DRAFT FINAL (REVISION 1)

VOLUME 3

HEALTH AND SAFETY PLAN

SITE WIDE GROUNDWATER (OPERABLE UNIT 03)

WEST LAKE LANDFILL SITE

BRIDGETON, MISSOURI

April 22, 2020

Project #: 63N-001-002

SUBMITTED BY: Trihydro Corporation

1252 Commerce Drive, Laramie, WY 82070

ENGINEERING SOLUTIONS. ADVANCING BUSINESS.

30488352

memorandum

To:	West Lake OU-3 Project-Team Members
From:	Ms. Allison Riffel, P.E.
Date:	April 22, 2020
Re:	Health and Safety Plan (HASP) Orientation

The purpose of this memorandum is to provide Trihydro employees and Trihydro subcontractors with a Health and Safety Plan (HASP) orientation, including a summary of the project, its common hazards, minimum personal protective equipment (PPE) required, and 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. Incidents and hazards identified will be documented during daily tailgate safety meetings, recorded on Job Safety Analyses (JSAs) and memorialized in the HASP. This memorandum must be read in conjunction with the site-specific HASP, which contains detailed site hazard and response information.

INTRODUCTION

The West Lake Landfill (the site) was added to the Superfund National Priorities List (NPL) in 1990 and currently consists of three Operable Units (OUs) including former industrial and municipal waste cells and groundwater. Operable Unit 1 (OU-1) is comprised of areas that have been identified as containing radiological impacted material (RIM), and includes Area 1, Area 2, the Buffer Zone, and Lot 2A2 (USEPA ID#MOD079900932). Operable Unit 2 (OU-2) is the remainder of the site including the closed construction and demolition (C&D) Landfill, Inactive Sanitary Landfill, and the Bridgeton Landfill. Operable Unit 3 (OU-3), which is the focus of the Remedial Investigation/Feasibility Study (RI/FS) for which this HASP has been prepared, includes groundwater at or surrounding the site that may have been impacted by contaminants at the site. The OU-3 RI/FS is underway and anticipated to extend through 2023.

Access to OU-1 areas is restricted to trained personnel under the OU-1 Radiation Safety Plan. 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 areas:

- Area 1
- Area 2
- Closed Demolition Landfill

- Inactive Sanitary Landfill
- The Bridgeton Landfill (North and South Quarries)

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

The West Lake Landfill site 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 at various locations at the site 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) (Herst & Associates 2005).

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 (Herst & Associates 2005). The landfill was not officially permitted for use as a sanitary landfill until 1952. USEPA 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" (USEPA 1989). USEPA 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. USEPA 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.

This project HASP has been developed specifically for the OU-3 RI/FS field scope of work. When Trihydro personnel and subcontractors enter OU-1 (for well surveying, inventory, and groundwater gauging/sampling), personnel will follow the March 30, 2020 OU-1 Radiation Safety Plan (RSP) prepared by Ameriphysics and the September 2019 OU-1 Emergency Response Plan. Note, the RSP for OU-1 is currently being updated, and this HASP for OU-3 will accordingly be updated with the latest version of the RSP once that document is finalized.

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 to determine the potential risk posed by such releases to human health and the environment. The objectives of the RI/FS are to refine the current understanding of the hydrogeologic system at and around the site, 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 OU-3 RI field investigation may include, but is not limited to, the following tasks: well inspection and surveying, surficial and subsurface geologic investigations and sampling, monitoring well/soil boring drilling and installation, fluid level gauging, aquifer pump and slug testing, groundwater sampling, leachate sampling, indoor air testing, surveying/global positioning system (GPS), vapor intrusion investigations, ecological assessments, and routine site visits.

Updates to this HASP will be completed to add new tasks as necessary during implementation of the RI and subsequent FS activities.

MINIMUM/ANTICIPATED PERSONAL PROTECTIVE EQUIPMENT (PPE)

The minimum PPE for this project is listed below. Refer to the HASP and task-specific Job Safety Analysis (JSA) forms for additional anticipated PPE as entering OU-1 requires additional safety measures and PPE.

- Safety-toed boots
- Safety glasses
- Hard hat
- Work gloves
- Chemical resistant gloves (as needed)
- 4-Gas meter (as needed)
- H_2S monitor (as needed)
- Photo-ionization detector (PID) (as needed)
- Hearing protection (as needed)
- High-visibility vest

The requirements for working within the OU-1 area are outlined in the attached OU-1 Radiation Safety Plan and OU-1 Emergency Response Plan.

TRAINING/DRUG SCREENING REQUIREMENTS

- Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response (OSHA HAZWOPER) 40-Hour Training
- Radiation Awareness Training (see OU-1 RSP)
- Radiation Worker Training (Designated Radiation Workers – see OU-1 RSP)
- Bridgeton Landfill On-site Orientation

The drug consortium (a third-party administrator that manages Trihydro's drug and alcohol testing) 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, including prescription medications. Employees found under the influence of or having consumed such 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), including GPS devices, 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-001-002

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		April 22, 2020
Reviewer's Name	Reviewer's Signature	Date

Project Manager:

Allison Riffel		April 22, 2020
Final Reviewer's Name	Final Reviewer's Signature	Date

PRE-ENTRY BRIEFING ACKNOWLEDGEMENT

I certify that I have read and understand the contents of this Health and Safety Plan (HASP) for West Lake Landfill OU-3, and reviewed appropriate Job Safety Analysis (JSA) forms, site 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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1.0 EMERGENCY RESPONSE PLAN

If working within OU-1, Trihydro Corporation (Trihydro) personnel will follow the OU-1 Radiation Safety Plan and OU-1 Emergency Response Plan (Appendix D) in addition to the requirements below.

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 Trihydro personnel are trained in CPR and first aid:

Allison Riffel	Kelly Birkenhauer
Michael Sweetenham	Charles VanHeuvelen
Drew Caschette	John Alten

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 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	THERE ARE NO SITE ALARMS AT THE WEST LAKE LANDFILL

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 or #2 Primary Muster Point, as appropriate, as discussed in daily tailgate meeting
Secondary:	Bridgeton Landfill Office, as discussed in daily tailgate safety meeting
Tertiary:	Forshaw Earth City Warehouse (13200 Corporate Exchange Drive, Bridgeton, MO), 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 Principal, Gary Risse ..... (678) 428-5308 cell
Project Manager (PM), Allison Riffel ..... (303) 818-6032 cell
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

Erin Fanning, Division Manager, Bridgeton Landfill, LLC ..... Cell: (209) 227-9531

Federal/Government Contacts

Environmental Protection Agency (USEPA) 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 OU-3 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 through1-10, and post in a central location on site (if available).***
- Team members need to have their WorkCare™ contact cards available.
- When present, the PM, or other Trihydro representative, needs to accompany the injured employee to the hospital.
- WorkCare™ needs to be contacted by a project-team member 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 primary 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 both verbally and in writing to Trihydro's PM and Corporate Health and Safety (H&S) Office any incidents or near misses resulting in personal or public injury, environmental impact, or property damage to the site, materials, or equipment, including motor vehicles owned by Trihydro or its subcontractors. 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 OU-3 Project Coordinator 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 of personnel or equipment, 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, OSHA-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 materials)
- Security (e.g., vandal – damages, burglaries, break and enters, robberies, thefts, public disturbances, trespasses)
- Vehicle (e.g., vehicle accidents, cars/pickups/trucks, drill rigs)

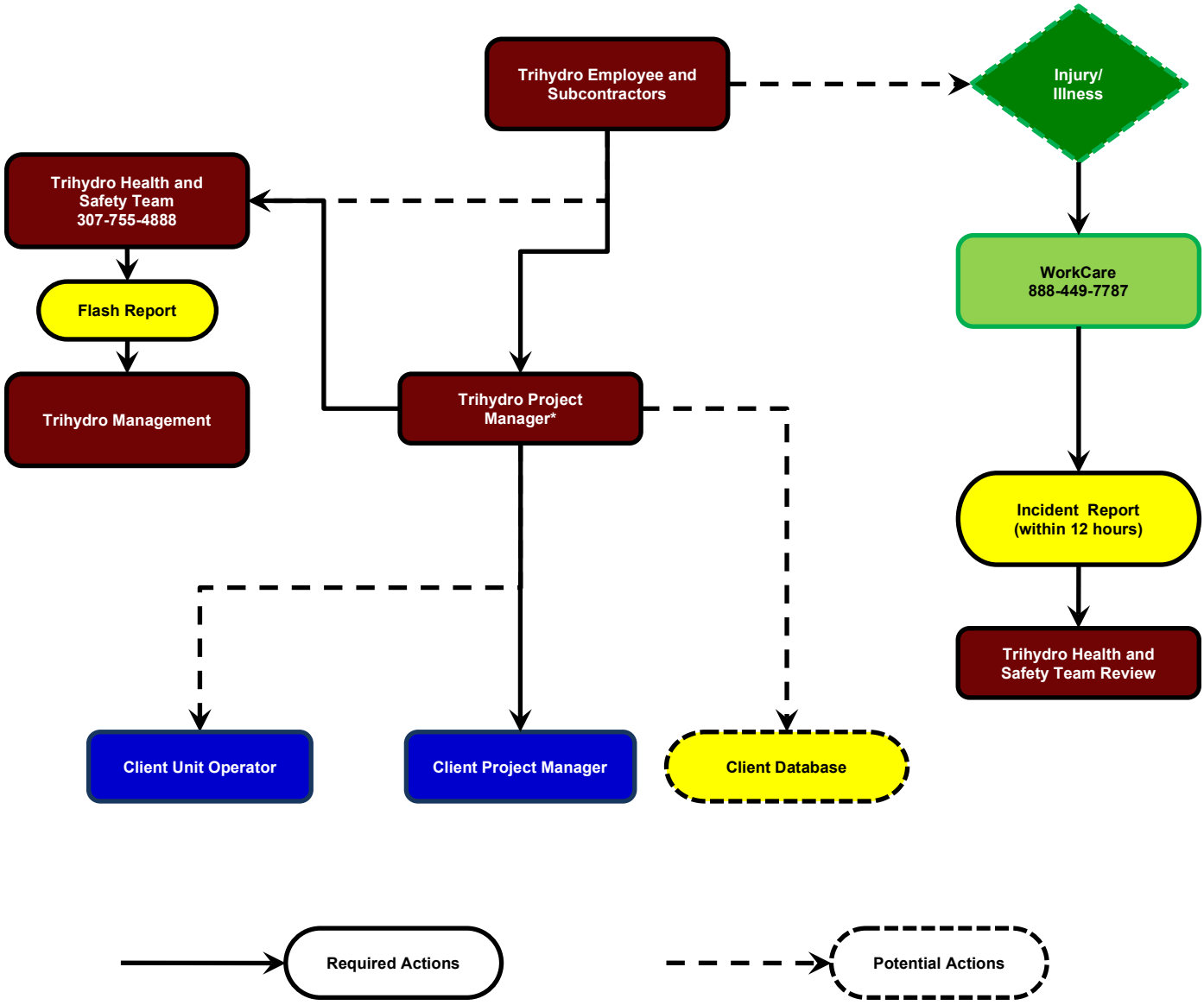
Incident and accident reporting are important for the following reasons:

- 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 so they can be updated.

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**.

Additional incident reporting requirements are highlighted in the OU-1 ERP. This document can be found in **Appendix D**.

1.6 INCIDENT REPORTING FLOWCHART



The Trihydro PM is to notify the client representatives.

It is crucial that 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: April 21, 2020

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 employee's 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 (9311), if applicable
  - Notify the Trihydro H&S Office using the Safety Response Line (307) 755-4888
  - Notify the PM
  - Notify the employee's 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 1-3.

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. 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 OU-3 HASP applies to the site specified and those tasks and operations identified in Section 2.0.

2.3 PURPOSE

The purpose of this OU-3 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 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. In the event of multiple applicable standards, 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**.
- The OU-1 Radiation Safety Plan and OU-1 Emergency Response Plan have been prepared and will be followed while working within OU-1. See **Appendix D**.
- Safety Data Sheets (SDSs) / Material Safety Data Sheets (MSDS). See **Appendix E**.

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
☒ Aquifer Test/Pumping Test	☐ 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
☒ Data Logger Deployment Retrieval	☒ Hydraulic Direct Push Sampler	☒ Well Abandonment
☒ Drilling Oversight	☒ Management of IDW	☐ Well Bailing
☐ Dump Truck Loading	☒ Leachate Sampling	☒ Well Development
☐ Dump Truck Operations	☒ Site Visit	☐ Well Replacement
☒ Ecological Survey	☒ Other: Sub-slab Vapor Probe Installation	
☐ Flume Sampling	☒ Other: Soil Vapor Sampling	

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	☒ Radium (Radon)
☐ Acrylonitrile	☐ Fly/Coal Ash	☐ Methane, Compressed	☐ Simple Green
☐ Anhydrous Ammonia	☐ Fuel Oil	☐ Methanol	☐ S-K 105 Solvent
☐ Aniline	☒ Gasoline	☐ Methyl Methacrylate	☐ Sodium Hydroxide
☐ Aromatic 150	☐ Grease	☒ Methylene Chloride	☐ Sodium Phosphate Monobasic
☒ Asbestos	☒ Hexane	☐ Methyl Isobutyl Ketone	
☒ Benzene	☐ Hexanone	☐ Motor Oil	☐ Surflan
☐ BTEX Calibration Gas	☐ Hydraulic Oil/Fluid	☐ MTBE	☐ Survey Marker Paint
☐ Celtone	☐ Hydrochloric Acid	☒ Nitric Acid	☐ Tetrahydrofurane
☒ Chloroform	☐ Hydrofluoric Acid	☐ Nitrogen, Compressed	☒ Toluene
☐ Coal	☐ Hydrogen	☐ Nitrogen, Liquid	☒ Trichloroethane
☐ Coal Fly Ash	☐ Hydrogen, Compressed	☐ Oxygen, Compressed	☐ Triethylamine
☐ Coke	☐ Hydrogen Chloride	☐ Perchloric Acid	☐ Vinyl Acetate
☐ Crude Oil	☐ Isobutane	☐ Phthalic Anhydride	☒ Vinyl Chloride
☒ Dichloroethane	☒ Isobutylene	☐ Propane	☒ Xylene
☒ Diesel Fuel	☒ Isopropyl Alcohol	☒ Other: 1,1-Dichloroethane	
☐ Dimethyl Sulfide	☐ Kerosene	☒ Other: Non Flammable Gas Mixture	
☐ DIPE	☐ Lead	☒ Other: Tetrachloroethene	
☐ Ethanol	☐ Lead Acid (Battery)	☒ Other: 1,1,2-Trichloroethane	
☒ Other: Trans 1,2-DCE	☒ Other: Cis 1,2-DCE	☒ Other: 1,2-Dichloroethane	
☒ Other: Carbon tetrachloride	☒ Other: Methyl ethyl ketone	☒ Other: 1,1,1-Trichloroethane	
☒ Other: Isopropyl Alcohol	☒ Other: Chromium	☒ Other: Trichloroethylene	

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). Trihydro employees and subcontractors should have certification in the 40-hour HAZWOPER course and, if staff will be performing supervisory duties, the 8-hour supervisor's course.

Employees entering OU-1 will be required to have Radiation Awareness Training as required by the OU-1 RSP. Employees who are designated as Radiation Workers will be required to have Radiation Worker Training as required by the OU-1 RSP. There is the potential to encounter asbestos during drilling activities. Employees conducting intrusive activities will undergo 2-hour asbestos awareness training.

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 Trihydro'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 Trihydro PM 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 Project Site Health and Safety Officer (PSHSO) as necessary to determine the effectiveness of the site HASP. Deficiencies in the effectiveness of the site HASP will be corrected by Trihydro.

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:

- Vehicle Operation
- Borehole Clearance
- Monitoring Well/Soil Boring Drilling (Sonic Rig and CPT Technology Rig)
- Soil/Bedrock Sampling
- Well Construction
- Well Inventory and Repair
- Well Development
- Well Abandonment
- Ecological Field Survey
- Fluid Level Gauging
- Slug Testing and Aquifer Pump Testing
- Groundwater Sampling
- Leachate Sampling
- Installation and Monitoring of Staff Gauges
- Vapor Sampling
- Surveying/GPS
- Routine Site Visits

3.1 SITE MAP

A site map (**Figure 3-1**) is provided for project-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 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. Prior to entering OU-1, Trihydro and its subcontractors will coordinate with the Radiation Safety Officer for access and radiation safety coverage. See the OU-1 RSP for detailed procedures with accessing the OU-1 areas.

3.3 SITE SECURITY

For client-controlled sites, Trihydro employees and subcontractors will follow the client's security policies and procedures. At any time that a Trihydro employee or subcontractor observes a breach in site security measures or suspicious activities that contradict security protocol, the notification process specified in this HASP will be initiated, followed by reporting the situation 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:	Gary Risse
Project Manager (PM):	Allison Riffel
Project Site Manager:	Michael Sweetenham
Project Site Health and Safety Officer* (PSHSO):	To be identified based on field personnel onsite each day
Trihydro Team Members:	Charles VanHeuvelen
	Kelly Birkenhauer
	John Alten

*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 Field 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 OU-3 HASP.
- Communicate to workers their expected tasks/duties.
- Note weather conditions.
- Identify and schedule training.
- Calibrate air and personal monitoring equipment.
- Identify and remove hazards where possible.
- Make PPE available.
- Monitor activities for the proper use of PPE specified in this OU-3 HASP, such as respirators with appropriate filters and/or canisters, protective coveralls, gloves, safety boots, protective eyewear, ear plugs, and hard hats.
- 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 OU-3 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
- ☒ ***Other:*** Face Masks
- ☐ ***Other:*** _____

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 (based on PID readings this may be required)
- ☐ Full-Face Respirator
- ☐ Chemical Cartridge
- ☐ Particulate Filter
- ☒ Cartridge/Filter Combo
- ☐ Ammonia Cartridge
- ☐ H_2S Escape Cartridge
- ☒ Asbestos Filter (P100/HEPA)

Hearing Protection

- ☒ Ear Plugs
- ☐ Ear Muffs

Biological Protection

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

*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: _____ *(Specify)*	☒ Temperature Gauge
☐ Other: _____ *(Specify)*	☐ Other: _____ *(Specify)*	☒ Photoionization Detector (PID)
		☐ Flame-Ionization Detector (FID)
		☐ Other: _____ *(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 photoionization detector (PID) or flame ionization detector (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 Trihydro 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.

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, and hydrogen sulfide.

Trihydro personnel working within the landfill area will utilize a BW Gas Alert Microclip or similar meter. Off-site work areas may also require utilization of the multi-gas meter. This decision will be based on preliminary field readings. The multi-gas meter will be equipped with the following pre-set alarm levels as noted in the manual (**Appendix J**):

Gas	TWA	STEL	Low	High
O_2	N/A	N/A	19.5% vol.	23.5% vol.
LEL	N/A	N/A	10% LEL	20% LEL
CO	35 ppm	50 ppm	35 ppm	200 ppm
H_2S	10 ppm	15 ppm	10 ppm	15 ppm

A self-test will be performed daily, which includes a sensor test, power test, and auto-zero and oxygen calibration, upon startup of meter. The meter will be calibrated every 6 months or if necessary as part of troubleshooting.

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 is located **Appendix J**.

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 is located **Appendix J**.

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. For the OU-3 RI/FS work, a flow-through meter will be used to collect DO, ORP, pH, conductivity, temperature, and turbidity data.

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 uses an optical device in which dissolved oxygen affects the magnitude of the luminescence of chemical dyes within the DO sensor. The DO probe emits a light resulting in luminesce, which is at the maximum value when DO readings are low. The luminescence decreases as higher DO is present.. It records the DO 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. A pH meter will be used at the site during groundwater and leachate sampling.

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 current is applied across the sensor. The meter then converts the current reading into temperature.

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
- ☒ Silica 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)
- ☒ COVID-19
- ☒ 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 (when working near surface water bodies as part of OU-3 staff gauge installation and monitoring), 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.** Workers who enter confined spaces must be trained prior to entry. 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, administrative controls, and/or PPE.

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, and puncture risks, and then selecting the appropriate glove based on material, thickness, length, and other traits. The site may have strict guidelines for proper glove selection, so check with the 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!

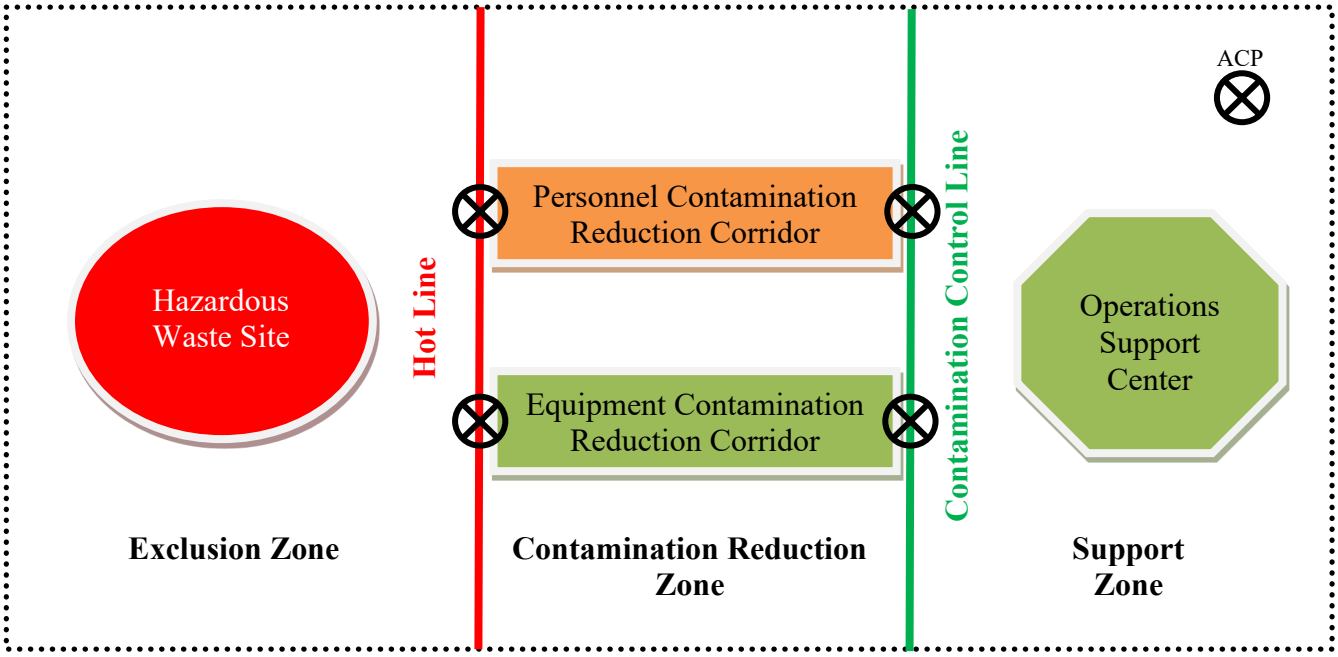
7.3 WORK ZONE ACCESS

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 work zone for OU-3 work is defined as the 30-foot radius surrounding field personnel. 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 OU-3 intrusive operations, it may be necessary to set up work zones to control chemical exposures and prevent the public from entering the work zone. The site currently has these areas designated by fencing and signage at OU-1 Areas 1 and 2. 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 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

The Trihydro Project Manager will strive to avoid lone worker situations. In the instance that a worker is unaccompanied, Lone Worker Safety Procedures will be established by the PM to provide an effective means of communication between a single field team member and the project management group. 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, or creating a trip hazard.
- 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.
- Equipment will be stored and secured outside the work zone until use is required.
- Ice will be removed or treated with sand 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 any of the following situations are encountered:

- Loose, irregular surfaces, such as gravel, shifting floor tiles, and uneven sidewalks can make it difficult to maintain 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 a worker 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 vision and impair your balance.
- Inattention and distraction interfere with awareness of these hazards and increase 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, 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 three 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 safety data sheets (SDSs) or material safety data sheets (MSDSs) for each substance in the workplace. OSHA has updated the requirements for SDSs (formerly known as MSDSs) effective on 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 are required to have pictograms [consisting 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.

If a potentially hazardous material is encountered that the employee is not familiar with, the employee will review the SDS/MSDS for that material. Specifically, the employee must 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**. Two particular on-site hazards are:

- 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 there are 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 Hazardous Materials Identification System (MIS) 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 (if generated during OU-3 activities) 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 ASBESTOS HAZARDS

There is a potential for asbestos exposure at this site; therefore, employees need to be aware of potential asbestos hazards. Once asbestos fibers are trapped in the body, the fibers can cause serious health hazards. The most common way for asbestos fibers to enter the body is through inhalation. If asbestos is unearthed or disturbed during site activity employees will immediately stop work and evacuate the area and notify the appropriate client personnel.

If soils that may have been mixed with asbestos are encountered, they will be kept adequately wet (sufficiently mixed or penetrated with water to completely prevent the release of particulate material into the ambient air), and workers will work upwind of activities.

Additional requirements under the OSHA's asbestos standards include training, exposure assessment, hazard communication (Signage), PPE, special work practices, medical surveillance, and recordkeeping.

OSHA's Asbestos Standard is an exposure-based standard, and as such, the regulations are not limited to only activities involving asbestos containing materials (ACM) that have greater than 1% asbestos, but materials with trace to 1% asbestos may also be subject to the OSHA standard if workplace air concentrations exceed the OSHA permissible exposure limit (PEL):

- The permissible exposure limit (PEL) is 0.1 f/cc of air, on an 8-hour time weighted average (TWA). TWA means exposure concentration averaged over an 8-hour period.
- An excursion limit (EL) of 1.0 f/cc, over a 30-minute TWA. This number is also known as a Short-Term Exposure Limit, or STEL.

7.8 NATURAL DISASTERS

7.8.1 TORNADOS

If the work area is are under a tornado WARNING, seek shelter immediately! The location of the nearest shelter will vary depending on whether a worker is on-site or off-site.

7.8.1.1 IF INDOORS

- Go to a pre-designated shelter area such as a safe room, basement, storm cellar, or the lowest building level. There are several on-site tornado shelters as shown on **Figure 3-1**. For workers that are off-site, identify a nearby publicly accessible building.
- 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.

7.8.1.2 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.

7.8.1.3 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; it is safer to lie 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.

7.9 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

7.9.1 HEAT STRESS

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

7.9.1.1 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.

7.9.1.2 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

7.9.1.3 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**.

7.9.2 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.

7.9.2.1 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 it cannot be 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).

7.9.2.2 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

7.9.2.3 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.**

7.10 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.

7.10.1 LIFTING PROCEDURES

Back injuries can happen as quickly as one wrong move. Lifting and carrying objects can be safer by taking the following steps:

- 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.

7.11 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.

7.12 RADIATION HAZARDS

Site workers should refer to Trihydro's Ionizing Radiation Program and the OU-1 Radiation Safety Plan included in **Appendix D** to this OU-3 HASP that presents the specific radiological requirements that will be met while potentially contacting materials 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.

Areas 1 and 2 are operated under one radiation safety plan that is managed by OU-1. OU-3 will adhere to the OU-1 HASP and RSP when working within OU-1. The OU-1 RSP includes radiation hazards, PPE, and warning signs.

7.13 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. 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.

7.14 SILICA HAZARDS

Crystalline silica is a common mineral found in many naturally-occurring and man-made materials used at project sites (e.g., sand, concrete, brick, block, stone, and mortar). Amorphous silica, (e.g., silica gel) is not crystalline silica. Respirable crystalline silica is generated by high-energy operations like cutting, sawing, grinding, drilling, and crushing stone, rock, concrete, brick, block and mortar, or during abrasive sand blasting.

Breathing crystalline silica particles can causes diseases, including silicosis, an incurable lung disease that leads to disability and death. Respirable crystalline silica also causes lung cancer, chronic obstructive pulmonary disease (COPD), and kidney disease.

Silicosis typically occurs after 15 to 20 years of occupational exposure to respirable crystalline silica. The Occupational Safety and Health Administration (OSHA) Respirable Crystalline Silica standard for general industry and construction requires employers to limit worker exposures to respirable crystalline silica and take other precautionary steps to protect workers.

OSHA lists an occupational exposure limit (OEL) for respirable crystalline silica (including quartz) at 0.025 milligrams per cubic meter (mg/m3). This is a concentration to which workers could be exposed for 8 hours a day, 5 days a week, without adverse health effects. However, as a suspected carcinogen, crystalline silica is also an "As Low As Reasonably Achievable" (ALARA) substance, and exposures must be reduced to ALARA levels below the OEL. The OSHA Respirable Crystalline Silica Standards apply to all occupational exposures to Respirable Crystalline Silica work, except where employee exposure will remain below 25 micrograms of Respirable Crystalline Silica per cubic meter of air (25 µg/m3) as an 8-hour time-weighted average (TWA).

Trihydro uses various methods to assist with assessing possible and actual silica exposures. These methods include, but may not necessarily be limited to:

- Reviewing data/reports available in the public domain (i.e., information available through regulatory agencies and industry associations).
- Regularly consulting with safety resources/client safety managers from companies that perform similar work.
- Implementing a respirable silica exposure monitoring program. This program will check that (over time) Trihydro has quantifiable silica exposure data available that is representative of regularly occurring, as well as reasonably foreseeable work activities. Exposure monitoring will generally be conducted "in-house," although assistance (i.e., monitoring and/or interpretation of results) may be obtained through outside consultants.

When possible and applicable, Trihydro will conduct activities with potential silica exposure to be consistent with OSHA's Construction Standard Table 1, which is included in Trihydro's Crystalline Silica Exposure Control Policy, Program & Procedure. Project managers will check exposure levels for each employee under their supervision who is engaged in a task identified on OSHA's Construction Standard Table 1.

During project activities, teams will have fully and properly implemented the engineering controls, work practices, and respiratory protection specified for the task in Table 1 (unless Trihydro has assessed and limited employee exposure to Respirable Crystalline Silica in accordance with the Alternative Exposure Control Methods Section of this program). Engineering Control Methods including elimination wet methods, operator isolation, and personal protective equipment (PPE) will help project-team members stay safe.

7.14.1 WET METHODS

Wet-spray methods can greatly reduce silica exposure levels of team members and the general public who work near operations that may produce silica dust. Wet methods should use the following guidance:

- Locate nozzles upstream of dust generation points.
- Position nozzles to thoroughly wet the material.
- Check that the volume and size of droplets is adequate to sufficiently wet the material (optimal droplet size is between 10 and 150 µm).
- Ensure nozzles provide complete water coverage but are not so far that the water is carried away by wind.

7.14.2 OPERATOR ISOLATION

Operator isolation includes using either an enclosed booth or a remote-control station. Operators using machines with enclosed cabs can limit their silica exposure by staying inside the cab during operations. The enclosed cab must:

- Be well-sealed and well-ventilated using positive pressure.
- Have door jambs, window grooves, power-line entries and other joints that work properly and are tightly sealed.

7.14.3 RESPIRATORY PROTECTION

An air purifying respirator fitted with HEPA cartridges is the most common PPE provided and used by Trihydro to minimize exposure to silica dust. Depending on the effectiveness of other engineering control measures, either a "full-face piece" or "half-face piece" respirator will be used by personnel (most situations will require a half-face respirator).

When working indoors or in other areas with poor ventilation, a full-face respirator may be required. Both respirators are "seal dependent," and thus the users must be "fit tested" and clean shaven where the respirator seals to the face.

7.15 DRILLING ACTIVITIES

Before any subsurface activities, Trihydro employees involved will complete Trihydro's Subsurface Utility Location and Excavation best practices training.

Potential hazards that may be encountered by workers performing drilling activities associated with OU-3 include encountering municipal solid landfill wastes, wastes that may contain asbestos containing materials (ACM), and radiologically-impacted material near/within Area 1. Based on Trihydro's planned scope of work, these hazards should not be encountered. However, should the unexpected occur, all work will cease, workers will exit the area, and Trihydro will defer and adhere to the existing health and safety policies/procedures for OU-1 **(Appendix D**) (See Section 6.1.4.3).

When performing hollow stem auger, flight auger, air rotary, casing hammer, mud rotary, sonic, cone penetrometer test drilling, or direct push drilling operations, the following applies:

7.15.1 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.

7.15.2 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.

7.15.3 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.

7.15.4 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.

7.15.5 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.

7.16 TRAFFIC HAZARDS

7.16.1 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-road, 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 two years.
- Employees are expected to complete a Journey Assessment Form found on the Trihydro H&S Web site before departure when traveling outside of 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.

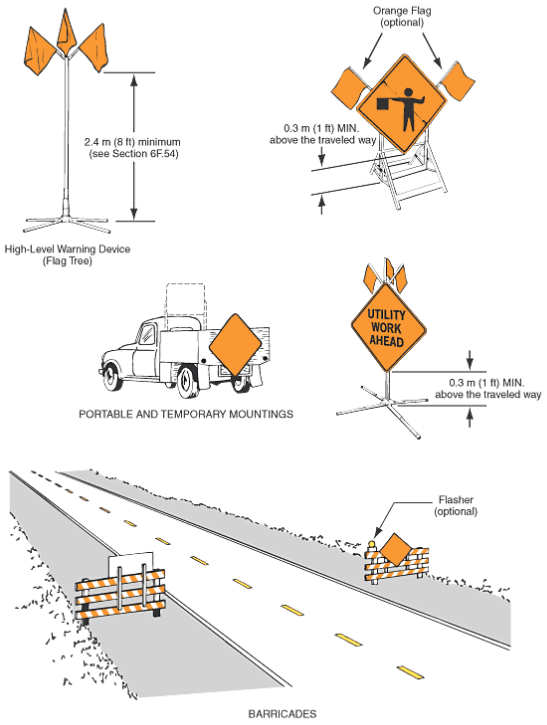
- Employees will enter and exit through the gates or pathway provided and designated for this use.
- Keys to unattended vehicles and equipment will be left in the ignition so the vehicles and equipment can be moved as necessary (on unsecured sites, this is at the discretion of the PM). Where applicable, 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.

7.16.2 VEHICULAR SAFETY

The protection of project-team members from vehicular hazards 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 (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.

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



- 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 one 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.

7.17 BIOLOGICAL HAZARDS

7.17.1 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.**

7.17.2 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.

7.17.3 HISTOPLASMOSIS

Although histoplasmosis is usually associated with bird and bat droppings, it actually is caused by a fungus. Histoplasmosis infects a person through inhalation of 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.

7.17.4 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.

7.17.5 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.

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.

7.17.6 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.

7.17.6.1 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.

7.17.6.2 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.

7.17.6.3 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.

7.17.6.4 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.

7.17.7 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.

7.17.7.1 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.

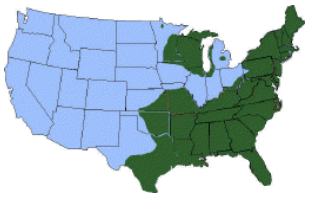
7.17.7.2 FIRST AID AND MEDICAL TREATMENT

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”).

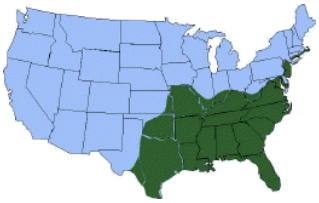
7.17.7.3 TICK IDENTIFICATION

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.

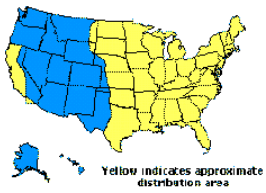
The following ticks can be considered a hazard at the project site:



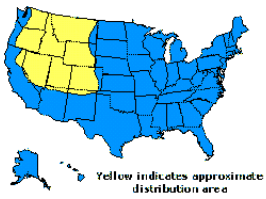
☒ Deer Tick (Range in Green)



☒ Lone Star Tick (Range in Green)



☒ Dog Tick (Range in Yellow)



☐ Rocky Mountain Wood Tick (Range in Yellow)

7.17.8 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.

7.17.9 COVID-19 HAZARD

COVID-19, a form of coronavirus, is a respiratory illness that can spread from person to person. Caused by exposure to the SARS-CoV-2 virus, symptoms can appear **2-14 days after exposure** based on information from the Center for Disease Control (CDC). These symptoms may include fever, dry cough, and shortness of breath. Trihydro personnel and subcontractors will be required to notify team members of any COVID-19 symptoms prior to initiating field work daily.

To prevent the virus from spreading, Trihydro follows the CDC, NIOSH, U.S. and State Department of Health, and client recommendations regarding personal hygiene and precautions. The following measures can help protect employees on and off the job:

- Practice proper housekeeping and sterilization measures.
- Frequently wash hands with soap and water; if soap and water are not available, use alcohol-based hand sanitizer with at least 60% alcohol.
- Avoid touching eyes, nose, or mouth with unwashed hands.
- Avoid close contact with people who are sick.
- Stay home when sick and report flu-like symptoms to supervisor immediately.
- Adhere to the social distancing requirement of 10 people or less (CDC). If a larger work group is required, use "bubbling" or compartmentalization (e.g., assign smaller groups different tasks in different areas in the building or project site) to reduce potential of workforce exposures.
- Maintain a distance of at least 6 ft or whatever distance meets current CDC recommendations.
- Don a cloth face mask that meets current CDC guidance (https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/diy-cloth-face-coverings.html).

If an employee develops **early warning signs** or suspects they may have contracted COVID-19, the employee will seek **medical attention immediately**. Emergency warning signs include trouble breathing, persistent chest pain or pressure, headache, fever, confusion, or bluish lips or face. This list is not all inclusive; please consult WorkCare™ for other severe or early warning symptoms. Trihydro employees and subcontractors that contract COVID-19 will not return to work until they meet current CDC recommendations for returning to work.

Additional information on COVID-19 and Trihydro's Pandemic Prevention Plan can be found in Appendix K and on Trihydro's COVID-19 News & Response Plan SharePoint Website. Employees will also follow all applicable site-specific policies from Bridgeton Landfill, LLC. If a task cannot be safely performed under the restrictions and safety requirements for COVID-19, Stop Work Authority will be used to allow the project team to identify alternatives and communicate path forward with site personnel.

7.17.10 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 sought immediately. A cloth dampened with cold water or filled with ice may be applied to the bite while awaiting help.

7.17.10.1 BROWN RECLUSE (LOXOSCELES RECLUSA)

The Brown Recluse spider 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.

7.17.10.2 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 rattlesnake), 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.

7.17.11 POISON OAK/IVY/SUMAC

Reaction to poisonous shrubs is an allergic response and ranges from no reaction to a severe “rhus” dermatitis. Rhus is the class of poisonous plants which also includes poison ivy and poison sumac, mango, and other urushiol containing plants.

Shrubs are usually 12" to 30" high, or a tree-climbing vine, with triple leaflets and short, smooth hair underneath. Early berries are fuzzy and white; later, dun-colored. Plants are red and dark green in spring and summer with yellowing leaves anytime, especially in dry areas. Leaves may achieve bright reds in fall, but the plant loses its (yellowed, then brown) leaves in winter, leaving toxic stems. All parts of the plant remain toxic throughout the seasons.

Primary contamination results from contact with bruised or broken plant parts that release "toxicodendrol," an oily resin containing the toxic chemical "urushiol."

Poison Ivy

Poison Sumac

Poison Oak

The best way to prevent exposure is to recognize the plants and avoid working in areas where poisonous shrubs are present. If you will work in areas with poisonous shrubs, contact your PSHSO to determine the best procedures to prevent contamination.

7.17.11.1 FIRST AID

If there is exposure, use the following first aid procedures or others you may find to alleviate the pain and itch.

- Keep your hands away from your eyes, mouth, and face
- Do not scratch or rub the rash
- Apply one of these to the skin rash:
  - Calamine (not Caladryl) lotion
  - Zinc oxide ointment
  - Paste made with baking soda - mix 3 teaspoons of baking soda with 1 teaspoon of water
- Take an over-the-counter antihistamine such as Benadryl, as stated on the label

If self-care/first aid measures do not bring relief, or for extreme cases of exposure, contact your doctor.

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.

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 subcontractor 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 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.
- Provide 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 one year.

9.0 DECONTAMINATION PROCEDURES

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 contamination reduction zone (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 outside of OU-1 (see **Appendix D** for decontamination procedures for within OU-1):

- 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 will be 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) will be 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 will be 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

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 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

[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.

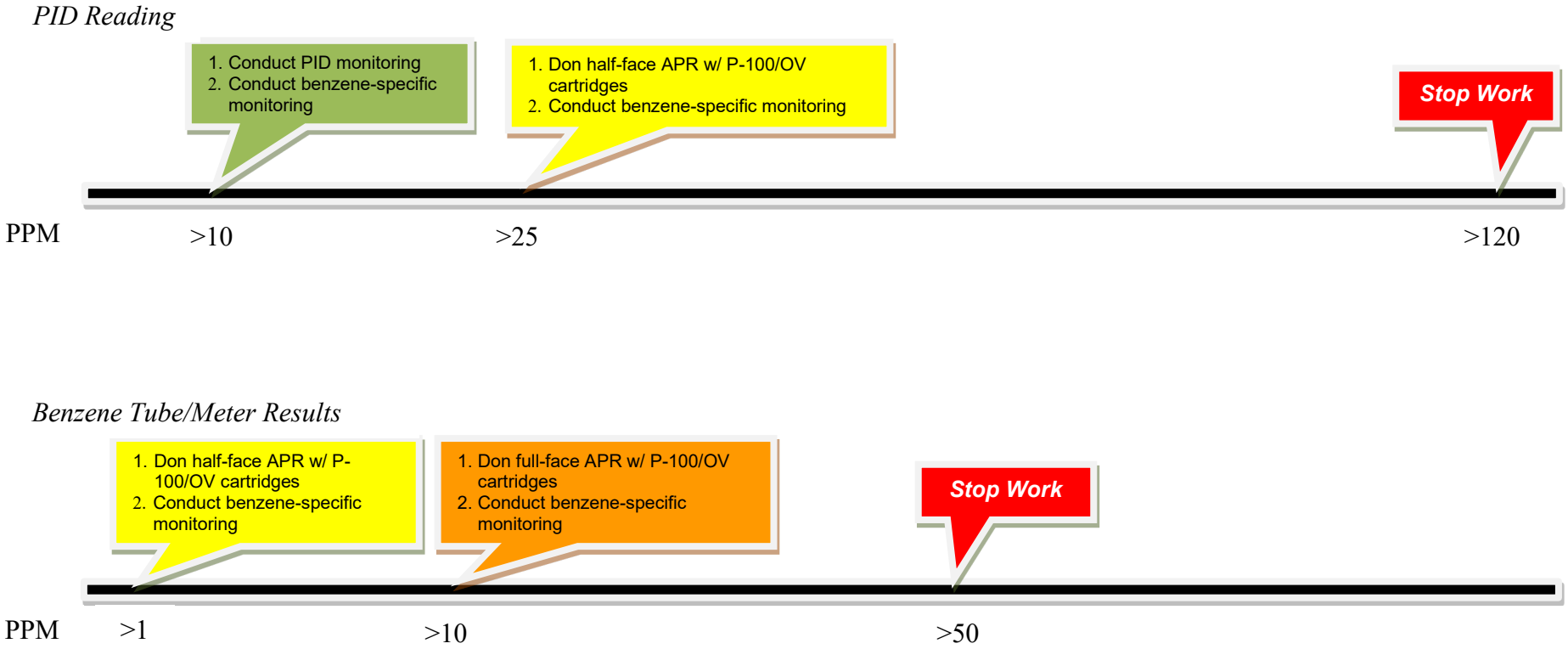
If both tables apply to a particular site, the lower of the two exposure limits will be used.

