

Company ____________ Name ____________ Signature ____________ Date ____________

Utility Located: ☐ Gas ☐ Electric ☐ Sewer ☐ Communication ☐ Water ☐ Other: ____________

Company ____________ Name ____________ Signature ____________ Date ____________

APPENDIX I

EXPOSURE INCIDENT REPORT

EXPOSURE INCIDENT REPORT

Trihydro

EXPOSED INDIVIDUAL: **Name:** _____

Address: _____

Route(s) of exposure: ☐ **Eye** ☐ **Mouth** ☐ **Mucous membrane**

(check any that apply) ☐ **Non-intact skin** ☐ **Puncture**

To what was the employee exposed? ☐ **Blood** ☐ **Vomit** ☐ **Feces**

☐ **Urine** ☐ **Other** **(describe below)**

Describe the exposure incident on the attached DJJ incident report. Include description of:

- **What work was being done**
- **What caused the incident**
- **What personal protective equipment was worn**
- **What action was taken following the incident**

SOURCE INDIVIDUAL: **Name:** _____

Address: _____

Does your state have a confidentiality requirement? ☐ **Yes** ☐ **No** ☐ **Unknown**

Is the source individual infected with HBV or HIV? ☐ **Yes** ☐ **No** ☐ **Unknown**

Has the source individual consented to blood testing? ☐ **Yes** ☐ **No**

MEDICAL EXAMINATION CHECKLIST:

Provide the following to the doctor performing follow-up medical evaluation:

- **Copy of blood-borne pathogens standard (29 CFR 1910.1030)**
- **Copy of this report**
- **Results of source individual's blood tests**
- **Copy of the exposed employee's medical records relevant to the exposure**

Completed by: _____ **Date:** _____

Continued on back

EXPOSED EMPLOYEE MEDICAL RELEASE:

I AFFIRM THAT THE INFORMATION IN THIS REPORT IS CORRECT, AND AUTHORIZE MY EMPLOYER TO RELEASE ALL RELEVANT MEDICAL RECORDS TO THE HEALTH CARE PROVIDER WHO WILL PERFORM THE MEDICAL EVALUATION AND FOLLOW-UP FOR THIS EXPOSURE INCIDENT. I UNDERSTAND THAT ALL INFORMATION COLLECTED DURING THIS EVALUATION AND THE CONTENTS OF THIS REPORT WILL REMAIN CONFIDENTIAL.

Employee signature _____ **Date:** _____

APPENDIX J

RADIATION SAFETY PLAN (RSP)

Radiation Safety Plan for Operable Unit 03
Groundwater Remedial Investigation/Feasibility Study

WEST LAKE LANDFILL
13570 ST. CHARLES ROCK ROAD
BRIDGETON, MISSOURI 63044

April 11, 2019

Prepared by:

AMERIPHYSICS

9111 Cross Park Drive, Suite D200
Knoxville, TN 37923
800.563.7497

Contents

Abbreviations and Acronyms

ALARA	As Low as Reasonably Achievable
ALI	Annual Limit on Intake
Ameriphysics	Ameriphysics, LLC
CHP	Certified Health Physicist
DAC	Derived Air Concentration
dpm	Disintegration Per Minute
EPA	Environmental Protection Agency
MDNR	Missouri Department of Natural Resources
OU	Operable Unit
Plan	Radiation Safety Plan
RCA	Radiologically Controlled Area
RCM	Ameriphysics' Radiological Control Manual
RCP	Radiological Control Procedure
RCS	Radiological Control Supervisor
RI/FS	Remedial Investigation/Feasibility Study
RIM	Radiologically Impacted Material
RSO	Radiation Safety Officer
RWP	Radiation Work Permit
Site	West Lake Landfill Site
TEDE	Total Effective Dose Equivalent
TENORM	Technologically Enhanced Naturally Occurring Material

1 PURPOSE

The West Lake Landfill Site (Site) currently consists of three operable units (OU) that contain several former industrial and municipal waste cells and groundwater. OU-1 primarily addresses two disposal areas at the West Lake Landfill, known as Areas 1 and 2, that contain radiologically impacted material (RIM). OU-2 consists of portions of the landfill complex that do not contain RIM, including the Bridgeton Landfill. OU-3 addresses groundwater at the Site. Where remedial actions are concerned, the Environmental Protection Agency (EPA) is the Site's lead regulatory authority with certain responsibilities deferred to Missouri Department of Natural Resources (MDNR).

A Remedial Investigation/Feasibility Study (RI/FS) is planned for OU-3 and will include collecting groundwater samples from existing and new locations. This Radiation Safety Plan (Plan) is primarily for work in OU-1 Areas 1 and 2. However, radiological surveys of drilling and sampling equipment as well as sampling of cores and borehole cuttings or other investigated derived waste will be performed as appropriate for the drilling/sampling locations.

It is expected that Technologically Enhanced Naturally Occurring Material (TENORM) will be encountered during these activities, primarily in OU-1. This Plan has been developed to present the radiological requirements while performing the drilling/sampling activities at the site.

All work in radiological area will be conducted under the Ameriphysics, LLC (Ameriphysics) Radiological Control Manual (RCM) and associated procedures.

2 SCOPE

This Plan is applicable to all work conducted at the site in support of the OU-3 investigation, but is mostly applicable to work performed in OU-1 (TENORM impacted soils and debris).

These work activities include, but are not limited to:

- Work area surveys;
- Work area preparation;
- Invasive sub-surface activities such as sampling and drilling operations;
- Movement and storage of equipment that may be impacted by contact with TENORM;
- Monitoring and decontamination of equipment; and
- General health physics monitoring of radiological conditions and personnel.

This Plan is intended to be used with the most recent version of the Health and Safety Plan in effect during this project.

3 RESPONSIBILITIES

All employees and visitors are responsible for working safely and acting in a manner that does not jeopardize their safety, the safety of others, or the quality of the environment. They are responsible to immediately report unsafe conditions to their supervisor or site contact whether radiological or due to general safety conditions. All persons have the right and obligation to pause work if unsafe conditions are suspected, and such stop-work authority is conveyed without fear of reprisal. Other job-specific responsibilities are described in the sections that follow.

3.1 Radiation Protection Personnel

Ameriphysics will provide radiological oversight and support for OU-3 activities when such activities involve RIM. Ameriphysics will be responsible for assessing radiological conditions and any required controls. This includes radiological training of personnel, performing radiological surveys, determining protective clothing requirements, determining personnel exposure monitoring requirements, and monitoring personnel, vehicles and equipment for contamination when exiting controlled areas.

Ameriphysics will provide radiological support to the project via the following organizational elements. These elements and the reporting chain for such relative to the Site's overall organization are described in the Health and Safety Plan.

3.1.1 Radiation Safety Officer

Ameriphysics' Radiation Safety Officer (RSO) is responsible for executive-level administration of the radiological control program in accordance with prevailing procedures and industry practices. Specific responsibilities include the following:

- Establishing standards and guidelines for radiological operations;
- Limiting occupational radiation exposures to levels that are as low as reasonably achievable (ALARA);
- Suspending any operation that presents a radiological or safety threat to employees, the environment, or the general public;
- Ensuring the quality of protective equipment for personnel and prescribing usage standards;
- Establishing procedures for radiological protection and monitoring; and
- Overall responsibility for the radiation protection training program.

Tim Pratt is Ameriphysics' RSO. Because he is an executive-level manager, his work is conducted from Ameriphysics' corporate office in Knoxville, TN.

3.1.2 Heath Physicist

The project will be supported by a Certified Health Physicist (CHP) that is responsible for any professional-level validation that arises over the course of the project. The project health physicist is Tom Hansen, Jr., PhD, CHP. Support from the Health Physicist may be accomplished from off-site.

3.1.3 Radiological Control Supervisor

The RSO will assign a designed Radiation Control Supervisor (RCS) to the project. The RCS is responsible to the RSO for field implementation of the radiological control and safety program at the project level. The RCS has the authority to and shall order any operations suspended when such operations present an imminent radiological or safety threat or hazard to employees, the environment, or the public. A RCS will be present onsite at any time radiological work is conducted. If the RCS must be away from the site, his or her responsibilities will be designated to an appropriately experienced Health-Physics Technician such that continuity of radiological supervision is maintained at all times.