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.



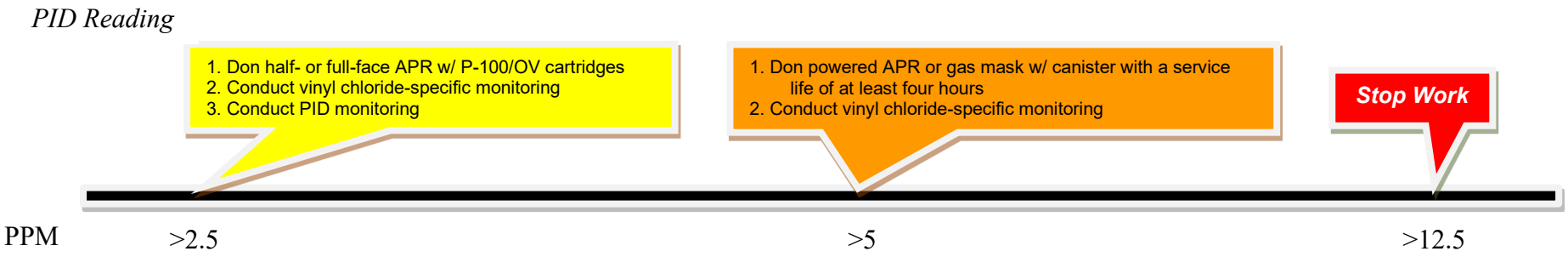
PID Action Levels, Petroleum Hydrocarbon Sites (10.6 eV Lamp calibrated with 100 ppm isobutylene)

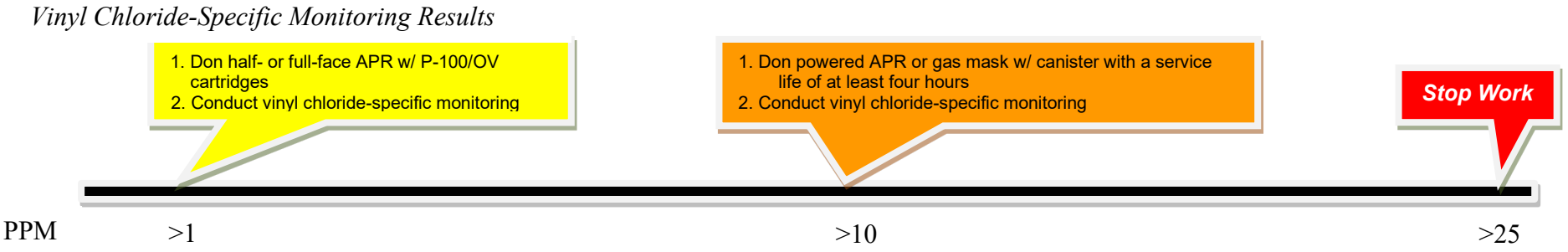
10.6 eV Lamp calibrated with 100 ppm isobutylene span gas
Reference: Benzene STEL of 5 ppm, IDLH of 500 ppm, and correction factor of 0.53

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

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.

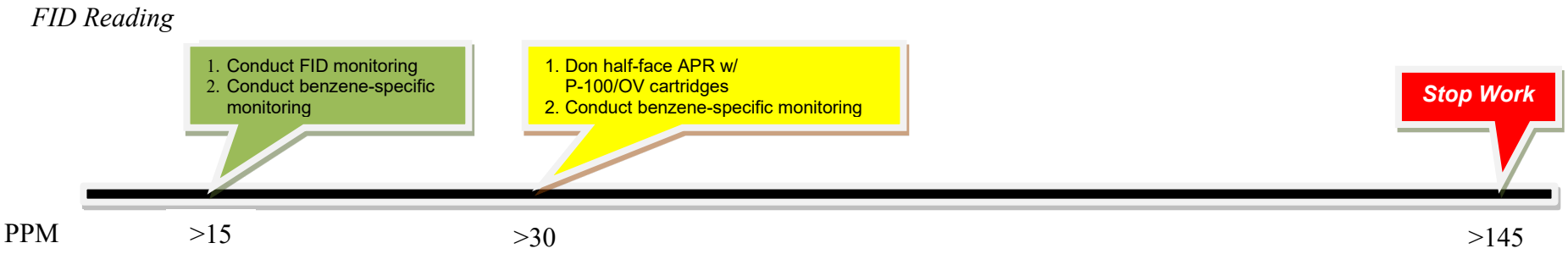
If both tables apply to a particular site, the lower of the two exposure limits will be used.

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

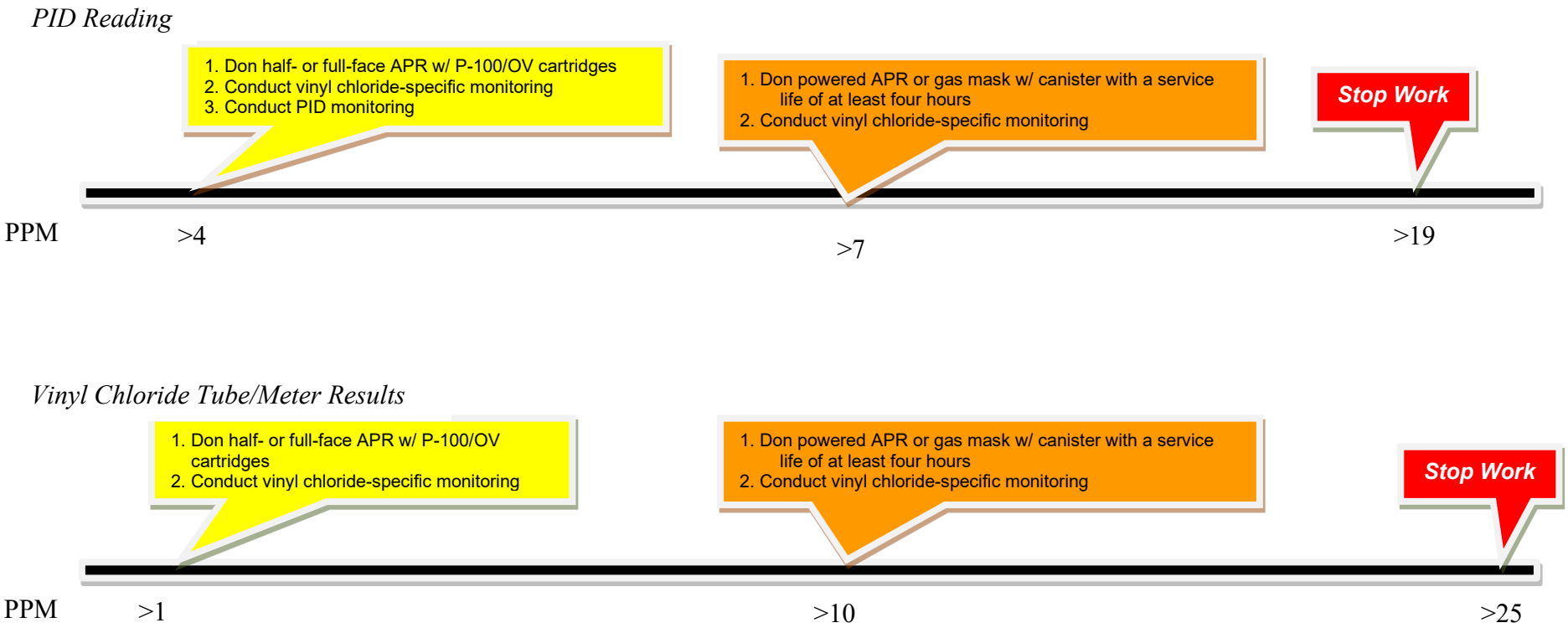
Thermo Electron TVA-1000B FID calibrated with 100 ppm methane span gas

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 POTENTIAL CHEMICALS OF CONCERN

	OSHA Permissible Exposure Levels (PEL)			
Chemical	**TWA[1]**	**STEL[2]**	**Ceiling[3]**	**IDLH[4]**
Benzene (vapor)	1 ppm	5 ppm	25 ppm	500 ppm
Toluene (vapor)	200 ppm	300 ppm	300 ppm	500 ppm
Ethyl benzene (vapor)	100 ppm	125 ppm		800 ppm
Xylene (vapor)	100 ppm	150 ppm	300 ppm	900 ppm
Diesel (vapor)	None			
Gasoline (vapor)	None			
Methylene chloride	25 ppm	125 ppm		2300 ppm
Tetrachloroethene	25 ppm	100 ppm	300 ppm	500 ppm
1,2-Dichloroethene	200 ppm			1000 ppm
1,2-Dichloroethane	50 ppm		100 ppm	
Trichloroethene	100 ppm	100 ppm	200 ppm	1000 ppm
1,1-Dichloroethane	100 ppm	250 ppm		3000 ppm
Chloroform	2 ppm	2 ppm	50 ppm	500 ppm
Vinyl chloride	1 ppm		5 ppm	
Acetone	750 ppm	1,000 ppm		2500 ppm
1,1,2-Trichloroethane	10 ppm			100 ppm
Trans 1,2-DCE	200 ppm			1000 ppm
Cis 1,2-DCE	200 ppm			1000 ppm
1,1,1-TCA	350 ppm	450 ppm		700 ppm
Carbon tetrachloride	10 ppm		25 ppm	25 ppm
Methyl ethyl ketone	200 ppm	300 ppm		3000 ppm
Vinyl acetate	10 ppm	15 ppm		
Isopropyl alcohol	400 ppm	500 ppm	800 ppm	2000 ppm
Chromium	1 mg/m3			250 mg/m3

† 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.
* NIOSH (based on 60 minute exposure).

TABLE 7-5. 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 7-6. 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											

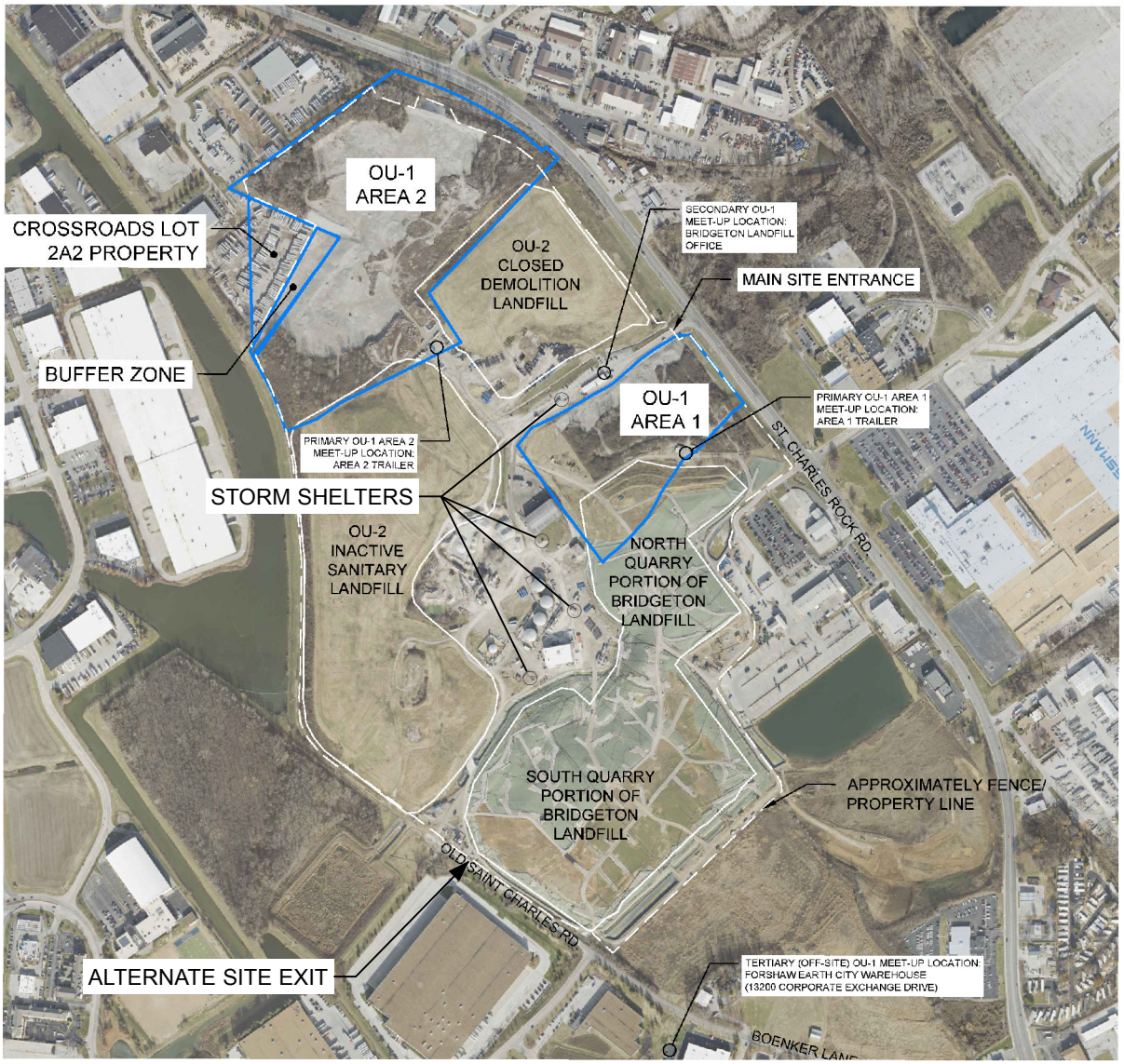
Reference: NOAA's National Weather Service, 01/07/2009, http://www.crh.noaa.gov/ddc/?n=windchill

TABLE 7-7. 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 FEEZOR ENGINEERING, INC. FROM FIGURE 2 SITE LAYOUT, BRIDGETON WEST LAKE LANDFILL EMERGENCY RESPONSE PLAN

N

0 1,000 '

Trihydro CORPORATION
1252 Commerce Drive
Laramie, WY 82070
www.trihydro.com
(P) 307.745.7474 (F) 307/745.7729

DRAFT

FIGURE 3-1

WEST LAKE LANDFILL
HEATH AND SAFETY PLAN

WEST LAKE LANDFILL
BRIDGETON, MO

Drawn By: TE	Checked By: SLL	Scale: 1 " = 1,000 '	Date: 11/6/19	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 # _____

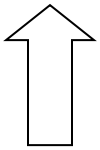
Tow Truck Operator:
Company: _____ Phone #: _____
Drivers Name: _____
Address Towed To: _____

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

AIRKNIFE HYDROVAC BOREHOLE CLEARANCE
AQUIFER TEST/PUMPING TEST
CONTRACTOR OVERSIGHT
DEPLOYING/RETRIEVING DATA LOGGERS FROM WELLS
CPT DRILLING OVERSIGHT
ECOLOGICAL SURVEY
GPS SURVEYING
HAND AUGERING
INVESTIGATION DERIVED WASTE MANAGEMENT
LANDFILL LEACHATE COLLECTION SYSTEM SAMPLING
GROUNDWATER SAMPLING
SITE WALK
SOIL SAMPLING
SOIL VAPOR SAMPLING
SONIC DRILLING OVERSIGHT
SUBSLAB VAPOR PROBE INSTALLATION
SUMMA CANISTER AIR SAMPLING
VEHICLE OPERATION
WELL ABANDONMENT
WELL DEVELOPMENT
WELL GAUGING

JOB SAFETY ANALYSIS

JSA Version Date: 10/18/2019		
Job Description: AirKnife/HydroVac Borehole Clearance		
Project: West Lake Landfill	Site Location: Bridgeton, MO	

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. Allison Riffel	Project Manager	10/18/2019
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
Mobe and Demobe					Vehicle damage or collisions	Complete site orientation, use spotter if backing, review guidelines for clearance.	
		X					
Vacuum/compressed air/water operation					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.	
		X		X			
Unload soil from vacuum chamber					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.	
		X					

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

Seed JSA Development Information:		
Job Description: Aquifer Test/Pumping Test		
Seed JSA Template Version Date: March 7, 2011		
Seed JSA Development Team: Jeremy Sell, Justin Simon, Tyson Markham		
Project Seed JSA Adaption Review Process (Seed JSA modifications made for the project):		
Project Name: West Lake Landfill	Site Location: Bridgeton, MO	Project Number: 63N-001-001
Project Management Reviewer Name	**Signature**	**Date (MM/DD/YYYY)**
Allison Riffel		11/5/2019
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 Goggles (when working with pressurized lines)	Steel Toed Boots	
Head Protection	***Biological Protection***	***Respiratory Protection***
Hard Hat	As needed	
Hearing Protection	***High Visibility Clothing***	***Protective Clothing***
	Vest or Jacket	
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***
Imbedded blade (hook) knife		Traffic cones
Communications	***Atmospheric Monitoring Devices***	***Other***

Specialized/Site-Specific Safety Training Required:

Permits Required:

Job Steps		Potential Hazard(s)	Critical Action(s)
1.	Mobilization/Demobilization	A. Motion – Traffic Hazards B. Motion – Backing	A. Drive defensively and at or below the posted speed limits. B. Always attempt to park so that the first move is forward. When not feasible or practical, use spotters to help guide the vehicle. Walk around the vehicle and confirm paths are clear before driving from a parked position (GOAL). C. Set parking brake. Chock wheels if parked on an incline.
2.	Pre-task, coordination, and safety meeting	A. Operation hazards B. Site-specific hazards C. Traffic hazards	A. Review SOP and make contact with task leader to determine equipment and safety needs. B. Discuss site-specific hazards. Have workers sign the tailgate meeting form. Review previous activities, hazards encountered, and current hospital route(s). C. Conduct vehicle inspections and document. Know destination and route prior to driving. Be aware of potential obstructions or hazards in the road, or those hidden by vegetation off-road. If driving off road, walk path before driving to look for hazards. Observe safe vehicle speeds and traffic routes.
3.	Open well	A. Struck-by traffic B. Slips/Trips/Falls C. Biological hazards (spiders, stinging insects, poisonous snakes, scorpions, etc.) D. Pinch hazards E. Temperature stress F. Muscle/ back strain G. Lacerations	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). Wear work gloves to protect against stings/bites. Wear snake gaiters in areas with poisonous snakes. D. Avoid pinch points such as hinges, lids, or caps. Wear work gloves. E. 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).

Job Steps		Potential Hazard(s)	Critical Action(s)
			F. Use correct body positioning when you bend over to open lid. Use correct tool to unlock/ loosen lid
4.	Setup Airline and Discharge Hose, Lower Submersible Pump	A. Muscle strain/ Sprain B. Slip/ trips/ falls C. Hand injury	A. Use proper body positioning when pulling hose B. Watch where you walk/ place your feet C. Avoid Uneven surfaces D. Use proper gloves for hand protection.
5.	Gauge well	A. Chemical exposure B. Hand lacerations	A. Wear nitrile gloves and safety glasses. Avoid direct skin contact with fluids. Lower and remove fluid level gauge slowly to avoid splashing fluids. B. Keep hands clear of sharp edges of tape or wear work gloves.
6.	Conduct Pump Test	A. Chemical exposure to skin and face/eyes. B. Pressurized lines could become disconnected. C. Hand lacerations D. Slips/trips/falls E. Electrical	A. Wear nitrile gloves and goggles. B. Tie down and/or monitor pressurized lines for signs of weakness. Shut off pump if necessary to address worn lines. C. Wear work gloves when handling sharp edges. D. Keep work site area clear. Establish exclusion zone around equipment to minimize public from entering work site. E. Use GFCI outlets. Avoid contact of electrical equipment with water.
7.	Decontaminate tubing, probe and tape	A. Chemical exposure B. Hand lacerations	A. Wear nitrile gloves and safety glasses. Avoid direct skin contact with fluids. B. Keep hands clear of sharp edges of tape or wear work gloves.
8.	Close and lock well	A. Pinch hazards	A. Avoid pinch points such as hinges, lids, or caps. Wear work gloves.
9.	Leaving site and/or returning to office	A. Slip/trip/fall hazards B. Loss of phone contact/location with site supervisor C. Site emergencies D. Exiting site E. Vehicle Hazards	A. Watch steps for ice/snow and/or other ground hazards B. Return to the check-in location and regain contact. If returning back to office, inform task lead of departure and arrival at destination. C. Exercise extreme caution when entering public roadways. Avoid backing onto a public roadway.

Job Steps		Potential Hazard(s)	Critical Action(s)
			Check that gates or barricades are in proper order before exiting jobsite. D. Be aware of potential obstructions or hazards in the road, or those hidden by vegetation when travelling to the next site or back to the office.

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: 10/22/2019		
Job Description: Contractor Oversight		
Project: West Lake Landfill OU-3	Site Location: Bridgeton, Missouri	
Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Allison Riffel	Engineer	(303) 494 1172
2.		
3.		
Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1. Michael Sweetenham	Hydrogeologist	10/22/2019
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 the Site, Project Manager will review and sign the HASP. Subcontractors will sign HASP during daily tailgate health and safety meeting.		A. Administrative function - no hazards anticipated. Action is to ensure health and safety compliance	A. Preventative Measures: Employees must have required training: Supervisor Training (Supervisors) OSHA 40-Hour HAZWOPER, Drug screening (as required).	
Walking around the site		A. 1) Slips, Trips, and Falls 2) Temperature stress 3) Biological hazards 4) Vehicle Traffic 5) Heavy / Equipment Hazards 6) Flying Debris/Objects	A. 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.		A. 1) Noise 2) Heat stress 3) Severe weather 4) Chemical exposure 5) Biological hazards 6) Slips, trips, and falls 7) Struck by equipment	A. 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	

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
						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 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: West Lake Landfill	Site Location: Bridgeton, MO	Project Number: 63N-001-001
Project Management Reviewer Name	**Signature**	**Date (MM/DD/YYYY)**
Allison Riffel		10/18/2019
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	Steel-toed boots	
Head Protection	***Biological Protection***	***Respiratory Protection***
Hard Hat (if overhead hazard present)	As needed	
Hearing Protection	***High Visibility Clothing***	***Protective Clothing***
		As needed
Hand Protection	***Water Safety Devices***	***Other***
Industrial work gloves, chemical-resistant gloves	Life jacket for working near deep water bodies	Sunscreen as needed

Safety Tools/Equipment/Instruments Anticipated (complete applicable boxes):		
Safety Knives	***Ventilation***	***Barricades or Access Control***
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 D. Chemical hazards 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 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). Wear work gloves to protect against stings/bites. 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 C. Gauge well and record data after it has stabilized (5-10 minutes)

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

JSA Version Date: 4/21/2020		
Job Description: CPT Drilling Oversight		
Project: West Lake Landfill	Site Location: Bridgeton, MO	
Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Allison Riffel	Senior Engineer	303-494-1172
2.		
3.		
Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1.		
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
Mobilize to/from drilling location		A. Pedestrians B. Vehicular traffic C. Backing D. Site operations E. Overhead utilities/structures	A. Drive within the site speed limits or slower in congested areas. Stop at crosswalks. B. Do not drive distracted. Follow local traffic laws. C. Attempt to drive forward into drilling location (first move forward). If it is necessary to back up, use a spotter. When possible only use vehicles with backup cameras. Check that the ground is stable so the rig will not get stuck. D. Check in with the client project manager for a briefing of the day's site activities. Familiarize workers with the site & current site activities. E. Use a ground guide when rig is in close proximity of overhead utilities and other facility structures.	
Park CPT drill rig		A. Power line strike/electrocution B. Rolling rig C. Rig tip-over D. Traffic hazards	A. Verify mast of rig when raised will clear energized power lines by a minimum of 10'. If rig must be raised closer than 10', have the utility company wrap the lines to prevent contact. Keep non-essential personnel out of work zone and keep clear of rig in the event there is contact with the power lines. B. Place rig in park. Set parking brake. Chock wheels. C. Using traffic cones and caution tape or other similar materials, establish a work zone around the rig large enough to encompass the rig mast if tipped over. D. Develop and implement a traffic control plan taking in consideration for vehicle, bicycle, and pedestrian traffic by using signs and barriers.	
Observing drilling contractor		A. Slips, Trips, and Falls B. Temperature/Weather stress C. Vehicular Traffic D. Drill Rig Hazards E. Flying Debris/Objects	A. Survey area for slip/trip/fall hazards and remove if possible. Choose the safest walk path to sampling area. Practice good housekeeping practices.	

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
					F. Noise Hazard G. Unknown/unmarked underground or overhead utility H. Equipment failure resulting in injury or property damage I. Chemical Exposure	B. Check weather forecast and dress appropriately. During hot weather, drink adequate fluids, take breaks, and find shade where possible. During cold weather, reschedule travel if roads are unsafe, dress appropriately, and take breaks to warm up. If lightening is observed, seek shelter until storm has passed. Suspend fieldwork if lightning within 10 miles of site or tornado warning issued. C. Alert onsite personnel to your presence through onsite representative. Make eye contact with truck/equipment operators when you need to approach their area. If the site is large, create a journey management plan and share with Project Manager and client representative. Wear reflective clothing. Ensure a traffic management plan is in place if required by regulations or frequency or speed of traffic. Park the rig away from traffic areas where possible. Do not drive or walk in the path of operating equipment. D. Stay out of immediate area near drill rig operations and pressurized lines. 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. Ask driller where not to stand and what hazards you should be aware of associated with the rig. E. Be aware of potential falling/flying objects. Use hard-hat and safety glasses with side shields to keep airborne dust particles and flying debris out of eyes. Verify driller is not using hook to pull augers (clevis hook only) due to tendency of hooks to bend resulting in potential eye injuries.	

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
						F. 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. G. Begin by walking the location. Check that utilities have been clearly marked and sample locations have been cleared. If unsure the location is clear or not, do not proceed. Contact the site manager for confirmation. Clear all boreholes with hand auger or hydroknife/air knife down to frost line. H. Perform a detailed rig inspection prior to operations each day and document. Verify each emergency stop is identifiable, is operational, and brief project team on their locations. Test emergency shut off switch. I. Monitor breathing zone with PID and if over trigger level in HASP, monitor breathing zone with Draeger Tubes. Wear half-face respirator with appropriate cartridge as needed. Keep soil cores covered where possible to limit exposure. Wear nitrile gloves and other appropriate PPE; stand upwind.	
Decontaminate non-disposable equipment					A. Chemical exposure B. Slip/trip/fall hazards C. Hazardous material spills	A. Wear chemical protective PPE. B. Maintain a clear work area free of tools, equipment, and materials. C. Establish a decon area with poly sheeting or dedicated decon pad. Collect all decon fluids and solids and containerize for waste characterization and disposal. Keep spill kit on hand during decon operations.	

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

Job Description: Ecological Survey					
Seed JSA Template Version Date: 10/11/2016					
Seed JSA Development Team: Jana White					
Site-specific Information:	**Weather:**		**Temp:**	**Winds:**	
Project: West Lake Landfill	Site Location: Bridgeton, MO		Project Number: 63N-001-001		
Site-specific modifications made by:	**Position/Title:**		**Date (MM/DD/YYYY)**	**Primary Contact**	
1. Jana White	Senior Ecologist		10/11/2016	(970) 988-9360	
2.				( ) -	
Project Management Reviewer	**Signature**			**Date (MM/DD/YYYY)**	
Allison Riffel				10/18/2019	
Health and Safety Team Reviewer	**Signature**			**Date (01/11/2011)**	

Personal Protective Equipment (PPE) Anticipated:

Eye and Face Protection	*Foot Protection*	*Fall Protection*
None	Leather Work boots	None
Head Protection	***Biological Protection***	***Respiratory Protection***
None	Sunscreen Insect repellant (as needed)	None
Hearing Protection	***High Visibility Clothing***	***Protective Clothing***
None	Reflective Safety Vest (as needed)	Warm or Cold Weather Clothing
Hand Protection	***Water Safety Devices***	***Other***
None	None	Trihydro WorkCare Cards

Safety Tools/Equipment/Instruments Anticipated:

Safety Knives	*Ventilation*	*Barricades or Access Control*
No	No	No
Communications	***Atmospheric Monitoring Devices***	***Other***
Cell Phone Contact list	None	None

Specialized/Site-Specific Safety Training Needed:

Permits Needed:

None

Job Steps		Potential Hazard(s)	Critical Action(s)
A.	Pre-task, coordination, and safety meeting	A. Operation hazards B. Site-specific hazards C. Traffic hazards	A. Review SOP and make contact with task leader to determine equipment and safety needs. B. Discuss site-specific hazards. Have workers sign the tailgate meeting form. Review previous activities, hazards encountered, and current hospital route(s). C. Conduct vehicle inspections and document. Know destination and route prior to driving. Be aware of potential obstructions or hazards in the road, or those hidden by vegetation off-road. If driving off road, walk path before driving to look for hazards. Observe safe vehicle speeds and traffic routes.
B.	Arriving at Site and donning PPE	A. Loss of phone contact/location with site supervisor B. Site hazards C. Slips/Trips/Falls D. Site emergencies E. Parking	A. Using cell phone text messaging as available, inform task lead or project manager of arrival at site. B. Inspect and don appropriate PPE as indicated in the site-specific HASP. C. Keep eyes on path; be aware of slip/trip/fall hazards. D. When available, take note of emergency evacuation routes and muster points. E. Park vehicle(s) in designated or approved location. Park so first move will be forward when departing.
C.	Walking around the site and within project enclosures	A. Slips, Trips, and Falls B. Severe Weather C. Temperature stress	A. Watch footing and where you are walking. Be alert and exercise additional care when passing through fences and/or climbing into enclosures. Take extra caution in rainy, snowy, icy, or muddy conditions. B. Locate nearest severe weather shelter/strong structure before beginning field work. Suspend fieldwork if lightning within 10 miles of site or tornado warning issued. C. Dress appropriately, but within constraints of HASP. Drink plenty of water or other hydrating liquids (i.e., not sodas).
D.	Walking around the site or along survey transects (cont'd)	A. Biological hazards B. Vehicle Traffic C. Flying Debris/Objects	A. 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. B. Wear reflective vest if traffic hazards are present and/or within hunting season.

Job Steps		Potential Hazard(s)	Critical Action(s)
E.	Leaving site and/or returning to office	A. Slip/trip/fall hazards B. Loss of phone contact/location with site supervisor C. Site emergencies D. Exiting site E. Vehicle Hazards	A. Watch steps for ice/snow and/or other ground hazards B. Return to the check-in location and regain contact. If returning back to office, inform task lead of departure and arrival at destination. C. Be aware of unusual site activities which may indicate an emergency condition. Contact site manager to determine if it is safe to leave site. D. Exercise extreme caution when entering public roadways. Avoid backing onto a public roadway. Check that gates or barricades are in proper order before exiting jobsite. E. Be aware of potential obstructions or hazards in the road, or those hidden by vegetation when travelling to the next site or back to the office.

I have read and understand the PPE, safety tools/equipment/instruments, and associated permits needed for this task prior to work. 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 task site with pen-and-ink changes (dirty) are to be kept in the project folder for record.

Name	**Signature**	**Date**

JOB SAFETY ANALYSIS

JSA Version Date: 10/18/2019		
Job Description: GPS Surveying		
Project: West Lake Landfill	Site Location: Bridgeton, MO	

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. Allison Riffel	Project Manager	10/18/2019
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 (if overhead hazard present)	☒ 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
Mobe and Demobe to Site		X			Traffic, heavy equipment in use at site	Plan route, practice 3D driving skills, watch for third-party equipment and avoid path of heavy equipment vehicles.	
Set up and complete site survey		X		**X**	Slip/trip/fall hazards. Vehicular traffic.	Avoid high hazard areas where possible. Watch footing and avoid walking while using GPS. Set up traffic control if necessary and/or park defensively.	

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: 10/18/2019		
Job Description: Hand Augering		
Project: West Lake Landfill	Site Location: Bridgeton, MO	

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. Allison Riffel	Project Manager	10/18/2019
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
Utility locates.					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. 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).	
				X			
		X		X			
Assemble hand auger equipment					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. C. Wear safety-toed boots to protect against dropped tools and equipment.	
				X			
		X					
Sample collection				x	A. Electrocution B. Struck-by: dropping heavy equipment C. Slips, trips, falls D. Caught-in: auger E. Flying debris F. Chemical exposure from the borehole G. Back injuries from lifting heavy equipment (hand auger, core barrel, etc.) H. Overhead hazards	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. 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.	
		x		x			
		x		x			

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

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

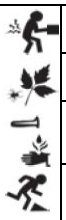
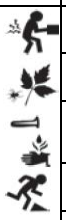
JSA Version Date: 11/6/2019		
Job Description: Investigation Derived Waste Management		
Project: West Lake Landfill	Site Location: Bridgeton, MO	

Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Allison Riffel	Senior Engineer	303-494-1172
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		11/07/2019
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:*** Spill Kit
☐ ***Other:***	☒ ***Other:*** Gamma and alpha/beta scintillators	☐ ***Other:***

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
1. Containerize water into drums or tanks.				X X X	A. Pinch points may occur when closing drums and sealing tank lids. B. Lift related injuries. C. Chemical exposure. D. Tripping over hoses or pipes used to convey water. E. Fall injuries could occur if accessing tank from a ladder. F. Radiation exposure.	A. Wear leather work gloves. when touching sharp edges. B. Use a drum dolly, lift gate on a truck, or fork lift for managing full drums. C. Wear nitrile gloves when, position yourself upwind. handling bulk liquids. D. Avoid setting up hoses in high foot traffic areas. Deploy cones or barriers to identify the hazard. E. Load tanks from bottom instead of top to minimize ladder use. Use a spotter when using a ladder for tank offloading. F. Screen water using a gamma and alpha/beta scintillators. Follow the Radiation Safety Plan to determine if additional measures are necessary for material handling.	
2. Containerize solids (soil, rock, piping, hosing, PPE) into drums or rolloff bins.				**X** **X** **X**	A. Pinch points may occur when covering rolloff bins and closing drums. B. Lift or equipment (if using forklift) related injuries. C. Chemical exposure. D. Radiation exposure.	A. Wear leather work gloves when touching sharp edges. B. Use a drum dolly, lift gate on a truck, or fork lift for managing full drums. C. Wear nitrile gloves when handling soils/rock from the site. D. Screen with gamma and alpha/beta scintillators. Follow the Radiation Safety Plan to determine if additional measures are necessary for material handling.	
3. Coordinate pick up of IDW.			X		A. Chemical exposure and environmental damage from accidental releases. B. Traffic hazards including uneven terrain.	A. Don nitrile gloves, work upwind of possible airborne exposures and maintain spill kit for deploying in emergency situations. B. Set up exclusion zone as appropriate to limit to limit traffic around loading area. Place bins/tanks on even ground with safe truck access.	

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

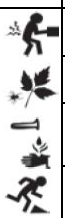
JSA Version Date: April 21, 2015		
Job Description: Landfill Leachate Collection System Sampling		
Project: West Lake Landfill	Site Location: Bridgeton, MO	

Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Marge Bedessem	Project Director	307-760-5645
2. Mike Bradford	Project Manager	307-343-2788
3. Pak Landers	Field Technician	307-761-5738

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

Driving on landfill property		x			Landfill access roads are unpaved and will have heavy equipment traffic and light customer traffic. Access to leachate pump house will be off the main road over undeveloped land and down a steep/narrow unpaved ramp. Road access in front of pump house has limited space for vehicle maneuvering.	-While driving along main access roads obey posted traffic signs, give right of way to heavy traffic, and/or make eye contact or receive visual direction from equipment operators before proceeding. -When driving off-road proceed cautiously and be aware of natural and engineered stormwater ditches. -Due to limited maneuverability along ramp and pump house access drive back down the ramp, if needed. Do not use ramp if wet.	
Open pump house doors.		x		**x**	Building has two doors which are heavy metal doors opening outward, potential hazard when windy. Building may have an accumulation of landfill gas (H2S and Methane). Potential tripping hazards when exiting vehicle and walking around pump house.	-When opening door be aware of wind and open slowly bracing the door. Once open secure the door in place. -Let the building vent with both doors open for several minutes prior to entry with 4 gas meter monitoring air quality inside. -Observe ground conditions prior to exiting vehicle and observe and prepare for existing and potential tripping hazards.	
Enter pump house		**x**		**x** **x**	After venting the building it may still have an accumulation of landfill gas (H2S and Methane). Step into building through doorways is 12”-18” high. Building may be a shelter for snakes or insects.	- Using a 4 gas meter sweep the high and low spots of the building for H2S concentration and Methane %LEL. -Prior to entry visually inspect the interior of the building for potentially dangerous wildlife. -Carefully step down into building.	
Remove 4” sampling port blind flange.		**x** **x**		**x** **x**	Hazardous atmosphere potential due to LFG generation throughout task (H2S and Methane). Sample port may be a point of generation of hazardous gas (H2S and Methane). Blind flange is bolted onto the sample port and will require use of hand tools to remove. Building interior is narrow front to back and maneuverability inside is limited. Building may be a shelter for snakes or insects.	- Prior to removing the sample port blind flange sample the air quality around the flange before and after removing the flange for H2S concentration and Methane %LEL. Continuously monitor gas levels near sample port throughout sampling. Keep doors open for natural venting throughout task. Do not place face directly over sample port. - Wear work gloves during removal of flange to protect hands. - Be aware of high step at doorway while moving around. - Be continuously aware of potential presence of dangerous wildlife within building.	
Insert Pump		x **x**		x x	Hazardous atmosphere potential due to LFG generation throughout task (H2S and Methane). Sample port may be a point of generation of hazardous gas (H2S and Methane). Blind flange is bolted onto the sample port and will require use of hand tools to remove. Building interior is narrow front to back and maneuverability	-Keep air monitoring device turned on and near the opening of the well. -Wear nitrile gloves and attach the tubing to the pump. - Lower pump down well using the tubing to push the pump. -Keep tubing and cord to pump from getting tangled up.	

					inside is limited. Building may be a shelter for snakes or insects.		
Collect leachate sample.		 x x		 **X** **X** **X**	Hazardous atmosphere potential due to LFG generation throughout task (H2S and Methane). Sample port may be a point of LFG generation (H2S and Methane). Sample pump will be connected to a vehicle battery for power, potential shock hazard. Leachate may be chemically hazardous if contacts skin or eyes. Building interior is narrow front to back and maneuverability inside is limited. Building may be a shelter for snakes or insects.	- Continuously monitor gas levels (H2S concentration and Methane %LEL) near sample port throughout sampling. Keep doors open for natural venting throughout task. Do not place face directly over sample port. -Do not directly touch battery terminals. -Wear chemically resistant (nitrile) gloves during sampling to protect hands. -Wear safety glasses while sampling to protect eyes from potential splash. - Be aware of high step at doorway while moving around. - Be continuously aware of potential presence of dangerous wildlife within building.	
Remove sample pump		 **X**		**X** **X**	Hazardous atmosphere potential due to LFG generation throughout task (H2S and Methane). Sample port may be a point of generation of hazardous gas (H2S and Methane). Blind flange is bolted onto the sample port and will require use of hand tools to remove. Building interior is narrow front to back and maneuverability inside is limited. Building may be a shelter for snakes or insects. Pinch points Bending and lifting Slips, trips and falls	- Continuously monitor gas levels (H2S concentration and Methane %LEL) near sample port throughout sampling. Keep doors open for natural venting throughout task. Do not place face directly over sample port. -Do not directly touch battery terminals. While disconnecting pump from car battery. -Do not get hands wrapped up in cordage or tubing when retrieving pump. -Wear chemically resistant gloves. -Bend your knees and use proper lifting technique while retrieving pump. -Keep cordage and tubing away from feet while retrieving pumps to avoid and slips, trips or falls. - Be aware of high step at doorway while moving around. - Be continuously aware of potential presence of dangerous wildlife within building.	
Replace 4” sampling port blind flange.		 x x		 **X** **X**	Hazardous atmosphere potential due to LFG generation throughout task (H2S and Methane). Sample port may be a point of generation of hazardous gas (H2S and Methane). Blind flange is bolted onto the sample port and will require use of hand tools to replace. Building interior is narrow front to back and maneuverability inside is limited. Building may be a shelter for snakes or insects.	- Continuously monitor gas levels (H2S concentration and Methane %LEL) near sample during task. Keep doors open for natural venting throughout task. Do not place face directly over sample port. - Wear work gloves during replacement of flange to protect hands. - Be aware of high step at doorway while moving around. - Be continuously aware of potential presence of dangerous wildlife	

						within building.	
Exit pump house and close doors.				x	Step out of building through doorway is 12”-18” high. Building has two doors which are heavy metal doors opening outward, potential hazard when windy.	-Carefully step up out of building. -When removing door anchors be aware of wind and remove slowly while bracing the doors. Once removed slowly close and secure the doors.	
Driving on landfill property					Landfill access roads are unpaved and will have heavy equipment traffic and light customer traffic. Access to leachate pump house will be off the main road over undeveloped land and down a steep/narrow unpaved ramp. Road access in front of pump house has limited space for vehicle maneuvering.	-While driving along main access roads obey posted traffic signs, give right of way to heavy traffic, and/or make eye contact or receive visual direction from equipment operators before proceeding. -When driving off-road proceed cautiously and be aware of natural and engineered stormwater ditches. -Drive slowly and cautiously along narrow pump house access road and up access ramp.	