3.1.4 Health-Physics Technicians

Health-Physics Technicians are assigned by the RCS for specific day-to-day oversight of radiological workers and radiological operations. They act as the RCS's representative(s) in specifically implementing the radiological control and safety practices as assigned.

3.2 Radiation Workers

Radiation workers are those personnel who work in restricted areas, handle or transport radioactive material, or otherwise receive occupational exposure to radiation as a result of their job function. Radiation Workers will perform radiological operations under the guidance of and will follow the instructions from Radiation Protection Personnel.

4 RADIATION PROTECTION REQUIREMENTS

4.1 Training Requirements

Radiation Safety Training is required for all work involving the handling of radioactive materials or exposure to ionizing radiation, and a certification of completion shall be provided by the RSO for each Training Module completed.

Radiation Safety Training Module 2, as defined in Ameriphysics Radiological Control Procedure (RCP) 2-1, *Radiation Safety Training Procedure*, will be provided to all employees classified as Radiation Workers who in one year are likely to receive an occupational effective dose equivalent in excess of 100 mrem. The course will familiarize the trainee with the following concepts:

- Radiation and its effects on the body;
- Federal dose limits and administrative controls;

- ALARA and personnel monitoring programs;
- Radiological postings;
- Contamination controls; and
- Federal and state regulations.

Initial training shall consist of instructor led training and may be provided by personnel qualified at a minimum as a Health Physics Technician. This training may be administered at any location, provided additional training is administered covering any specific procedures in effect for job site operations. Qualification is good for one year and is attained by completing the required coursework and passing a written examination with a score of 70 percent or better. Requalification can be attained by challenging the exam in lieu of classroom training, provided a passing score is attained on the first attempt, correct responses to missed questions are reviewed with the trainee, and any new rules or revisions to the radiation safety program are explained.

Position-specific training and qualifications required for persons described in Section 3.1 are described in Section 2 of Ameriphysics' RCM.

4.2 Occupational Exposure Limits

Occupational dose limits for adults are set forth in 10 CFR 20.1201, and the dose limit for the embryo/fetus of a declared pregnant woman is specified in 10 CFR 20.1208. As a measure to prevent exceeding these limits, Administrative Limits equal to 80% of the prescribed limits are used. These limits are tabulated in Table 1.

Table 1. Occupational Dose Limits

	Occupational Dose	Administrative Limit
Total effective dose equivalent (TEDE)	5 rem/yr	4 rem/yr
Sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye	50 rem/yr	40 rem/yr
Skin (shallow-dose equivalent)	50 rem/yr	40 rem/yr
Lens of the eye (shallow-dose equivalent)	15 rem/yr	12 rem/yr
Dose equivalent to the embryo/fetus	0.5 rem for entire pregnancy	0.4 rem for entire pregnancy

An ALARA goal of 0.1 rem/yr TEDE is initially established for the site, meaning no person is allowed to exceed this goal without the consent of the RSO. The ALARA goal should be reviewed annually to make sure it is reasonable and adjusted according with concurrence from the RSO.

4.3 Airborne Exposure Limits

Airborne radioactive material means radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors or gases.

Airborne Radioactivity Area means a room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of licensed material, exist in concentrations:

1. In excess of the derived air concentrations (DAC) specified in Appendix B to 10 CFR 20; or
2. To such a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the annual limit on intake (ALI) or 12 DAC-hours.

ALI means the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent of 5 rems or a committed dose equivalent of 50 rems to any individual organ or tissue.

DAC means the concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2,000 hours under conditions of light work, results in an intake of one ALI.

DAC-hour is the product of the concentration of radioactive material in air (expressed as a fraction or multiple of the derived air concentration for each radionuclide) and the time of exposure to that radionuclide, in hours. Thus, 2,000 DAC-hours is one ALI, equivalent to a committed effective dose equivalent of 5 rems.

Personnel exposure to airborne radioactivity is maintained ALARA primarily through administrative and engineering controls to limit exposures to a concentration of no more than 10% of the DAC. Personnel protective equipment, i.e., respiratory protection, should be used only after a reasonable effort is made to control the hazard otherwise. The use of respiratory protection equipment is not anticipated for this project. The RSO will be consulted to establish appropriate controls and protections if airborne concentrations exceeding 10% of the DAC are encountered.

4.4 Site Monitoring

4.4.1 General Area Surveys

The purpose of a general area survey is to characterize the ambient radiation environment of the Site, exclusive of the areas to be investigated. General area radiation surveys shall be conducted at every job site where drilling/sampling operations are to be performed. As part of the general area survey, ambient exposure rates in various areas around the Site will be measured with a Ludlum Model 19 or equivalent. The frequency of these surveys will be determined by the RCS, but will include, at minimum, surveys at the beginning and the end of the job and when substantive changes are made to the site.

4.4.2 Personnel Exposures

In accordance with 10 CFR 20.1502(a), *Conditions requiring individual monitoring of external and internal occupational dose*, external exposure dosimetry shall be worn by:

1. Adults likely to receive, in 1 year from sources external to the body, a dose in excess of 500 mrem per year;
2. Minors likely to receive, in 1 year from radiation sources external to the body, a deep dose equivalent in excess of 100 mrem, a lens dose equivalent in excess of 150 mrem, or a shallow dose equivalent to the skin or to the extremities in excess of 500 mrem;
3. Declared pregnant women likely to receive during the entire pregnancy, from radiation sources external to the body, a deep dose equivalent in excess of 100 mrem; and
4. Individuals entering a high or very high radiation area.

Project personnel directly involved with handling of TENORM-impacted soils are required to wear personal dosimetry while working on Site. Dosimetry shall be issued to each radiation worker that will require entry into radiologically controlled areas.

When a dosimeter is issued, the individual will be briefed on its proper use and care. A dosimeter can only be worn by the person to which it is assigned. The dosimeters will be collected at the end of the work activity or at the end of the shift, as required by the RCS. If a dosimeter is lost, the individual shall immediately leave the area and notify the RCS so an investigation can be conducted.

4.4.3 Portable Air Sampling

Airborne particulate surveys shall be performed daily when work is accomplished in OU-1 according to Ameriphysics procedure RCP 4-4, *Airborne Radioactivity Control Program*. With concurrence from the RSO, air sampling may be ceased when it is demonstrated that work does not result in airborne concentrations above 0.1 DAC. The use of personnel air samplers is not anticipated.

The system used for counting air samples shall be capable of achieving a minimum detectable concentration not greater than 10% of the applicable DAC. Because the DAC values for radionuclides present in RIM are so low, it may be necessary to obtain samples for more than one shift or day to obtain sufficient volume.

5 HEALTH PHYSICS CONTROLS

Maintaining personnel exposures ALARA is the primary goal of this Plan. This is accomplished with a combination of engineering and administrative controls.

5.1 Exposure and Contamination Control

Work in areas where radiation and radioactive materials are used or stored shall be performed in accordance with approved procedures and work instructions to ensure the regulatory limits in Section 4.2 are maintained. Ameriphysics procedure RCP 4-1, *Exposure and Contamination Control Procedure*, describes in detail procedures for:

- Working in a radiologically controlled area (RCA);
- Proper use of a radiation work permit (RWP);
- Access control point;
- Shielding;
- Administrative controls;
- Engineering controls; and
- Postings and labels.

A few of the engineering controls that that may be implemented to ensure worker doses are ALARA include:

- Wetting of soil to minimize the suspension of radioactive material;
- Use of berms and coverings as appropriate during operations; and
- Using mechanical equipment to handle contaminated material rather than by hand.

The following lists administrative controls that will be implemented to ensure worker doses are ALARA.

- Work activities will be defined and delineated using a daily permitting system using job-specific RWPs;
- Areas where work will be managed under a RWP are to be designated Permitted Areas;
- Access to Permitted Areas are restricted for radiological reasons, as compared to Controlled Areas which are restricted for any reason (safety, space constraints, etc.);
- All nonessential personnel will be restricted from Permitted Area;
- No eating, drinking or smoking will be allowed in Permitted Areas; and
- Individuals will, to the extent practical, remain up-wind of surface preparation, sampling and material handling operations.