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”)

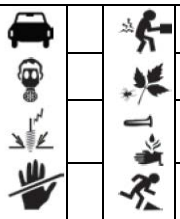
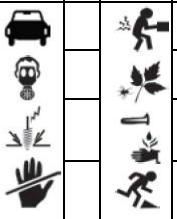
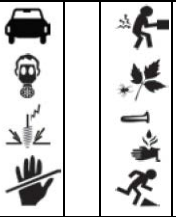
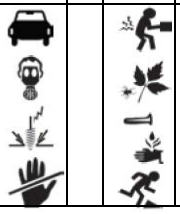
Date	Job Step #	REVISION	Does JSA need to be updated permanently?		Responsible Person
			Yes	No	

JOB SAFETY ANALYSIS

JSA Version Date: 10/18/2019		
Job Description: Groundwater Sampling		
Project: West Lake Landfill	Site Location: Bridgeton, MO	
Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Allison Riffel	Senior Engineer	303-494-1172
2.		
3.		
Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1.		
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 (if overhead hazard)	☒ 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:***

Job Steps	Hazard(s)	Potential Hazard(s)	Critical Action(s)	Responsible Person
Gauge groundwater fluid level with oil/water interface probe.		A. Tight of way traffic or onsite facility traffic B. Pinch points and or friction burn from fluid level probe reel C. Chemical exposure	A. Wear reflective safety vest, position body appropriately, use safety cones, and/or park defensively. B. Do not allow probe to “free fall” from ground surface. Keep hands from between probe reel and protective well casing. C. Wear safety glasses with side shields. Wear chemical resistant gloves.	
Collect groundwater samples		A. Chemical exposure to constituents of concern or preservatives B. Cuts from broken bottles C. Pinch points from parameter meter or pump connections D. Electrical shock	A. Wear safety glasses with side shields. Wear resistant gloves. B. Inspect vials when unpacking for scratches and cracks; do not use if present. Grasp bottom and cap with fingers; do not over tighten sample jar lids. C. Work slowly. Select equipment with fewer pinch points where possible. D. Keep electrical connections dry and hands away from exposed metal.	
If necessary, remove sample pump from monitoring well.		A. Muscle strain from lifting pump	A. Use proper lifting procedures. If necessary, use two people or a mechanical wench to remove pump.	
Equipment decontamination		A. Chemical exposure - Groundwater or detergent water could splash into individuals eyes during decontamination in detergent water buckets	A. Verify that the flow controller is turned off prior to moving the pump from one decontamination solution to the rinse buckets. Wear safety glasses and nitrile gloves during decontamination process	

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: 10/18/2019		
Job Description: Site Walk		
Project: West Lake Landfill	Site Location: Bridgeton, MO	

Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Allison Riffel	Senior Engineer	303-494-1172
2.		
3.		

Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1.		
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 (if overhead hazard exists)	☒ 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:***

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
Walking around the site		X			A. Slips, Trips, Falls B. Temperature/Weather stress C. Biological hazards D. Vehicle traffic E. Chemical exposure F. Noise exposure	A. Walk slowly and be alert for obstacles on the ground. Avoid multi-tasking such as taking photos while walking. B. Check weather forecast and dress appropriately. During hot weather, drink adequate fluids, take breaks, and find shade where possible. During cold weather, reschedule travel if roads are unsafe, dress appropriately, and take breaks to warm up. If lightening is observed, seek shelter until storm has passed. Suspend fieldwork if lightning within 10 miles of site or tornado warning issued. C. Avoid exposure to biological habitats for spiders and other stinging insects. Apply insect repellent prior to potential exposure. Check for bites. D. Alert onsite personnel to your presence through onsite representative. Coordinate site-specific safety orientation with onsite representative and sign into process units (if applicable). Make eye contact with truck/equipment operators when you need to approach their area. Observe onsite traffic flows and minimize time spent in high traffic areas. If the site is large, create a journey management plan and share with Project Manager and client representative. Wear reflective clothing and take caution when rounding corners or crossing designated traffic lanes. E. Verify what areas may be off limits for your visit and whether your PPE is adequate. Avoid areas with potential chemical exposure hazards where possible. F. Don hearing protection (foam ear plugs) when site operations are in progress and are loud enough to impede conversation.	
				X X X			

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: 10/18/2019		
Job Description: Soil Sampling		
Project: West Lake Landfill	Site Location: Bridgeton, MO	

Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Allison Riffel	Senior Engineer	303-494-1172
2.		
3.		

Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1.		
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
Drive sampler, shovel, or trowel into soil		A. Chemical exposure to VOCs. B. Chemical exposure to radionuclides.	A. Monitor breathing zone with PID. If over PID trigger level in HASP, monitor breathing zone with Draeger Tubes. Wear respirator with appropriate cartridge as needed. Keep soil cores covered where possible to limit exposure. Wear nitrile gloves and other appropriate PPE; stand upwind. B. Monitor breathing zone with microR and dual phosphor scintillator field equipment. Wear respirator with appropriate cartridge as needed. Keep soil cores covered where possible to limit exposure. Wear nitrile gloves and other appropriate PPE; stand upwind.	
Collect soil samples		A. Lacerations or cuts from jar breakage	A. Use retractable-blade knives, wear appropriate gloves, wear eye protection.	
Decontaminate non-disposable equipment		A. Chemical exposure B. Slip/trip/fall hazards C. Hazardous material spills	A. Wear chemical protective PPE. B. Maintain a clear work area free of tools, equipment, and materials. C. Establish a decon area with poly sheeting or dedicated decon pad. Collect all decon fluids and solids and containerize for waste characterization and disposal. Keep spill kit on hand during decon operations.	

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	

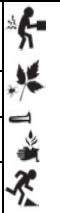
JOB SAFETY ANALYSIS

JSA Version Date: 4/15/2020		
Job Description: Soil Vapor Sampling		
Project: West Lake Landfill	Site Location: Bridgeton, MO	

Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1.		
2.		
3.		
Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1. Allison Riffel	Project Manager	04/15/2020
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 Pants	☐ Chemical Cartridge
☐ Ear Muffs	***Biological Protection***	☐ Particulate Filter
Hand Protection	☐ Snake Gaiters	☐ Cartridge/Filter Combo
☒ Industrial Work Gloves	☐ Sunscreen	☐ Ammonia Cartridge
☒ Protective Nitrile 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:*** H_2S Monitor	☐ Personnel Decontamination	☐ ***Other:***
☐ ***Other:***	☐ ***Other:***	☐ ***Other:***

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
1) Load equipment and mobilize to vapor sampling well or building is slated to occur		X x		X X	1) Personal injuries or equipment damage associated with lifting. 2) Personal injuries or equipment damage associated with slip, trip, and fall hazards. 3) Harm to hands due to pinch points.	1) Use proper lifting techniques, including squatting to lift loads and not bending at waist, avoid twisting or rapid movements at waist while carrying loads. Limit loads to 50 pounds or less (knowing your own limits) and seek assistance for unwieldy or heavier loads. The large soil vapor sampling board weighs 62 lbs with both pumps attached. Remove one pump or use two people to lift. Use wheels on case when possible. Summa can boxes can weigh over 50 lbs and can be awkward to carry. Use two people to lift boxes that are over 50 lbs or are awkward. 2) Plan route and complete walk through prior to lifting any load ensuring that walk ways and surfaces are clear of hazards, any obstructions are removed (including propping doorways when appropriate). Recheck pathway while returning from vehicle each time. Use two people to carry vapor sampling board or large Summa can boxes through doors or down steps. 3) Wear leather work gloves while loading and unloading equipment. Maintain manageable loads and request assistance for unwieldy or heavy loads.	
2) Inspect sample locations and unload equipment from vehicle.		 x		x x	1) Personal injuries or equipment damage associated with lifting. 2) Personal injuries or equipment damage associated with slip, trip, and fall hazards. 3) Harm to hands due to pinch points.	1) Use proper lifting techniques, including squatting to lift loads and not bending at waist, avoid twisting or rapid movements at waist while carrying loads. Limit loads to 50 pounds or less (knowing your own limits) and seek assistance for unwieldy or heavier loads. 2) Plan route and complete walk through prior to lifting any load ensuring that walk ways and surfaces are clear of hazards and any obstructions are removed (including propping doorways when appropriate). Recheck pathway while returning from vehicle each time. 3) Wear leather work gloves while loading and unloading equipment. Maintain manageable loads and request assistance for unwieldy or heavy loads.	
3) Calibrate field instruments.		 x 		 x 	1) Burns from compressed gas ignition. 2) Exposure to hazardous gas.	1) Use proper regulators and keep away from open flames and other ignition sources. 2) Calibrate meters in well-ventilated area.	
4) Open monitoring well, prepare sample equipment and SUMMA canisters.		 x		x 	1) Personal injury to hands from pinch points (motion). 2) Strain from lifting.	1) Wear leather gloves to avoid puncture wounds/pinch points to skin Use proper tools to open/close well vault lid (i.e., wrench, screw driver, etc.) Do not force open/close at awkward position When possible - pull tool towards body. Do not force parts together. Use the correct tools and fittings for connecting equipment. 2) Lift heavy objects using leg strength and proper posture. Use correct gloves and tools when opening wells and handling equipment.	
5) Prepare helium tank.					1) Blunt force injury or property damage from rapid release of pressure	1) Protect tank from tipping using appropriate carts and tie downs. Replace the valve cover when not in use. Follow JSA for compressed gas canister management.	

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
6) Conduct pneumatic testing, purging, and soil vapor sample collection activities at each location.		 X X		 X 	1) Personal injury or property damage while mobilizing or using helium as a tracer. 2) Harm to hands due to pinch points, cuts, scrapes, etc. 3) Inhalation of harmful vapors. 4) Back strain due to improper body positioning.	1) Use hand cart while moving helium tank, secure tank to cart using strapping or tie downs, secure tank during transport and storage. Ensure cover is threaded tightly onto valve stem when moving or storing tank. Do not move compressed gas canister with regulator in place. 2) Use correct tools including properly sized open and adjustable wrenches while tightening fittings, do not force or over-tighten fittings. Use tubing cutters, NO FOBKs. 3) Monitor breathing zone using photoionization detector during installation of the probes. If ambient air concentrations exceed 10 ppmv use colorimetric tube for benzene. If the benzene concentration exceeds PEL then don half-face respirator with organic vapor cartridge. 4) Use good posture, mats, portable chairs or other methods to maintain proper body positioning. Take frequent breaks and stretch back, neck, arms, and legs.	
7) Disassemble sample train, cap SUMMA canister, and close monitoring wells.		 X		X 	1) Personal injury to hands from pinch points. 2) Strain from lifting.	1) Wear leather gloves to avoid puncture wounds/pinch points to skin Use proper tools to open/close well vault lid (i.e., wrench, screw driver, etc.). Do not force open/close at awkward position When possible - pull tool towards body Do not force parts together. Use the correct tools and fittings for connecting equipment. 2) Lift heavy objects using leg strength and proper posture. Use correct gloves and tools when opening wells and handling equipment.	
8) Clean-up work area, load equipment, and demobilize from monitoring location.		 X		X X	1) Personal injuries or equipment damage associated with lifting. 2) Personal injuries or equipment damage associated with slip, trip, and fall hazards. 3) Harm to hands due to pinch points.	1) Use proper lifting techniques, including squatting to lift loads and not bending at waist, avoid twisting or rapid movements at waist while carrying loads. Limit loads to 50 pounds or less (knowing your own limits) and seek assistance for unwieldy or heavier loads. 2) Plan route and complete walk through prior to lifting any load ensuring that walk ways and surfaces are clear of hazards and any obstructions are removed (including propping doorways if necessary). Recheck pathway while returning from vehicle each time. 3) Wear leather work gloves while loading and unloading equipment. Maintain manageable loads and request assistance for unwieldy or heavy loads.	

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

END OF DAY

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

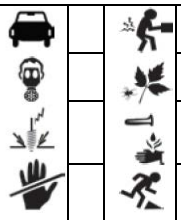
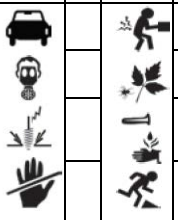
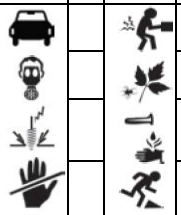
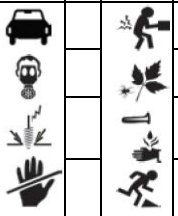
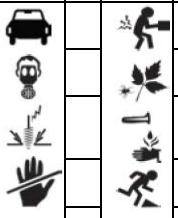
Date	Job Step #	REVISION	Does JSA need to be updated permanently?		Responsible Person
			Yes	No	

JOB SAFETY ANALYSIS

JSA Version Date: 10/18/2019		
Job Description: Sonic Drilling Oversight		
Project: West Lake Landfill	Site Location: Bridgeton, MO	
Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Allison Riffel	Sr. Engineer	(303) 494-1172
2.		
3.		
Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1.		
2.		
3.		/ /

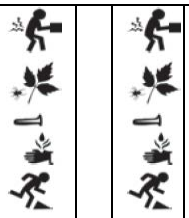
Personal Protective Equipment (PPE) Needed:

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
Call One-Call at 811		A. Explosion, Electrocution, injury, death, property damage.	A. Request utilities locates a minimum 2 days prior to drilling.	
Permission for site access		A. Inability to perform work due to locked gates	A. Call client before mobilization to verify that site will be accessible on the scheduled day of drilling	
Check the weather		A. Unexpected storm, lightning, rain, snow, heat and cold stress	A. Check the local weather forecast. Ensure you have wet-weather gear if needed. In warmer weathers ensure you have plenty of drinking water and access to shade.	
Mobilize to drilling location		A. Vehicular traffic, pedestrians B. Backing C. Site operations D. Overhead utilities/structures	A. Drive within the site speed limits or slower in congested areas. Utilize 3D driving methods. B. Attempt to drive forward into drilling location (first move forward). If it is necessary to back up, use a spotter. Check that the ground is stable so the rig will not get stuck. C. Check in with the client project manager for a briefing of the day's site activities. Familiarize workers with the site & current site activities. D. Maintain a minimum of 4' between rig and energized power lines when mast is down in the transporting position. Use a ground guide when rig is in close proximity of overhead utilities and other facility structures.	
Drill Rig Set-up		A. Spill hazard B. Power line strike/electrocution	A. Verify rig inspection has been completed. Inspect equipment for signs of wear. Check all emergency shut off switches, personal observe they work. B. Verify mast of rig when raised will clear energized power lines by a minimum of 10'. If rig must be raised closer than 10', have the utility company wrap the lines to prevent contact. Keep non-essential personnel out of work zone and keep clear of rig in the event there is contact with the power lines. Only raise/lower	

Job Steps	Hazard(s)	Potential Hazard(s)	Critical Action(s)	Responsible Person
			mast when rig has been stabilized.	
		C. Rolling rig	C. Place drilling rig in park. Set parking brake. Chock wheels for drill rig, support truck and shaker table.	
		D. Rig tip-over	D. Verify outriggers are extended and if placed on unstable ground, place cribbage that will not splay apart under outriggers. Using traffic cones and caution tape or other similar materials, establish a work zone around the rig large enough to encompass the rig mast if tipped over.	
		E. Traffic hazards	E. Develop and implement a traffic control plan taking in consideration for vehicle, bicycle, and pedestrian traffic by using signs and barriers.	
Sonic Drilling		A. Dropping steel samplers on feet/toes.	A. Use mechanical lifting equipment and a tag line to lift augers and other heavy/awkward materials. When not available, use a multiple-person lift. Wear safety-toed boots and leather gloves.	
		B. Slip/trip/fall hazards.	B. Maintain a clear work area free of tools, equipment, materials, and spoils.	
		C. Entanglement in equipment.	C. Verify equipment is protected by machine guarding. Do not get within 12” of drill bit. Do not wear loose fitting clothing, clothing with ties such as hooded sweatshirts, jewelry, or loose gloves near rotating equipment. Long hair is to be tied back securely and braid tucked into clothing.	
		D. Back injuries from lifting heavy equipment or from shoveling soil.	D. Use mechanical lifting equipment and a tag line to lift flights and other heavy/awkward materials. When not available, use a multiple-person lift. Use proper lifting techniques and request help when necessary. While shoveling do not overload the shovel or turn the torso.	
		E. Struck-by overhead cables/ hooks.	E. Keep non-essential personnel out of the work zone unless cleared by the rig operator. Communicate with co-workers when shoveling or maneuvering a swing-hook from the drill mast.	
		F. Pinch points	F. Crew members are to keep their hands clear of pinch points. Wear high-visibility work gloves for hand placement awareness and protection.	
		G. Heat/burns from sonic drilling.	G. Use thermometer to take surface	

Job Steps	Hazard(s)	Potential Hazard(s)	Critical Action(s)	Responsible Person
		H. Noise.	temperature of casing before touching. H. Use earplugs.	
Sample Collection		A. Carrying heavy load. B. Air blown cuttings. C. Exposure to organic vapors.	A. Load samples in cooler on truck to prevent lifting. Verify path is clear prior to lifting. Use team lift for heavy/awkward loads. Use proper lifting techniques. B. Staff is to stand clear of blown cuttings. Operators using compressed air for blowing cuttings are to wear face shields over safety glasses/goggles. C. Wear nitrile gloves and other appropriate PPE; stand upwind.	
Well casing assembly and installation		A. Pinch-points at threads B. Struck-by swinging long pipe sections near personnel.	A. Keep clear of pinch points. Wear work gloves at all times. Stay focused on the task at hand. B. Keep non-essential staff clear of work zone. Inform everyone at well site of upcoming activities.	
Installing well box surface completion		A. Sharp metal edges on well box B. Muscle strains from mixing concrete, pushing wheelbarrow, lifting shovel with concrete mixture or dumping wheelbarrow.	A. Wear laceration-proof gloves B. Share tasks with coworkers. Keep loads light. Use proper lifting techniques.	
Breakdown at drilling location		A. Slip/trip/fall hazards. B. Lost loads. C. Overhead utilities/structures	A. Maintain a clear work area free of tools, equipment, materials, and spoils. B. Check that equipment, materials, and tools are secured to the rig before moving. C. Do not drive unless the mast is lowered.	
Clean-up/Decon		A. Chemical burns B. Slip/trip/fall hazards C. Hazardous material spills D. Cross contamination of equipment, public perception	A. Wear chemical protective PPE. Have a neutralizing agent on hand in the event of skin contact. B. Maintain a clear work area free of tools, equipment, and materials. C. Have a neutralizing agent on hand. D. Containerize decon fluids and materials with labels on containers.	

Job Steps	Hazard(s)	Potential Hazard(s)	Critical Action(s)	Responsible Person
Demobilize from the site		A. Overhead utilities/structure B. Traffic Hazards	A. Maintain a minimum of 4' between rig and energized power lines when mast is down in the transporting position. Use a ground guide when rig is in close proximity of overhead utilities and other facility structures. B. Obey all traffic rules, check that equipment, coolers, etc. are secured and tail-gate is in the upright position (if applicable).	

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: 4/15/2020		
Job Description: Subslab Vapor Probe Installation		
Project:	Site Location:	

Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1.		
2.		
3.		

Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1. Allison Riffel	Project Manager	04/15/2020
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	☒ Knee Pads (if needed)	☐ Full-Face Air Purifying Respirator
☒ Ear Plugs	☐ Long Pants	☐ Chemical Cartridge
☐ Ear Muffs	***Biological Protection***	☐ Particulate Filter
Hand Protection	☐ Snake Gaiters	☐ Cartridge/Filter Combo
☒ Industrial Work Gloves	☐ Sunscreen	☐ Ammonia Cartridge
☒ Chemical Resistant Gloves (nitrile)	☐ 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:*** H_2S Monitor	☐ Personnel Decontamination	☐ ***Other:***
☐ ***Other:***	☐ ***Other:***	☐ ***Other:***

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
1. Locate drill-hole point for sub-slab sampling and set-up work area					A) Sub-surface utilities strikes. B) Slip/Trip/Fall on tools and equipment. C) Personal injury due to not wearing proper PPE.	A) Scan concrete for electrical signals. Verify client has cleared sub-surface utilities. If unsure, stop work, notify unit operator, and re-verify clearance before proceeding. B) Be aware of surroundings at all times and conduct a WSSA. Be sure area is setup and clear of equipment to avoid slips, trips, and falls. Clear pathways for moving equipment into and out of buildings C) Wear safety glasses, chemical goggles (if applicable), nitrile gloves, leather gloves, H_2S monitor, and other required PPE.	
		X					
		X		X			
2. Insert vapor sampling point in hole and seal according to the work plan					A) Damage to vapor probe	A) Use caution when inserting vapor probe.	
3. Clean-up work area					A) Slip/Trip/Fall on tools and/or equipment	A) Be sure area is free of tools and equipment. Vacuum area before leaving. Seal hole according to work-plan specifications.	
				X			

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Name	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: 10/18/2019		
Job Description: SUMMA Canister Air Sampling		
Project: West Lake Landfill	Site Location: Bridgeton, MO	

Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Allison Riffel	Project Manager	303-494-1172
2.		
3.		

Reviewed By Please include the reviewers employer and email if not employed by Trihydro Corporation:	**Position**	**Review Date (MM/DD/YYYY)**
1.		
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 (if overhead hazard exists)	☒ 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.	

Job Steps	Hazard(s)				Potential Hazard(s)	Critical Action(s)	Responsible Person
Disconnect SUMMA canister		x		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.	
Deconstruct sampling area		x			A. Vehicular traffic	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: 10/18/2019		
Job Description: Vehicle Operation		
Project: West Lake Landfill	Site Location: Bridgeton, MO	
Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Michael Chamberlan	Sr. 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. Todd Forry	Health and Safety Manager	12/02/2011
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:*** Seat belt	☒ ***Other:*** First Aid Kit	☐ ***Other:***
☒ ***Other:*** Sun glasses	☒ ***Other:*** Fire Extinguisher	☐ ***Other:***

	Job Steps	Potential Hazard(s)	Critical Action(s)
1.	Operation	A. Backing B. Unfamiliar Vehicle C. Speed D. Distance / Spacing E. Skids F. Blind Spots G. Distractions H. Equipment Failure I. Drug / Alcohol J. Driver Attitude K. Loaded Vehicle L. Parking M. Jobsite Navigation N. Exiting Jobsite	A. Check that area is clear of obstructions by walking around vehicle before moving. Use a spotter when possible. Check mirrors prior to moving vehicle. Back slowly. Anticipate other vehicle's movements. First move should be forward where applicable. B. Familiarize yourself with the vehicle controls before moving. Properly adjust the mirrors and seat. C. Obey posted speed limits. Reduce speed during hazardous conditions (fog, rain, etc.). D. Continually check mirrors. Do not tailgate. Use the 3 second rule for a car or van, 4 seconds for truck, 5 for tractor trailer; add seconds for wet or slippery roads AND over 40 mph. Regularly scan the area you will be entering in the next 10-12 seconds. Always leave yourself an out during travel. When stopping, leave adequate space between you and the vehicle ahead of you. When stopped you should be able to see the rear tires on the ground of the vehicle ahead of you. E. To reduce potential for skids, proceed cautiously during hazardous conditions. Reduce speed! If the vehicle begins to skid out of control, turn the wheel in the direction of the skid. F. Familiarize yourself with your vehicle's blind spots. Use directional (turn signal) lights when changing lanes. Perform a "head check" to verify blind spots are clear. Avoid other driver's blind spots. G. The use of cell phones while driving is prohibited except during an emergency. Pull off safely to the side of the road to receive or place calls or text messages. Do not attempt to read maps or other material while driving. Do not eat or drink while driving. H. Inspect your vehicle daily. Perform proper maintenance. Check tire pressure, fluid levels, and emergency response equipment. I. Never drive under the influence of drugs, medications that can impair your response time, or alcohol. J. Refrain from operating vehicles when abnormally tired. Keep an even temper while driving. Do not drive if you are frustrated, rushed, distracted or drowsy.

Job Steps	Potential Hazard(s)	Critical Action(s)
		K. Honor the load capacity of the vehicle. Secure equipment and supplies within the body of the vehicle using proper tie downs. Periodically confirm that equipment and supplies are secured properly. Obtain proper permits for transporting hazardous materials. L. Park vehicle(s) in designated or approved location. Do not park near heavy equipment, heavy equipment travel ways, stockpiles, fuel tanks, or open trenches. Do not park in areas that may block fire access, contractor access, or where vehicle(s) may become blocked in. M. Only travel in approved areas. Do not travel behind heavy equipment. Do not travel near open trenches, fuel tanks, or excessively muddy areas. Do not travel at speeds in excess of the site speed limit, especially near work crews. Scan the site and choose travel ways that minimize hazards such as collisions, sudden drops, punctured tires, steep slopes, muddy/slippery terrain, or damage to property or grass. If driving off-trail, select a vehicle designated for such and operate within the manufactures limitations and specification. Perform a ground recon or use a spotter prior to driving the terrain. Be cautius of terrain and biological hazards when reconning the path. N. Exercise extreme caution when entering public roadways. Avoid backing onto a public roadway. Prevent tracking mud or dirt from jobsite onto public roadways. Verify that gates or barricades are in proper order before exiting jobsite.

JOB SAFETY ANALYSIS

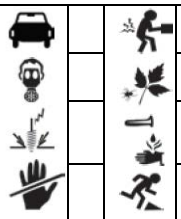
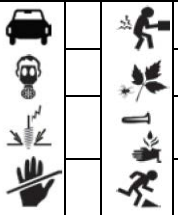
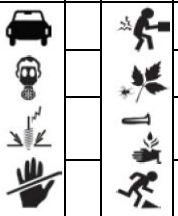
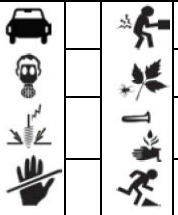
JSA Version Date: 10/18/2019		
Job Description: Well Abandonment		
Project: West Lake Landfill	Site Location: Bridgeton, MO	

Development Team Please include the team members employer and email if not employed by Trihydro Corporation:	**Position/Title:**	**Primary Contact**
1. Allison Riffel	Project Manager	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.		
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
Work Planning.		A. Poor planning prior to activity	A. Identify overhead hazards or areas of high traffic prior to work being conducted.	
Mobilize to sample location.		A. General traffic, other site activities. B. Site activities C. Rig damage	A. Drive at safe speeds, follow 3-D driving procedure. B. Familiarize yourself with the site, current site activities, and drilling locations prior to setting up. Verify nearest hospital, fire exit, and eye wash station. C. Check path to the intended location is stabile for a drill rig and has adequate vertical and lateral clearance.	
Set up at location.		A. Overhead utilities, B. Bystander safety. C. Emergency response obstructions D. Equipment damage	A. Setup drill rig a safe distance from overhead lines or obstructions and a safe distance from potential bystander pathways. Use a spotter if needed. B. Setup a secure work area if bystander participation is possible. C. Check that the drill rig is not positioned so as to cut off potential emergency vehicle access or other vehicle egress routes, in case of emergency. D. Check that drill rig hydraulic lifts rest on supports (if necessary) and are positioned on firm ground to prevent subsidence or slippage. Setup vehicles (other than drilling support vehicles) a safe distance from the rig.	
Conduct Safety Meeting		A. Poor communication B. Equipment damage	A. Conduct safety meeting to go over potential safety hazards with site workers. Discuss Chemicals of concern, proper PPE, hospital routes, emergency phone numbers, potential external hazards (weather, trip/fall, etc). B. Have oeprators conduct and document inspection. Check safety latches on winch hooks, check for worn catshead rope or frayed cable, check for presence of an adequate number of cable connectors on winch lines, note the locations of drill rig kill switches and check that the kill switches are in working order.	

Job Steps	Hazard(s)	Potential Hazard(s)	Critical Action(s)	Responsible Person
Observe drilling and abandonment.		A. Personal hazard B. Slip, trip, fall C. Equipment hazards D. Weather hazards	A. Wear proper PPE: ear plugs, safety glasses, hard hat, safety shoes. B. Keep work area clear of tools and equipment. C. Keep safe distance from drill rig. D. Cancel drilling if inclement weather or lightning is present.	
Breakdown at Drilling Location		A. Overhead utilities and obstructions. B. Slip, trip, fall hazards. C. Bystander safety.	A. Observe overhead lines and obstructions when lowering mast and tightening winch lines. B. Keep work area clear of tools and equipment. C. Keep bystanders at a safe distance. Use caution tape if appropriate	

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: 10/18/2019		
Job Description: Well Development		
Project: West Lake Landfill	Site Location: Bridgeton, MO	

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. Allison Riffel	Senior Engineer	10/18/2019
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:***	☐ ***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: West Lake Landfill	Site Location: Bridgeton, MO	

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. Allison Riffel	Project Manager	10/18/2019
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 (if overhead hazard present)	☒ 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
Investigation of work area		x x		 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. 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		 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. 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		 x		 x	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				x	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		 x			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-SPECIFIC HEALTH AND SAFETY POLICIES, PROCEDURES, AND PLANS (BRIDGING DOCUMENT)

Bridging of Trihydro Corporation and Subcontractor Safety Requirements to West Lake Landfill Policies and Procedures

The Site-Specific Health and Safety Plan (HASP) for project site work conducted at the West Lake Landfill project located in [Keywords], 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 the West Lake Landfill, as applicable to the work of Trihydro and its subcontractors in the site environment. Where Trihydro, its subcontractors, and West Lake Landfill 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 OU-1 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 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 West Lake Landfill, 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 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 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
OU-1 Radiation Safety Plan
OU-1 Emergency Response Plan

Radiation Safety Plan for Operable Unit-1

1157-I-001

Prepared for:

WEST LAKE LANDFILL SUPERFUND SITE
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Abbreviations and Acronyms

ALARA	As Low as Reasonably Achievable
ALI	Annual Limit on Intake
Ameriphysics	Ameriphysics, LLC
CFR	Code of Federal Regulations
CHP	Certified Health Physicist
cm^2	square centimeters
DAC	Derived Air Concentration
dpm	Disintegration Per Minute
EPA	Environmental Protection Agency
ICRP	International Commission on Radiological Protection
µCi	microcurie
µCi/ml	microcurie per ml
MDNR	Missouri Department of Natural Resources
NRC	U.S. Nuclear Regulatory Commission
OU	Operable Unit
PPE	Personal Protective Equipment
RCA	Radiologically Controlled Area
RCM	Ameriphysics' Radiological Control Program Manual
RCP	Radiological Control Procedure
RCS	Radiological Control Supervisor
RIM	Radiologically Impacted Material
RSO	Radiation Safety Officer
RSP	Radiation Safety Plan
RWP	Radiation Work Permit
Site	West Lake Landfill Site
TEDE	Total Effective Dose Equivalent

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1 PURPOSE

The West Lake Landfill Superfund Site (Site) currently consists of three operable units (OU). OU-1 primarily addresses two disposal areas at the West Lake Landfill, known as Areas 1 and 2, that have been identified as containing radiologically impacted material (RIM). OU-2 consists of portions of the Site that have not been identified as containing RIM. OU-3 addresses groundwater associated with the Site, including the groundwater immediately beneath Areas 1 and 2. The United States Environmental Protection Agency (USEPA) is the Site's lead regulatory agency for the remedial activities and investigations at the Site, with certain responsibilities deferred to the Missouri Department of Natural Resources (MDNR).

Areas 1 and 2 are specifically designated as radiologically controlled areas (RCAs) because of the potential for workers within their boundaries to contact or disturb RIM. Consequently, any access to, egress from, and work within these areas will be controlled according to a radiation protection program conforming to Title 10, Code of Federal Regulations (CFR), § 20.1101. On a case-by-case basis, areas outside of Areas 1 and 2, such as the Buffer Zone, Lot 2A2, and adjacent property(ies), may be designated RCAs and controlled accordingly when there is concern that work in such areas exhibits a reasonable potential to disturb RIM.

Ameriphysics, LLC (Ameriphysics) is a Nuclear Regulatory Commission (NRC) licensee, and it maintains an NRC approved and audited § 20.1101-based radiation protection program that will be used to control work within RCAs. Ameriphysics' program is described in its Radiological Control Program Manual (RCM) and implementing Radiological Control Procedures (RCPs).

The purpose of this Radiation Safety Plan (RSP) is to describe the site-specific controls that are necessary to implement the existing Ameriphysics radiation protection program at the Site. The Ameriphysics RCM and RCPs will be submitted to USEPA in their entirety under separate cover; however, they will be onsite and available for use and reference whenever work is accomplished according to this RSP.

2 SCOPE

This RSP is applicable to any activities requiring access to OU-1 Areas 1 and 2 or otherwise demonstrating a reasonable potential to disturb RIM such as near-surface disturbances of soil in the Buffer Zone and Lot 2A2 and borings near the Area 1 and 2 fence line. Specific activities requiring radiological controls include, but are not limited to:

- Work area visits and surveys;
- Work area preparations;
- Invasive subsurface activities such as sampling and drilling operations;
- Above-ground monitoring or sampling activities associated with air, stormwater, or other media;

- Maintenance/repair of the engineered cover within the Areas;
- Movement and storage of equipment that may be impacted by contact with RIM;
- Monitoring and decontamination of equipment; and
- General monitoring of radiological conditions and personnel.

This RSP is intended to be used with the most recent versions of any health and safety and other site-specific plans that describe Areas 1 and 2, work that will be conducted, and other organizational aspects. Consequently, the scope of this RSP is limited to the particular instructions that are needed to implement the Ameriphysics Radiation Protection Program at the Site.

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 OU-1 Site Supervisor

The OU-1 Site Supervisor is responsible for providing access and egress to any person or organization requiring access to Areas 1 and 2, including the necessary monitoring and support required by this RSP.

3.2 Radiation Protection Personnel

Ameriphysics will provide radiological oversight and support for activities conducted in Areas 1 and 2 or deemed as potentially involving RIM. Ameriphysics will be responsible for assessing radiological conditions, specifying required controls, conducting radiological training, performing radiological surveys, specifying protective clothing requirements, determining personnel exposure monitoring requirements, and monitoring persons, vehicles and equipment for contamination.

Ameriphysics will provide radiological support to the project with the following organizational elements and required monitoring equipment.

3.2.1 Radiation Safety Officer

Ameriphysics' Radiation Safety Officer (RSO) is responsible for executive-level administration of the corporate 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' corporate RSO. Because he is an executive-level manager, he does not need to be present in the field, and his work will be conducted from Ameriphysics' corporate office in Knoxville, TN.

3.2.2 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. Support from the Health Physicist may be accomplished offsite.

3.2.3 Radiological Control Supervisor

A Radiological Control Supervisor (RCS) reports to the RSO and oversees field implementation of the radiological control and safety program at the project level. Such implementation is described in Sections 5, 6, 7, and 8 of this RSP and the current version of Ameriphysics RCM and implementing RCPs. 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.

An RCS will be onsite any time work exhibiting a potential to disturb RIM is conducted. If the designated RCS must be away from the Site, his or her responsibilities will temporarily be assigned to an appropriately experienced Health-Physics Technician so that continuity of radiological supervision is always maintained. The designated RCS is only allowed to temporarily pass his or her responsibilities onto an individual that the RSO has approved to serve in such a capacity.

Because the complexity of the work may vary vastly as the project unfolds, and work occurring in multiple areas may reflect a need for more than one RCS, a specific person is not named by this RSP as the sole RCS representing the radiation protection organization. Instead, the RSO will propose and the Health Physicist will approve any person serving the project in the role of RCS. The proposal and approval will be in writing. This requirement does not preclude the RSO or project Health Physicist from serving as an RCS.

3.2.4 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.

3.3 Radiation Workers

Radiation Workers are any persons, regardless of employer, who engage in work activities in RCAs and are not classified as visitors by the RCS according to Section 6.6 of this RSP. Radiation Workers will follow the instructions from Radiation Protection Personnel but do not perform the duties assigned to Radiation Protection Personnel unless specifically authorized to do so by the RCS.

4 RADIOLOGICAL CONTAMINANTS OF CONCERN

The occurrences of RIM have been identified to consist of radionuclides in the uranium (U-238), actinium (U-235), and thorium (Th-232) decay series. Important radionuclides comprising these decay series are listed in Table 1 of the September 2018 Record of Decision Amendment. These radionuclides and corresponding properties from International Commission on Radiological Protection (ICRP) Publication 107, *Nuclear Decay Data for Dosimetric Calculations*, are demonstrated on Table 1.

Table 1. Radionuclides of Concern

Nuclide	Half-Life[1]	Decay Mode[2] (Fraction)	Energy Emitted (MeV/transformation)			
			Alpha	Electron	Photon	Total
Uranium Series						
U-238	4.468E+9 y	A (1.00) SF (5.5E-07)	4.2584	0.0092	0.0014	4.2691
Th-234	24.10 d	B- (1.00)	-	0.0622	0.0105	0.0728
Pa-234	6.70 h	B- (1.00)	-	0.4037	1.4718	1.8755
U-234	2.455E+5 y	A (1.00)	4.8430	0.0137	0.0020	4.8587
Th-230	7.538E+4 y	A (1.00)	4.7538	0.0146	0.0018	4.7702
Ra-226	1600 y	A (1.00)	4.8603	0.0039	0.0074	4.8716
Pb-214	26.8 m	B- (1.00)	-	0.2948	0.2533	0.5481
Bi-214	19.9 m	B- (1.00) A (2.1E-4)	0.0012	0.6631	1.4793	2.1436

Nuclide	Half-Life[1]	Decay Mode[2] (Fraction)	Energy Emitted (MeV/transformation)			
			Alpha	Electron	Photon	Total
Pb-210	22.20 y	B- (1.00) A (1.9E-8)	<0.0001	0.0404	0.0053	0.0457
Actinium Series						
U-235	7.04E+8 y	A (1.00)	4.4693	0.0530	0.1669	4.6891
Th-231	25.52 h	B- (1.00)	-	0.1622	0.0269	0.1891
Pa-231	3.276E+4 y	A (1.00)	5.0592	0.0538	0.0450	5.1580
Ac-227	21.772 y	B- (0.99) A (0.01)	0.0693	0.0150	0.0011	0.0853
Th-227	18.68 d	A (1.00)	5.9883	0.0755	0.1317	6.1955
Ra-223	11.43 d	A (1.00)	5.7702	0.0781	0.1413	5.9895
Pb-211	36.1 m	B- (1.00)	-	0.4543	0.0644	0.5187
Bi-211	2.14 m	A (1.00) B- (2.8E-3)	6.6757	0.0100	0.0473	6.7330
Thorium Series						
Th-232	1.405E+10 y	A (1.00)	4.0688	0.0126	0.0015	4.0829
Ra-228	5.75 y	B- (1.00)	-	0.0132	0.0031	0.0163
Ac-228	6.15 h	B- (1.00)	-	0.4495	0.8671	1.3166
Th-228	1.9116 y	A (1.00)	5.4956	0.0210	0.0036	5.5202
Ra-224	3.66 d	A (1.00)	5.7766	0.0023	0.0104	5.7893
Pb-212	10.64 h	B- (1.00)	-	0.1766	0.1450	0.3217
Bi-212	60.55 m	B- (0.64) A (0.36)	2.2164	0.5046	0.1038	2.8247
Tl-208	3.053 m	B- (1.00)	-	0.6113	3.3603	3.9716

[1] Key to half-life: h is hours, m is minutes, d is days, and y is years

[2] Key to decay mode: A is alpha, B- is beta minus, SF is spontaneous fission

5 RADIATION PROTECTION REQUIREMENTS

5.1 Training Requirements

Persons must possess the Radiation Safety Training required by Ameriphysics procedure RCP 2-1, *Radiation Safety Training Procedure*, in order to access RCAs unless designated as visitors according to Section 6.6 of this RSP and escorted. The training and a certificate of completion will be provided by Ameriphysics.

Workers who receive or are likely to receive an occupational effective dose equivalent in excess of 0.1 rem in one year are provided Radiation Worker Training. The approximately 1-day course familiarizes trainees 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.

A worker who is not likely to receive an occupational effective dose equivalent in excess of 0.1 rem in one year is provided Radiation Awareness Training. This training familiarizes workers with site hazards and provides instructions for avoiding contact with radioactive material and for keeping individual doses less than 0.1 rem.

The initial Radiation Safety Training required by this section 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 jobsite 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 completing 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 3.2 are described in Section 2 of Ameriphysics' RCM.

5.2 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 2.

Table 2. 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.

5.3 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 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. The unit for ALI is the microcurie (µCi).

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. The unit for DAC is µCi per milliliter (µCi/ml).

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.

The most-restrictive stochastic inhalation ALIs and DACs from 10 CFR § 20, Appendix B, for site-specific radionuclides of concern from Table 1 are shown on Table 3.

Table 3. ALIs and DACs for Radionuclides of Concern

Uranium Series			Actinium Series			Thorium Series		
Nuclide	ALI (µCi)	DAC (µCi/ml)	Nuclide	ALI (µCi)	DAC (µCi/ml)	Nuclide	ALI (µCi)	DAC (µCi/ml)
U-238	1E+0	6E-10	U-235	1E+0	6E-10	Th-232	1E-3	5E-13
Th-234	2E+2	8E-8	Th-231	6E+3	3E-6	Ra-228	1E+0	5E-10
Pa-234	8E+3	3E-6	Pa-231	2E-3	6E-13	Ac-228	9E+0	4E-9
U-234	1E+0	5E-10	Ac-227	4E-4	2E-13	Th-228	1E-2	4E-12
Th-230	6E-3	3E-12	Th-227	3E-1	1E-10	Ra-224	2E+0	7E-10

Ra-226	6E-1	3E-10	Ra-223	7E-1	3E-10	Pb-212	3E+1	1E-8
Pb-214	8E+2	3E-7	Pb-211	6E+2	3E-7	Bi-212	2E+2	1E-7
Bi-214	8E+2	3E-7	Bi-211	4E-4	2E-13	Tl-208	2E+2	1E-7
Pb-210	2E-1	1E-10						

Thus, the most restrictive ALI (i.e., 4E-04 µCi) and DAC (i.e., 2E-13 µCi/ml) are for the radionuclides Ac-227 and Bi-211.

Personal protective equipment (PPE), i.e., Tyvek© clothing and respiratory protection, should be used only after the RCS is convinced that the organization responsible for the work activity has made a reasonable effort 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.

5.4 Site Monitoring

5.4.1 General Area Surveys

The purpose of a general area survey is to characterize the ambient radiation environment of the entire Site and not just the immediate work area. The frequency of these surveys will be determined by the RCS, but will include, at minimum, surveys at the beginning and the end of any major work activity and when substantive changes are made to the Site. These surveys will be made with a Ludlum Model 19 or equivalent that is setup and operated according to Ameriphysics Procedure RCP 4-3, *Survey Instrument Procedure*.

5.4.2 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 0.5 rem per year;
2. Declared pregnant women likely to receive during the entire pregnancy, from radiation sources external to the body, a deep dose equivalent in excess of 0.1 rem; and
3. Individuals entering a high or very high radiation area as defined by 10 CFR § 20.1003, *Definitions*.