The RCS may change existing engineering and administrative controls to maintain worker protection or improve efficiency (if it does not compromise worker safety). Such changes will be coordinated with the Trihydro Project Manager.

5.2 Surveys and Monitoring

Radiation surveys are performed as necessary to ensure personnel do not exceed radiation exposure limits, to meet requirements for posting radiation areas, and to control the spread of contamination.

These surveys shall be performed at prescribed locations and intervals according to approved procedures. These procedures are described in detailed in Ameriphysics procedure RCP 4-2, *Surveys and Monitoring Procedure*.

All vehicles and equipment entering OU-1 will be surveyed by a qualified health physics technician for alpha and beta contamination before its initial entrance into OU-1 as well as when exiting OU-1. The survey will be conducted using a Ludlum Model 2360 coupled to a Model 43-93 (or equivalent). Wipe samples will be collected, as appropriate, and analyzed on a Ludlum 3030E or equivalent.

Radiological surveys of the drilling and sampling equipment as well as sampling of cores and borehole cuttings or other investigation derived waste will be performed at all drilling/sampling locations (OU-1, OU-2, or offsite).

Surveys of personnel will be performed when exiting a permitted area or exiting any area where potential contamination may be present. A whole-body scan survey of each person will be performed using a Ludlum Model 2360 coupled to a Model 43-93 (or equivalent).

Contamination survey limits are based on Regulatory Guide 1.86, Table 1, *Acceptable Surface Contamination Limits*. Ra-226 and Th-20 limits are the most restrictive at 100 dpm/100 cm^2 total activity and 20 dpm/100 cm^2 removable activity.

5.2.1 Fixed Contamination Surveys

1. Measurement with an instrument and detector appropriate for the type of contamination (alpha, beta/gamma, or both) and the energy of the emission(s).
2. Measured fixed contamination levels are actually the total surface contamination and may include some loose contamination.

5.2.2 Direct Measurements

1. Performed by holding the detector stationary as close to the evaluated surface as practical and counting the surface for a certain amount of time.
2. Results are usually converted to units of disintegrations per minute (dpm) per 100 cm^2.

5.2.3 Scan Surveys

1. Performed by slowly and systematically passing a detector over a surface.
2. Used to search for fixed contamination or when trying to find the most highly contaminated portion of contaminated materials or areas.
3. Technician should listen to the audible response as visual meter indications respond slower than audible indication.

5.2.4 Removable Contamination

Removable contamination surveys shall be performed:

1. Daily: Contamination areas and at access control points;
2. Weekly: Areas where frequent handling of radioactive materials occur; and areas where radioactive material and waste is stored; and
3. In-Process: During any of the following:
   a. Decontamination and release of equipment;
   b. Areas where airborne radioactivity has exceeded the concentrations specified in Ameriphysics procedure RCP 4-4, *Airborne Radioactivity Control Program*; and
   c. When determining the need for anti-contamination clothing and to determine the extent of contaminated areas;

Removable contamination is evaluated by obtaining representative wipes and counting the contamination on the wipe using a Ludlum 3030E or equivalent.

5.3 Survey Instrumentation

An adequate number of calibrated radiation detection and measurement instruments will be available at each project site to make radiation measurements. Instruments shall be calibrated at least annually or after each repair. Instruments will be checked before use according to Ameriphysics procedure RCP 4-3, *Survey Instrument Procedure*.

5.4 Access Control Points

An access control point is a location on the perimeter of a radiation area or contamination area through which all entries and exits are made and where precautions are taken to prevent unnecessary exposure or the spread of radioactive contamination to adjacent uncontaminated areas.