Minors are also required to wear external exposure dosimetry if they are likely to receive, in one year from radiation sources external to the body, a deep dose equivalent in excess of 0.1 rem, a lens dose equivalent in excess of 0.15 rem, or a shallow dose equivalent to the skin or to the extremities in excess of 0.5 rem; however, the presence of minors at the Site is not anticipated. Permanent-record dosimetry shall be issued by Ameriphysics to each individual that is required by this section to wear external exposure dosimetry. 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 returned to Ameriphysics 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.

The RSO will report individual monitoring results to workers annually and at the request of any individual formerly wearing dosimetry provided by Ameriphysics. These reports are provided directly to the monitored individuals and not their employers unless the worker directs the RSO otherwise in writing.

5.4.3 Portable Air Sampling

Airborne particulate surveys shall be performed by Radiation Protection Personnel daily in the vicinity of any work that exhibits a potential to disturb RIM. These surveys will be performed according to Ameriphysics procedure RCP 4-4, *Airborne Radioactivity Control Procedure*. 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.

6 HEALTH PHYSICS CONTROLS

Maintaining personnel exposures ALARA is the primary goal of this RSP. This is accomplished with a combination of engineering and administrative controls.

6.1 Exposure and Contamination Control

Work in areas where RIM is handled, used, or stored shall be performed in accordance with approved procedures and work instructions to ensure that 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 an 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 may be implemented to ensure worker doses are ALARA include:

- Wetting of soil to minimize the suspension of contaminated 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.

- Any work activities conducted in Areas 1 or 2 or involving a potential to handle RIM will be defined and delineated using job-specific RWPs;
- All nonessential personnel will be restricted from RCAs;
- No eating, drinking or smoking will be allowed in RCAs; and
- Individuals will, to the extent practical, remain up-wind of surface preparation, sampling and material handling operations.

The RCS ensures that engineering and administrative controls are sufficient to maintain worker protection. In doing so, the RCS coordinates with the OU-1 Site Supervisor and other supervisory personnel to ensure that controls are understood, effective, and not unnecessarily impeding work.

6.2 Postings

Areas where radiation or the potential for radiation exist will be posted in accordance with 10 CFR § 20.1902, *Posting requirements*. The following postings are likely or possible based on known contaminants and concentrations.

- Each radiation area will be posted with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, RADIATION AREA." Radiation area means an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.
- Each airborne radioactivity area (as defined in Section 5.3) will be posted with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, AIRBORNE RADIOACTIVITY AREA" or "DANGER, AIRBORNE RADIOACTIVITY AREA."
- Unless already posted as a radiation area or airborne radioactivity area, each RCA will be posted with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL(S)" or "DANGER, RADIOACTIVE MATERIAL(S)."

6.3 Surveys, Monitoring, Action Levels, and Decontamination

Radiological surveys are performed by Radiation Protection Personnel 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*.

Area radiation surveys are performed by Radiation Protection Personnel:

1. Daily, at boundaries and access control points of radiation areas;
2. Weekly, in occupied radiation areas, areas where radioactive material and waste is stored, and at boundaries of work sites where the public could be exposed;
3. Whenever operations are performed that might be expected to change existing radiation levels;
4. When highly radioactive equipment (i.e., radiation level at 30 cm is greater than 0.1 rem per hour) is moved; and
5. When performing operations that could result in personnel being exposed to small intense beams of radiation.

Surface contamination surveys are performed by Radiation Protection Personnel:

1. Prior to initial entry to an area where contamination is possible;
2. In-process to verify appropriateness of contamination controls, control processes, direct remedial efforts, and free release items or areas.

Removable contamination surveys are performed by Radiation Protection Personnel:

1. Daily, in active work areas where contamination is possible and at access control points;
2. Weekly, in areas where handling of RIM occurs and areas where RIM is stored; and
3. In-Process, during any of the following:
    a. Decontamination and release of equipment;
    b. In areas where airborne radioactivity has exceeded the concentrations specified in Ameriphysics procedure RCP 4-4, *Airborne Radioactivity Control Procedure*; and
    c. When determining the need for anti-contamination clothing and to determine the extent of contamination in an area.

Removable contamination is evaluated by obtaining representative wipes and counting the contamination on the wipe using a Ludlum 3030E or equivalent.

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All vehicles and equipment entering Areas 1 or 2 will be surveyed by a qualified Health Physics Technician for alpha and beta contamination before its initial entrance as well as when exiting the area. The survey will be conducted using a Ludlum Model 2360 coupled to a Model 43-93 (or equivalent). A removable contamination survey is also required for any vehicles or equipment leaving the Site.

Radiological surveys of any drilling or sampling equipment and cores, borehole cuttings, and other investigation-derived waste will be performed in the immediate vicinity of the work activity location (i.e., this material and equipment will be surveyed before it is moved).

Ameriphysics' surface contamination survey limits are based on Regulatory Guide 1.86, Table 1, *Acceptable Surface Contamination Limits*. These limits are commensurate with limits from Regulatory Guide 8.23, Table 3, *Acceptable Surface Contamination Levels for Uncontrolled Release of Equipment*. Of the known Site contaminants, the most restrictive limits for alpha-emitting nuclides are 100 disintegrations per minute (dpm)/100 cm^2 total activity and 20 dpm/100 cm^2 removable activity, and the most restrictive limits for beta-emitting nuclides are 1,000 dpm/100 cm^2 total activity and 200 dpm/100 cm^2 removable activity. These limits serve as the action levels at which decontamination of equipment is required. Radiation Protection Personnel will decide if decontamination can be accomplished or assisted by persons qualified as Radiation Workers. For example, it is reasonable to expect Radiation Workers to be able to clean equipment that is contaminated with materials they are already authorized to handle during their regular work. Nonetheless, Radiation Workers will not undertake decontamination on their own without authorization.

Surveys of personnel (i.e., "frisking") will be performed when exiting an RCA. The type of scan (i.e., whole body, hand and foot, etc.) will be designated on the RWP. Unlike surveys of equipment, the action level for contamination of skin or clothing is any detectable contamination. Radiation Workers will not attempt to decontaminate themselves; only Radiation Protection Personnel are allowed to decontaminate people.

Ameriphysics procedure RCP 4-9, *Decontamination Procedure*, describes general techniques for decontamination. Due to the nature of the work that is planned and the physical characteristics of the RIM, decontamination beyond basic tape-presses or cleaning with damp cloths and a mild over-the-counter detergent is not expected.

6.4 Survey Instrumentation

Radiation Protection Personnel will make an adequate number of calibrated radiation detection and measurement instruments available. 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*.

6.5 Access Control Points

An access control point is a location on the perimeter of an RCAthrough 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. Boundaries shall be conspicuously marked and posted;
3. Cover the floor of the 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 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 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 used PPE, respirators, and equipment at the 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 Protection Personnel shall designate, stock, staff, and otherwise maintain the control point;
10. Only personnel in assigned PPE should enter RCAs;
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*.

6.6 Visitors

Management, technical, and other personnel who require occasional access to RCAs and areas where RIM is stored and who enter these for observation or similar purposes, or to perform work not involving RIM, 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 to 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.

7 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 4.

Table 4. 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

8 EMERGENCY RESPONSE

The Site operates according to an Emergency Response Plan that describes the procedures that will be used in the event of an accident or emergency at OU-1. In the event of a medical emergency, fire, explosion, or other emergency event potentially involving RIM, priority shall always be given to injured personnel and personnel safety, then to combating of the fire or other emergency. Radiological controls shall be given secondary importance to these tasks.

DRAFT

EMERGENCY RESPONSE PLAN

WEST LAKE LANDFILL SUPERFUND SITE OPERABLE UNIT-1

Prepared For:
The United States Environmental Protection Agency Region VII

Prepared on Behalf of:
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LIST OF ACRONYMS

ACRONYM	Definition	ACRONYM	Definition
ASAOC	Administrative Settlement Agreement and Order of Consent	OU	Operable Unit
BMP	Best Management Practices	PPE	personal protective equipment
EPA	Environmental Protection Agency	RA	Remedial Action
ERP	Emergency Response Plan	RD	Remedial Design
FS	Feasibility Study	RI	Remedial Investigation
GERT	General Employee Radiation Training	RIM	Radiologically Impacted Material
HASP	Health and Safety Plan	ROD	Record of Decision
HAZWOPER	Hazardous Waste Operations and Emergency Response	RSP	Radiation Safety Plan
IMP	Incident Management Plan	SPCC	Spill Prevention, Control, and Countermeasures
MDNR	Missouri Department of Natural Resources	SOW	Statement of Work
NCC	Non-Combustible Cover	SWMP	Site Wide Monitoring Plan
OEM	Office of Emergency Management	UAO	Unilateral Administration Order
O&M	Operation & Maintenance Plan	USC	United States Code

1.0 INTRODUCTION

This Emergency Response Plan (ERP) has been prepared for Operable Unit-1 (OU-1) of the West Lake Landfill Superfund Site (the "site"). The plan describes the procedures that will be used in the event of an accident or emergency at OU-1 during the implementation of the Remedial Design (RD) / Remedial Action (RA).

This plan has been prepared in accordance with the requirements of the Remedial Design Statement of Work (SOW), Operable Unit-1, West Lake Landfill Superfund Site (EPA 2019b). Specifically, the plan is intended to fulfill the requirements of SOW Paragraph 5.7(b) ["Emergency Management Plan"]. This ERP is Deliverable 3 on the RD Schedule presented in SOW Paragraph 6.2.

This ERP may be revised as necessary – if approved by EPA – during the RD/RA process to reflect changes in site conditions, RD/RA activities, or the party(ies) conducting RA.

The ERP is organized is organized as follows:

- Introduction: This section, which describes the purpose of the plan;
- Site Description: Describes the site location, layout, and history;
- Emergency Response Roles and Responsibilities: Describes the OU-1 emergency response roles and responsibilities;
- Plan Development and Revisions: Describes pre-emergency planning efforts and the ERP revision process for OU-1;
- Emergency Assessment and Response Strategy: Describes the general emergency assessment and response strategy procedures for OU-1;
- Emergency Notifications: Describes the emergency notification procedures applicable to OU-1;
- Emergency Response Infrastructure and Equipment: Describes site infrastructure and equipment that is pertinent to OU-1 emergency response activities;
- Radiation Safety During Emergencies: Describes radiation safety practices that are applicable to OU-1 during emergencies;
- Post-Response Reporting: Describes the post-response reporting procedures for emergencies that occur in OU-1; and
- Emergency Response Training: Describes the emergency response training that is applicable to OU-1.

2.0 SITE DESCRIPTION

The West Lake Landfill Superfund Site is an approximately 200-acre inactive solid waste disposal facility, located at the physical address 13570 St. Charles Rock Road in the City of Bridgeton, St. Louis County, Missouri. The site is approximately 18 miles northwest of downtown St. Louis, Missouri, approximately one mile north of the intersection of Interstate 70 and Interstate 270, and approximately one-and-three-quarters (1.75) miles west-northwest of the St. Louis Lambert International Airport. The Missouri River is approximately one-and-a-half (1.5) miles to the west of the site. Industrial properties are located on and adjacent to the site, and commercial and residential properties are located near its perimeter. The site's location is illustrated on **Figure 1**, along with the locations of local fire district facilities and hospitals.

The general layout of the site is illustrated on **Figure 2**. The site is divided into three Operable Units. OU-1 is the subject of this ERP and includes areas with radiologically impacted materials (RIM). OU-1 is comprised of the following areas:

- Radiological Area 1 (Area 1): This approximately 17.6-acre area is located in the eastern-to-northeastern portion of the site, immediately southwest of the site's main entrance from St. Charles Rock Road. Area 1 was associated with unregulated landfill operations conducted at the site prior to the commencement of state regulations in 1974. Radionuclides are present in and on the soils and waste materials that have become interspersed within the landfill matrix. The southwestern portion of Area 1 is overlain by 40 to 45 feet of more recent, non-RIM-containing waste materials (referred to as the "muffin top" or "mound"). These materials were placed above-grade between 2002 and 2004 in the North Quarry portion of the Bridgeton Landfill (see below). Due to the disposal of these more recent waste materials, some areas contaminated with RIM occur at depths of up to 85 feet in the southwestern portion of Area 1.
- Radiological Area 2 (Area 2): This approximately 41.8-acre area is located in the northwestern portion of the site. Area 2 was also associated with unregulated landfill operations conducted at the site prior to the commencement of state regulations in 1974. Radionuclides are present in and on soils and waste materials that have become interspersed within the landfill matrix.
- Buffer Zone: This approximately 1.8-acre strip of property is located immediately west-southwest of Area 2. The property was acquired by the landfill operator in 2001 after it was discovered that radiologically-impacted soils had eroded from Area 2 and onto the property.
- Lot 2A2 (Crossroads Properties, LLC): This approximately 3.6-acre privately-owned commercial property is located immediately west-northwest of the Buffer Zone and immediately southwest of the northern portion of Area 2. It has been determined that radiologically-impacted soils have also eroded from Area 2 and onto the Lot 2A2 property.

A Non-Combustible Cover (NCC) was installed over portions of OU-1 Area 1 and Area 2 (as well as the Buffer Zone) in 2016, with additional installation occurring in some steeply-sloped portions of Area 2 in 2018. The NCC installation was performed pursuant to the EPA's December 9, 2015 Unilateral Administrative Order (UAO) (EPA 2015). The NCC was installed over those portions of OU-1 where RIM was present at or near the ground surface. The cover design consists of a graded 8-in.-thick limestone gravel layer overlaying a non-woven geotextile. The extent of the NCC in Area 1 and Area 2 (including the Buffer Zone) is illustrated on **Figures 3** and **4**, respectively.

OU-2 includes those areas where RIM has not been identified. It is comprised of the following areas: a Closed Demolition Landfill in the northeastern portion of the site; an Inactive Sanitary Landfill in the western portion of the site; and a Former Active Sanitary Landfill, also known as Bridgeton Landfill, in the eastern and southern portion of the site. As noted above, waste materials were placed above-grade in the North Quarry portion of

Bridgeton Landfill, over the southwestern portion of what is now OU-1 Area 1. In accordance with the July 25, 2008 Record of Decision (ROD) for OU-2 (EPA 2008), EPA has deferred oversight of the Closed Demolition Landfill and Former Active Sanitary Landfill to the Missouri Department of Natural Resources (MDNR), while EPA remains the lead regulatory agency overseeing the remedy at the Inactive Sanitary Landfill.

Sitewide groundwater is being investigated as a separate Operable Unit, OU-3. A Remedial Investigation (RI) and Feasibility Study (FS) for OU-3 will be implemented pursuant to a February 6, 2019 Administrative Settlement Agreement and Order on Consent (ASAOC) (EPA 2019a).

Also included within the boundaries of the site are several structures and facilities that are not part of the waste disposal areas, including a solid waste transfer station, a leachate pre-treatment plant, and an asphalt batch plant.

Note that the emergency response procedures described in this ERP are applicable only to OU-1. The remainder of the site – including OU-2 and the other structures and facilities – is addressed in the Incident Management Plan (IMP) (Bridgeton Landfill 2019).

2.1 OIL STORAGE

There are no in-use containers within the boundaries of OU-1 with oil storage capacity of 55 gallons or greater. The only container with 55 gallons or more of oil storage capacity within the boundaries of OU-1 is an underground (i.e., completely buried) former diesel tank in Area 1 that is believed to be abandoned (i.e., permanently closed). In accordance with Title 40 of the Code of Federal Regulations (CFR) 112.19(d)(2)(i) and (5), the requirements of 40 CFR Part 112 are not applicable to OU-1, and a Spill Prevention, Control, and Countermeasures (SPCC) Plan is not required for OU-1.

If oil storage (e.g., for fuel and lubricants) is needed during the performance of RD/RA activities, this ERP may be revised as necessary to incorporate the required SPCC Plan.

3.0 EMERGENCY RESPONSE ROLES AND RESPONSIBILITIES

This section describes the OU-1 emergency response roles and responsibilities.

The individuals designated for each of the following emergency response roles – as well as their contact information – are specified on **Table 1**. For ease of access, the designated individuals and their contact information are also reiterated on the emergency response strategies presented in **Appendix A.**

3.1 OU-1 PROJECT COORDINATOR

The OU-1 Project Coordinator has overall responsibility for the implementation of the OU-1 RD/RA. For the RD, this individual will interface between the Environmental Protection Agency (EPA) and the OU-1 Respondents: Cotter Corporation (N.S.L.), Bridgeton Landfill, LLC, and the Department of Energy. Because the Respondents are still negotiating the Consent Decree and participation in the RA with EPA, the ERP and designated personnel may change at the RA stage, depending on the party(ies) conducting RA. The ERP will be revised with EPA's permission at the appropriate time to reflect any such changes.

3.2 EMERGENCY RESPONSE MANAGER

The OU-1 Emergency Response Manager has overall responsibility for emergency response at OU-1. This individual will report to the Project Coordinator and ensure that the procedures described in this ERP are followed. The Emergency Response Manager is responsible for initial emergency assessment and coordination of emergency response activities for OU-1. If the Emergency Response Manger is not available, one of the Alternates listed on **Table 1** may fulfill their responsibilities.

3.3 RADIATION SAFETY OFFICER

The OU-1 Radiation Safety Officer has responsibility for OU-1 radiation protection practices. This individual will report to the Emergency Response Manager and will coordinate with first responders and assist them with the implementation of radiation safety practices as necessary and appropriate during an emergency. If the Radiation Safety Officer is not available, the Alternate listed on **Table 1** may fulfill their responsibilities.

3.4 SUPPORT CONTACTS

The Support Contacts are personnel associated with Bridgeton Landfill. The OU-1 Emergency Response Manager may coordinate with the Support Contacts as needed to procure assistance and resources when responding to emergencies.

4.0 PLAN DEVELOPMENT AND REVISIONS

This section describes pre-emergency planning efforts and the ERP revision process for OU-1.

This ERP has been developed based in part on the current IMP (Bridgeton Landfill 2019) for the larger West Lake Landfill Superfund Site. The IMP was developed pursuant to the UAO (EPA 2015), which required that the facility prepare an IMP for OU-1. The IMP that was eventually prepared incorporated the entirety of the West Lake site, including OU-1, and was based in part on a plan originally developed for the Bridgeton Landfill (CEC 2015). The IMP was developed in close consultation with local and regulatory authorities, including emergency responders. Since it was first submitted on March 21, 2016, the IMP has been revised multiple times, based on changes to site conditions and activities, and on comments provided by the local and regulatory authorities.

Within 30 days of EPA Region 7 approval of this ERP, the plan will be submitted with a request for comments to the first responders listed on **Table 1**. The OU-1 Emergency Response Manager will coordinate with these first responders to ensure that their comments on the ERP are implemented. This may include a webinar, teleconference, or in-person meeting with the first responders at the Bridgeton Landfill office (or other agreed-upon venue) to review any submitted comments and discuss their implementation. The Emergency Response Manager will coordinate with EPA Region 7 regarding any such "post-approval" revisions based on comments from first responders.

Thereafter, the Emergency Response Manager will conduct routine ERP meetings with the first responders listed on **Table 1** and EPA Region 7. These meetings will be held at the Bridgeton Landfill office (or other agreed-upon venue) on – at minimum – a quarterly basis. During these meetings, the OU-1 first responders and Support Contacts listed on **Table 1** will convene to review site conditions, activities, emergencies from the past quarter (if any), and work planned for the next quarter. Any notes generated during an ERP meeting will be compiled and distributed to the invited regulatory and local authorities within 7 days of the meeting. Based on the result of the ERP meeting, changes will be incorporated into the ERP, if needed, and the revised plan then distributed to the OU-1 first responders and EPA Region 7 personnel within 30 days of the meeting. The Emergency Response Manager will have responsibility for distributing meeting notes and any ERP revisions.

ERP first responder meetings may be needed on a more frequent basis during RD and RA activities, depending on the nature of the activities and the rate at which site conditions or activities change. The OU-1 Emergency Response Manager will review the ERP on a quarterly basis to ensure the information in the document is still current.

It is anticipated that the ERP will be revised at certain points during the RD / RA process as the RD / RA activities are defined in greater detail and the party(ies) conducting RA are confirmed. Specifically, it is anticipated that major revisions to the ERP will likely be submitted concurrently with the following deliverables specified in the SOW:

- Design Investigation Work Plan (DIWP) (SOW Deliverable #8): The ERP will be updated to reflect the planned design investigation field activities described in the DIWP and its supporting deliverables, in particular the Field Sampling Plan (FSP) (SOW Deliverable #9) and Health and Safety Plan (HASP) (SOW Deliverable #11). The update will include a discussion of any design investigation activities that could potentially affect emergency responders.
- Site Wide Monitoring Plan (SWMP) (SOW Deliverable #14): The ERP will be updated to reflect the planned site monitoring field activities described in the SWMP. The update will include a discussion of any site monitoring activities that could potentially affect emergency responders.

- **Pre-Final (90%) Remedial Design (90% RD) (SOW Deliverable #21):** Per SOW Paragraph 3.8(b), the ERP will be updated to reflect the planned RA activities described in the 90% RD and its supporting deliverables, in particular the Operation & Maintenance Plan (O&M Plan) (SOW Deliverable #18). The update will include a discussion of any RA activities that could potentially affect emergency responders.
- **Draft Final (100%) Remedial Design (100% RD) (SOW Deliverable #22):** Per SOW Paragraph 3.9, the 100% RD will include final versions of all RD deliverables, including the ERP. The ERP will be updated at this point to reflect any EPA comments on the (90% RD).

As with the initial version of this ERP (see above) within 30 days of EPA approval of a revised version of the ERP, the plan will be submitted with a request for comments to the regulatory and local authorities listed on **Table 1**.

Note that the site's current IMP will be revised to reflect the fact that emergency response for OU-1 will be addressed by this ERP once it has been approved and formally adopted. The IMP will continue to address the remainder of the site, including OU-2 and the other structures and facilities. Note that the site will hold quarterly IMP review meetings with many of same first responders listed on **Table 1**, in accordance with the requirements of the IMP**.** During these IMP review meetings, Bridgeton Landfill personnel will discuss site conditions, activities, and incidents from the past quarter (if any) for the non-OU-1 portions of the site. For the convenience of the first responders, the quarterly ERP review meeting may occur immediately before or after the quarterly IMP meeting at the Bridgeton Landfill office (or other agreed-upon venue).

5.0 EMERGENCY ASSESSMENT AND RESPONSE STRATEGY

This section describes the general emergency assessment and response strategy procedures for OU-1.

5.1 INITIAL NOTIFICATION

Individuals who perform work within or near the boundaries of OU-1 – including OU-1 site workers, Bridgeton Landfill personnel, contractors, and visiting regulatory and local authorities – must notify the OU-1 Emergency Response Manager if they observe a potential emergency situation. The OU-1 Emergency Response Manager is responsible for initial emergency assessment and coordination of emergency response activities for OU-1. After any on-site personnel are notified of the existence of a potential emergency, the Emergency Response Manager will be the first individual notified. As indicated on the emergency response strategies presented **Appendix A**, Bridgeton Landfill Support Contacts will also be notified as a part of each response action.

*Note: The exception is that during a Level 1 emergency (see "Emergency Assessment" below) the 9-1-1 operator will often be the first individual notified, per the emergency response strategies presented in **Appendix A**. In such instances, the OU-1 Emergency Response Manager will be notified immediately after notifying 9-1-1, as indicated on the appropriate strategies.*

In the event of an emergency, the OU-1 Emergency Response Manager will be notified by phone. The OU-1 Emergency Response Manager's cell phone number will be posted on a gate placard at the Area 1 and Area 2 primary entrances (see "Site Entrances" under "Emergency Response Infrastructure and Equipment" below). In addition, laminated copies of **Table 1** and the emergency response strategies presented **Appendix A** – which include the cell phone number of the Emergency Response Manager – will be posted in both the Area 1 and Area 2 trailers. The forthcoming Health and Safety Plan (HASP) (SOW Deliverable #11) will also include the OU-1 Emergency Response Manager's contact information.

During their initial site / project orientation, workers performing activities within OU-1 (including contractors) will be instructed to notify the Emergency Response Manager via phone in the event of a potential emergency. Laminated copies of **Table 1** and the emergency response strategies presented **Appendix A** – which include the cell phone number of the Emergency Response Manager -- will be provided to OU-1 workers. One complete set of laminated copies will be provided for each field vehicle operating within OU-1. These laminated sets will be stored in the Area 1 and Area 2 trailers when not in use.

Local authorities will be instructed to notify the Emergency Response Manager via phone in the event of a potential OU-1 emergency. The local authorities will be involved in the initial development and regular review of this ERP (see "Plan Development and Revisions" above) and will accordingly be provided with copies of the most up-to-date version of the plan, including the contact information for the Emergency Response Manager.

Bridgeton Landfill personnel and other site personnel (including contractors) will also be instructed to notify the Emergency Response Manager via phone in the event of a potential OU-1 emergency. Copies of **Table 1** and the emergency response strategies presented in **Appendix A** will be posted at the Bridgeton Landfill office and laminated copies will be maintained for distribution to personnel as needed. Following EPA Region 7 approval of this ERP, the *Bridgeton Landfill Health and Safety Plan* (Bridgeton Landfill 2016) will also be updated to include notification instructions and contact information for the OU-1 Emergency Response Manager.

5.2 9-1-1 / SPILL LINE CALLS

If an individual associated with OU-1 or other portions of the site (e.g. Bridgeton Landfill) makes a call to 9-1-1, the EPA spill line, or MDNR spill line, that individual will also immediately notify the OU-1 Emergency Response Manager after notifying 9-1-1. If a call to 9-1-1 or a spill line is made by an individual outside OU-1 or other portions of the site (e.g., a member of the public), the 9-1-1 / spill line operator may notify the OU-1 Emergency Response Manager. During the development of the site's current IMP, the site requested of regulatory and local authorities that the 9-1-1 / spill line operator make this notification in such situations.

5.3 EMERGENCY ASSESSMENT

An emergency is a situation that is non-routine or anomalous and which poses a potential threat to the health and safety of on-site personnel or the public. The Emergency Response Manager (or their Alternate) is responsible for making the initial determination as to whether a given situation occurring at OU-1 rises to the level of an emergency.

The OU-1 Emergency Response Manager (or their Alternate) will be on call 24 hours a day, 7 days a week throughout the RD and RA phases of the project. In the event of an emergency, the Emergency Response Manager (or their Alternate) will be available to arrive at the site within approximately six hours or less of initial notification via phone (see "Initial Notification" above). A Support Contact for Bridgeton Landfill (i.e., the Bridgeton Landfill Division Manager or their Alternate) will also be on call 24 hours a day, 7 days a week throughout the RD and RA phases of the project. In the event of an emergency, the OU-1 Emergency Response Manager with notify and coordinate with this Support Contact by phone, per the emergency response strategies presented in **Appendix A**.

If the Emergency Response Manager (or their Alternate) is on site at the time a potential emergency is first identified, they will perform this initial assessment on site, supported by any relevant observations from other individuals. If the Emergency Response Manager (or their Alternate) is not on site at the time a potential emergency is first identified, they may perform this initial assessment from off-site based on information related to them by phone from the individual who performs the initial notification (see "Initial Notification" above). Even if the initial assessment is performed from off site, the Emergency Response Manager (or their Alternate) will mobilize to the site to provide further evaluation and coordination with emergency responders.

Once a determination has been made that an emergency is occurring at OU-1, the Emergency Response Manager will make an initial assessment of the emergency and classify its category and severity.

Four categories of potential emergencies have been identified for OU-1:

- Incoming Call to 9-1-1 / EPA Spill Line / MDNR Spill Line
- Personal Injury / Man Down / Personnel Contamination
- Sudden Waste Movement / Exposed Waste
- Surface Fire (Vegetation or Landfill Fire)

If site conditions or RD/RA activities change such that new categories of potential emergencies are applicable to OU-1, this ERP may be revised as necessary to reflect those categories.

The severity of the emergency is classified as Level 0 or Level 1:

- **Level 0 Emergency:** An emergency that can be addressed entirely by on-site support personnel and equipment, if requested by the Emergency Response Manager. In some cases, notification to local and regulatory authorities may be necessary.

- **Level 1 Emergency:** An emergency that requires the assistance of local authorities to address. May include emergencies with potential to harm the health or safety of on-site personnel.

5.4 EMERGENCY RESPONSE STRATEGY

Once the Emergency Response Manager has determined category and severity of the emergency, the appropriate response strategy will be selected, and the listed response actions will be performed in the designated order. A response strategy for each of the potential emergency categories listed above is presented in **Appendix A**. These response strategies include actions for Level 0 emergencies and actions for Level 1 emergencies (if applicable).

If more than one strategy is applicable to an emergency situation (e.g., the Sudden Waste Movement / Exposed Waste strategy and Surface Fire strategy for exposed burning waste), the most responsive strategy will be used.

The Emergency Response Manager has responsibility for ensuring that the response actions listed on the appropriate response strategy are performed, and that they are performed in the listed order. A checklist for the emergency assessment process and the implementation of emergency response strategies is presented in **Appendix B**.

In the event of a Level 1 emergency involving a response from local authorities (such as a sudden waste movement or surface fire), those authorities will designate an Incident Commander to represent them and to coordinate all local authority response activities. The Incident Commander will designate an on-site Command Center location -- outside the boundaries OU-1 -- from which response activities will be coordinated.

6.0 EMERGENCY NOTIFICATIONS

This section describes the emergency notification procedures applicable to OU-1.

Each of the emergency response strategies presented in **Appendix A** includes notification actions to local and regulatory authorities. These notification actions must be performed in the order listed on the response strategies. For ease of access, contact information for local and regulatory authorities is presented directly on the response strategies.

The Emergency Response Manager has responsibility for ensuring that the notification actions listed on the appropriate response strategy are performed, and that they are performed in the listed order.

Local and regulatory authorities– along with their contact information – are also listed on **Table 1** for reference.

6.1 HAZARDOUS SUBSTANCE RELEASE

Pursuant to the Title 42 of the United States Code (USC) § 9603, the National Response Center must be notified in the event of the release of a reportable quantity (as defined by 42 USC § 9602) of a hazardous substance. The National Response Center hotline number is listed on **Table 1**. Pursuant to 42 USC § 11004, the community emergency coordinator must also be notified in the event of an applicable release (per §11004(a)). Contact information for the St. Louis County Office of Emergency Management (OEM) is presented on **Table 1**, as well as on the applicable emergency response strategies in **Appendix A**.

In the event of such a hazardous substance release at, on, or from OU-1, the EPA Project Coordinator will also be immediately notified orally, in accordance with the requirements of SOW Paragraph 3.10(b). Contact information for the EPA Project Coordinator is presented on **Table 1**.

6.2 WASTE MATERIAL RELEASE

In the event of a waste material release at, on, or from OU-1, the EPA Project Coordinator will be immediately notified orally, in accordance with the requirements of SOW Paragraph 3.10(a). Contact information for the EPA Project Coordinator is presented on **Table 1.**

7.0 EMERGENCY RESPONSE INFRASTRUCTURE AND EQUIPMENT

This section describes site infrastructure and equipment that is pertinent to OU-1 emergency response activities.

The larger West Lake site – with the exception of the borrow area – is enclosed by fencing, and access to the site is controlled by Bridgeton Landfill. Access to OU-1 Area 1, Area 2, and the Buffer Zone is also further controlled. These OU-1 areas are enclosed by chain-link fences that are approximately six feet in height and topped with three strands of barbed wire. There are no permanent structures inside the OU-1 fence lines; only shipping containers (CONEX boxes) used for storage of dedicated site equipment and investigative soil/waste cores. The only substantial infrastructure within OU-1 consists of gravel access roads and the NCC. A septic holding tank for the Bridgeton Landfill site office is located just inside the northern fence line of Area 1, but this tank is accessed from outside Area 1. Area 1 and Area 2 each have an office trailer located just outside the fence line, near each area's respective primary entrance. Site features for Area 1 are illustrated on **Figure 3**. Site features for Area 2 and the Buffer Zone are illustrated on **Figure 4**.

There are presently no ongoing waste disposal activities occurring within OU-1. Workers only enter OU-1 to perform routine inspection and maintenance activities (e.g., inspection of the NCC) or to perform activities that are part of the OU-1 RD/RA.

7.1 SITE ENTRANCES

The entrances to Area 1 are illustrated on **Figure 3**. The primary foot and vehicle entrance to Area 1 is a 20-ft gate on the southern side of the area's fence line. There are also three emergency exits at various locations: a 6-ft gate at the northwest corner; and two 20-ft gates on the north side, accessible from the larger West Lake site's main entrance and parking area.

The entrances to Area 2 are illustrated on **Figure 4**. The primary foot and vehicle entrance to Area 2 is a 20-ft gate on the southeastern side of the area's fence line. There are also five emergency exits at various locations: a 12.5-ft gate near the southwestern corner, accessible from Boenker Lane / Old St. Charles Rock Road; a 20-ft gate at the southwest end of the Buffer Zone, accessible from Boenker Lane / Old St. Charles Rock Road; a 3-ft gate near the northern corner; a 3-ft gate on the northern side, accessible from St. Charles Rock Road; and a 6-ft gate near the northeastern corner.

Signage on the primary entrance gates for Area 1 and Area 2 indicates that there is no entry without proper authorization. The primary entrances and emergency exits for Area 1 and Area 2 are kept closed and padlocked when not in use. These padlocks keys are maintained by the OU-1 Radiation Safety Officer.

Emergency key boxes containing a spare padlock key will be maintained near each emergency exit in OU-1 Area 1 and Area 2. These key boxes will be located approximately 10 feet from the corresponding emergency exit, such that the key is accessible to an individual inside (but not outside) the OU-1 fence line. Key boxes will be installed and maintained such that they are clearly visible and clear of vegetation. In an emergency, the key stored in the emergency key box will allow evacuating individuals to unlock and exit through the corresponding emergency exit.

In the event of an emergency inside OU-1, any workers present will proceed to the primary entrance, if possible, and exit OU-1. If egress is not possible via the primary entrance, workers will proceed to the nearest

emergency exit, unlock it, and exit OU-1. The locations of the primary and secondary entrances to the larger West Lake Landfill Superfund Site are illustrated on **Figure 5**. Once workers have been evacuated from OU-1, they can be evacuated from the larger West Lake site at these locations, if necessary.

In the event of an emergency, first responders are expressly permitted to gain access to OU-1 using appropriate measures, such as cutting of gate locks.

7.2 ROADS

The emergency access road plan for the site is illustrated on **Figure 5**. This figure illustrates the names and locations of the site's native roads (i.e., roads not constructed on waste). Per first responder comments during past IMP revisions, it is understood that responders' preference is for emergency vehicles to be restricted to native roads for structural / stability reasons. **Figure 5** also distinguishes between roads that are passable to both tractor trailers and fire trucks and those that are passable only to fire trucks, based on turning radius modeling performed during the IMP development process. Signage installed around the site indicates the road names and delineates the native roads to provide emergency responders with a visual reference in the field.

There are no native roads within the boundaries of OU-1, but native road access is available at the perimeter of each OU-1 area, as illustrated on **Figure 5**. The nearest native road access to OU-1 Area 1 is along the area's northern fence line, which runs along the West Lake Landfill Superfund Site's main entrance and parking area. The nearest native road access to OU-1 Area 2 is at the area's primary entrance on the southeastern side of the area's fence line.

It is anticipated that site infrastructure – including roads within and around OU-1 – may change significantly at various points during the RD and RA phases of the project. As described under "Plan Development and Revisions" above, the ERP will be revised as the RD / RA activities are defined in greater detail in future SOW-required deliverables. It is anticipated that revisions to the site's road network will be addressed in the revised ERPs submitted concurrently with the Design Investigation Work Plan (SOW Deliverable #8) and Pre-Final (90%) Remedial Design (SOW Deliverable #21), and potentially in other revised versions of the plan, as necessary. As a part of these revisions, the planned road infrastructure will be reevaluated regarding their suitability for use by emergency response personnel and equipment.

7.3 FIRE HYDRANTS

The locations of the site's four on-site fire hydrants – as well as off-site fire hydrants near the site – are illustrated on **Figure 5**. Signage installed around the site indicates the on-site fire hydrant locations, to provide emergency responders with a visual reference in the field.

7.4 EMERGENCY COMMUNICATION AND MEET-UP LOCATIONS

In the event of an emergency, individuals will use their personal cell phones or, if needed, personal two-way radios for internal communication within OU-1 or for communication between individuals inside and outside OU-1. As noted under "Emergency Assessment" in the "Emergency Response Strategy and Assessment" section above, a Support Contact for Bridgeton Landfill (i.e., the Bridgeton Landfill Division Manager or their Alternate) will be on call 24 hours a day, 7 days a week throughout the RD and RA phases of the project. In the event of an emergency, this Support Contact can be contacted by phone for the purposes of coordinating access to particular site areas or equipment.

During the RD phase of the project, worker access to OU-1 will be overseen by the Radiation Safety Officer. The Radiation Safety Officer will be responsible for maintaining a sign-in / sign-out log for OU-1 Area 1 and Area 2. The Radiation Safety Officer will maintain possession of this log while work is being performed inside OU-1; the log will otherwise be kept at the Radiation Safety Officer's off-site office. Prior to entry, each OU-1 site worker will record their name, affiliation, cell phone number, area (1 or 2) and the current date and time in the log. Upon exiting OU-1, each worker will again record the current date and time. In the event of an emergency, the Emergency Response Officer (or their Alternate) will coordinate with the Radiation Safety Officer and refer to the sign-in / sign-out log to determine which workers are currently present within OU-1, and, if necessary, use the listed cell phone numbers to contact individual workers.

During an emergency, evacuated OU-1 workers will meet up at designated locations according to the following priority list:

- Primary Emergency Meet-Up Location: If possible, evacuated workers will meet up at the trailer immediately outside the Area 1 or Area 2 primary entrance (as appropriate).
- Secondary Emergency Meet-Up Location: If the applicable OU-1 trailer is inaccessible, evacuated workers will meet up at the Bridgeton Landfill office.
- Tertiary Emergency Meet-Up Location: If the Bridgeton Landfill office is inaccessible, the evacuated workers will meet up at the Forshaw Earth City Warehouse (13200 Corporate Exchange Drive), located off-site to the immediate south of the facility.

The emergency meet-up locations are indicated on **Figure 2**. Workers performing activities within OU-1 will be instructed as to these primary, secondary, and tertiary emergency meet-up locations during their initial site / project orientation.

It is anticipated that site communication, personnel tracking, and emergency meet-up procedures will change during the RA phase of the project. As described under "Plan Development and Revisions" above, the ERP will be revised as the RA activities are defined in greater detail in future SOW-required deliverables. It is anticipated that revisions to this section will be addressed in the revised ERP submitted concurrently with the Pre-Final (90%) Remedial Design (SOW Deliverable #21) – and potentially in other revised versions of the plan, as necessary.

7.5 ON-SITE EMERGENCY RESOURCES

Table 2 lists other on-site resources which are available for OU-1 emergency response activities, including heavy equipment, vehicles, personal protective equipment (PPE), and field instruments. The table distinguishes between 1) those resources available inside OU-1, in the office trailers located just outside the OU-1 fence lines, or in the OU-1 Radiation Safety Officer's off-site office; and 2) those resources which are affiliated with the larger West Lake site (including Bridgeton Landfill) but are available for emergency response activities in OU-1 if needed.

In the event of emergency in OU-1, support personnel affiliated with the Bridgeton Landfill can commit these resources and potentially provide emergency response support at the request of the Emergency Response Manager. These support personnel are listed along with their contact information on **Table 1.**

8.0 RADIATION SAFETY DURING EMERGENCIES

This section describes radiation safety practices that are applicable to OU-1 during emergencies. The Radiation Safety Officer (or their Alternate) will coordinate with first responders and assist them with the implementation of these radiation safety practices as necessary and appropriate during an emergency.

8.1 PRIORITIES DURING EMERGENCY RESPONSE

When an emergency occurs within the boundaries of OU-1, it is recommended that the following priorities be followed in the listed order during the performance of emergency response activities:

1. If possible, the emergency should be addressed from outside the boundaries of OU-1.
2. If entry into OU-1 is necessary to respond to an emergency, vehicles and personnel should, if possible, be confined to those portions of OU-1 covered by rock, i.e., gravel access roads and the NCC. The extent of the NCC in Area 1 and Area 2 (as well as the Buffer Zone) is illustrated on **Figures 3** and **4**, respectively.
3. If entry into portions of OU-1 that are not covered by rock is necessary, personnel should use the applicable PPE to the extent possible. The applicable PPE constitutes a Level D ensemble (work boots with steel toe and shank; high-visibility vest or shirt; hard hat; and safety glasses) plus the following equipment:
    - Tyvek coveralls;
    - Taped rubber gloves; and
    - Taped rubber booties

Tyvek coveralls, rubber gloves, and rubber boots are available in the office trailers located just outside the fence lines for OU-1 Area 1 and Area 2. The locations of the Area 1 and Area 2 trailers are illustrated on **Figure 3** and **Figure 4**, respectively. The Area 1 and Area 2 trailers are not locked, and emergency responders may freely access the PPE stored there. In addition, the OU-1 Radiation Safety Officer should be contacted to coordinate the provision of any additional PPE that may be needed by emergency response personnel who need to enter OU-1.

During an emergency, emergency responders and their equipment will not be subject to radiation safety frisking prior to entry into OU-1. The Radiation Safety Officer will coordinate the frisking and (if necessary) decontamination of emergency personnel and equipment during egress from OU-1, unless there is a life-threatening injury or other extenuating circumstance (e.g., an imminent need to evacuate the West Lake site).

Currently, frisking and decontamination procedures are performed in accordance with the requirements of the Radiation Safety Plan (RSP) prepared for the installation of the NCC (Auxier 2016). Frisking and decontamination procedures specific to the RD / RA will be detailed in the RSP that will be included in the forthcoming HASP (SOW Deliverable # 11). These procedures will supersede those devised and implemented for NCC installation and maintenance activities.

If an individual working inside OU-1 needs to be transported to a hospital during an emergency, their PPE will be removed prior to transport (if possible) and the Radiation Safety Officer will notify the hospital.

8.1.1 Emergencies Requiring Air Monitoring

If an emergency occurs in OU-1 that involves a potential for the release of radionuclide-containing dust, monitoring data obtained from the OU-1 air monitoring program will be collected and evaluated to assess the potential for a release and any impacts that may have been associated with such a release. These monitoring results will be provided to the EPA. Full details on the OU-1 air monitoring program are presented in the Air Monitoring, Sampling, and QA/QC Plan (Auxier 2014). Note that this plan is currently being revised in accordance with the EPA's August 15, 2019 comment letter. It is anticipated that this section of the ERP will be revised following approval of that revised plan, which will also be included as an appendix to the OU-1 Site Management Plan.