The following items outline the basic considerations for establishing an access control point:

1. Determine the extent of the area to be isolated and the location where entry and exit shall be controlled;
2. Plan for physical boundaries to prevent inadvertent or unauthorized access to the contaminated area. Boundaries shall be conspicuously marked and posted. ;
3. Cover the floor of the contamination control point using paper or plastic sheet or other material provided for this purpose (optional in outdoor areas). The intent is to provide an easily removable walking surface within the contamination control point to prevent tracking of contamination from the area. Maintain a supply of the material to replace floor covering as necessary;
4. Provide a “step-off pad” at the exit from the contamination control point (optional in outdoor locations). This is to be used when removing clothing during exit from the area;
5. Provide easily accessible receptacles for radioactive waste and contaminated clothing, respirators, and equipment at the contamination control point. A supply of plastic bags

shall be available as necessary for receiving contaminated equipment and tools. Radiation tags or labels shall be available to identify contaminated items being removed from the area;

6. Provide radiation detection instruments for monitoring personnel and equipment. Frisking should be performed in a low radiation background and where the audible response of the frisker can be heard;
7. Provide means of recording stay times, as may be required, at the entrance of the areas for personnel. It may be necessary to provide a record of previous radiation exposures received by personnel entering an RCA so that maximum allowable time in the RCA can be determined;
8. At the entrance to the access control point, information shall be posted concerning radiation and contamination conditions, precautions for entry, precautions for exit, step-off points, clothing and waste receptacles, and personnel survey. A copy of the applicable RWP shall be posted at the access control point;
9. Radiological control personnel should maintain the control point;
10. Only personnel in assigned anti-contamination clothing should enter suspected or existing contamination areas;
11. Adequately trained personnel may be permitted to assist in frisking other personnel and themselves; and
12. Contaminated individuals shall be processed in accordance with Ameriphysics procedure RCP 4-9, *Decontamination Procedure*.

5.5 Visitors

Management, technical, and other personnel who require occasional access to RCAs and areas where radioactive materials are stored and who enter these for observation or similar purposes, or to perform work not involving radioactive materials shall have the radiological control training necessary for the radiological conditions expected to be encountered or shall be escorted by appropriately qualified personnel at all times. The RCS or designee will be required escort all visitors, and these personnel are not allowed to receive an exposure exceeding the 10 CFR 20.1301, Radiation Dose Limits for Individual Members of the Public, of 0.1 rem per year or 0.002 rem in any one hour.

6 RECORD KEEPING

Ameriphysics is required to maintain and retain records of the radiation protection program and to make certain notifications. The RSO is responsible for administering the program, and the RCS is responsible for maintaining radiation protection project records generated during the project. Records shall be maintained in accordance with Ameriphysics' Quality Assurance Manual Section 17.

Radiological records are retained according to Table 2.

Table 2. Project Records Retention

Record	Retention Period
Characterization Records	7 years
Background Data	7 years
Calibration Records	Permanent
Instrument Setup Sheets	Permanent
Daily Instrument Checks	Permanent
Survey Logs	Permanent
Survey Raw Data	7 years
Surveys	Permanent
Field Log Books	Permanent
Chain of Custody Forms	Permanent
Laboratory Reports	Permanent
Radiation Work Permit Logs	Permanent
Radiation Work Permits	Permanent
Air Sample Logs	Permanent
Air Sample Results	Permanent
Dosimetry Records	Permanent
Exposure Reports	Permanent
Pathway Models	Permanent

7 EMERGENCY RESPONSE

In the event of a medical emergency, fire, or explosion involving radioactive materials, priority shall always be given to injured personnel and personnel safety, then to combating of the fire itself. Radiological controls shall be secondary to these tasks. The following steps shall be carried out concurrently with each other, although not necessarily in the order given unless specifically required.

7.1 Medical Emergency

Immediately notify the RCS to report the person's injury and location. The RCS is responsible to ensure proper emergency personnel are summoned.

7.1.1 Immediate Actions

1. Do not move any individual who is unconscious or has had a back, neck, or head injury unless they are in immediate, life threatening danger.
2. Check unconscious individuals for respiration and pulse. Administer CPR if individual does not have pulse and respiration. Administer rescue breathing if individual has a pulse but is not breathing.
3. Administer first aid within your training and capabilities. Use a blanket to keep victim warm and apply direct pressure to stop bleeding.

4. After proper notifications have been made and first aid has been rendered, take steps to prepare the individual for transport to an aid station or hospital. Remove protective clothing and collect dosimetry if this can be accomplished without contaminating the individual or interference to responders.
5. Make preparations to support emergency medical personnel when they arrive. Provide lab coats, boots, and gloves to emergency personnel if victim is in contaminated area and if time permits. Do not delay response waiting for protective clothing.
6. Issue self-reading pocket dosimeters (SRD) or other dosimetry if time permits. Do not delay the ambulance personnel response to issue dosimetry.
7. If injured person cannot be surveyed out of contamination area, treat the individual as being contaminated until the individual can be surveyed. Line the stretcher with plastic to contain any contamination. Line the ambulance floor with plastic to contain contamination, if necessary. Do not delay emergency response to place plastic sheeting.
8. If transporting a radioactively contaminated individual, dispatch a health physics technician with the ambulance to provide guidance on controlling contamination in the ambulance and at the hospital. The health physics technician should perform surveys of materials and maintain control of items that may have become radioactively contaminated in the process of treating the injured individual.

7.1.2 Supplementary Actions

Once initial response actions have been completed, take the following supplementary actions:

1. Survey all personnel who entered contaminated areas in response to the injury;
2. Perform surveys of contamination area boundaries where personnel entered and exited to confirm contamination has not been spread as a result of the response;
3. Survey materials and equipment used in response to the injury. Decontaminate or discard items determined to be radioactively contaminated;
4. Restock and restore first aid kits and equipment used in response to the injury;
5. Survey, and decontaminate as necessary, emergency response personnel and equipment including the ambulance, emergency medical personnel, hospital areas, and personnel;
6. Collect any personnel dosimetry issued to medical personnel and other responders. Have dosimeters processed as necessary; and
7. Evaluate the incident and make regulatory notifications as required.

7.2 Fire

For all fires, immediately notify the RCS to report the fire. The RCS is responsible to ensure proper emergency personnel are summoned.

7.2.1 Immediate Actions

1. Immediately notify other area occupants and have them exit the area. On area evacuation, personnel should gather at designated emergency assembly areas to take roll and to identify any missing persons.
2. After proper notifications have been made, take steps to fight the fire if this can be done so without putting yourself in danger. Small fires can be extinguished with portable fire extinguishers by aiming the extinguishing agent at the base of the fire. DO NOT use water on Class B (liquid/oil) fires.
3. De-energize affected electrical circuits if possible to do so without putting yourself in danger.
4. Prepare to support fire-fighting personnel when they arrive. Turnout gear is sufficiently protective that additional protective clothing is not necessary.
5. Issue self-reading dosimeters or other dosimetry if time permits. Do not delay the firefighting response to issue dosimetry.
6. Warn response personnel of possible radiological hazards inside the area including expected contamination and radiation levels. Advise them of any radiation sources which are present which could elevate radiation levels if the shielding failed. Identify potential chemical hazards in the area or area to response personnel.
7. Advise the emergency responders to approach the fire from the upwind side of the area if possible.

7.2.2 Supplementary Actions

Upon completion of initial response actions, take the following supplementary actions to support fire-fighting activities and to return to normal conditions when the fire is under control.

1. Collect air samples downwind from the release of material and in breathing zones of event responders;
2. Take water samples during the fire for assessment of offsite liquid releases;
3. If possible, collect firefighting runoff water in bermed areas or direct it to storm water retention ponds for later analysis and treatment;
4. Establish area boundaries and conduct contamination and radiation surveys to confirm that boundaries are properly located. Establish a step off pad for personnel exiting the area. Update radiological postings to reflect current conditions;
5. Monitor personnel evacuated from the area and near the area during the fire for contamination and decontaminate as necessary. Consider the need for bioassay to evaluate doses to individuals internally exposed;
6. Prepare to survey firefighting personnel and equipment as they exit the area and establish decontamination areas; and
8. Evaluate the incident and make regulatory notifications as required.

7.3 Reports

RCS shall report to the RSO immediately any incidents or emergencies defined by RCM Section 3.5.2, *Notifications of Incidents*. Additionally, the RCS will complete Form HSF 5-2, *Incident Report and Investigation*, which shall be provided to the RSO in accordance with the timeline established on the form. Other documentation required for the incident will be determined by the RSO.