8.1.2 Emergencies Requiring Water Application

The NCC that has been constructed over surface RIM in OU-1 Area 1 and Area 2 includes a non-woven geotextile overlain by 8 in. of limestone gravel. Accordingly, surface RIM is not currently exposed in such a manner that allows for the transport of this material via surface runoff.

If emergency response activities performed in OU-1 involve the application of water that could run off the surface of OU-1 (e.g., the use of water to suppress a vegetation fire), best management practices (BMPs) such as the application of straw wattles will be used to mitigate the potential transport of small quantities of non-RIM-containing surface soils from OU-1 to other areas. In the event of extreme circumstances – e.g., emergency application of an extremely high volume of water that results in significant disturbance of the NCC – the site will implement appropriate and practicable corrective action measures to contain, divert, pump, and/or store potential runoff.

9.0 POST-RESPONSE REPORTING AND ACTIONS

This section describes the post-response reporting procedures for emergencies that occur in OU-1.

As soon as reasonably possible after an emergency and associated response activities, the OU-1 Emergency Response Manager will prepare a written Post-Response Report. This report will include, at minimum:

- The name, address, and contact information for the site;
- The date, time, category, severity, and general description of the type of emergency (e.g., fire injury, etc.);
- The name and quantity of any hazardous materials released as a result of the emergency, as well as the estimated quantity and disposition of any recovered materials;
- An assessment of any actual or potential hazards to human health or the environment resulting from the emergency;
- A description of the steps taken to respond to the emergency and to ensure the health and safety of on-site personnel and the public; and
- An initial evaluation of the potential cause of the emergency and recommendations for preventing such an event in the future, if possible.

Within 15 days of a Level 1 emergency, the Emergency Response Manager will submit the Post-Response Report to EPA and, as appropriate, other regulatory and local authorities. In the case of a Level 0 emergency, the Post-Response Report may be submitted to EPA and other regulatory and local authorities at the discretion of the Emergency Response Manager, or as circumstances may otherwise dictate. In all instances, a copy of the Post-Response Report will be retained at the Bridgeton Landfill office for five years.

In the event of a hazardous substance or waste material release from OU-1, the Post-Response Report will meet the EPA reporting requirements specified in SOW Paragraph 3.10(d).

If an emergency (or the response to an emergency) results in a breach in the NCC, the cover will be repaired to its original specifications unless otherwise approved by the EPA.

10.0 EMERGENCY RESPONSE TRAINING

This section describes the emergency response training that is applicable to OU-1.

Site workers that enter OU-1 must complete 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training (including annual 8-hour refreshers) as specified in 29 CFR 1910.120. Site workers that enter OU-1 must also undergo General Employee Radiation Training (GERT) every two years. Contractors and other temporary workers can enter OU-1 without completing HAZWOPER and GERT training if they are accompanied by a worker who has completed the training. All workers that enter OU-1 should also read this ERP and familiarize themselves with its contents prior to beginning work inside the boundaries of OU-1.

It is recommended that emergency responders who enter OU-1 should also have completed 40-hour HAZWOPER training and radiation safety training that is comparable to GERT.

It is anticipated any additional health and safety training that is required for the OU-1 RD/RA process will be further defined in the HASP (Deliverable 11 on the RD Schedule presented in SOW Paragraph 6.2).

11.0 REFERENCES

Auxier. 2014. Air Monitoring, Sampling, and QA/QC Plan, West Lake Superfund Site Operable Unit 1. Prepared by Auxier & Associates, Inc. October 2014.

Auxier. 2016. Radiation Safety Plan for Installation of Non-Combustible Cap. West Lake Landfill Operable Unit 1. Prepared by Auxier & Associates, Inc. January 4, 2016

Bridgeton Landfill. 2016. Bridgeton Landfill Health and Safety Plan. Prepared by Bridgeton Landfill LLC. 2016.

Bridgeton Landfill. 2019. Incident Management Plan (IMP) with Contingency Plan and Emergency Procedures. Prepared by Bridgeton Landfill LLC. March 28, 2019 (Revised).

CEC. 2015. Incident Management Plan with Contingency Plan and Emergency Procedures, Bridgeton Landfill. Prepared by Civil & Environmental Consultants, Inc. June 10, 2015.

EPA. 2008. *Record of Decision (ROD), West Lake Landfill Site, Operable Unit 2. U.S. Environmental Protection Agency, Region 7*. July 25, 2008.

EPA. 2015. *Unilateral Administrative Order (UAO) for Removal Action. U.S. Environmental Protection Agency, Region 7.* Docket No. CERCLA-07-2016-0002. December 9, 2015.

EPA. 2019a. *West Lake Landfill OU-3, Administrative Settlement and Order on Consent (ASAOC) for Remedial Investigation / Feasibility Study. U.S. Environmental Protection Agency, Region 7.* Docket CERCLA-07-20018-0259. February 2, 2019.

EPA. 2019b. *Remedial Design Statement of Work (SOW), Operable Unit-1, West Lake Landfill Superfund Site. In: Third Amendment to Administrative Settlement Agreement and Order on Consent (ASAOC). U.S. Environmental Protection Agency, Region 7*. Docket VII-93-F-0005. May 6, 2019

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Tables

Table 1
Emergency Response Roles and Contact Information

OU-1 Emergency Response Roles

EMERGENCY RESPONSE ROLE	DESIGNATED INDIVIDUAL	CONTACT INFORMATION
OU-1 Project Coordinator	Paul Rosasco - Engineering Management Support, Inc.	Cell: 303-808-7227
Emergency Response Manager	Daniel Feezor - Feezor Engineering, Inc.	Cell: 217-836-8842
Alternate Emergency Response Manager 1	Bill Abernathy - Feezor Engineering, Inc.	Cell: 314-502-1299
Alternate Emergency Response Manager 2	Jon Wilkinson - Feezor Engineering, Inc.	Cell: 636-578-8635
Radiation Safety Officer	Bill Abernathy - Feezor Engineering, Inc.	Cell: 314-502-1299
Alternate Radiation Safety Officer	Jon Wilkinson - Feezor Engineering, Inc.	Cell: 636-578-8635

Support Contacts

SUPPORT CONTACT	NAME	CONTACT INFORMATION
Bridgeton Landfill Division Manager	Erin Fanning	Cell: 209-227-9531
Alternate Bridgeton Landfill Contact 1	Mike Lambrich	Cell: 314-683-3921
Alternate Bridgeton Landfill Contact 2	Dana Sincox	Cell: 314-313-0838
Alternate Bridgeton Landfill Contact 3	Matt Stewart	Cell: 314-477-6140

Regulatory Authorities

REGULATORY AUTHORITY	NAME	CONTACT INFORMATION
EPA Region 7 - Regional Project Manager	Christine Jump	Office: 913-551-7141 Cell: 816-398-1965
EPA Region 7 - On-Scene Coordinator	Tom Mahler	Cell: 816-604-0546
EPA Region 7 - Spill Line	-	913-281-0991
MDNR Waste Management Program - Director	Chris Nagel	Office: 573-751-5401 Cell 1: 573-680-5146 Cell 2: 573-690-5371
MDNR Waste Management Program - Compliance/Enforcement Section	Mike Parris	Office: 573-526-3918 Cell: 573-680-6669
MDNR Department of Health and Senior Services	Keith Henke	Cell: 573-645-8943
MDNR Environmental Emergancy Response - Spill Line	-	573-634-2436
MDNR Environmental Response - St. Louis Region - Route 66	Mike Ruddy	Office: 636-938-7809 Cell: 314-640-5198
St. Louis County Department of Health	Mark Milward	Office: 314-615-4116 Cell: 314-520-1373

Local Authorities

LOCAL AUTHORITY	NAME	CONTACT INFORMATION
Robertson Fire Department - Assistant Fire Chief	Maynard Howell	Cell: 314-575-5011
Pattonville Fire Department - Battallion Chief (Primary Contact)	Battallion Chief	Cell: 314-393-4802
Pattonville Fire Department - Assistant Fire Chief (Secondary Contact)	Jim Usry	Cell: 314-393-4807 Office: 314-739-3118
Bridgeton Police Department (Primary Contact)	Chief Donald Hood	Cell: 314-420-9112
Bridgeton Police Department (Secondary Contact)	Major Mossotti	Cell: 314-602-3632
St. Louis County Office of Emergency Management (OEM) - LEPC Coordinator	Mark Diedrich	Office: 314-615-9500
St. Louis County Office of Emergency Management (OEM) - Bureau of Communications	24/7 Emergency Line	314-615-5360

Other Contacts

OTHER CONTACT	NAME	CONTACT INFORMATION
SSM Health DePaul Hospital	-	314-344-6000
SSM Health St. Joseph Hospital - St. Charles	-	636-947-5000
National Response Center	-	800-424-8802

Table 2
On-Site Emergency Resources

West Lake Superfund Site OU-1 Resources

RESOURCE	QUANTITY
Tyvek Coveralls, Rubber Gloves, Rubber Booties *	100+
Ludlum Model 19 microR Gamma Survey Meter †	1
Ludlum Model 2360 Data Logger with 43-93 Alpha-Beta Detector †	1

Other Resources‡

RESOURCE	QUANTITY
Fire Hydrants	4
Soil Stock Pile	10,000 c.y.
Bulldozers	2
Water Truck (3,500-gal. with Cannon)	1
Water Truck Adapter to 5-in. Storz Fitting	1
Excavators	2
Spill Cleanup Kits	18
Eye Wash Stations	8
Portable Fire Extinguishers	66
Knife Gates	18
Vacuum Trucks	1
ATVS (2-Man with Tool Bed)	7
ATVs (4-Man with Tool Bed)	1
UltraRAE 3000 Benzene-Specific Photoionization Detector (PID) Meter	1
RKI GX-2009 Portable 4-Gas Meter	1
RKI GX-6000 Portable 5-Gas Meter with Benzene-Specific PID Meter	1
Class A SFFF (Structural Fire Fighting Foam), 5-gal. Containers	40

Notes
* Located in OU-1 Area 1 and Area 2 office trailers, just outside OU-1 fence lines.
† Maintained off-site in the Radiation Safety Officer's office, along with check sources for the instruments: 3377 Hollenberg Drive, Bridgeton, MO 63044. See Figure 1 for location.
‡ Resources affiliated with the larger West Lake Landfill Superfund Site (including Bridgeton Landill). Bridgeton Landfill support contacts can commit these resources during an emergency.

Figures

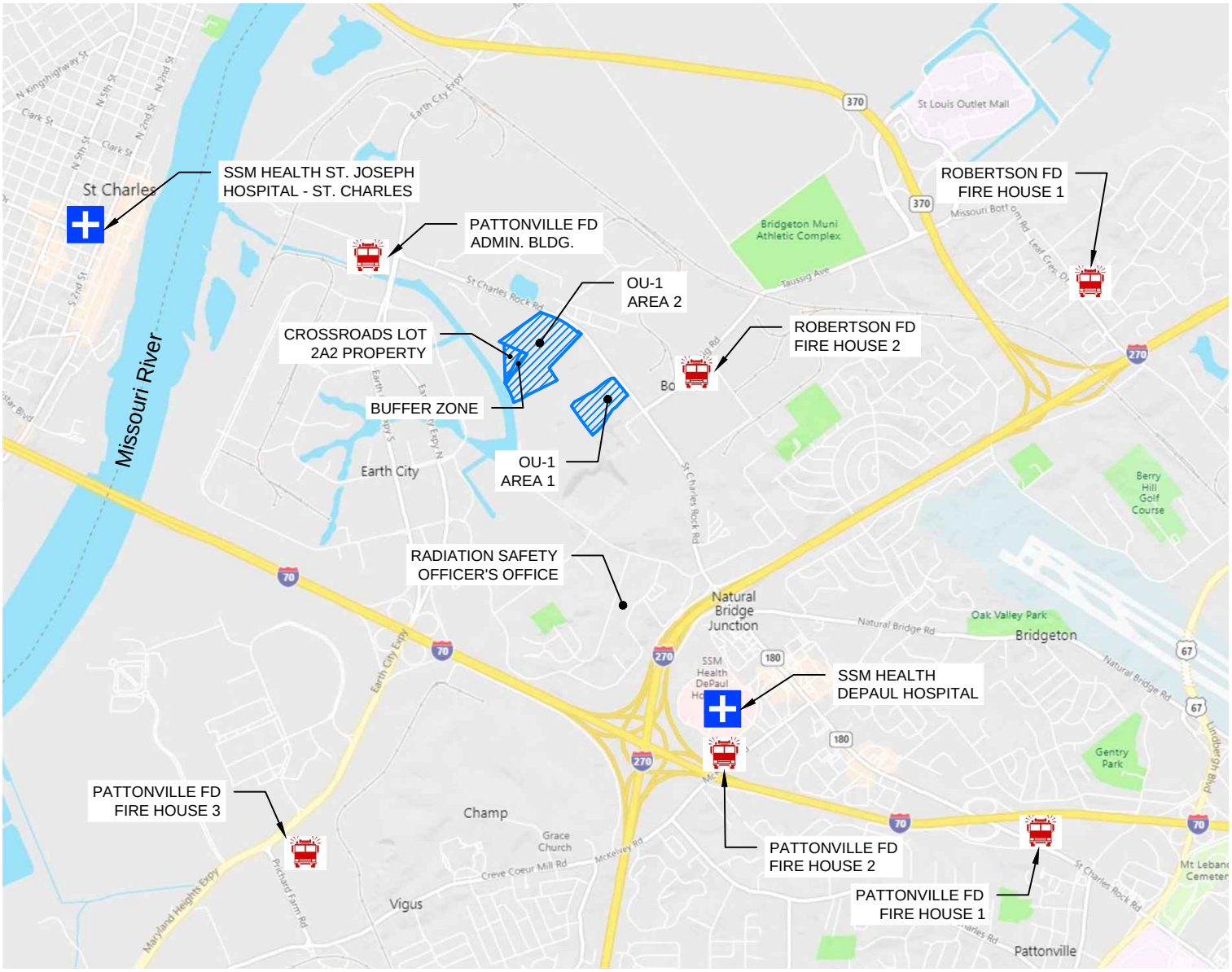


Image: © 2019 HERE, Open Street Map

0 2500 5000 Feet

NORTH

NOTE:

1.) BASED ON FIGURES ORIGINALLY PREPARED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND PRESENTED IN THE MARCH 28, 2019 INCIDENT MANAGEMENT PLAN

PREPARED BY

Engineering for a Better World
FEEZOR ENGINEERING, INC.

3377 Hollenberg Dr, Bridgeton, MO 63044, Ph: 217-483-3118
Missouri State Certificate Of Authority #: E-200912211

PROJECT
WEST LAKE LANDFILL
SITE MANAGEMENT PLAN
BRIDGETON, MISSOURI 63044

MAY 2019

DESIGNED BY: IN

APPROVED BY: ---

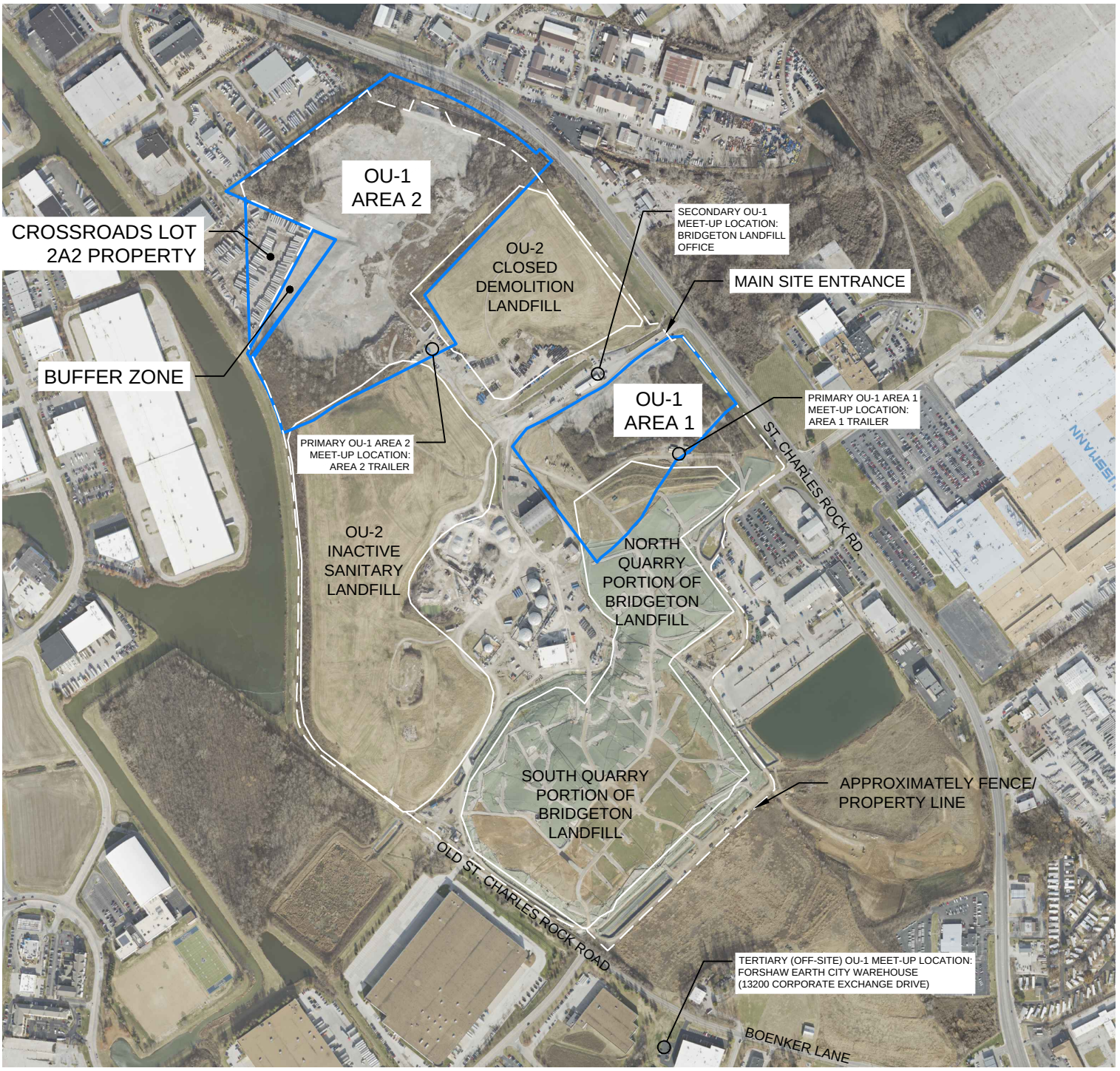
FIGURE 1

DRAWING TITLE

SITE LOCATION

PROJECT NUMBER: BT-191.5

FILE PATH: D:\Dropbox (Feezor Engineering)\Bridgeton\BT-191 (RDWP Design And Management)\BT-191.5 - 02500 - Emergency Response Plan\Figures\BT-191.5-ERP Figures



NOTES:

1.) AERIAL IMAGERY PROVIDED BY COOPER AERIAL SURVEYS, INC. AND IS DATED DECEMBER 12, 2018
2.) BASED ON FIGURES ORIGINALLY PREPARED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND PRESENTED IN THE MARCH 28, 2019 INCIDENT MANAGEMENT PLAN

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PROJECT
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MAY 2019
DESIGNED BY: IN
APPROVED BY: ---

FIGURE 2

DRAWING TITLE

SITE LAYOUT

PROJECT NUMBER: BT-191.5

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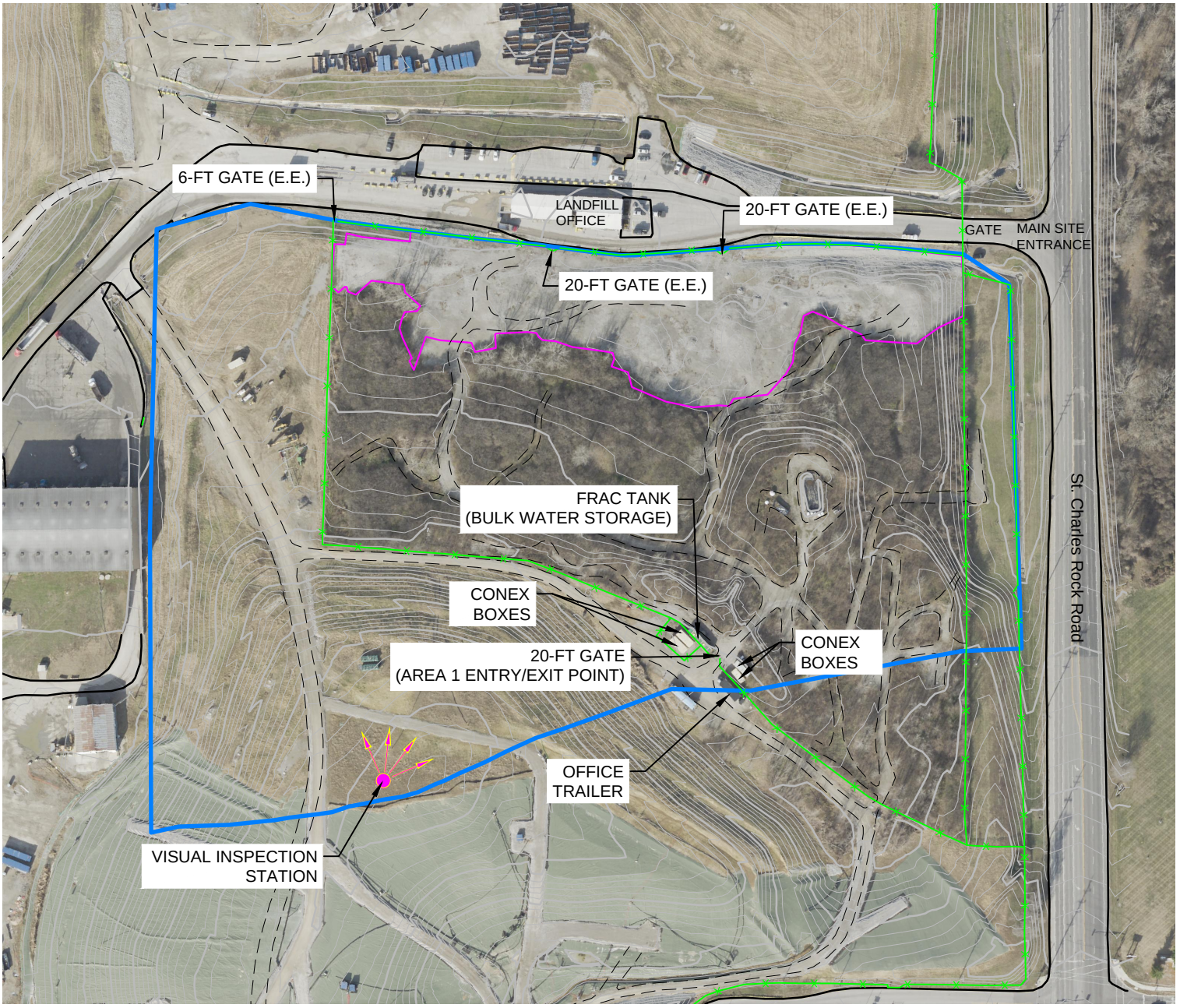

LEGEND

- BASE TOPOGRAPHY (2' CONTOUR)
- BASE TOPOGRAPHY (10' CONTOUR)
- LIMIT OF NON-COMBUSTIBLE COVER
- OU-1 AREA 1
- FENCE
- GRAVEL ROAD
- PAVED ROAD

0 150 300 Feet

NORTH

NOTES:

1) AERIAL TOPOGRAPHY AND IMAGERY PROVIDED BY COOPER AERIAL SURVEYS, INC. AND IS DATED DECEMBER 12, 2018
2) E.E. - EMERGENCY EXIT
3) BASED ON FIGURES ORIGINALLY PREPARED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND PRESENTED IN THE MARCH 28, 2019 INCIDENT MANAGEMENT PLAN

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PROJECT
WEST LAKE LANDFILL
SITE MANAGEMENT PLAN
BRIDGETON, MISSOURI 63044

MAY 2019
DESIGNED BY: IN
APPROVED BY: ---

FIGURE 3

DRAWING TITLE

OU-1 AREA 1 FEATURES

PROJECT NUMBER: BT-191.5

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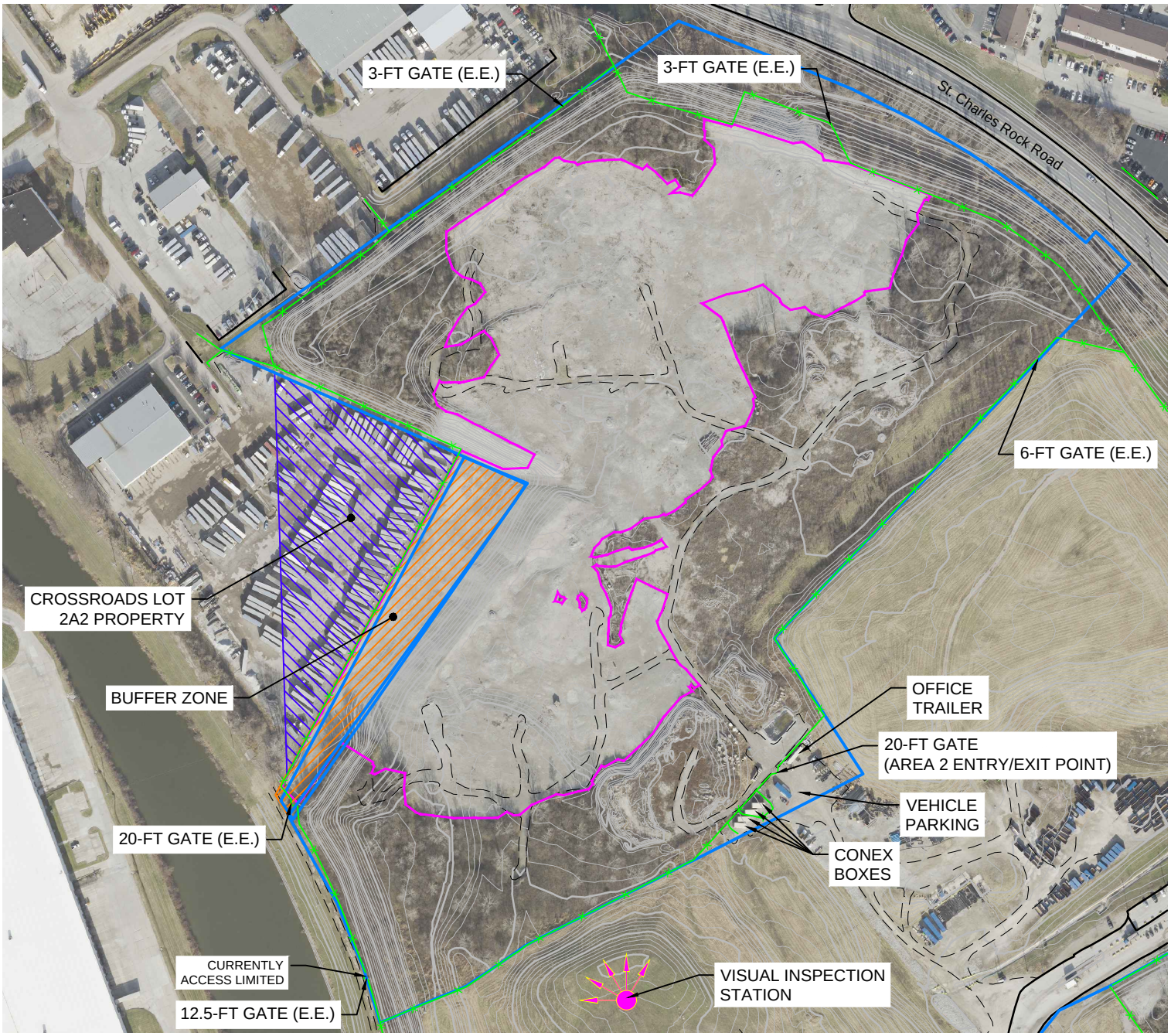

LEGEND

- BASE TOPOGRAPHY (2' CONTOUR)
- BASE TOPOGRAPHY (10' CONTOUR)
- LIMIT OF NON-COMBUSTIBLE COVER
- OU-1 AREA 2
- FENCE
- GRAVEL ROAD
- PAVED ROAD
- BUFFER ZONE
- CROSSROADS LOT 2A2 PROPERTY

0 300 600 Feet

NORTH

NOTES:

1) AERIAL TOPOGRAPHY AND IMAGERY PROVIDED BY COOPER AERIAL SURVEYS, INC. AND IS DATED DECEMBER 12, 2018
2) E.E. - EMERGENCY EXIT
3) BASED ON FIGURES ORIGINALLY PREPARED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND PRESENTED IN THE MARCH 28, 2019 INCIDENT MANAGEMENT PLAN

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PROJECT
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SITE MANAGEMENT PLAN
BRIDGETON, MISSOURI 63044

MAY 2019
DESIGNED BY: IN
APPROVED BY: ---

FIGURE 4

DRAWING TITLE

OU-1 AREA 2 FEATURES

PROJECT NUMBER: BT-191.5

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LEGEND

- NATIVE ROADS - TRACTOR TRAILER AND FIRE TRUCK PASSABLE
- NATIVE ROADS - FIRE TRUCK PASSABLE
- FENCE
- FIRE HYDRANT

0 500 1000 Feet

NORTH

NOTES:

1.) AERIAL IMAGERY PROVIDED BY COOPER AERIAL SURVEYS, INC. AND IS DATED DECEMBER 12, 2018
2.) BASED ON FIGURES ORIGINALLY PREPARED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC. AND PRESENTED IN THE MARCH 28, 2019 INCIDENT MANAGEMENT PLAN

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Missouri State Certificate Of Authority #: E-200912211

PROJECT
WEST LAKE LANDFILL
SITE MANAGEMENT PLAN
BRIDGETON, MISSOURI 63044

MAY 2019
DESIGNED BY: IN
APPROVED BY: ---

FIGURE 5

DRAWING TITLE

EMERGENCY RESPONSE INFRASTRUCTURE AND FEATURES

PROJECT NUMBER: BT-191.5

FILE PATH: D:\Dropbox (Feezor Engineering)\Bridgeton\BT-191 (RDWP Design And Management)\BT-191.5 - 02500 - Emergency Response Plan\Figures\BT-191.5-ERP Figures

Appendix A - Emergency Response Strategies

EMERGENCY – WEST LAKE LANDFILL SUPERFUND SITE OU-1 – CALL TO 9-1-1 / EPA SPILL LINE / MNDR SPILL LINE

INITIAL ASSESSMENT BY 9-1-1 / SPILL LINE OPERATOR (Call from Outside OU-1 / West Lake LF / Bridgeton LF)

Incoming Call Regarding OU-1

1. 9-1-1, EPA spill line, and/or MDNR spill line operator receives an emergency call regarding OU-1

RESPONSE

1. Operator calls and notifies OU-1 Emergency Response Manager to notify them of the situation
2. OU-1 Emergency Response Manager notifies other OU-1 personnel and Bridgeton Landfill Support

CONTACT INFORMATION

OU-1 Personnel
- Paul Rosasco cell: 303-808-7227
- Dan Feezor (Emergency Response Manager) cell: 217-836-8842
- Bill Abernathy cell: 314-502-1299
- Jon Wilkinson cell: 636-578-8635

Bridgeton Landfill Support
- Erin Fanning cell: 209-227-9531
- Mike Lambrich cell: 314-683-921
- Dana Sincox cell: 314-313-0838
- Matt Stewart cell: 314-477-6140

INITIAL ASSESSMENT BY EMERGENCY RESPONSE MANAGER (Call from OU-1 / West Lake LF / Bridgeton LF Personnel)

Outgoing Call Regarding OU-1

1. OU-1, West Lake Landfill, or Bridgeton Landfill personnel places an emergency call to 9-1-1, EPA spill line, and/or MDNR spill line operator regarding OU-1

RESPONSE

1. Call OU-1 Emergency Response Manager to notify them of the situation
2. Call other OU-1 personnel and Bridgeton Landfill Support to notify them of the situation

CONTACT INFORMATION

OU-1 Personnel
- Paul Rosasco cell: 303-808-7227
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EMERGENCY – WEST LAKE LANDFILL SUPERFUND SITE OU-1 - PERSONAL INJURY / MAN DOWN / PERSONNEL CONTAMINATION

INITIAL ASSESSMENT BY EMERGENCY RESPONSE MANAGER

Level 0

- Injury handled with on-site first aid

RESPONSE

1. Call and notify OU-1 Emergency Response Manager
2. Notify Bridgeton Landfill Support
3. Remove injured individual's PPE prior to exiting OU-1
4. No follow-up is required with first responders or regulatory agencies

Level 1

- Injury requiring first responder or paramedic assistance

RESPONSE

1. Call 9-1-1
2. Follow 9-1-1 operator instructions until first responders arrive
3. Call and notify OU-1 Emergency Response Manager
4. Notify Bridgeton Landfill Support
5. Brief first responders and/or Incident Commander upon arrival—follow instructions
6. Notify OU-1 personnel if the response requires entry or activities within OU-1
7. Remove injured individual's PPE prior to exiting OU-1, unless instructed otherwise by first responders
8. If necessary, OU-1 personnel or Bridgeton Landfill personnel may transport injured person to Command Center for transport if off-site treatment is required

CONTACT INFORMATION

Emergency Dispatch
- 9-1-1 Dispatcher: 9-1-1

OU-1 Personnel
- Paul Rosasco cell: 303-808-7227
- Dan Feezor (Emergency Response Manager) cell: 217-836-8842
- Bill Abernathy cell: 314-502-1299
- Jon Wilkinson cell: 636-578-8635

Bridgeton Landfill Support
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EMERGENCY– WEST LAKE LANDFILL SUPERFUND SITE OU-1 - SUDDEN WASTE MOVEMENT / EXPOSED WASTE

INITIAL ASSESSMENT BY EMERGENCY RESPONSE MANAGER

Level 0

- Movement within limits of temporary cap or
- Little or no exposed waste, and
- Minor odor release

RESPONSE

1. Call and notify OU-1 Emergency Response Manager
2. Place soil at the toe of any areas where waste movement occurs in order to stabilize the area(s)
3. Lightly cover tension cracks with clean, clayey soil
4. Notify EPA R7, Bridgeton Landfill Support, other OU-1 personnel, MDNR WMP, MDHSS, and St. Louis Co. DoH
5. Notify EPA Region 7 Spill Line
6. Notify Pattonville FD On-duty Battalion Chief and Assistant Fire Chief
7. Notify Robertson FD Assistant Fire Chief
8. Notify Bridgeton PD
9. Inspect infrastructure for any damage, leaks or failures
10. Implement measures to control run-on and run-off from any areas where waste materials are exposed
11. Monitor for one week; if no further movement, implement relocation of waste material and restoration

CONTACT INFORMATION

Pattonville FD
- On-Duty Battalion Chief: 314-393-4802
- Assistant Fire Chief: 314-393-4807

Robertson FD
- Assistant Fire Chief: 314-575-5011

Bridgeton PD
- Chief Hood: 314-420-9112
- Major Mossotti: 314-602-3632

EPA Region 7
- Christine Jump cell: 816-398-1965
- Tom Mahler cell: 816-604-0546

EPA R7 Spill Line: 913-281-0991

MDNR WMP
- Chris Nagel cell: 573-680-5146
- Mike Parris cell: 573-680-6669

MDHSS
- Keith Henke: 573-645-8943

St. Louis Co. DoH
- Mark Milward cell: 314-520-1373

OU-1 Personnel
- Paul Rosasco cell: 303-808-7227
- Dan Feezor (Emergency Response Manager) cell: 217-836-8842
- Bill Abernathy cell: 314-502-1299
- Jon Wilkinson cell: 636-578-8635

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- Dana Sincox cell: 314-313-0838
- Matt Stewart cell: 314-477-6140

Level 1

- Massive movement, slope failure, erosion, flooding, tornado or other event that exposes waste material
- Large exposure of waste material or
- Hot (steaming) or burning waste exposed (refer to Surface Fire strategy and use most responsive strategy)
- Extensive release of gas and/or odors

RESPONSE

1. Notify on-site personnel
2. Call 9-1-1
3. Call and notify OU-1 Emergency Response Manager
4. Call Pattonville FD On-Duty Battalion Chief and Assistant Chief
5. Call Robertson FD Assistant Fire Chief
6. Call Bridgeton PD
7. Notify EPA Region 7 Spill Line
8. Notify EPA R7, Bridgeton Landfill Support, other OU-1 personnel, MDNR WMP, MDHSS, St. Louis Co. DoH, and St. Louis Co. OEM
9. Place soil at the toe of any areas where waste movement occurs in order to stabilize the area(s)
10. Implement measures to control run-on and run-off from any areas where waste materials are exposed
11. Lightly cover exposed waste with clean, clayey soil while buttressing toe at direction of professional engineer
12. Monitor for one month; if no further movement, implement relocation of waste material and restoration

CONTACT INFORMATION

Emergency Dispatch
- 9-1-1 Dispatcher: 9-1-1

Pattonville FD
- On-Duty Battalion Chief: 314-393-4802
- Assistant Fire Chief: 314-393-4807

Robertson FD
- Assistant Fire Chief: 314-575-5011

Bridgeton PD
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MDHSS
- Keith Henke: 573-645-8943

St. Louis Co. DoH
- Mark Milward cell: 314-520-1373

St. Louis Co. OEM
- Mark Diedrich: 314-615-9500
- 24/7 Emergency: 314-615-5360

OU-1 Personnel
- Paul Rosasco cell: 303-808-7227
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EMERGENCY – WEST LAKE LANDFILL SUPERFUND SITE OU-1 - SURFACE FIRE

INITIAL ASSESSMENT BY EMERGENCY RESPONSE MANAGER

Level 0

- Small affected area, or
- Minor smoke plume, and
- Equipment and personnel on-site sufficient to resolve incident.

RESPONSE

1. Notify on-site personnel
2. Call and notify OU-1 Emergency Response Manager
3. Notify EPA R7, Bridgeton Landfill Support, other OU-1 personnel, MDNR WMP, MDHSS, and St. Louis Co. DoH
4. Notify Pattonville FD On-Duty Battalion Chief and Assistant Fire Chief
5. Notify Robertson FD Assistant Fire Chief
6. Notify Bridgeton PD
7. Notify EPA R7 Spill Line
8. Coordinate extinguishment (with extinguishers or water truck spray)
9. Implement measures to control run-on and run-off from any areas where water is applied
10. Monitor continuously for one hour to ensure fire has been extinguished
11. Assess potential damage to systems and make repairs

CONTACT INFORMATION

Pattonville FD
- On-Duty Battalion Chief: 314-393-4802
- Assistant Chief: 314-393-4807

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- Chief Hood: 314-420-9112
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Level 1

- After normal business hours, or
- Insufficient on-site resources, or
- Flame/smoke visible from off-site, or
- Large affected area

RESPONSE

1. Notify on-site personnel
2. Call 9-1-1
3. Call and notify OU-1 Emergency Response Manager
4. Call Pattonville FD On-Duty Battalion Chief and Assistant Fire Chief
5. Call Robertson FD Assistant Fire Chief
6. Call Bridgeton PD
7. Call EPA R7 Spill Line
8. Notify EPA R7, Bridgeton Landfill Support, other OU-1 personnel, MDNR WMP, MDHSS, St. Louis Co. DoH, and St. Louis Co. OEM
9. Suspend impacted, non-critical operations (unless such operation minimizes incident)
10. Coordinate extinguishment with Incident Commander
11. Implement measures to control run-on and run-off from any areas where water is applied
12. Monitor continuously for 48 hours to assure extinguishment
13. Assess potential damage to systems and make repairs
14. Resume regular operations with consent of Incident Commander

CONTACT INFORMATION

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Appendix B - Emergency Assessment and Response Action Checklist

West Lake Landfill Superfund Site OU-1
Emergency Response Plan (ERP)

EMERGENCY ASSESSMENT AND RESPONSE ACTION CHECKLIST FOR EMERGENCY RESPONSE MANAGER

1. Make initial determination as to whether situation rises to the level of an emergency.

2. Classify category and severity (Level 0 or 1) of emergency.

3. Initiate appropriate response strategy (ERP Appendix A) and follow listed response actions in order given.

4.For emergency notification actions, collect the following information and communicate it to notified parties:

- Location of emergency in OU-1: Area 1, Area 2, or Buffer Zone and general direction (e.g., eastern side of Area 1)
- OU-1 site entrance closest to emergency
- Emergency category and severity (Level 0 or 1)

5. Account for site personnel.

6. Ensure that appropriate OU-1 site entrance and emergency exits are unlocked and open.

7. Determine if a hazardous substance or waste material release is occurring / has occurred, and takes steps to contain, if needed.

8. Resume normal operation with consent of Incident Commander.

EMERGENCY DETAILS

Date and Time of Incident: _____

Emergency Response Coordinator:_____

Description of Emergency:_____

_____

_____

_____

_____

_____

Date and Time Normal Operation Resumed:_____

_____

APPENDIX E

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

Safety Data Sheet
acc. to OSHA HCS

Printing date 10/20/2017 Reviewed on 10/20/2017

1 Identification

· **Product identifier**

· **Trade name:** **Nitric Acid 1.0 Normal**
NIST Traceable Solution

· **Article number:** CY061A

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Aqua Solutions, Inc.
6913 Highway 225
DEER PARK, TX 77536
USA
800-256-2586

· **Information department:**
Technical Coordinator
Sherman Nelson sherman@aquasolutions.org
· **Emergency telephone number:**
Chemtrec: 800-424-9300
Canutec: 613-996-6666

2 Hazard(s) identification

· **Classification of the substance or mixture**

GHS05 Corrosion

Skin Corr. 1A H314 Causes severe skin burns and eye damage.
Eye Dam. 1 H318 Causes serious eye damage.

· **Label elements**
· **GHS label elements** The product is classified and labeled according to the Globally Harmonized System (GHS).
· **Hazard pictograms**

GHS05

· **Signal word** Danger

· **Hazard-determining components of labeling:**
Nitric Acid
· **Hazard statements**
Causes severe skin burns and eye damage.
· **Precautionary statements**
Do not breathe dusts or mists.
Wash thoroughly after handling.
Wear protective gloves/protective clothing/eye protection/face protection.
If swallowed: Rinse mouth. Do NOT induce vomiting.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
IF INHALED: Remove person to fresh air and keep comfortable for breathing.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Immediately call a poison center/doctor.
Specific treatment (see on this label).

(Contd. on page 2)

Safety Data Sheet
acc. to OSHA HCS

Trade name: Nitric Acid 1.0 Normal
NIST Traceable Solution

(Contd. of page 1)

Wash contaminated clothing before reuse.
Store locked up.
Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Classification system:**
· **NFPA ratings (scale 0 - 4)**

Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

Health = 3
Fire = 0
Reactivity = 0

· **Other hazards**
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Mixtures**
· **Description:** Mixture of the substances listed below with nonhazardous additions.

· **Dangerous components:**		
CAS: 7697-37-2	Nitric Acid	8.737%

· **Table of Nonhazardous Ingredients**		
CAS: 7732-18-5	Water	91.263%

4 First-aid measures

· **Description of first aid measures**
· **General information:** Immediately remove any clothing soiled by the product.
· **After inhalation:** In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
· **After swallowing:** Drink copious amounts of water and provide fresh air. Immediately call a doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed** No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:** Use fire fighting measures that suit the environment.
· **Special hazards arising from the substance or mixture** No further relevant information available.

(Contd. on page 3)

Safety Data Sheet
acc. to OSHA HCS

Printing date 10/20/2017 Reviewed on 10/20/2017

Trade name: Nitric Acid 1.0 Normal
NIST Traceable Solution

(Contd. of page 2)

· **Advice for firefighters**
· **Protective equipment:** No special measures required.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Wear protective equipment. Keep unprotected persons away.
· **Environmental precautions:**
Dilute with plenty of water.
Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Use neutralizing agent.
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.
· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.
· **Protective Action Criteria for Chemicals**

· **PAC-1:**		
CAS: 7697-37-2	Nitric Acid	0.16 ppm

· **PAC-2:**		
CAS: 7697-37-2	Nitric Acid	24 ppm

· **PAC-3:**		
CAS: 7697-37-2	Nitric Acid	92 ppm

7 Handling and storage

· **Handling:**
· **Precautions for safe handling** No special precautions are necessary if used correctly.
· **Information about protection against explosions and fires:** No special measures required.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:**
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Keep receptacle tightly sealed.
· **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see item 7.

(Contd. on page 4)

Safety Data Sheet
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Printing date 10/20/2017 Reviewed on 10/20/2017

Trade name: Nitric Acid 1.0 Normal
NIST Traceable Solution

(Contd. of page 3)

· **Control parameters**

· **Components with limit values that require monitoring at the workplace:**	
CAS: 7697-37-2 Nitric Acid	
PEL	Long-term value: 5 mg/m³, 2 ppm
REL	Short-term value: 10 mg/m³, 4 ppm Long-term value: 5 mg/m³, 2 ppm
TLV	Short-term value: 10 mg/m³, 4 ppm Long-term value: 5.2 mg/m³, 2 ppm

· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes.
Avoid contact with the eyes and skin.
· **Breathing equipment:** Not required.
· **Protection of hands:**

Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation
· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.
· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
· **Eye protection:**

Tightly sealed goggles

· **Body protection:** Protective work clothing

9 Physical and chemical properties

· **Information on basic physical and chemical properties**
· **General Information**
· **Appearance:**

Form:	Liquid
Color:	Clear

(Contd. on page 5)

Safety Data Sheet
acc. to OSHA HCS

Trade name: Nitric Acid 1.0 Normal
NIST Traceable Solution

(Contd. of page 4)

· **Odor:**	Odorless
· **Odor threshold:**	Not determined.
· **pH-value at 20 °C (68 °F):**	<2
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	83 °C (181.4 °F)
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Not applicable.
· **Ignition temperature:**	
Decomposition temperature:	Not determined.
· **Auto igniting:**	Product is not selfigniting.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure at 20 °C (68 °F):**	23 hPa (17.3 mm Hg)
· **Density at 20 °C (68 °F):**	1.03172 g/cm³ (8.6097 lbs/gal)
· **Relative density**	Not determined.
· **Vapor density**	Not determined.
· **Evaporation rate**	Not determined.
· **Solubility in / Miscibility with**	
Water:	Fully miscible.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not determined.
Kinematic:	Not determined.
· **Solvent content:**	
Water:	91.3 %
VOC content:	0.00 % 0.0 g/l / 0.00 lb/gl
Solids content:	0.0 %
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.

(Contd. on page 6)

Safety Data Sheet
acc. to OSHA HCS

Trade name: Nitric Acid 1.0 Normal
NIST Traceable Solution

(Contd. of page 5)

· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **on the skin:** Strong caustic effect on skin and mucous membranes.
· **on the eye:**
Strong caustic effect.
Strong irritant with the danger of severe eye injury.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**
The product shows the following dangers according to internally approved calculation methods for preparations:
Corrosive
Irritant
Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

· **Carcinogenic categories**

· **IARC (International Agency for Research on Cancer)**
None of the ingredients is listed.

· **NTP (National Toxicology Program)**
None of the ingredients is listed.

· **OSHA-Ca (Occupational Safety & Health Administration)**
None of the ingredients is listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 2 (Self-assessment): hazardous for water
Do not allow product to reach ground water, water course or sewage system.
Must not reach bodies of water or drainage ditch undiluted or unneutralized.
Danger to drinking water if even small quantities leak into the ground.
Rinse off of bigger amounts into drains or the aquatic environment may lead to decreased pH-values. A low pH-value harms aquatic organisms. In the dilution of the use-level the pH-value is considerably increased, so that after the use of the product the aqueous waste, emptied into drains, is only low water-dangerous.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No further relevant information available.

(Contd. on page 7)

Safety Data Sheet
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Trade name: Nitric Acid 1.0 Normal
NIST Traceable Solution

(Contd. of page 6)

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** *Disposal must be made according to official regulations.*
· **Recommended cleansing agent:** *Water, if necessary with cleansing agents.*

14 Transport information

· **UN-Number**	
· **DOT, IMDG, IATA**	*UN3264*
· **UN proper shipping name**	
· **DOT**	*Corrosive liquid, acidic, inorganic, n.o.s. (Nitric acid)*
· **IMDG, IATA**	*CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S. (NITRIC ACID)*
· **Transport hazard class(es)**	
· **DOT**	

· **Class**	*8 Corrosive substances*
· **Label**	*8*
· **IMDG, IATA**	

· **Class**	*8 Corrosive substances*
· **Label**	*8*
· **Packing group**	
· **DOT, IMDG, IATA**	*III*
· **Environmental hazards:**	*Not applicable.*
· **Special precautions for user**	*Warning: Corrosive substances*
· **Danger code (Kemler):**	*80*
· **EMS Number:**	*F-A,S-B*
· **Segregation groups**	*Acids*
· **Stowage Category**	*B*
· **Stowage Code**	*SW2 Clear of living quarters.*
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	*Not applicable.*

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Safety Data Sheet
acc. to OSHA HCS

Printing date 10/20/2017 Reviewed on 10/20/2017

Trade name: Nitric Acid 1.0 Normal
NIST Traceable Solution

(Contd. of page 7)

· **Transport/Additional information:**

· **DOT**
· **Quantity limitations** On passenger aircraft/rail: 1 L
On cargo aircraft only: 30 L

· **IMDG**
· **Limited quantities (LQ)** 1L
· **Excepted quantities (EQ)** Code: E2
Maximum net quantity per inner packaging: 30 ml
Maximum net quantity per outer packaging: 500 ml

· **UN "Model Regulation":** UN 3264 CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S. (NITRIC ACID), 8, III

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
· **Sara**

· **Section 355 (extremely hazardous substances):**

CAS: 7697-37-2	Nitric Acid

· **Section 313 (Specific toxic chemical listings):**

CAS: 7697-37-2	Nitric Acid

· **TSCA (Toxic Substances Control Act):**
Nitric Acid
Water

· **Proposition 65**

· **Chemicals known to cause cancer:**
None of the ingredients is listed.

· **Chemicals known to cause reproductive toxicity for females:**
None of the ingredients is listed.

· **Chemicals known to cause reproductive toxicity for males:**
None of the ingredients is listed.

· **Chemicals known to cause developmental toxicity:**
None of the ingredients is listed.

· **Carcinogenic categories**

· **EPA (Environmental Protection Agency)**
None of the ingredients is listed.

· **TLV (Threshold Limit Value established by ACGIH)**
None of the ingredients is listed.

· **NIOSH-Ca (National Institute for Occupational Safety and Health)**
None of the ingredients is listed.

· **GHS label elements** The product is classified and labeled according to the Globally Harmonized System (GHS).

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Safety Data Sheet
acc. to OSHA HCS

Trade name: Nitric Acid 1.0 Normal
NIST Traceable Solution

(Contd. of page 8)

· **Hazard pictograms**

GHS05

· **Signal word** Danger

· **Hazard-determining components of labeling:**
Nitric Acid
· **Hazard statements**
Causes severe skin burns and eye damage.
· **Precautionary statements**
Do not breathe dusts or mists.
Wash thoroughly after handling.
Wear protective gloves/protective clothing/eye protection/face protection.
If swallowed: Rinse mouth. Do NOT induce vomiting.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
IF INHALED: Remove person to fresh air and keep comfortable for breathing.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Immediately call a poison center/doctor.
Specific treatment (see on this label).
Wash contaminated clothing before reuse.
Store locked up.
Dispose of contents/container in accordance with local/regional/national/international regulations.
· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Department issuing SDS:** Environment protection department.
· **Contact:**
· **Date of preparation / last revision**
Creation date for SDS 12-08-2015. STN
10-20-2017: review SDS for accuracy. STN
10/20/2017 / -
· **Abbreviations and acronyms:**
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
ACGIH: American Conference of Governmental Industrial Hygienists
EINECS: European Inventory of Existing Commercial Chemical Substances
ELINCS: European List of Notified Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
VOC: Volatile Organic Compounds (USA, EU)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health

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Safety Data Sheet
acc. to OSHA HCS

Printing date 10/20/2017 *Reviewed on 10/20/2017*

Trade name: Nitric Acid 1.0 Normal
NIST Traceable Solution

(Contd. of page 9)

TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Skin Corr. 1A: Skin corrosion/irritation – Category 1A
Eye Dam. 1: Serious eye damage/eye irritation – Category 1

Hexane (n-Hexane)

SECTION 1 : Identification of the substance/mixture and of the supplier

Product name : **Hexane (n-Hexane)**

Manufacturer/Supplier Trade name:

Manufacturer/Supplier Article number: **S25352A**

Recommended uses of the product and uses restrictions on use:

Manufacturer Details:

AquaPhoenix Scientific
9 Barnhart Drive, Hanover, PA 17331

Supplier Details:

Fisher Science Education
15 Jet View Drive, Rochester, NY 14624

Emergency telephone number:

Fisher Science Education Emergency Telephone No.: 800-535-5053

SECTION 2 : Hazards identification

Classification of the substance or mixture:

Environmentally Damaging
Chronic hazards to the aquatic environment, category 2

Flammable
Flammable liquids, category 2

Health hazard
Aspiration hazard, category 1
Reproductive toxicity, category 2

Irritant
Skin irritation, category 2
Specific target organ toxicity following single exposure, category 3

STOT SE 3
Aspiration Tox.1
Flammable Liq. 2
Aquatic Chronic 2
Reproductive 2
Skin Irritation, Category 2
STOT RE 2

Signal word :Danger

Hazard statements:
Explosive; mass explosion hazard
Explosive; severe projection hazard
Heating may cause an explosion
Heating may cause a fire or explosion

Heating may cause a fire
In contact with water releases flammable gases which may ignite spontaneously
May cause fire or explosion; strong oxidizer
Contains gas under pressure; may explode if heated
Toxic if swallowed
Fatal in contact with skin
May be harmful if swallowed
Toxic to aquatic life with long lasting effects
Precautionary statements:
Do not eat, drink or smoke when using this product
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
IF exposed or concerned: Get medical advice/attention
If skin irritation occurs: Get medical advice/attention
In case of fire: Use ... for extinction
Store in a well ventilated place. Keep container tightly closed
Store locked up
Dispose of contents/container to ...

Other Non-GHS Classification:

WHMIS

B2

D2A

D2B

NFPA/HMIS

NFPA SCALE (0-4)

HMIS RATINGS (0-4)

SECTION 3 : Composition/information on ingredients

Ingredients:		
CAS 110-54-3	n-Hexane	>95 %

Percentages are by weight

SECTION 4 : First aid measures

Description of first aid measures

After inhalation: Move exposed individual to fresh air. Loosen clothing as necessary and position individual in a comfortable position.Seek medical advice if discomfort or irritation persists.

After skin contact: Wash affected area with soap and water. Rinse thoroughly. Seek medical attention if irritation, discomfort or vomiting persists.

After eye contact: Protect unexposed eye. Rinse/flush exposed eye(s) gently using water for 15-20 minutes. Remove contact lens(es) if able to do so during rinsing. Seek medical attention if irritation persists or if concerned.

After swallowing: Rinse mouth thoroughly. Do not induce vomiting. Have exposed individual drink sips of water. Seek medical attention if irritation, discomfort or vomiting persists.

Most important symptoms and effects, both acute and delayed:

Irritation, Nausea,Headache, Shortness of breath.;

Indication of any immediate medical attention and special treatment needed:

If seeking medical attention, provide SDS document to physician.

SECTION 5 : Firefighting measures

Extinguishing media

Suitable extinguishing agents: Carbon dioxide, dry chemical, foam, halon. If in laboratory setting, follow laboratory fire suppression procedures. Use appropriate fire suppression agents for adjacent combustible materials or sources of ignition

For safety reasons unsuitable extinguishing agents:

Special hazards arising from the substance or mixture:

Combustion products may include carbon oxides or other toxic vapors.

Advice for firefighters:

Protective equipment:

Additional information (precautions): Move product containers away from fire or keep cool with water spray as a protective measure, where feasible.

SECTION 6 : Accidental release measures

Personal precautions, protective equipment and emergency procedures:

Wear protective equipment. Use respiratory protective device against the effects of fumes/dust/aerosol. Keep unprotected persons away. Ensure adequate ventilation.Keep away from ignition sources. Protect from heat.Stop the spill, if possible. Contain spilled material by diking or using inert absorbent. Transfer to a disposal or recovery container.

Environmental precautions:

Prevent from reaching drains, sewer or waterway. Collect contaminated soil for characterization per Section 13

Methods and material for containment and cleaning up:

If in a laboratory setting, follow Chemical Hygiene Plan procedures.Collect liquids using vacuum or by use of absorbents. Place into properly labeled containers for recovery or disposal. If necessary, use trained response staff/contractor.

Reference to other sections:

SECTION 7 : Handling and storage

Precautions for safe handling:

Prevent formation of aerosols. Follow good hygiene procedures when handling chemical materials. Do not eat, drink, smoke, or use personal products when handling chemical substances. If in a laboratory setting, follow Chemical Hygiene Plan.Use only in well ventilated areas.Avoid splashes or spray in enclosed areas.

Conditions for safe storage, including any incompatibilities:

Store in a cool location. Provide ventilation for containers. Avoid storage near extreme heat, ignition sources or open flame. Store away from foodstuffs. Store away from oxidizing agents.Store in cool, dry conditions in well sealed containers. Keep container tightly sealed.

SECTION 8 : Exposure controls/personal protection

Control Parameters:	110-54-3, n-Hexan, ACGIH (TLV-TWA) 50 ppm TWA 110-54-3, n-Hexane, NIOSH (TWA) 50 ppm TWA; 180 mg/m3 TWA 110-54-3 , n-Hexane, OSHA (PELs) 500 ppm TWA; 1800 mg/m3 TWA 110-54-3 , n-Hexane, OSHA (STEL) 1000 ppm STEL; 3600 mg/m3 STEL 110-54-3, NIOSH , 1100 ppm IDLH (10% LEL)
Appropriate Engineering controls:	Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use/handling.Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor or mists below the applicable workplace exposure limits (Occupational Exposure Limits-OELs) indicated above.
Respiratory protection:	Not required under normal conditions of use. Use suitable respiratory protective device when high concentrations are present. Use suitable respiratory protective device when aerosol or mist is formed. For spills, respiratory protection may be advisable.
Protection of skin:	The glove material has to be impermeable and resistant to the product/ the substance/ the preparation being used/handled.Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation.
Eye protection:	Safety glasses with side shields or goggles.
General hygienic measures:	The usual precautionary measures are to be adhered to when handling chemicals. Keep away from food, beverages and feed sources. Immediately remove all soiled and contaminated clothing. Wash hands before breaks and at the end of work. Do not inhale gases/fumes/dust/mist/vapor/aerosols. Avoid contact with the eyes and skin.

SECTION 9 : Physical and chemical properties

Appearance (physical state,color):	Form : liquid Colour : colourless	**Explosion limit lower**: **Explosion limit upper**:	Not Determined Not Determined
Odor:	gasoline	**Vapor pressure**:	341.3 hPa (256.0 mmHg) at 37.7 °C (99.9 °F) 176.0 hPa (132.0 mmHg) at 20.0 °C (68.0 °F)

Hexane (n-Hexane)

Odor threshold:	Not Determined	**Vapor density**:	Not Determined
pH-value:	7.0	**Relative density**:	0.659 g/mL at 25 °C (77 °F)
Melting/Freezing point:	- 95 °C (- 139 °F)	**Solubilities**:	Insoluble
Boiling point/Boiling range:	69 ° C (156 °F)	**Partition coefficient (n-octanol/water)**:	Not Determined
Flash point (closed cup):	- 26.0 °C (- 14.8 °F) - closed cup	**Auto/Self-ignition temperature**:	234.0 °C (453.2 °F)
Evaporation rate:	5.8	**Decomposition temperature**:	Not Determined
Flammability (solid,gaseous):	Not Determined	**Viscosity**:	a. Kinematic:Not Determined b. Dynamic: Not Determined
Density: Not Determined			

SECTION 10 : Stability and reactivity

Reactivity: Nonreactive under normal conditions.
Chemical stability: No decomposition if used and stored according to specifications.
Possible hazardous reactions: None under normal processing
Conditions to avoid: Store away from oxidizing agents, strong acids or bases.Heat, Sparks, Open Flames.
Incompatible materials: Strong acids.Strong bases.
Hazardous decomposition products: Carbon oxides (CO, CO2).

SECTION 11 : Toxicological information

Acute Toxicity:		
Oral:	110-54-3	LD50 Rat 25 g/kg
Dermal:	110-54-3	LD50 Rabbit 3000 mg/kg
Inhalation:	110-54-3	LC50 Rat 48000 ppm 4 h
Chronic Toxicity: No additional information.		
Corrosion Irritation: No additional information.		
Sensitization:		No additional information.
Single Target Organ (STOT):		No additional information.
Numerical Measures:		No additional information.
Carcinogenicity:		No additional information.
Mutagenicity:		No additional information.
Reproductive Toxicity:		No additional information.

SECTION 12 : Ecological information

Ecotoxicity

Fish (acute 110-54-3: : 96 Hr LC50 Pimephales promelas: 2.1 - 2.98 mg/L [flow-through]

Persistence and degradability: Readily degradable in the environment.
Bioaccumulative potential:
Mobility in soil: Aqueous solution has high mobility in soil.
Other adverse effects:

SECTION 13 : Disposal considerations

Waste disposal recommendations:

Product/containers must not be disposed together with household garbage. Do not allow product to reach sewage system or open water.It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities (US 40CFR262.11). Consult federal state/ provincial and local regulations regarding the proper disposal of waste material that may incorporate some amount of this product.

SECTION 14 : Transport information

UN-Number

1208

UN proper shipping name

Hexanes

Transport hazard class(es)

Class:
3 Flammable liquids

Packing group:II
Environmental hazard:
Transport in bulk:
Special precautions for user:

SECTION 15 : Regulatory information

United States (USA)

SARA Section 311/312 (Specific toxic chemical listings):

None of the ingredients is listed

SARA Section 313 (Specific toxic chemical listings):

110-54-3 n-Hexane

RCRA (hazardous waste code):

None of the ingredients is listed

TSCA (Toxic Substances Control Act):

All ingredients are listed.

CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act):

None of the ingredients is listed

Proposition 65 (California):

Chemicals known to cause cancer:

None of the ingredients is listed

Chemicals known to cause reproductive toxicity for females:

None of the ingredients is listed

Chemicals known to cause reproductive toxicity for males:

None of the ingredients is listed

Chemicals known to cause developmental toxicity:

None of the ingredients is listed

Canada

Canadian Domestic Substances List (DSL):

All ingredients are listed.

Canadian NPRI Ingredient Disclosure list (limit 0.1%):

None of the ingredients is listed

Canadian NPRI Ingredient Disclosure list (limit 1%):

110-54-3 n-Hexane

SECTION 16 : Other information

This product has been classified in accordance with hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations.Note:. The responsibility to provide a safe workplace remains with the user.The user should consider the health hazards and safety information contained herein as a guide and should take those precautions required in an individual operation to instruct employees and develop work practice procedures for a safe work environment.The information contained herein is, to the best of our knowledge and belief, accurate.However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by the use of this material.It is the responsibility of the user to comply with all applicable laws and regulations applicable to this material.

GHS Full Text Phrases:

Abbreviations and acronyms:
IMDG: International Maritime Code for Dangerous Goods
PNEC: Predicted No-Effect Concentration (REACH)
CFR: Code of Federal Regulations (USA)
SARA: Superfund Amendments and Reauthorization Act (USA)
RCRA: Resource Conservation and Recovery Act (USA)
TSCA: Toxic Substances Control Act (USA)
NPRI: National Pollutant Release Inventory (Canada)
DOT: US Department of Transportation
IATA: International Air Transport Association
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
ACGIH: American Conference of Governmental Industrial Hygienists
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
WHMIS: Workplace Hazardous Materials Information System (Canada)
DNEL: Derived No-Effect Level (REACH)

Effective date : 12.14.2014
Last updated : 03.19.2015

Ethylbenzene
Safety Data Sheet

According to Regulation 2012 OSHA Hazard Communication Standard; 29 CFR Part 1910.1200

Section 1: Identification

1.1. Product identifier

Product form : Substance

Product Identifier(s) : Ethylbenzene
Ethyl benzene
EB

CAS No : 100-41-4

1.2. Recommended use of the chemical and restrictions on use

Use of the substance/mixture : Industrial use resulting in manufacture of another substance (use of intermediates)
Solvent

1.3. Details of the supplier of the safety data sheet

Total Petrochemicals & Refining USA, Inc.
P O Box 674411
Houston, TX 77267-4411

For non-emergency product information:
Phone: 713-483-5000
Email: product.stewardship@total.com

1.4. Emergency telephone number

Emergency number : CHEMTREC: 1-800-424-9300 (Toll Free USA & Canada) / 703-527-3887 (Multiple languages)
Total Petrochemicals & Refining USA, Inc.: 1-800-322-3462 (Language: English only)

Section 2: Hazards identification

2.1. Classification of the substance or mixture

Classification (GHS-US)

Flammable liquids Category 2

Acute toxicity (inhalation:vapor) Category 4

Germ cell mutagenicity Category 1B

Carcinogenicity Category 2

Reproductive toxicity Category 2

Specific target organ toxicity (single exposure) Category 3 - Respiratory irritation

Specific target organ toxicity (single exposure) Category 3 - Narcotic effects

Specific target organ toxicity (repeated exposure) Category 2

Aspiration hazard Category 1

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :

Signal word (GHS-US) : **Danger**

Hazard statements (GHS-US) : **Highly flammable liquid and vapor**
May be fatal if swallowed and enters airways
Harmful if inhaled
May cause respiratory irritation
May cause drowsiness or dizziness
May cause genetic defects
Suspected of causing cancer
Suspected of damaging fertility or the unborn child
May cause damage to organs (hearing organ (loss of hearing), kidneys) through prolonged or repeated exposure

Precautionary statements (GHS-US) : Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.

Keep away from heat, hot surfaces, open flames, sparks. - No smoking.
Keep container tightly closed.
Ground/bond container and receiving equipment.
Use explosion-proof electrical, lighting, ventilating equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Do not breathe mist, spray, vapors.
Use only outdoors or in a well-ventilated area.
Wear eye protection, flame retardant protective clothing, impermeable protective gloves.
If swallowed: Immediately call a doctor, poison center.
Do NOT induce vomiting.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
If inhaled: Remove person to fresh air and keep comfortable for breathing.
If exposed or concerned: Get medical advice/attention.
Get medical advice/attention if you feel unwell.
In case of fire: Use carbon dioxide (CO2), dry chemical, foam, water spray to extinguish.
Store in a well-ventilated place. Keep cool.
Store locked up.
Dispose of contents and container in accordance with all local, regional, national and international regulations.

2.3. Hazards not otherwise classified

Other hazards not contributing to the classification : Product can accumulate electrostatic charges that may cause fire by electrical discharges.

2.4. Unknown acute toxicity (GHS-US)

Not applicable

2.5. Additional information

Based on conditions common to industrial workplace use of this product : May cause mild eye irritation.
May cause mild skin irritation.

Section 3: Composition/information on ingredients

3.1. Substance

Name : Ethylbenzene

CAS No : 100-41-4

Formula : C8H10

Impurities and/or Stabilizing Additives which Contribute to the Classification:

Name	CAS No	%
Benzene (Impurity)	71-43-2	<= 0.2
Toluene (Impurity)	108-88-3	<= 0.2

3.2. Mixture

Not applicable

Section 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Never give anything by mouth to an unconscious person. If exposed or concerned: Get medical advice/attention.

First-aid measures after inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a poison center/doctor/physician if you feel unwell.

First-aid measures after skin contact : Rinse skin with water/shower. Remove/Take off immediately all contaminated clothing.

First-aid measures after eye contact : IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

First-aid measures after ingestion : Rinse mouth. Do NOT induce vomiting. Immediately call a poison center or doctor/physician.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries : May cause genetic defects. Suspected of damaging fertility or the unborn child. Causes damage to organs.

Symptoms/injuries after inhalation : May cause drowsiness or dizziness. May cause respiratory irritation.

Symptoms/injuries after skin contact : May cause mild skin irritation.

Symptoms/injuries after eye contact : May cause mild eye irritation.

Symptoms/injuries after ingestion : May be fatal if swallowed and enters airways.

Chronic symptoms : May cause cancer. May cause genetic defects.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available

Section 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Foam. Dry powder. Carbon dioxide. Water spray. Sand.

Unsuitable extinguishing media : Do not use a heavy water stream.

5.2. Special hazards arising from the chemical

Fire hazard : Highly flammable liquid and vapor.

Explosion hazard : May form flammable/explosive vapor-air mixture.

5.3. Advice for firefighters

Firefighting instructions : Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire. Prevent fire-fighting water from entering environment.

Protection during firefighting : Do not enter fire area without proper protective equipment, including respiratory protection.

Section 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Emergency procedures for non-emergency personnel : Evacuate unnecessary personnel.

Emergency procedures for emergency responders : Ventilate area.

6.2. Methods and material for containment and cleaning up

For containment : Take up liquid spill into absorbent material, e.g.: sand, earth, vermiculite. Do not allow material to contaminate ground water system.

Methods for cleaning up : Soak up spills with inert solids, such as clay or diatomaceous earth as soon as possible. Collect spillage. Store away from other materials.

6.3. Reference to other sections

See section 8. Exposure controls/personal protection.

Section 7: Handling and storage

7.1. Precautions for safe handling

Additional hazards when processed : Handle empty containers with care because residual vapors are flammable.

Precautions for safe handling : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapor. No bare lights. No smoking. Use only non-sparking tools. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Eliminate all ignition sources if safe to do so. Avoid breathing vapors, mist, spray. Use only outdoors or in a well-ventilated area.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures : Proper grounding procedures to avoid static electricity should be followed. Ground/bond container and receiving equipment. Use explosion-proof electrical, lighting, ventilating equipment. All efforts should be made to prevent any leaks or spills. Storage tanks should be engineered to prevent contact with water resources, as this material could contaminate the water resources. Surface spills can reach groundwater through porous soil or cracked surfaces. The storage tanks should be monitored regularly for leaks. Where spills or leaks are possible, a comprehensive response plan should be developed and implemented.

Storage conditions : Keep only in the original container in a cool, well ventilated place away from : flames, heat sources, Direct sunlight, sparks. Keep in fireproof place. Keep container tightly closed.

Incompatible materials : Sources of ignition. Direct sunlight. Heat sources.

Section 8: Exposure controls/personal protection

8.1. Occupational Exposure Limits

The following constituents are the only constituents of the product which have a PEL, TLV, or other recommended exposure limit. At this time, the other constituents have no known exposure limits.

Ethylbenzene (100-41-4)		
USA ACGIH	ACGIH TWA (ppm)	20 ppm

USA OSHA	OSHA PEL (TWA) (mg/m³)	435 mg/m³
USA OSHA	OSHA PEL (TWA) (ppm)	100 ppm
Benzene (71-43-2)		
USA ACGIH	ACGIH TWA (ppm)	0.5 ppm
USA ACGIH	ACGIH STEL (ppm)	2.5 ppm
USA OSHA	OSHA PEL (TWA) (ppm)	1 ppm
USA OSHA	OSHA PEL (STEL) (ppm)	5 ppm
USA OSHA	Remark (OSHA)	(see 29 CFR 1910.1028)
Toluene (108-88-3)		
USA ACGIH	ACGIH TWA (ppm)	20 ppm
USA OSHA	OSHA PEL (TWA) (ppm)	200 ppm
USA OSHA	OSHA PEL (Ceiling) (ppm)	300 ppm
USA OSHA	Remark (OSHA)	See 29 CFR 1910.1000 TABLE Z-2.

8.2. Exposure controls

Appropriate engineering controls : Ensure adequate ventilation.

Personal protective equipment : Avoid all unnecessary exposure.

Hand protection : Impermeable protective gloves. Choosing the proper glove is a decision that depends not only on the type of material, but also on other quality features, which differ for each manufacturer. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough. The exact break trough time has to be found out by the manufacturer of the protective gloves and has to be observed.

Eye protection : Chemical goggles or safety glasses.

Skin and body protection : Wear fire/flame resistant/retardant clothing.

Respiratory protection : An approved organic vapor respirator/supplied air or self-contained breathing apparatus must be used when vapor concentration exceeds applicable exposure limits.

Other information : Do not eat, drink or smoke during use.

Section 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Liquid

Appearance : Clear, colorless, volatile liquid.

Color : Colorless.

Odor : Characteristic. Aromatic. Sweet.

Odor threshold : No data available

pH : Not applicable

Relative evaporation rate (butyl acetate=1) : No data available

Relative evaporation rate (ether=1) : < 94

Melting point : -94.9 °C

Freezing point : -94.9 °C

Boiling point : 136 °C

Flash point : 21 (21 - 23) °C

Auto-ignition temperature : 432 °C

Decomposition temperature : No data available

Flammability (solid, gas) : No data available

Vapor pressure : 9.3 mm Hg @ 25°C

Relative vapor density at 20 °C : 3.7 Air =1

Relative density : 0.9

Solubility : Water: 0.2 g/l
Organic solvent:100 %

Log Kow : 2.2 - 2.7

Viscosity, kinematic : 0.64 cSt @ 40°C

Viscosity, dynamic : No data available

Explosive limits : 1 - 7 vol %

9.2. Other information

VOC content : 100 %

Section 10: Stability and reactivity

10.1. Reactivity

Flammable liquid and vapor.

10.2. Chemical stability

Stable at ambient temperature and under normal conditions of use.

10.3. Possibility of hazardous reactions

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

10.4. Conditions to avoid

Direct sunlight. Extremely high or low temperatures. Open flame.

10.5. Incompatible materials

Strong oxidizing agents.

10.6. Hazardous decomposition products

Hazardous decomposition products formed under fire conditions: carbon monoxide, carbon dioxide, toxic fumes.

Section 11: Toxicological information

11.1. Information on toxicological effects

Likely routes of exposure : Inhalation. Ingestion. Skin and eye contact.

Acute toxicity : Inhalation:vapor: Harmful if inhaled.

Ethylbenzene (100-41-4)	
LD50 oral rat	3500 mg/kg
LD50 dermal rabbit	15354 mg/kg
LC50 inhalation rat	17.2 mg/l/4h

Skin corrosion/irritation : Not classified

Serious eye damage/irritation : Not classified

Respiratory or skin sensitization : Not classified

Germ cell mutagenicity : May cause genetic defects.
Classification as a Mutagen 1B is due to the benzene content of this material.

Carcinogenicity : Suspected of causing cancer.

Ethylbenzene (100-41-4)	
Additional information	**IARC has evaluated ethylbenzene as 2B, possibly carcinogenic to humans. In IARC's evaluation, it states that:** **"There is inadequate evidence in humans for the carcinogenicity of ethylbenzene. There is sufficient evidence in experimental animals for the carcinogenicity of ethylbenzene."** **IARC also notes that ethylbenzene typically contains, 0.1 – 0.3 wt % benzene, similar to the benzene content of this product (≤ 0.2 wt %). Benzene is a known human carcinogen.** **Additionally, the types of cancers observed in experimental animals exposed to ethylbenzene are not the same as the types of cancers known to be caused by exposure to benzene.** **There is inadequate evidence that exposure to ethylbenzene containing low levels (≤ 0.2 wt %) of benzene causes carcinogenicity in humans, while there is sufficient evidence that exposure to ethylbenzene causes carcinogenicity in experimental animals. Therefore, ethylbenzene has been US-GHS classified as Carcinogen 2.**

Ethylbenzene (100-41-4)	
IARC group	2B - Possibly carcinogenic to humans
Benzene (71-43-2)	
IARC group	1 - Carcinogenic to humans
National Toxicology Program (NTP) Status	1 - Known Human Carcinogens
OSHA Carcinogen Status	In OSHA Specifically Regulated Carcinogen list
Additional information	**Benzene is a known human carcinogen and is known to cause acute myeloid leukemia & myelodysplastic syndrome (disease that affects the bone marrow and blood) in**

	humans who have been repeatedly exposed to benzene.
Toluene (108-88-3)	
IARC group	3 - Not classifiable

Reproductive toxicity : Suspected of damaging fertility or the unborn child.
Based on animal studies, exposure to high levels of ethylbenzene may cause developmental effects (decreases in growth and increased skeletal variations).

Specific target organ toxicity (single exposure) : May cause respiratory irritation. May cause drowsiness or dizziness.

Specific target organ toxicity (repeated exposure) : May cause damage to organs (hearing organ (loss of hearing), kidneys) through prolonged or repeated exposure.

Aspiration hazard : May be fatal if swallowed and enters airways.

Section 12: Ecological information

12.1. Toxicity

Ecology - general : Harmful to aquatic life with long lasting effects.

12.2. Persistence and degradability

No additional information available

12.3. Bioaccumulative potential

Ethylbenzene (100-41-4)	
Log Pow	3.6
Log Kow	2.2 - 2.7

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

Other information : Avoid release to the environment.

Section 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Dispose in a safe manner in accordance with local/national regulations. Dispose of contents and container in accordance with all local, regional, national and international regulations.

Additional information : Handle empty containers with care because residual vapors are flammable.

Ecology - waste materials : Avoid release to the environment. Hazardous waste due to toxicity.

Section 14: Transport information

US Transport (DOT) for Bulk Shipments (Non-Bulk Shipments May Differ)

Transport document description : UN1175, Ethylbenzene, 3, PGII

UN or NA Number : UN1175

Proper Shipping Name : Ethylbenzene

Primary Hazard Class : 3 - Flammable liquid

Packing Group : PGII

Reportable Quantities (RQ)* : Ethylbenzene 1000 lbs (454 kg), Benzene 10 lbs (4.54 kg), Toluene 1000 lbs (454 kg)

*It is the shipper's responsibility to determine whether an RQ must be reported for each individual shipment.

Hazard labels :

Emergency Response Guide (ERG) Number : 130

Transport by sea (IMDG)

Transport document description : UN1175, ETHYLBENZENE, 3, PGII

UN Number : UN1175

Proper Shipping Name : Ethylbenzene

Primary Hazard Class : 3 - Flammable liquids

Packing Group : PGII

Hazard labels (IMDG) :

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Product Name: Ethylbenzene
Pollution Category: Y
Ship Type: 2

Cargo name listed in 46 CFR 30.25, Table 30.25-1 : Ethylbenzene

Cargo name listed in 46 CFR 153, Table 1 : Ethylbenzene

Air transport (IATA)

Transport document description : UN1175, Ethylbenzene, 3, PGII

UN Number : UN1175

Proper Shipping Name : Ethylbenzene

Primary Hazard Class : 3 - Flammable Liquids

Packing Group : PGII

Hazard labels (IATA) :

Section 15: Regulatory information

15.1. US Federal regulations

EPA TSCA Status

All components of this product are listed or excluded from listing on the United States Environmental Protection Agency Toxic Substances Control Act (TSCA) inventory.

SARA Section 313 Supplier Notification

This product contains the following toxic chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372:

CAS number	Chemical name	Concentration
100-41-4	Ethylbenzene	99.5 - 100%
71-43-2	Benzene	<= 0.2%

This information must be included in all Safety Data Sheets that are copied and distributed for this product. For additional information, see 40 CFR §372.45 Notification About Toxic Chemicals.

SARA Section 311/312 Hazard Classes
Fire hazard
Acute health hazard
Chronic health hazard

15.2. International regulations

CANADA

Ethylbenzene (100-41-4)

WHMIS Classification
Class B Division 2 - Flammable Liquid
Class D Division 2 Subdivision A - Very toxic material causing other toxic effects
Class D Division 2 Subdivision B - Toxic material causing other toxic effects

National inventories

(100-41-4)
Listed on the AICS (Australian Inventory of Chemical Substances)
Listed on the Canadian DSL (Domestic Sustances List)
Listed on the China Inventory of Existing Chemical Substances (IECSC)
Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

Listed on the Japanese ENCS (Existing & New Chemical Substances) inventory
Listed on the Korean ECL (Existing Chemicals List)
Listed on NZIoC (New Zealand Inventory of Chemicals)
Listed on the Philippines Inventory of Chemicals and Chemical Substances (PICCS)
Japanese Pollutant Release and Transfer Register Law (PRTR Law)
Listed on the Canadian IDL (Ingredient Disclosure List)

15.3. US State regulations

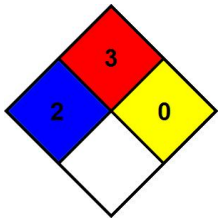
California Proposition 65 - This substance is known to the state of California to cause cancer and/or reproductive toxicity.

Ethylbenzene (100-41-4)	
U.S. - California - Proposition 65 - Carcinogens List	Yes
U.S. - California - Proposition 65 - Developmental Toxicity	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Female	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No
Non-significant risk level (NSRL)	54 µg/day (inhalation)
Benzene (71-43-2)	
U.S. - California - Proposition 65 - Carcinogens List	Yes
U.S. - California - Proposition 65 - Developmental Toxicity	Yes
U.S. - California - Proposition 65 - Reproductive Toxicity - Female	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Male	Yes
Non-significant risk level (NSRL)	6.4 µg/day (oral)
Toluene (108-88-3)	
U.S. - California - Proposition 65 - Carcinogens List	No
U.S. - California - Proposition 65 - Developmental Toxicity	Yes
U.S. - California - Proposition 65 - Reproductive Toxicity - Female	Yes
U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No

Section 16: Other information

NFPA (National Fire Protection Association)

NFPA health hazard : 2
NFPA fire hazard : 3
NFPA reactivity : 0



HMIS III Rating

Health : 2*
Flammability : 3
Physical Hazard : 0
Personal Protection : See section 8 of SDS

US OSHA LABEL as specified under 29 CFR §1910.1200 (f)

Ethylbenzene

Total Petrochemicals & Refining USA, Inc.
PO Box 674411
Houston, TX 77267-4411 USA
Tel. 713-483-5000 or 1-877-871-2709

Danger

Highly flammable liquid and vapor
May be fatal if swallowed and enters airways
Harmful if inhaled
May cause respiratory irritation
May cause drowsiness or dizziness
May cause genetic defects
Suspected of causing cancer
Suspected of damaging fertility or the unborn child
May cause damage to organs (hearing organ (loss of hearing), kidneys) through prolonged or repeated exposure

Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep away from heat, hot surfaces, open flames, sparks. - No smoking.
Keep container tightly closed.
Ground/bond container and receiving equipment.
Use explosion-proof electrical, lighting, ventilating equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Do not breathe mist, spray, vapors.
Use only outdoors or in a well-ventilated area.
Wear eye protection, flame retardant protective clothing, impermeable protective gloves.
If swallowed: Immediately call a doctor, poison center.
Do NOT induce vomiting.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
If inhaled: Remove person to fresh air and keep comfortable for breathing.
If exposed or concerned: Get medical advice/attention.
Get medical advice/attention if you feel unwell.
In case of fire: Use carbon dioxide (CO_2), dry chemical, foam, water spray to extinguish.
Store in a well-ventilated place. Keep cool.
Store locked up.
Dispose of contents and container in accordance with all local, regional, national and international regulations.

Supplemental Information

Product can accumulate electrostatic charges that may cause fire by electrical discharges.

Version : 2.2
Date of issue : August 17, 2015

MSDS ID: ETHYLBENZENE
SDS REFERENCE NUMBER: BC0003

SDS Template - TOTAL SDS US (GHS HazCom 2012) TPRI Version 4.02

The information contained in this Safety Data Sheet (SDS) is believed by Total Petrochemicals & Refining USA, Inc. (TPRI) to be accurate on the date issued. However, materials may present unknown hazards and should be used with caution. Final determination of suitability and use of any material is the sole responsibility of the user. Neither TPRI nor any of its subsidiaries or affiliated companies assumes any liability whatsoever for the accuracy or completeness of the information contained herein or reliance thereto. If the material is repackaged, the user is responsible and must ensure that proper health, safety and other necessary information is included with the material and/or on the container. NO WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE MADE REGARDING THE MATERIALS OR THE INFORMATION CONTAINED IN THIS SDS. ALTERATION OF THIS DOCUMENT IS STRICTLY PROHIBITED.

Safety Data Sheet for Radium-226

FACT SHEET 26-017-0617

Section 1: Identification - Radium-226 (Ra-226, ^{226}Ra)

Section 2: Hazard Identification - Radium-226 can present an internal and external radiation hazard. Solid sources of radium-226 pose little external hazard, but decay products of radium-226 such as radium-222 can be a slight external hazard. Liquid or gas sources of radium-226 can be an internal and external hazard.

Section 3: Composition/Information on Ingredients – The half-life of radium-226 is 1622 years. Radium-226 emits alpha particles that can travel about 6.5 centimeters. It also emits low-energy gamma radiation.

Section 4: First-aid Measures – In the event of skin contact, wash with soap and water. Blot the skin dry; do not scrub as doing so may damage the skin. For inhalation or ingestion, cover mouth while seeking clean air. Contact medical professionals for guidance on how to remove materials from the body and to properly assess dose received.

Section 5: Fire-fighting Measures – A self-contained breathing apparatus used by fire fighters is sufficient for preventing inhalation; decontaminate after retreating from the source.

Section 6: Accidental Release Measures - Gas and liquid forms of radium-226 should only be used in HEPA filtered fume hoods. If a capsule or vial that contains radium-226 is broken, secure the room or area to prevent exposure or contamination. Contact you Safety office, Radiation Safety Officer, and the Health Physics Division at the Army Public Health Center for further guidance.

Section 7: Handling and Storage - Radium-226 should be stored in areas approved by a radiation safety officer and labelled appropriately. Personnel who handle it should have radiation safety training. Food or beverages should not be consumed where radium-226 is used. Store items that contain radium-226 in a dry, well-ventilated place. The AN/PDR-77 RADIAC set can detect radium-226 with a pancake probe or an alpha probe. These probes effectively indicate presence/absence, and they can detect contamination.

Section 8: Exposure Controls/Personal Protection - Radium-226 should be handled as little as possible. This source should be kept as far away from the body as is practical.

Section 9: Physical and Chemical Properties - Radium-226 can be found in such medical devices as teletherapy units and brachytherapy needles. It can also be found as paint on clock dials and on gauges in tanks and aircraft. All of these sources are solid and pose no internal hazard as long as they are not damaged. Radium-226 is the source of radon-222. Radon-222 is a radioactive inert gas that can collect in areas with limited ventilation, such as basements and mines.

Section 10: Stability and Reactivity – Radium is very reactive with most non-metals, including oxygen, fluorine, chlorine, and nitrogen. Chemical reactions with any isotope of radium may result in radium gas, which can be an inhalation hazard.

Army Public Health Center, Health Physics Program
5158 Blackhawk Road, Aberdeen Proving Ground, Maryland 21010-5403
410-436-3502 or DSN 584-3502
http:/phc.amedd.army.mil
Approved for public release, distribution unlimited.

Section 11: Toxicological Information -

High-energy short-lived daughter products: radon-222, polonium-218, astatine-218, radon-218, bismuth-214, polonium-214, thallium-214, lead-210, bismuth-210, polonium-210.
Specific Activity: 1.0 Ci/g
Dose, ingestion: 2.8E-7 Sv/Bq (f_1 = 0.2)
Dose, inhalation: 3.6E-7 Sv/Bq (Type F, f_1 = 0.3)
3.5E-6 Sv/Bq (Type M, f_1 = 0.1)
9.5E-6 Sv/Bq (Type S, f_1 = 0.01)
Gamma Constant: 3.274E-6 mSv h^{-1} per MBq at 1 meter (Does not include progeny)
For more information, see "Health Physics and Radiological Health, 4th Edition" by Thomas E. Johnson and Brian K. Birky, (Lippincott Williams & Wilkins, 2012)

Section 12: Ecological Information - None

Section 13: Disposal Considerations - Radioactive materials cannot be disposed of as regular trash. The US Army Joint Munitions Command manages the disposal of radioactive materials in the Army. Contact the radiation waste experts at Rock Island Arsenal Garrison for radioactive disposal from contact numbers found at https://www.usagria.army.mil/about/phonebook.aspx .

Section 14: Transportation Information - When shipping radioactive materials, consult 49 CFR (Code of Federal Regulations) 173 for instructions. Packaging and shipping radioactive materials requires Department of Transportation certified training.

Section 15: Regulatory Information – 10 CFR is the federal regulation for use, storage, and disposal of licensed radioactive materials under U.S. Nuclear Regulatory Commission jurisdiction.

Section 16: Other Information - Contact your command Safety office or the Health Physics Division at Army Public Health Center (410-436-3502) for more information on regulations or emergencies relating to use of radioactive materials in the U.S. Army.

SAFETY DATA SHEET

Creation Date 21-Sep-2009 **Revision Date** 25-Apr-2019 **Revision Number** 4

1. Identification

Product Name **Vinyl acetate, stabilized**

Cat No. : **O5057-4; O5057-FB115**

CAS-No 108-05-4
Synonyms Ethenyl ethanoate; Vinyl A monomer; Ethenyl acetate

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 2
Acute Inhalation Toxicity - Vapors	Category 4
Carcinogenicity	Category 2
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	

Label Elements

Signal Word
Danger

Hazard Statements
Highly flammable liquid and vapor
Harmful if inhaled
Suspected of causing cancer
May cause respiratory irritation

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting/equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Avoid breathing dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Response
IF exposed or concerned: Get medical attention/advice
Call a POISON CENTER or doctor/physician if you feel unwell
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
Skin
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Ingestion
Do NOT induce vomiting
Fire
In case of fire: Use CO2, dry chemical, or foam for extinction
Storage
Store locked up
Store in a well-ventilated place. Keep cool
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
None identified

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Vinyl acetate	108-05-4	> 99
Hydroquinone	123-31-9	< 0.01

4. First-aid measures

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.

Inhalation Remove from exposure, lie down. Move to fresh air. If not breathing, give artificial respiration. Obtain medical attention.

Ingestion Do not induce vomiting. Never give anything by mouth to an unconscious person. Obtain medical attention.

Most important symptoms and effects Breathing difficulties. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Carbon dioxide (CO_2). Dry chemical. Use water spray to cool unopened containers. Cool closed containers exposed to fire with water spray.

Unsuitable Extinguishing Media No information available

Flash Point -8 °C / 17.6 °F

Method - No information available

Autoignition Temperature 385 °C / 725 °F

Explosion Limits

Upper 14.0%

Lower 2.6%

Sensitivity to Mechanical Impact No information available

Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical

Flammable. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Containers may explode when heated. Vapors may form explosive mixtures with air.

Hazardous Combustion Products

Carbon monoxide (CO) Carbon dioxide (CO_2)

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	3	2	N/A

6. Accidental release measures

Personal Precautions Ensure adequate ventilation. Use personal protective equipment. Remove all sources of ignition. Take precautionary measures against static discharges.

Environmental Precautions See Section 12 for additional ecological information. Do not flush into surface water or sanitary sewer system.

Methods for Containment and Clean Up Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment. Ensure adequate ventilation. Avoid contact with skin and eyes. Do not breathe vapors or spray mist. Take precautionary measures against static discharges. Use only in area provided with appropriate exhaust ventilation. Use explosion-proof equipment. Use only non-sparking tools. Keep away from open flames, hot surfaces and sources of ignition. To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded.

Storage Keep in a dry place. Keep container tightly closed. Keep away from heat and sources of ignition. Keep away from direct sunlight. Refrigerator/flammables. May form explosive peroxides on prolonged storage.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Vinyl acetate	TWA: 10 ppm STEL: 15 ppm	(Vacated) TWA: 10 ppm (Vacated) TWA: 30 mg/m³ (Vacated) STEL: 20 ppm (Vacated) STEL: 60 mg/m³	Ceiling: 4 ppm Ceiling: 15 mg/m³	TWA: 10 ppm STEL: 15 ppm
Hydroquinone	TWA: 1 mg/m³	(Vacated) TWA: 2 mg/m³ TWA: 2 mg/m³	IDLH: 50 mg/m³ Ceiling: 2 mg/m³	TWA: 1 mg/m³

Legend

ACGIH *- American Conference of Governmental Industrial Hygienists*
OSHA *- Occupational Safety and Health Administration*
NIOSH IDLH: *The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health*

Engineering Measures Use explosion-proof electrical/ventilating/lighting/equipment. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Clear
Odor	sweet
Odor Threshold	No information available
pH	7
Melting Point/Range	-93 °C / -135.4 °F
Boiling Point/Range	72 - 73 °C / 161.6 - 163.4 °F
Flash Point	-8 °C / 17.6 °F
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	14.0%
Lower	2.6%
Vapor Pressure	No information available
Vapor Density	No information available
Specific Gravity	0.930
Solubility	23 g/L @ 20 °C
Partition coefficient; n-octanol/water	No data available

Autoignition Temperature	385 °C / 725 °F
Decomposition Temperature	No information available
Viscosity	No information available
Molecular Formula	C4 H6 O2
Molecular Weight	86.09

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability May form explosive peroxides. Stable under normal conditions. Light sensitive.

Conditions to Avoid Keep away from open flames, hot surfaces and sources of ignition. Excess heat. Exposure to light. Incompatible products.

Incompatible Materials Acids, Bases, oxygen, Peroxides, Acid anhydrides, Metals, Butyl rubber

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2)

Hazardous Polymerization Hazardous polymerization may occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Vinyl acetate	LD50 = 2900 mg/kg (Rat)	LD50 = 2335 mg/kg (Rabbit)	LC50 = 3680 ppm (Rat) 4 h LC50 = 11.4 mg/L (Rat) 4 h
Hydroquinone	LD50 = 298 mg/kg (Rat)	LD50 = 74800 mg/kg (Rabbit)	Not listed

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation No information available

Sensitization No information available

Carcinogenicity Possible cancer hazard. May cause cancer based on animal data. The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Vinyl acetate	108-05-4	Group 2B	Not listed	A3	X	A3
Hydroquinone	123-31-9	Not listed	Not listed	A3	Not listed	A3

Mutagenic Effects Not mutagenic in AMES Test

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information

Component	EU - Endocrine Disrupters Candidate List	EU - Endocrine Disruptors - Evaluated Substances	Japan - Endocrine Disruptor Information
Vinyl acetate	Group III Chemical	Not applicable	Not applicable

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

This product contains the following substance(s) which are hazardous for the environment. Contains a substance which is:. Harmful to aquatic organisms. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Vinyl acetate	Not listed	LC50: = 14 mg/L, 96h static (Pimephales promelas) LC50: 15.04 - 21.54 mg/L, 96h static (Lepomis macrochirus) LC50: 26.1 - 36.63 mg/L, 96h static (Poecilia reticulata)	EC50 = 2080 mg/L 5 min	EC50: = 52 mg/L, 24h (Daphnia magna)
Hydroquinone	EC50: = 0.335 mg/L, 72h (Pseudokirchneriella subcapitata) EC50: = 13.5 mg/L, 120h (Desmodesmus subspicatus)	LC50: = 0.17 mg/L, 96h (Brachydanio rerio) LC50: = 0.044 mg/L, 96h flow-through (Oncorhynchus mykiss) LC50: 0.1 - 0.18 mg/L, 96h static (Pimephales promelas) LC50: = 0.044 mg/L, 96h flow-through (Pimephales promelas)	EC50 = 0.038 mg/L 15 min EC50 = 0.0382 mg/L 30 min EC50 = 0.042 mg/L 5 min EC50 = 23.75 mg/L 60 min	EC50: = 0.29 mg/L, 48h (Daphnia magna)

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Vinyl acetate	0.73
Hydroquinone	0.5

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

UN-No UN1301
Proper Shipping Name VINYL ACETATE, STABILIZED
Hazard Class 3
Packing Group II

TDG

UN-No UN1301

Proper Shipping Name VINYL ACETATE, STABILIZED
Hazard Class 3
Packing Group II

IATA
UN-No UN1301
Proper Shipping Name VINYL ACETATE, STABILIZED
Hazard Class 3
Packing Group II

IMDG/IMO
UN-No UN1301
Proper Shipping Name VINYL ACETATE, STABILIZED
Hazard Class 3
Packing Group II

15. Regulatory information

United States of America Inventory

Component	CAS-No	TSCA	TSCA Inventory notification - Active/Inactive	TSCA - EPA Regulatory Flags
Vinyl acetate	108-05-4	X	ACTIVE	-
Hydroquinone	123-31-9	X	ACTIVE	-

Legend:
TSCA - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories
Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Australia (AICS), China (IECSC), Korea (ECL).

Component	CAS-No	DSL	NDSL	EINECS	PICCS	ENCS	AICS	IECSC	KECL
Vinyl acetate	108-05-4	X	-	203-545-4	X	X	X	X	KE-35324
Hydroquinone	123-31-9	X	-	204-617-8	X	X	X	X	KE-02558

U.S. Federal Regulations

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Vinyl acetate	108-05-4	> 99	0.1
Hydroquinone	123-31-9	< 0.01	1.0

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Vinyl acetate	X	5000 lb	-	-

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Vinyl acetate	X		-
Hydroquinone	X		-

OSHA - Occupational Safety and Health Administration Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Vinyl acetate	5000 lb	5000 lb
Hydroquinone	100 lb	100 lb

California Proposition 65 This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Vinyl acetate	X	X	X	X	X
Hydroquinone	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security This product contains the following DHS chemicals:
Legend - STQs = Screening Threshold Quantities, APA = A placarded amount

Component	DHS Chemical Facility Anti-Terrorism Standard
Vinyl acetate	Release STQs - 10000lb

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 21-Sep-2009
Revision Date 25-Apr-2019
Print Date 25-Apr-2019
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

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End of SDS

SAFETY DATA SHEET

Creation Date 13-Apr-2009 **Revision Date** 17-Jan-2018 **Revision Number** 6

1. Identification

Product Name **Methyl Ethyl Ketone**

Cat No. : **M209-1, M209-20, M209-200, M209-4, M209-500, M209S-4, M209FB-19, M209FB-50, M209FB-115, M209FB-200, M209RB-115, M209RS-19, M209RS-28, M209RS-50, M209RS-200, M209SS-28, M209SS-50, M209SS-115, M209SS-200**

CAS-No 78-93-3
Synonyms 2-Butanone; MEK; Ethyl methyl ketone

Recommended Use Laboratory chemicals.
Uses advised against Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver.	

Label Elements

Signal Word
Danger

Hazard Statements
Highly flammable liquid and vapor
Causes serious eye irritation
May cause drowsiness or dizziness
May cause damage to organs through prolonged or repeated exposure

Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting/equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Wear protective gloves/protective clothing/eye protection/face protection
Keep cool
Response
Get medical attention/advice if you feel unwell
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
Skin
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Fire
In case of fire: Use CO2, dry chemical, or foam for extinction
Storage
Store in a well-ventilated place. Keep container tightly closed
Store locked up
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Repeated exposure may cause skin dryness or cracking

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Methyl ethyl ketone	78-93-3	>95

4. First-aid measures

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Get medical attention if symptoms occur.

Inhalation Move to fresh air. Get medical attention if symptoms occur. If not breathing, give artificial respiration.

Ingestion	Do not induce vomiting. Obtain medical attention.
Most important symptoms and effects	Breathing difficulties. Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting: Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	CO_2, dry chemical, dry sand, alcohol-resistant foam. Cool closed containers exposed to fire with water spray.
Unsuitable Extinguishing Media	Water may be ineffective
Flash Point	-7 °C / 19.4 °F
Method -	Closed cup
Autoignition Temperature	404 °C / 759.2 °F
Explosion Limits	
Upper	11.4 vol %
Lower	1.4 vol %
Oxidizing Properties	Not oxidising
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Flammable. Risk of ignition. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Containers may explode when heated. Thermal decomposition can lead to release of irritating gases and vapors. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Carbon monoxide (CO) Carbon dioxide (CO_2)
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	3	1	N/A

6. Accidental release measures

Personal Precautions	Use personal protective equipment. Remove all sources of ignition. Take precautionary measures against static discharges. Avoid contact with skin, eyes and clothing. Ensure adequate ventilation.
Environmental Precautions	Avoid release to the environment. See Section 12 for additional ecological information.
Methods for Containment and Clean Up	Remove all sources of ignition. Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Use spark-proof tools and explosion-proof equipment.

7. Handling and storage

Handling	Wear personal protective equipment. Ensure adequate ventilation. Use spark-proof tools and explosion-proof equipment. Avoid contact with skin, eyes and clothing. Avoid ingestion and inhalation. Keep away from open flames, hot surfaces and sources of ignition. Take precautionary measures against static discharges. Use only non-sparking tools. To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition. Flammables area.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Methyl ethyl ketone	TWA: 200 ppm STEL: 300 ppm	(Vacated) TWA: 200 ppm (Vacated) TWA: 590 mg/m^3 (Vacated) STEL: 300 ppm (Vacated) STEL: 885 mg/m^3 TWA: 200 ppm TWA: 590 mg/m^3	IDLH: 3000 ppm TWA: 200 ppm TWA: 590 mg/m^3 STEL: 300 ppm STEL: 885 mg/m^3	TWA: 200 ppm TWA: 590 mg/m^3 STEL: 300 ppm STEL: 885 mg/m^3

Legend

ACGIH *- American Conference of Governmental Industrial Hygienists*
OSHA *- Occupational Safety and Health Administration*
NIOSH IDLH: *The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health*

Engineering Measures Ensure adequate ventilation, especially in confined areas. Use explosion-proof electrical/ventilating/lighting/equipment. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Characteristic - sweet
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-87 °C / -124.6 °F
Boiling Point/Range	80 °C / 176 °F
Flash Point	-7 °C / 19.4 °F
Method -	Closed cup
Evaporation Rate	3.7
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	11.4 vol %
Lower	1.4 vol %
Vapor Pressure	105 mbar @ 20 °C
Vapor Density	2.41
Specific Gravity	0.806
Solubility	Soluble in water
Partition coefficient; n-octanol/water	No data available

Autoignition Temperature	404 °C / 759.2 °F
Decomposition Temperature	No information available
Viscosity	0.42 mPa.s @ 15°C
Molecular Formula	C4 H8 O
Molecular Weight	72.11

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Hygroscopic.

Conditions to Avoid Incompatible products. Excess heat. Keep away from open flames, hot surfaces and sources of ignition. Exposure to moist air or water.

Incompatible Materials Strong oxidizing agents, Strong acids, Strong bases, Strong reducing agents, Ammonia, copper, Amines

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2)

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Methyl ethyl ketone	LD50 = 2483 mg/kg (Rat) LD50 = 2737 mg/kg (Rat)	LD50 = 5000 mg/kg (Rabbit) LD50 = 6480 mg/kg (Rabbit)	LC50 = 11700 ppm (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Methyl ethyl ketone	78-93-3	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects Not mutagenic in AMES Test

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)

STOT - repeated exposure Kidney Liver

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting: Inhalation of high vapor concentrations may cause symptoms like headache, dizziness,

tiredness, nausea and vomiting

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

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Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Methyl ethyl ketone	Not listed	Lepomis macrochirus: LC50=3,22 g/L 96 h	EC50 = 3403 mg/L 30 min EC50 = 3426 mg/L 5 min	EC50: 4025 - 6440 mg/L, 48h Static (Daphnia magna) EC50: = 5091 mg/L, 48h (Daphnia magna) EC50: > 520 mg/L, 48h (Daphnia magna)

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Methyl ethyl ketone	0.29

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Methyl ethyl ketone - 78-93-3	U159	-

14. Transport information

DOT

- **UN-No** UN1193
- **Proper Shipping Name** Ethyl methyl ketone
- **Hazard Class** 3
- **Packing Group** II

TDG

- **UN-No** UN1193
- **Proper Shipping Name** ETHYL METHYL KETONE
- **Hazard Class** 3
- **Packing Group** II

IATA

- **UN-No** UN1193
- **Proper Shipping Name** Methyl ethyl ketone
- **Hazard Class** 3
- **Packing Group** II

IMDG/IMO

- **UN-No** UN1193
- **Proper Shipping Name** Ethyl methyl ketone (Methyl ethyl ketone)
- **Hazard Class** 3
- **Packing Group** II

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Methyl ethyl ketone	X	X	-	201-159-0	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313 Not applicable

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act) Not applicable

Clean Air Act Not applicable

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Methyl ethyl ketone	5000 lb	-

California Proposition 65 This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Methyl ethyl ketone	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade Serious risk, Grade 3

16. Other information

Prepared By	Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com
Creation Date	13-Apr-2009
Revision Date	17-Jan-2018
Print Date	17-Jan-2018
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

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End of SDS

Chromium

Safety Data Sheet

Section 1: Identification

1.1 Product Identifier

Product Name:	Chromium
Product Form:	Solid
Chemical Family:	Metal
CAS Number:	7440-47-3
Molecular Formula:	Cr
Molecular Weight	51.996

1.2 Other Means of Identification

Synonyms:	Chrome; Chromium Element; Chromium Metal; Metallic Chromium; Cr; DLA05001; RTECS GB4200000

1.3 Recommended Uses

Recommended Use:	Variety of mechanical and industrial applications

1.4 Manufacturer, Importer, or Responsible Party

Responsible Party:	Defense Logistics Agency Strategic Materials 8725 John J. Kingman Road Fort Belvoir, Virginia 22060-6223 (571) 767-5525

1.5 Emergency Phone Number

Emergency Phone Number:	(800) 424-9300 (CHEMTREC) (703) 527-3887 (CHEMTREC INTERNATIONAL)

Section 2: Hazard(s) Identification

2.1 Classification of Chemical per OSHA CFR 1910.1200

Acute Toxicity (Oral):	Category 2
Skin Irritation:	Category 2
Eye Irritation:	Category 2B
Skin Sensitization:	Category 1A
Germ Cell Mutagenicity:	Category 2
Reproductive Toxicity:	Effects on or via Lactation
Target Organ Toxicity– Prolonged:	Category 1 (Lungs, Kidney)

2.2 Label Elements

Signal Word: DANGER

Symbol(s):

Hazard Statements:	Fatal if swallowed. Causes skin irritation. Causes eye irritation. May cause an allergic skin reaction. Suspected of causing genetic defects. May cause harm to breast-fed children. Causes damage to lungs and kidneys through prolonged or repeated exposure.
Precautionary Statements:	Prevention: Wear protective gloves, protective clothing, eye protection, and face protection. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Do not breathe dust. Contaminated clothing must not be allowed out of the workplace. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Avoid contact during pregnancy and/or while nursing. Response: If swallowed, immediately call a poison center and/or doctor. Rinse mouth. If on skin, wash with plenty of water. If skin irritation or rash occurs, get medical advice and/or attention. Take off contaminated clothing and wash it before reuse. If in eyes, rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists, get medical advice/attention. If exposed, concerned, or feeling unwell, get medical advice and/or attention. Storage: Store locked up. Disposal: Dispose of contents in accordance with federal, state, and local regulations.

2.3 Other Hazards
Negligible fire and explosion hazard in bulk form. Dust/air mixtures may ignite or explode.

2.4 Unknown Acute Toxicity
Does not apply to this product.

Section 3: Composition / Information on Ingredients

3.1 Chemical Name
Chemical Name:	Chromium
Composition:	99.00%-99.82% Cr

The health and physical hazards information provided in this SDS are for its major component. Chromium metal contains other elements in addition to Cr. For concentrations of other components, see the Certificates of Analysis for each lot.

3.2 Common Names/Synonyms
Synonyms: See **Section 1.2** for common names and synonyms.

3.3 CAS Number/Unique Identifiers
CAS Number:	7440-47-3
EC Number (EINECS):	231-157-5

3.4 Impurities/Stabilizing Additives
No data available.

Section 4: First-Aid Measures

4.1 Description of First-Aid Measures
Inhalation:	If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.
Skin Contact:	Wash skin with soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Cover skin burns with dry, sterile dressings after decontamination. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.
Eye Contact:	Flush eyes with plenty of water for at least 15 minutes. Get immediate

	medical attention.
Ingestion:	Rinse mouth and administer water for dilution if the patient can swallow, has a strong gag reflex, and does not drool. Get medical attention.

4.2 Most Important Symptoms/Effects, Acute and Delayed

Inhalation (Acute):	Irritation.
Inhalation (Chronic):	Digestive disorders and lung damage.
Skin Contact (Acute):	Irritation.
Skin Contact (Chronic):	Kidney damage.
Eye Contact (Acute):	Irritation.
Eye Contact (Chronic):	Tearing.
Ingestion (Acute):	Vomiting, stomach pain, and dizziness.
Ingestion (Chronic):	No data available.

4.3 Indication of immediate Medical Attention/Special Treatment

Antidote:	Dimercaprol, intramuscular

Section 5: Fire-Fighting Measures

5.1 Suitable Extinguishing Media

Dolomite, dry powder for metal fires, dry sand, graphite, soda ash, and sodium chloride. Do not get water directly on material.

5.2 Specific Hazards

Negligible fire and explosion hazard in bulk form. Dust/air mixtures may ignite or explode.

5.3 Special Protective Equipment and Precautions

Respiratory protection from chromium metal and insoluble chromium salts should include a self-contained breathing apparatus with a full face piece operated in pressure-demand or other positive pressure mode. Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep all unauthorized people away, isolate hazard area and deny entry. Let the fire burn. Use extinguishing agents appropriate for surrounding fire. Avoid inhalation of material or combustion by-products.

Section 6: Accidental Release Measures

6.1 Personal Precautions, Protective Equipment, and Emergency Procedures

Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202) 426-2675 (USA). Personal protective equipment is discussed in **Section 8.3**. Keep material out of water sources and sewers. Build dikes to contain flow as necessary. Cover solids with a plastic sheet to prevent dissolving in rain or firefighting water. If spilled in water, neutralize with agricultural lime, crushed limestone, or sodium bicarbonate. Adjust pH to neutral.

6.2 Methods and Materials for Containment and Clean Up

If chromium metal or insoluble chromium salts are spilled, the following steps should be taken:

1. Remove all ignition sources where metallic chromium has been spilled.
2. Ventilate area of spill.
3. Dampen the solid spill material with 5% ammonium hydroxide, and transfer the dampened material to a suitable container.
4. Deposit material and contaminated clothing in sealed containers for reclamation or for disposal in a secured sanitary landfill.
5. Wash all contaminated surfaces with 5% ammonium hydroxide followed by washing with a strong soap and water solution.
6. Do not re-enter the contaminated area until the Safety Officer (or other responsible person) has verified

that the area has been properly cleaned.

Liquid containing chromium metal or insoluble chromium salts should be absorbed in vermiculite, dry sand, earth, or a similar material.

Section 7: Handling and Storage

7.1 Precautions for Safe Handling

Handle in accordance with all current regulations and standards. Utilize personal protective equipment to avoid contact with skin. Personal protective equipment is discussed in **Section 8.3**.

7.2 Conditions for Safe Storage

Store in accordance with all current regulations and standards. Store in a tightly closed container. Store in a cool, dry place. Store in a well-ventilated area. Keep separated from incompatible substances. Incompatible materials are identified in **Section 10.5**.

Section 8: Exposure Controls / Personal Protection

8.1 Exposure Limits

OSHA PEL TWA (metal):	1 mg (Cr)/m^3
ACGIH TWA (metal):	0.5 mg (Cr)/m^3
NIOSH REL TWA 10 hour(s) (metal):	0.5 mg (Cr)/m^3
EC OEL TWA (IOELV) (metal):	2 mg/m^3
UK WEL TWA 8 hour(s) (metal):	0.5 mg/m^3

8.2 Appropriate Engineering Controls

Ventilation: Provide local exhaust ventilation system. Ensure compliance with applicable exposure limits.

8.3 Individual Protection Measures

Eye Protection: Wear splash resistant safety goggles. Provide an emergency eye wash fountain and quick drench shower in the immediate area.

Clothing: Wear appropriate chemical resistant clothing.

Gloves: Wear appropriate chemical resistant gloves.

Respirator:

The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.

2.5 mg/m^3: **1.** Any quarter-mask respirator.

5 mg/m^3: **1.** Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100 or P100.
2. Any supplied-air respirator.

12.5 mg/m^3: **1.** Any supplied-air respirator operated in a continuous-flow mode.
2. Any powered, air-purifying respirator with a high-efficiency particulate filter.

25 mg/m^3: **1.** Any air-purifying, full-facepiece respirator equipped with an N100, R100, or P100 filter.
2. Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter.
3. Any self-contained breathing apparatus with a full facepiece. Any supplied-air respirator with a full facepiece.

250 mg/m^3:	**1.** Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode.
Unknown Concentrations/IDLH:	**1.** Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode. **2.** Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.
Escape:	**1.** Any air-purifying, full-facepiece respirator equipped with an N100, R100, or P100 filter. **2.** Any appropriate escape-type, self-contained breathing apparatus.

Section 9: Physical and Chemical Properties

9.1 Appearance

Physical State:	Solid
Physical Description:	Blue-white to steel-gray, lustrous, brittle, hard, odorless solid in pig, ingot or tub form.

9.2 Odor

Odor:	Odorless

9.3 Odor Threshold

Not available.

9.4 pH

Not applicable.

9.5 Melting / Freezing Points

Melting Point:	3,339°F-3,411°F (1,837°C-1877°C)
Freezing Point:	No data available.

9.6 Boiling Point

Boiling Point:	4,842°F (2,672°C)

9.7 Flash Point

No data available.

9.8 Evaporation Rate

Not applicable.

9.9 Flammability

Flammability:	0.230 oz/ft^3

9.10 Upper/Lower Explosive Limits

No data available.

9.11 Vapor Pressure

Vapor Pressure:	1 mmHg @ 1,616°C

9.12 Vapor Density

Not applicable.

9.13 Relative Density

Water = 1:	7.20 @ 28°C

9.14 Solubility(ies)

Insoluble:	Water, Nitric Acid, and Aqua Regia
Soluble:	Dilute Sulfuric Acid and Hydrochloric Acid

9.15 Partition Coefficient

No data available.

9.16 Auto-Ignition Temperature

No data available.

9.17 Decomposition Temperature

No data available.

9.18 Viscosity

No data available.

Section 10: Stability and Reactivity

10.1 Reactivity

Stable at normal temperatures and pressures.

10.2 Chemical Stability

Stable at normal temperatures and pressures. Not oxidized by air, even in presence of much moisture.

10.3 Possibility of Hazardous Reactions

Alkali Carbonates:	Attacked.
Alkalies (Caustic):	Attacked.
Ammonium Nitrate (Fused):	Violent or explosive reaction.
Bromine Pentafluoride:	Violent reaction and possible ignition.
Hydrogen Peroxide:	Violent decomposition reaction.
Lithium (Molten):	Vigorous reaction at elevated temperatures.
Nitrogen Oxide:	Incandescent reaction.
Oxidizers (Strong):	Fire and explosion hazard.
Potassium Chlorate (Fused):	Vigorous incandescent reaction.
Sulphur Dioxide:	Incandescent reaction.

10.4 Conditions to Avoid

None reported.

10.5 Incompatible Materials

Incompatibilities:	Bases, oxidizing materials, halogens, peroxides, and metals.

Reacts with dilute hydrochloric acid and sulfuric acid. Safe storage of the material is discussed in **Section 7.2**.

10.6 Hazardous Decomposition Products

Thermal Decomposition Products:	Oxides of chromium.

Section 11: Toxicological Information

11.1 Likely Routes of Exposure

Routes of entry include inhalation, skin contact, eye contact, and ingestion.

11.2 Symptoms

See **Section 4.2** for symptoms related to the physical, chemical, and toxicological characteristics.

11.3 Short and Long Term Effects

Inhalation (Acute):	High concentrations of dusts or fumes may cause irritation.
Inhalation (Chronic):	Repeated or prolonged exposure to various chromium compounds has been reported to result in ulceration and perforation of the nasal septum, irritation of the throat and lower respiratory tract, less commonly in gastrointestinal disturbances, blood changes, pulmonary sensitization, pulmonary pneurnoconiosis or fibrosis, and rarely liver effects. These effects have not been reported from exposure to the metal per se.
Skin Contact (Acute):	Contact with dusts or powder may cause irritation.
Skin Contact (Chronic):	Repeated or prolonged exposure to various chromium compounds has been reported to cause various types of dermatitis, including eczema, "chrome holes", sensitization, and, in contact with damaged skin, kidney damage. These effects have not been reported from exposure to the metal per se.
Eye Contact (Acute):	Contact with dusts or powders may cause irritation.
Eye Contact (Chronic):	Repeated or prolonged exposure to some chromium compounds may cause conjunctivitis and lacrimation. These effects have not been reported from exposure to the metal per se.
Ingestion (Acute):	Chromium metal is poorly absorbed by the intestinal tract. Absorption of sufficient amounts of some chromium compounds may result in dizziness, intense thirst, abdominal pain, vomiting, shock, oliguria or anuria, and uremia, which may be fatal.
Ingestion (Chronic):	No data available.

11.4 Numerical Measures of Toxicity

Lethal Dose (LD_{50}):	27,500 µg/kg unreported-rat
Tumorigenic Data:	2,160 µg/kg intravenous-rat TDLo/6 week(s) intermittent; 1,200 µg/kg implant-rat TDLo/6 week(s) intermittent; 75 mg/kg implant-rabbit TDLo
Mutagenic Data:	DNA damage - human lung 1 µmol/L

11.5 Carcinogen Status

IARC:	Human Inadequate Evidence, Animal Inadequate Evidence, Group 3 (metal)
ACGIH:	A4 -Not Classifiable as a Human Carcinogen (metal)

Section 12: Ecological Information

12.1 Ecotoxicity

Fish Toxicity:	14,300 µg/L 96 hour(s) LC_{50} (Mortality) Common, mirror, colored, carp (*Cyprinus carpio*)
Invertebrate Toxicity:	2,000 µg/L 0-5 hour(s) LETH (Mortality) Copepod (*Tisbe holothuriae*)
Algal Toxicity:	3,000-5,000 µg/L NR hour(s) (Population Growth) Blue-green algae (*Synechocystis aquatilis*)
Phytotoxicity:	9,900 µg/L 32 week(s) EC_{50} (Biomass) Water-milfoil (*Myriophyllum spicatum*)

12.2 Persistence and Degradability

No data available.

12.3 Bioaccumulative Potential

Bioconcentration:	20-40 µg/L NR week(s) BCF (Residue) Common bay mussel, blue mussel (*Mytilus edulis*) 100 µg/L

12.4 Mobility in Soil

No data available.

12.5 Other Adverse Effects

No data available.

Section 13: Disposal Considerations

Hazardous Waste Number(s): D007. Dispose of in accordance with U.S. EPA 40 CFR 262 for concentrations at or above the regulatory level (5.0 mg/L). Dispose of in accordance with all applicable regulations.

Section 14: Transport Information

14.1 UN Number

UN Number:	3077

14.2 UN Proper Shipping Name

UN Proper Shipping Name:	RQ Environmentally hazardous substances, solid, n.o.s. (chromium)

14.3 Transport Hazard Class(es)

U.S. Department of Transportation:	Hazard Class or Division 9
CA Transportation/Dangerous Goods:	Hazard Class or Division 9
Land Transport ADR:	Hazard Class or Division 9; Classification Code M7
Land Transport RID:	Hazard Class or Division 9; Classification Code M7
Air Transport IATA:	Hazard Class or Division 9
Air Transport ICAO:	Hazard Class or Division 9
Maritime Transport IMDG:	Hazard Class or Division 9

14.4 Packing Group

U.S. Department of Transportation:	III
CA Transportation/Dangerous Goods:	III
Land Transport ADR:	III
Land Transport RID:	III
Air Transport IATA:	III
Air Transport ICAO:	III
Maritime Transport IMDG:	III

14.5 Environmental Hazards

No data available.

14.6 Transport in Bulk

No data available.

14.7 Special Precautions

No data available.

Section 15: Regulatory Information

US Regulations

CERCLA 102A/103 (40 CFR 302.4):	5,000 LBS RQ {solid metal particles <100 µm diameter (0.004 inches)}

SARA Title III

Section 302 (40 CFR 355.30):	Not regulated.
Section 304 (40 CFR 355.40):	Not regulated.
Sections 311/312 (40 CFR 370.21):	Not regulated.
Section 313 (40 CFR 372.65):	Yes (Chromium)

OSHA Process Safety:	Not regulated.

State Regulations
California Proposition 65: Not regulated.

National Inventory Status
US Inventory (TSCA): Listed on inventory.
TSCA 12(b) Export Notification: Not listed.

Section 16: Other Information

The information in this Safety Data Sheet meets the requirements of the United States Department of Labor OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION and regulations promulgated thereunder (29 CFR 1910.1200 et. seq.). This document is intended only as a guide to the appropriate precautionary material handling by a person trained in, or supervised by a person trained in, chemical handling. Exposure to this chemical may have serious adverse health effects. This chemical may interact with other substances. Since the potential uses are so varied, all of the potential hazards of use or interaction with other chemicals or materials cannot be identified on this Safety Data Sheet. The user should recognize that this chemical can cause injury, especially if improperly handled, precautionary measures are not followed, and personal protective equipment not worn. Read and understand all precautionary information prior to use. The Defense Logistics Agency (DLA) shall not be held liable for any damage resulting from handling or from contact with the above chemical.

References:

ChemADVISOR®, Inc. *Material Safety Data Sheet, Chromium*. September 4, 2008. (as provided by the Defense Logistics Agency)

American Conference of Governmental Industrial Hygienists. *2013 TLVs® and BEIs®*, ACGIH® Publication #0113. 2013.

US Department of Transportation. *Emergency Response Guidebook*. 2012

Centers for Disease Control and Prevention. *NIOSH Pocket Guide to Chemical Hazards*, http://www.cdc.gov/niosh/npg/.

National Institute of Health, Toxicology Data Network. http://toxnet.nlm.nih.gov/

NOTE: No data available: no data for this topic found using references listed.

Date of Preparation of Updated SDS: April 24, 2015

SAFETY DATA SHEET

Version 6.3
Revision Date 11/21/2018
Print Date 10/04/2019

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : cis-1,2-Dichloroethylene

Product Number : D62004
Brand : Aldrich
Index-No. : 602-026-00-3
CAS-No. : 156-59-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 Spruce Street
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 2), H225
Acute toxicity, Oral (Category 4), H302
Acute toxicity, Inhalation (Category 4), H332
Skin irritation (Category 2), H315

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H225 Highly flammable liquid and vapour.

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H302 + H332	Harmful if swallowed or if inhaled.
H315	Causes skin irritation.

Precautionary statement(s)

P210	Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/ eye protection/ face protection.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell. Rinse mouth.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor if you feel unwell.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P403 + P235	Store in a well-ventilated place. Keep cool.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms	:	cis-Acetylene dichloride
Formula	:	$C_2H_2Cl_2$
Molecular weight	:	96.94 g/mol
CAS-No.	:	156-59-2
EC-No.	:	205-859-7
Index-No.	:	602-026-00-3

Component	Classification	Concentration
cis-Dichloroethylene		
	Flam. Liq. 2; Acute Tox. 4; Skin Irrit. 2; H225, H302, H332, H315	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

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SECTION 4: First aid measures

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Dry powder Dry sand

Unsuitable extinguishing media
Do NOT use water jet.

5.2 Special hazards arising from the substance or mixture
Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

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6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Contain spillage, and then collect with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Handle and store under inert gas. Air and moisture sensitive. Light sensitive.
Storage class (TRGS 510): 3: Flammable liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
cis-Dichloroethylene	156-59-2	TWA	200 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Central Nervous System impairment Eye irritation		

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

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Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: light yellow
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: -80 °C (-112 °F) - lit.
f)	Initial boiling point and boiling range	60 °C 140 °F - lit.
g)	Flash point	6.0 °C (42.8 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	1.284 g/cm3 at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition	No data available

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temperature

q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

SECTION 10: Stability and reactivity

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Vapours may form explosive mixture with air.

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Oxidizing agents

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
Other decomposition products - No data available
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 770 mg/kg
LC50 Inhalation - Rat - 13700 ppm
Remarks: Behavioral:Somnolence (general depressed activity). Liver:Fatty liver degeneration.
Dermal: No data available
No data available

Skin corrosion/irritation
Skin - Rabbit
Result: Moderate skin irritation - 24 h

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

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Germ cell mutagenicity
No data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: KV9420000

narcosis, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

SECTION 12: Ecological information

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life with long lasting effects.

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SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

SECTION 14: Transport information

DOT (US)
UN number: 1150 Class: 3 Packing group: II
Proper shipping name: 1,2-Dichloroethylene
Reportable Quantity (RQ):
Poison Inhalation Hazard: No

IMDG
UN number: 1150 Class: 3 Packing group: II EMS-No: F-E, S-D
Proper shipping name: 1,2-DICHLOROETHYLENE

IATA
UN number: 1150 Class: 3 Packing group: II
Proper shipping name: 1,2-Dichloroethylene

SECTION 15: Regulatory information

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Fire Hazard

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

cis-Dichloroethylene	CAS-No. 156-59-2	Revision Date 1993-04-24
cis-Dichloroethylene	CAS-No. 156-59-2	Revision Date 1993-04-24

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New Jersey Right To Know Components

	CAS-No.	Revision Date
cis-Dichloroethylene	156-59-2	1993-04-24

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

SECTION 16: Other information

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.3 Revision Date: 11/21/2018 Print Date: 10/04/2019

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SAFETY DATA SHEET

Version 6.2
Revision Date 07/24/2019
Print Date 10/21/2019

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : TRANS-1,2-DICHLOROETHYLENE, 98%

Product Number : D62209
Brand : Aldrich
Index-No. : 602-026-00-3
CAS-No. : 156-60-5

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 Spruce Street
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 2), H225
Acute toxicity, Inhalation (Category 4), H332
Short-term (acute) aquatic hazard (Category 3), H402
Long-term (chronic) aquatic hazard (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)
H225 Highly flammable liquid and vapour.

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H332	Harmful if inhaled.
H412	Harmful to aquatic life with long lasting effects.

Precautionary statement(s)

P210	Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor if you feel unwell.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P403 + P235	Store in a well-ventilated place. Keep cool.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms	:	trans-1,2-Dichloroethene trans-Acetylene dichloride
Formula	:	$C_2H_2Cl_2$
Molecular weight	:	96.94 g/mol
CAS-No.	:	156-60-5
EC-No.	:	205-860-2
Index-No.	:	602-026-00-3

Component	Classification	Concentration
trans-Dichloroethylene		
	Flam. Liq. 2; Acute Tox. 4; Aquatic Acute 3; Aquatic Chronic 3; H225, H332, H402, H412	>= 90 - <= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

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SECTION 4: First aid measures

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Dry powder Dry sand

Unsuitable extinguishing media
Do NOT use water jet.

5.2 Special hazards arising from the substance or mixture
Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

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6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Contain spillage, and then collect with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Light sensitive. Air and moisture sensitive. Refrigerate before opening.
Storage class (TRGS 510): 3: Flammable liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
trans-Dichloroethylene	156-60-5	TWA	200 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Central Nervous System impairment Eye irritation		

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

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Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid, clear Colour: light yellow
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: -50 °C (-58 °F) - lit.
f)	Initial boiling point and boiling range	48 °C 118 °F - lit.
g)	Flash point	6.0 °C (42.8 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 12.8 %(V) Lower explosion limit: 9.7 %(V)
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	1.257 g/mL at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition	No data available

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temperature

q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

SECTION 10: Stability and reactivity

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Vapours may form explosive mixture with air.

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Oxidizing agents, Bases

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
Other decomposition products - No data available
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Skin corrosion/irritation

Serious eye damage/eye irritation

Respiratory or skin sensitisation

Germ cell mutagenicity

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

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Reproductive toxicity

Specific target organ toxicity - single exposure

Specific target organ toxicity - repeated exposure

Aspiration hazard

Additional Information
RTECS: KV9400000

SECTION 12: Ecological information

12.1 Toxicity

12.2 Persistence and degradability

12.3 Bioaccumulative potential

12.4 Mobility in soil

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life with long lasting effects.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

SECTION 14: Transport information

DOT (US)
UN number: 1150 Class: 3 Packing group: II
Proper shipping name: 1,2-Dichloroethylene
Reportable Quantity (RQ): 1000 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 1150 Class: 3 Packing group: II EMS-No: F-E, S-D
Proper shipping name: 1,2-DICHLOROETHYLENE

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IATA
UN number: 1150 Class: 3 Packing group: II
Proper shipping name: 1,2-Dichloroethylene

SECTION 15: Regulatory information

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Fire Hazard

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
trans-Dichloroethylene	156-60-5	1993-02-16

SECTION 16: Other information

Further information
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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.2 Revision Date: 07/24/2019 Print Date: 10/21/2019

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SAFETY DATA SHEET

Version 6.0
Revision Date 09/19/2019
Print Date 10/04/2019

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : 1,1,2-Trichloroethane

Product Number : 466212
Brand : Aldrich
CAS-No. : 79-00-5

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 Spruce Street
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 4), H302
Acute toxicity, Inhalation (Category 3), H331
Acute toxicity, Dermal (Category 4), H312
Carcinogenicity (Category 2), H351
Short-term (acute) aquatic hazard (Category 3), H402
Long-term (chronic) aquatic hazard (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

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Hazard statement(s)

H302 + H312	Harmful if swallowed or in contact with skin.
H331	Toxic if inhaled.
H351	Suspected of causing cancer.
H412	Harmful to aquatic life with long lasting effects.

Precautionary statement(s)

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P311	Call a POISON CENTER /doctor.
P322	Specific measures (see supplemental first aid instructions on this label).
P330	Rinse mouth.
P363	Wash contaminated clothing before reuse.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

Repeated exposure may cause skin dryness or cracking.

SECTION 3: Composition/information on ingredients

3.1 Substances

Formula	:	C2H3Cl3
Molecular weight	:	133.40 g/mol
CAS-No.	:	79-00-5

Component	Classification	Concentration
1,1,2-Trichloroethane		
	Acute Tox. 4; Acute Tox. 3; Acute Tox. 4; Carc. 2; Aquatic Acute 3; Aquatic Chronic 3; H302, H331, H312, H351, H402, H412	<= 100 %

2-Propanol		
	Flam. Liq. 2; Eye Irrit. 2A; STOT SE 3; H225, H319, H336 Concentration limits: >= 20 %: STOT SE 3,	>= 1 - < 5 %

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	H336;	

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides, Hydrogen chloride gas
Combustible.

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

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SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Storage class (TRGS 510): 6.1D: Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
1,1,2-Trichloroethane	79-00-5	TWA	10 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Central Nervous System impairment Liver damage Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption		
		TWA	10 ppm 45 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix C See Appendix A Potential for dermal absorption		

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		TWA	10 ppm 45 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		Skin designation The value in mg/m3 is approximate.		
		PEL	10 ppm 45 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		Skin		
2-Propanol	67-63-0	TWA	200 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Upper Respiratory Tract irritation Eye irritation Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen		
		STEL	400 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Upper Respiratory Tract irritation Eye irritation Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen		
		TWA	400 ppm 980 mg/m3	USA. NIOSH Recommended Exposure Limits
		ST	500 ppm 1,225 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	400 ppm 980 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		The value in mg/m3 is approximate.		
		PEL	400 ppm 980 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		STEL	500 ppm 1,225 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
2-Propanol	67-63-0	Acetone	40 mg/l	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift at end of workweek			

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8.2 Exposure controls

Appropriate engineering controls

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.4 mm
Break through time: 60 min
Material tested:Camatril® (KCL 730 / Aldrich Z677442, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

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SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	-37.0 °C (-34.6 °F)
f)	Initial boiling point and boiling range	110 - 115 °C 230 - 239 °F - lit.
g)	Flash point	()No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	1.435 g/cm3 at 25 °C (77 °F)
n)	Water solubility	soluble
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

No data available

10.2 Chemical stability

Reacts with air to form peroxides.
Stable under recommended storage conditions.
Contains the following stabiliser(s):

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2-Propanol (<=3 %)

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong bases, Strong oxidizing agents, Reacts violently with:, Sodium/sodium oxides, Potassium, Magnesium, Aluminum

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
Other decomposition products - No data available
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 836.0 mg/kg
Inhalation: No data available
Dermal: No data available
No data available

Skin corrosion/irritation
Skin - Rabbit
Result: Severe skin irritation - 24 h
Skin - Rabbit
Result: Mild skin irritation - 24 h

Serious eye damage/eye irritation
Eyes - Rabbit
Result: Mild eye irritation - 24 h

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification. The National Cancer Institute (NCI) has found clear evidence for carcinogenicity.
Limited evidence of carcinogenicity in animal studies

IARC:	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

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Reproductive toxicity
No data available
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: Not available

Central nervous system depression, prolonged or repeated exposure can cause:, narcosis,
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Kidney - Irregularities - Based on Human Evidence

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	LC50 - Lepomis macrochirus (Bluegill) - 40.00 mg/l - 96 h
	LC50 - Pimephales promelas (fathead minnow) - 81.60 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 43.00 mg/l - 48 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life with long lasting effects.
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life with long lasting effects.

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SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

SECTION 14: Transport information

DOT (US)
UN number: 2810 Class: 6.1 Packing group: III
Proper shipping name: Toxic, liquids, organic, n.o.s. (1,1,2-Trichloroethane)
Reportable Quantity (RQ): 100 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 2810 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: TOXIC LIQUID, ORGANIC, N.O.S. (1,1,2-Trichloroethane)

IATA
UN number: 2810 Class: 6.1 Packing group: III
Proper shipping name: Toxic liquid, organic, n.o.s. (1,1,2-Trichloroethane)

SECTION 15: Regulatory information

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
1,1,2-Trichloroethane	79-00-5	2007-07-01
2-Propanol	67-63-0	2007-03-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
1,1,2-Trichloroethane	79-00-5	2007-07-01
2-Propanol	67-63-0	2007-03-01

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Pennsylvania Right To Know Components

1,1,2-Trichloroethane	CAS-No. 79-00-5	Revision Date 2007-07-01
2-Propanol	67-63-0	2007-03-01

New Jersey Right To Know Components

1,1,2-Trichloroethane	CAS-No. 79-00-5	Revision Date 2007-07-01
2-Propanol	67-63-0	2007-03-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.1,1,2-Trichloroethane	CAS-No. 79-00-5	Revision Date 2007-09-28

SECTION 16: Other information

Further information

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Chloroform CAS No 67-66-3	MATERIAL SAFETY DATA SHEET SDS/MSDS

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Chloroform

CAS-No. : 67-66-3

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Industrial & for professional use only.

1.3 Details of the supplier of the safety data sheet

Company : Central Drug House (P) Ltd
7/28 Vardaan House
New Delhi-10002
INDIA

Telephone : +91 11 49404040
Email : care@cdhfinechemical.com

1.4 Emergency telephone number

Emergency Phone # : +91 11 49404040 (9:00am - 6:00 pm) [Office hours]

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008
Acute toxicity, Oral (Category 4), H302
Acute toxicity, Inhalation (Category 3), H331
Skin irritation (Category 2), H315
Eye irritation (Category 2), H319
Carcinogenicity (Category 2), H351
Reproductive toxicity (Category 2), H361d
Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336
Specific target organ toxicity - repeated exposure (Category 1), H372

For the full text of the H-Statements mentioned in this Section, see Section 16.

Classification according to EU Directives 67/548/EEC or 1999/45/EC
Xn, Xi Harmful, Irritant R20, R22, R48/20/22, R36/38, R40, R63, R67

For the full text of the R-phrases mentioned in this Section, see Section 16.

2.2 Label elements

Labelling according Regulation (EC) No 1272/2008
Pictogram

Signal word	Danger
Hazard statement(s)	
H302	Harmful if swallowed.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H331	Toxic if inhaled.
H336	May cause drowsiness or dizziness.
H351	Suspected of causing cancer.
H361d	Suspected of damaging the unborn child.
H372	Causes damage to organs through prolonged or repeated exposure.
Precautionary statement(s)	
P261	Avoid breathing vapours.
P281	Use personal protective equipment as required.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P311	Call a POISON CENTER or doctor/ physician.
Supplemental Hazard Statements	none

2.3 Other hazards

This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

SECTION 3: Composition/information on ingredients

3.1 Substances

Molecular weight	:	119,38 g/mol
CAS-No.	:	67-66-3
EC-No.	:	200-663-8
Index-No.	:	602-006-00-4

Hazardous ingredients according to Regulation (EC) No 1272/2008

Component		Classification	Concentration
Chloroform			
CAS-No.	67-66-3	Acute Tox. 4; Acute Tox. 3; Skin Irrit. 2; Eye Irrit. 2; Carc. 2; Repr. 2; STOT SE 3; STOT RE 1; H302, H315, H319, H331, H336, H351, H361d, H372	<= 100 %
EC-No.	200-663-8		
Index-No.	602-006-00-4		

Hazardous ingredients according to Directive 1999/45/EC

Component		Classification	Concentration
Chloroform			
CAS-No.	67-66-3	Xn, R20 - R22 - R48/20/22 - R36/38 - R40 - R63 - R67	<= 100 %
EC-No.	200-663-8		
Index-No.	602-006-00-4		

For the full text of the H-Statements and R-Phrases mentioned in this Section, see Section 16

SECTION 4: First aid measures

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2 .2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid breathing vapours, mist or gas. Ensure adequate ventilation.
Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Components with workplace control parameters

8.2 Exposure controls

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid, clear Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	-62,99 °C
f)	Initial boiling point and boiling range	61,0 °C
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	213,3 hPa at 20,0 °C
l)	Vapour density	No data available
m)	Relative density	1,48 g/cm3

n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: 1,97
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

Surface tension 27,1 mN/m at 20,0 °C

SECTION 10: Stability and reactivity

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents, Strong bases, Magnesium, Sodium/sodium oxides, Lithium

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 908 mg/kg
Remarks: Behavioral:Change in motor activity (specific assay). Behavioral:Ataxia. Lungs, Thorax, or Respiration:Respiratory stimulation.

LOEC Inhalation - Rat - male - 6 h - 500 ppm

LD50 Dermal - Rabbit - > 20.000 mg/kg

Skin corrosion/irritation
Skin - Rabbit
Result: Irritating to skin. - 24 h

Serious eye damage/eye irritation
Eyes - Rabbit
Result: Irritating to eyes. - 24 h

Respiratory or skin sensitisation
Did not cause sensitisation on laboratory animals.

Germ cell mutagenicity
Laboratory experiments have shown mutagenic effects.

Carcinogenicity

Carcinogenicity - Rat - Oral
Tumorigenic:Carcinogenic by RTECS criteria. Leukaemia

The National Cancer Institute (NCI) has found clear evidence for carcinogenicity. Limited evidence of a carcinogenic effect.

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Chloroform)

Reproductive toxicity
Suspected of damaging the unborn child. Suspected human reproductive toxicant

Specific target organ toxicity - single exposure
May cause drowsiness or dizziness.

Specific target organ toxicity - repeated exposure
The substance or mixture is classified as specific target organ toxicant, repeated exposure, category 1. - Liver, Kidney

Aspiration hazard
No data available

Additional Information
RTECS: Not available

Vomiting, Gastrointestinal disturbance, Exposure to and/or consumption of alcohol may increase toxic effects., To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	LC50 - Leuciscus idus (Golden orfe) - 162 mg/l - 48 h
	LC100 - Leuciscus idus (Golden orfe) - 220 mg/l - 48 h
	LC50 - other fish - 97 mg/l - 96 h
	LC50 - Danio rerio (zebra fish) - 121 mg/l - 96 h
	NOEC - Oryzias latipes - 122 mg/l - 10 d
	NOEC - Oncorhynchus mykiss (rainbow trout) - 24 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 79,00 mg/l - 24 h
	Immobilization EC50 - Daphnia magna (Water flea) - 51,6 mg/l - 48 h
	NOEC - Daphnia magna (Water flea) - 120 mg/l - 11 d
Toxicity to algae	EC50 - No information available. - 500,00 mg/l - 24 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential

Bioaccumulation	Lepomis macrochirus (Bluegill) - 14 d - 0,11 mg/l
	Bioconcentration factor (BCF): 6

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

12.6 Other adverse effects
Harmful to aquatic life.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

SECTION 14: Transport information

14.1 UN number

ADR/RID: 1888 IMDG: 1888 IATA: 1888

14.2 UN proper shipping name

ADR/RID: CHLOROFORM
IMDG: CHLOROFORM
IATA: Chloroform

14.3 Transport hazard class(es)

ADR/RID: 6.1 IMDG: 6.1 IATA: 6.1

14.4 Packaging group

ADR/RID: III IMDG: III IATA: III

14.5 Environmental hazards

ADR/RID: no IMDG Marine pollutant: no IATA: no

14.6 Special precautions for user

No data available

SECTION 15: Regulatory information

This safety datasheet complies with the requirements of Regulation (EC) No. 1907/2006.

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

No data available

15.2 Chemical Safety Assessment

For this product a chemical safety assessment was not carried out

SECTION 16: Other information

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Carc.	Carcinogenicity
Eye Irrit.	Eye irritation
H302	Harmful if swallowed.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H331	Toxic if inhaled.
H336	May cause drowsiness or dizziness.
H351	Suspected of causing cancer.
H361d	Suspected of damaging the unborn child.
H372	Causes damage to organs through prolonged or repeated exposure.
Repr.	Reproductive toxicity

Full text of R-phrases referred to under sections 2 and 3

Xn	Harmful
R20	Harmful by inhalation.
R22	Harmful if swallowed.
R36/38	Irritating to eyes and skin.
R40	Limited evidence of a carcinogenic effect.
R48/20/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
R63	Possible risk of harm to the unborn child.
R67	Vapours may cause drowsiness and dizziness.

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Central Drug House (P) Ltd and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.cdhfinechemical.com for additional terms and conditions of sale.

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

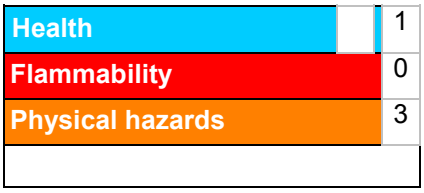
WHMIS (Canada) : Class A: Compressed gas.

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

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.

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

Isobutylene

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.

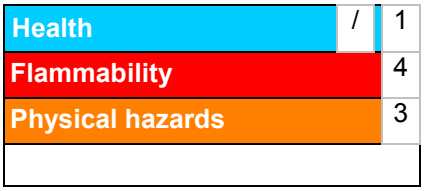
Turkey : Not determined.

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

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SAFETY DATA SHEET

Isopropyl Alcohol (Isopropanol)

Section 1. Identification

GHS product identifier : Isopropyl Alcohol (Isopropanol)

Chemical name : Isopropyl alcohol

Other means of identification : propan-2-ol; 2-Propanol; isopropanol; isopropyl alcohol

Product use : Synthetic/Analytical chemistry.

Synonym : propan-2-ol; 2-Propanol; isopropanol; isopropyl alcohol

SDS # : 001105

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 : FLAMMABLE LIQUIDS - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Highly flammable liquid and vapor.
May form explosive mixtures with air.
Causes serious eye irritation.
May cause drowsiness and dizziness.

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

Prevention : Wear protective gloves. Wear eye or face protection. Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Use explosion-proof electrical, ventilating, lighting and all material-handling equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Use only outdoors or in a well-ventilated area. Avoid breathing vapor. Wash hands thoroughly after handling. Use and store only outdoors or in a well ventilated place.

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Section 2. Hazards identification

Response : IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or physician if you feel unwell. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.

Storage : Store locked up. Store in a well-ventilated place. Keep cool.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : Isopropyl alcohol

Other means of identification : propan-2-ol; 2-Propanol; isopropanol; isopropyl alcohol

CAS number/other identifiers

CAS number : 67-63-0

Product code : 001105

Ingredient name	%	CAS number
propan-2-ol	100	67-63-0

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.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. 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 necessary, call a poison center or physician. 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. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. If necessary, call a poison center or physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention

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Section 4. First aid measures

immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Can cause central nervous system (CNS) depression. May cause drowsiness and dizziness.

Skin contact : No known significant effects or critical hazards.

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

Ingestion : Can cause central nervous system (CNS) depression. Irritating to mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness

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.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. 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 dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media : Do not use water jet.

Specific hazards arising from the chemical : Highly flammable liquid and vapor. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.

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Section 5. Fire-fighting measures

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. 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. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. 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 : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. 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 : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. 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). Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapor or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

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Section 7. Handling and storage

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 in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
propan-2-ol	**ACGIH TLV (United States, 3/2012).** TWA: 200 ppm 8 hours. STEL: 400 ppm 15 minutes. **OSHA PEL 1989 (United States, 3/1989).** TWA: 400 ppm 8 hours. TWA: 980 mg/m³ 8 hours. STEL: 500 ppm 15 minutes. STEL: 1225 mg/m³ 15 minutes. **NIOSH REL (United States, 1/2013).** TWA: 400 ppm 10 hours. TWA: 980 mg/m³ 10 hours. STEL: 500 ppm 15 minutes. STEL: 1225 mg/m³ 15 minutes. **OSHA PEL (United States, 6/2010).** TWA: 400 ppm 8 hours. TWA: 980 mg/m³ 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.

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Section 8. Exposure controls/personal protection

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: chemical splash goggles.

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. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

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

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

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid. [COLORLESS LIQUID WITH THE ODOR OF RUBBING ALCOHOL]

Color : Colorless.

Molecular weight : 60.11 g/mole

Molecular formula : C3-H8-O

Boiling/condensation point : 83°C (181.4°F)

Melting/freezing point : -90°C (-130°F)

Critical temperature : Not available.

Odor : Alcohol-like.

Odor threshold : Not available.

pH : Not available.

Flash point : Closed cup: 11.7°C (53.1°F)

Burning time : Not applicable.

Burning rate : Not applicable.

Evaporation rate : 1.7 (butyl acetate = 1)

Flammability (solid, gas) : Not available.

Lower and upper explosive (flammable) limits : Lower: 2%
Upper: 12%

Vapor pressure : 4.4 kPa (33.002681467 mm Hg) [room temperature]

Vapor density : 2.1 (Air = 1)

Specific Volume (ft ^{3}/lb) : 1.2739

Gas Density (lb/ft ^{3}) : 0.785

Relative density : 0.79

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Section 9. Physical and chemical properties

Solubility : Not available.

Solubility in water : Not available.

Partition coefficient: n-octanol/water : 0.05

Auto-ignition temperature : 456°C (852.8°F)

Decomposition temperature : Not available.

SADT : Not available.

Viscosity : Not available.

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. Do not allow vapor to accumulate in low or confined areas.

Incompatibility with various substances : Highly reactive or incompatible with the following materials: acids and moisture.

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
propan-2-ol	LC50 Inhalation Gas. LD50 Dermal LD50 Oral	Rat Rabbit Rat	45248 ppm 12800 mg/kg 5000 mg/kg	1 hours - -

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
propan-2-ol	Eyes - Moderate irritant	Rabbit	-	24 hours 100 milligrams	-
	Eyes - Moderate irritant	Rabbit	-	10 milligrams	-
	Eyes - Severe irritant	Rabbit	-	100 milligrams	-
	Skin - Mild irritant	Rabbit	-	500 milligrams	-

Sensitization

Not available.

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Section 11. Toxicological information

Mutagenicity

Not available.

Carcinogenicity

Not available.

Classification

Product/ingredient name	OSHA	IARC	NTP
propan-2-ol	-	3	-

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
propan-2-ol	Category 3	Not applicable.	Narcotic effects

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 : Causes serious eye irritation.

Inhalation : Can cause central nervous system (CNS) depression. May cause drowsiness and dizziness.

Skin contact : No known significant effects or critical hazards.

Ingestion : Can cause central nervous system (CNS) depression. Irritating to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
nausea or vomiting
headache
drowsiness/fatigue
dizziness/vertigo
unconsciousness

Skin contact : No specific data.

Ingestion : No specific data.

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

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Section 11. Toxicological information

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

Product/ingredient name	Result	Species	Exposure
propan-2-ol	Acute LC50 1400000 to 1950000 µg/l Marine water Acute LC50 4200 mg/l Fresh water	Crustaceans - Crangon crangon Fish - Rasbora heteromorpha	48 hours 96 hours

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
propan-2-ol	0.05	-	low

Mobility in soil

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

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

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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. 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. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1219	UN1219	UN1219	UN1219	UN1219
UN proper shipping name	ISOPROPANOL OR ISOPROPYL ALCOHOL	ISOPROPANOL; OR ISOPROPYL ALCOHOL	ISOPROPANOL OR ISOPROPYL ALCOHOL	ISOPROPANOL (ISOPROPYL ALCOHOL)	ISOPROPANOL
Transport hazard class(es)	3	3	3	3	3
Packing group	II	II	II	II	II
Environment	No.	No.	No.	No.	No.
Additional information	**Limited quantity** Yes. **Packaging instruction** **Passenger aircraft** Quantity limitation: 5 L **Cargo aircraft** Quantity limitation: 60 L **Special provisions** IB2, T4, TP1	**Explosive Limit and Limited Quantity Index** 1 **Passenger Carrying Road or Rail Index** 5	-	-	**Passenger and Cargo Aircraft**Quantity limitation: 5 L **Cargo Aircraft Only** Quantity limitation: 60 L **Limited Quantities - Passenger Aircraft** Quantity limitation: 1 L

"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.

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Section 15. Regulatory information

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

United States inventory (TSCA 8b): This material is listed or exempted.

Clean Air Act 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 : Fire hazard
Immediate (acute) health hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
propan-2-ol	100	Yes.	No.	No.	Yes.	No.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	Isopropyl alcohol	67-63-0	100
Supplier notification	Isopropyl alcohol	67-63-0	100

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

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.

Canada inventory : This material is listed or exempted.

International regulations

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Section 15. Regulatory information

International lists : **Australia inventory (AICS)**: This material is listed or exempted.
China inventory (IECSC): This material is listed or exempted.
Japan inventory: This material is listed or exempted.
Korea inventory: This material is listed or exempted.
Malaysia Inventory (EHS Register): Not determined.
New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted.
Philippines inventory (PICCS): This material is listed or exempted.
Taiwan inventory (CSNN): Not determined.

Chemical Weapons Convention List Schedule I Chemicals : Not listed

Chemical Weapons Convention List Schedule II Chemicals : Not listed

Chemical Weapons Convention List Schedule III Chemicals : Not listed

Canada

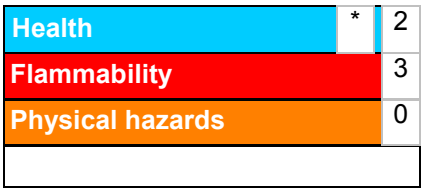
WHMIS (Canada) : Class B-2: Flammable liquid
Class D-2B: Material causing other toxic effects (Toxic).

CEPA Toxic substances: This material is not listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class B-2: Flammable liquid
Class D-2B: Material causing other toxic effects (Toxic).

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

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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.

History

Date of printing : 5/20/2015.

Date of issue/Date of revision : 5/20/2015.

Date of previous issue : 10/28/2014.

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 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

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Section 16. Other information

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.

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Ethylbenzene
Safety Data Sheet

According to Regulation 2012 OSHA Hazard Communication Standard; 29 CFR Part 1910.1200

Section 1: Identification

1.1. Product identifier

Product form : Substance

Product Identifier(s) : Ethylbenzene
Ethyl benzene
EB

CAS No : 100-41-4

1.2. Recommended use of the chemical and restrictions on use

Use of the substance/mixture : Industrial use resulting in manufacture of another substance (use of intermediates)
Solvent

1.3. Details of the supplier of the safety data sheet

Total Petrochemicals & Refining USA, Inc.
P O Box 674411
Houston, TX 77267-4411

For non-emergency product information:
Phone: 713-483-5000
Email: product.stewardship@total.com

1.4. Emergency telephone number

Emergency number : CHEMTREC: 1-800-424-9300 (Toll Free USA & Canada) / 703-527-3887 (Multiple languages)
Total Petrochemicals & Refining USA, Inc.: 1-800-322-3462 (Language: English only)

Section 2: Hazards identification

2.1. Classification of the substance or mixture

Classification (GHS-US)

Flammable liquids Category 2

Acute toxicity (inhalation:vapor) Category 4

Germ cell mutagenicity Category 1B

Carcinogenicity Category 2

Reproductive toxicity Category 2

Specific target organ toxicity (single exposure) Category 3 - Respiratory irritation

Specific target organ toxicity (single exposure) Category 3 - Narcotic effects

Specific target organ toxicity (repeated exposure) Category 2

Aspiration hazard Category 1

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :

Signal word (GHS-US) : **Danger**

Hazard statements (GHS-US) : **Highly flammable liquid and vapor**
May be fatal if swallowed and enters airways
Harmful if inhaled
May cause respiratory irritation
May cause drowsiness or dizziness
May cause genetic defects
Suspected of causing cancer
Suspected of damaging fertility or the unborn child
May cause damage to organs (hearing organ (loss of hearing), kidneys) through prolonged or repeated exposure

Precautionary statements (GHS-US) : Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.

Keep away from heat, hot surfaces, open flames, sparks. - No smoking.
Keep container tightly closed.
Ground/bond container and receiving equipment.
Use explosion-proof electrical, lighting, ventilating equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Do not breathe mist, spray, vapors.
Use only outdoors or in a well-ventilated area.
Wear eye protection, flame retardant protective clothing, impermeable protective gloves.
If swallowed: Immediately call a doctor, poison center.
Do NOT induce vomiting.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
If inhaled: Remove person to fresh air and keep comfortable for breathing.
If exposed or concerned: Get medical advice/attention.
Get medical advice/attention if you feel unwell.
In case of fire: Use carbon dioxide (CO2), dry chemical, foam, water spray to extinguish.
Store in a well-ventilated place. Keep cool.
Store locked up.
Dispose of contents and container in accordance with all local, regional, national and international regulations.

2.3. Hazards not otherwise classified

Other hazards not contributing to the classification : Product can accumulate electrostatic charges that may cause fire by electrical discharges.

2.4. Unknown acute toxicity (GHS-US)

Not applicable

2.5. Additional information

Based on conditions common to industrial workplace use of this product : May cause mild eye irritation.
May cause mild skin irritation.

Section 3: Composition/information on ingredients

3.1. Substance

Name : Ethylbenzene

CAS No : 100-41-4

Formula : C8H10

Impurities and/or Stabilizing Additives which Contribute to the Classification:

Name	CAS No	%
Benzene (Impurity)	71-43-2	<= 0.2
Toluene (Impurity)	108-88-3	<= 0.2

3.2. Mixture

Not applicable

Section 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Never give anything by mouth to an unconscious person. If exposed or concerned: Get medical advice/attention.

First-aid measures after inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a poison center/doctor/physician if you feel unwell.

First-aid measures after skin contact : Rinse skin with water/shower. Remove/Take off immediately all contaminated clothing.

First-aid measures after eye contact : IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

First-aid measures after ingestion : Rinse mouth. Do NOT induce vomiting. Immediately call a poison center or doctor/physician.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries : May cause genetic defects. Suspected of damaging fertility or the unborn child. Causes damage to organs.

Symptoms/injuries after inhalation : May cause drowsiness or dizziness. May cause respiratory irritation.

Symptoms/injuries after skin contact : May cause mild skin irritation.

Symptoms/injuries after eye contact : May cause mild eye irritation.

Symptoms/injuries after ingestion : May be fatal if swallowed and enters airways.

Chronic symptoms : May cause cancer. May cause genetic defects.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available

Section 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Foam. Dry powder. Carbon dioxide. Water spray. Sand.

Unsuitable extinguishing media : Do not use a heavy water stream.

5.2. Special hazards arising from the chemical

Fire hazard : Highly flammable liquid and vapor.

Explosion hazard : May form flammable/explosive vapor-air mixture.

5.3. Advice for firefighters

Firefighting instructions : Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire. Prevent fire-fighting water from entering environment.

Protection during firefighting : Do not enter fire area without proper protective equipment, including respiratory protection.

Section 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Emergency procedures for non-emergency personnel : Evacuate unnecessary personnel.

Emergency procedures for emergency responders : Ventilate area.

6.2. Methods and material for containment and cleaning up

For containment : Take up liquid spill into absorbent material, e.g.: sand, earth, vermiculite. Do not allow material to contaminate ground water system.

Methods for cleaning up : Soak up spills with inert solids, such as clay or diatomaceous earth as soon as possible. Collect spillage. Store away from other materials.

6.3. Reference to other sections

See section 8. Exposure controls/personal protection.

Section 7: Handling and storage

7.1. Precautions for safe handling

Additional hazards when processed : Handle empty containers with care because residual vapors are flammable.

Precautions for safe handling : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapor. No bare lights. No smoking. Use only non-sparking tools. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Eliminate all ignition sources if safe to do so. Avoid breathing vapors, mist, spray. Use only outdoors or in a well-ventilated area.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures : Proper grounding procedures to avoid static electricity should be followed. Ground/bond container and receiving equipment. Use explosion-proof electrical, lighting, ventilating equipment. All efforts should be made to prevent any leaks or spills. Storage tanks should be engineered to prevent contact with water resources, as this material could contaminate the water resources. Surface spills can reach groundwater through porous soil or cracked surfaces. The storage tanks should be monitored regularly for leaks. Where spills or leaks are possible, a comprehensive response plan should be developed and implemented.

Storage conditions : Keep only in the original container in a cool, well ventilated place away from : flames, heat sources, Direct sunlight, sparks. Keep in fireproof place. Keep container tightly closed.

Incompatible materials : Sources of ignition. Direct sunlight. Heat sources.

Section 8: Exposure controls/personal protection

8.1. Occupational Exposure Limits

The following constituents are the only constituents of the product which have a PEL, TLV, or other recommended exposure limit. At this time, the other constituents have no known exposure limits.

Ethylbenzene (100-41-4)		
USA ACGIH	ACGIH TWA (ppm)	20 ppm

USA OSHA	OSHA PEL (TWA) (mg/m³)	435 mg/m³
USA OSHA	OSHA PEL (TWA) (ppm)	100 ppm
Benzene (71-43-2)		
USA ACGIH	ACGIH TWA (ppm)	0.5 ppm
USA ACGIH	ACGIH STEL (ppm)	2.5 ppm
USA OSHA	OSHA PEL (TWA) (ppm)	1 ppm
USA OSHA	OSHA PEL (STEL) (ppm)	5 ppm
USA OSHA	Remark (OSHA)	(see 29 CFR 1910.1028)
Toluene (108-88-3)		
USA ACGIH	ACGIH TWA (ppm)	20 ppm
USA OSHA	OSHA PEL (TWA) (ppm)	200 ppm
USA OSHA	OSHA PEL (Ceiling) (ppm)	300 ppm
USA OSHA	Remark (OSHA)	See 29 CFR 1910.1000 TABLE Z-2.

8.2. Exposure controls

Appropriate engineering controls : Ensure adequate ventilation.

Personal protective equipment : Avoid all unnecessary exposure.

Hand protection : Impermeable protective gloves. Choosing the proper glove is a decision that depends not only on the type of material, but also on other quality features, which differ for each manufacturer. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough. The exact break trough time has to be found out by the manufacturer of the protective gloves and has to be observed.

Eye protection : Chemical goggles or safety glasses.

Skin and body protection : Wear fire/flame resistant/retardant clothing.

Respiratory protection : An approved organic vapor respirator/supplied air or self-contained breathing apparatus must be used when vapor concentration exceeds applicable exposure limits.

Other information : Do not eat, drink or smoke during use.

Section 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Liquid

Appearance : Clear, colorless, volatile liquid.

Color : Colorless.

Odor : Characteristic. Aromatic. Sweet.

Odor threshold : No data available

pH : Not applicable

Relative evaporation rate (butyl acetate=1) : No data available

Relative evaporation rate (ether=1) : < 94

Melting point : -94.9 °C

Freezing point : -94.9 °C

Boiling point : 136 °C

Flash point : 21 (21 - 23) °C

Auto-ignition temperature : 432 °C

Decomposition temperature : No data available

Flammability (solid, gas) : No data available

Vapor pressure : 9.3 mm Hg @ 25°C

Relative vapor density at 20 °C : 3.7 Air =1

Relative density : 0.9

Solubility : Water: 0.2 g/l
Organic solvent:100 %

Log Kow : 2.2 - 2.7

Viscosity, kinematic : 0.64 cSt @ 40°C

Viscosity, dynamic : No data available

Explosive limits : 1 - 7 vol %

9.2. Other information

VOC content : 100 %

Section 10: Stability and reactivity

10.1. Reactivity

Flammable liquid and vapor.

10.2. Chemical stability

Stable at ambient temperature and under normal conditions of use.

10.3. Possibility of hazardous reactions

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

10.4. Conditions to avoid

Direct sunlight. Extremely high or low temperatures. Open flame.

10.5. Incompatible materials

Strong oxidizing agents.

10.6. Hazardous decomposition products

Hazardous decomposition products formed under fire conditions: carbon monoxide, carbon dioxide, toxic fumes.

Section 11: Toxicological information

11.1. Information on toxicological effects

Likely routes of exposure : Inhalation. Ingestion. Skin and eye contact.

Acute toxicity : Inhalation:vapor: Harmful if inhaled.

Ethylbenzene (100-41-4)	
LD50 oral rat	3500 mg/kg
LD50 dermal rabbit	15354 mg/kg
LC50 inhalation rat	17.2 mg/l/4h

Skin corrosion/irritation : Not classified

Serious eye damage/irritation : Not classified

Respiratory or skin sensitization : Not classified

Germ cell mutagenicity : May cause genetic defects.
Classification as a Mutagen 1B is due to the benzene content of this material.

Carcinogenicity : Suspected of causing cancer.

Ethylbenzene (100-41-4)	
Additional information	**IARC has evaluated ethylbenzene as 2B, possibly carcinogenic to humans. In IARC's evaluation, it states that:** **"There is inadequate evidence in humans for the carcinogenicity of ethylbenzene. There is sufficient evidence in experimental animals for the carcinogenicity of ethylbenzene."** **IARC also notes that ethylbenzene typically contains, 0.1 – 0.3 wt % benzene, similar to the benzene content of this product (≤ 0.2 wt %). Benzene is a known human carcinogen.** **Additionally, the types of cancers observed in experimental animals exposed to ethylbenzene are not the same as the types of cancers known to be caused by exposure to benzene.** **There is inadequate evidence that exposure to ethylbenzene containing low levels (≤ 0.2 wt %) of benzene causes carcinogenicity in humans, while there is sufficient evidence that exposure to ethylbenzene causes carcinogenicity in experimental animals. Therefore, ethylbenzene has been US-GHS classified as Carcinogen 2.**

Ethylbenzene (100-41-4)	
IARC group	2B - Possibly carcinogenic to humans
Benzene (71-43-2)	
IARC group	1 - Carcinogenic to humans
National Toxicology Program (NTP) Status	1 - Known Human Carcinogens
OSHA Carcinogen Status	In OSHA Specifically Regulated Carcinogen list
Additional information	**Benzene is a known human carcinogen and is known to cause acute myeloid leukemia & myelodysplastic syndrome (disease that affects the bone marrow and blood) in**

	humans who have been repeatedly exposed to benzene.
Toluene (108-88-3)	
IARC group	3 - Not classifiable

Reproductive toxicity : Suspected of damaging fertility or the unborn child.

Based on animal studies, exposure to high levels of ethylbenzene may cause developmental effects (decreases in growth and increased skeletal variations).

Specific target organ toxicity (single exposure) : May cause respiratory irritation. May cause drowsiness or dizziness.

Specific target organ toxicity (repeated exposure) : May cause damage to organs (hearing organ (loss of hearing), kidneys) through prolonged or repeated exposure.

Aspiration hazard : May be fatal if swallowed and enters airways.

Section 12: Ecological information

12.1. Toxicity

Ecology - general : Harmful to aquatic life with long lasting effects.

12.2. Persistence and degradability

No additional information available

12.3. Bioaccumulative potential

Ethylbenzene (100-41-4)	
Log Pow	3.6
Log Kow	2.2 - 2.7

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

Other information : Avoid release to the environment.

Section 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Dispose in a safe manner in accordance with local/national regulations. Dispose of contents and container in accordance with all local, regional, national and international regulations.

Additional information : Handle empty containers with care because residual vapors are flammable.

Ecology - waste materials : Avoid release to the environment. Hazardous waste due to toxicity.

Section 14: Transport information

US Transport (DOT) for Bulk Shipments (Non-Bulk Shipments May Differ)

Transport document description : UN1175, Ethylbenzene, 3, PGII

UN or NA Number : UN1175

Proper Shipping Name : Ethylbenzene

Primary Hazard Class : 3 - Flammable liquid

Packing Group : PGII

Reportable Quantities (RQ)* : Ethylbenzene 1000 lbs (454 kg), Benzene 10 lbs (4.54 kg), Toluene 1000 lbs (454 kg)

*It is the shipper's responsibility to determine whether an RQ must be reported for each individual shipment.

Hazard labels :

Emergency Response Guide (ERG) Number : 130

Transport by sea (IMDG)

Transport document description : UN1175, ETHYLBENZENE, 3, PGII

UN Number : UN1175

Proper Shipping Name : Ethylbenzene

Primary Hazard Class : 3 - Flammable liquids

Packing Group : PGII

Hazard labels (IMDG) :

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Product Name: Ethylbenzene
Pollution Category: Y
Ship Type: 2

Cargo name listed in 46 CFR 30.25, Table 30.25-1 : Ethylbenzene

Cargo name listed in 46 CFR 153, Table 1 : Ethylbenzene

Air transport (IATA)

Transport document description : UN1175, Ethylbenzene, 3, PGII

UN Number : UN1175

Proper Shipping Name : Ethylbenzene

Primary Hazard Class : 3 - Flammable Liquids

Packing Group : PGII

Hazard labels (IATA) :

Section 15: Regulatory information

15.1. US Federal regulations

EPA TSCA Status

All components of this product are listed or excluded from listing on the United States Environmental Protection Agency Toxic Substances Control Act (TSCA) inventory.

SARA Section 313 Supplier Notification

This product contains the following toxic chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372:

CAS number	Chemical name	Concentration
100-41-4	Ethylbenzene	99.5 - 100%
71-43-2	Benzene	<= 0.2%

This information must be included in all Safety Data Sheets that are copied and distributed for this product. For additional information, see 40 CFR §372.45 Notification About Toxic Chemicals.

SARA Section 311/312 Hazard Classes
Fire hazard
Acute health hazard
Chronic health hazard

15.2. International regulations

CANADA

Ethylbenzene (100-41-4)

WHMIS Classification
Class B Division 2 - Flammable Liquid
Class D Division 2 Subdivision A - Very toxic material causing other toxic effects
Class D Division 2 Subdivision B - Toxic material causing other toxic effects

National inventories

(100-41-4)
Listed on the AICS (Australian Inventory of Chemical Substances)
Listed on the Canadian DSL (Domestic Sustances List)
Listed on the China Inventory of Existing Chemical Substances (IECSC)
Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

Listed on the Japanese ENCS (Existing & New Chemical Substances) inventory
Listed on the Korean ECL (Existing Chemicals List)
Listed on NZIoC (New Zealand Inventory of Chemicals)
Listed on the Philippines Inventory of Chemicals and Chemical Substances (PICCS)
Japanese Pollutant Release and Transfer Register Law (PRTR Law)
Listed on the Canadian IDL (Ingredient Disclosure List)

15.3. US State regulations

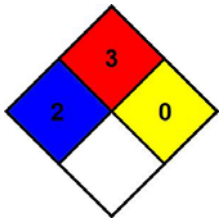
California Proposition 65 - This substance is known to the state of California to cause cancer and/or reproductive toxicity.

Ethylbenzene (100-41-4)	
U.S. - California - Proposition 65 - Carcinogens List	Yes
U.S. - California - Proposition 65 - Developmental Toxicity	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Female	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No
Non-significant risk level (NSRL)	54 µg/day (inhalation)
Benzene (71-43-2)	
U.S. - California - Proposition 65 - Carcinogens List	Yes
U.S. - California - Proposition 65 - Developmental Toxicity	Yes
U.S. - California - Proposition 65 - Reproductive Toxicity - Female	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Male	Yes
Non-significant risk level (NSRL)	6.4 µg/day (oral)
Toluene (108-88-3)	
U.S. - California - Proposition 65 - Carcinogens List	No
U.S. - California - Proposition 65 - Developmental Toxicity	Yes
U.S. - California - Proposition 65 - Reproductive Toxicity - Female	Yes
U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No

Section 16: Other information

NFPA (National Fire Protection Association)

NFPA health hazard : 2
NFPA fire hazard : 3
NFPA reactivity : 0



HMIS III Rating

Health : 2*
Flammability : 3
Physical Hazard : 0
Personal Protection : See section 8 of SDS

US OSHA LABEL as specified under 29 CFR §1910.1200 (f)

Ethylbenzene

Total Petrochemicals & Refining USA, Inc.
PO Box 674411
Houston, TX 77267-4411 USA
Tel. 713-483-5000 or 1-877-871-2709

Danger

Highly flammable liquid and vapor
May be fatal if swallowed and enters airways
Harmful if inhaled
May cause respiratory irritation
May cause drowsiness or dizziness
May cause genetic defects
Suspected of causing cancer
Suspected of damaging fertility or the unborn child
May cause damage to organs (hearing organ (loss of hearing), kidneys) through prolonged or repeated exposure

Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep away from heat, hot surfaces, open flames, sparks. - No smoking.
Keep container tightly closed.
Ground/bond container and receiving equipment.
Use explosion-proof electrical, lighting, ventilating equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Do not breathe mist, spray, vapors.
Use only outdoors or in a well-ventilated area.
Wear eye protection, flame retardant protective clothing, impermeable protective gloves.
If swallowed: Immediately call a doctor, poison center.
Do NOT induce vomiting.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
If inhaled: Remove person to fresh air and keep comfortable for breathing.
If exposed or concerned: Get medical advice/attention.
Get medical advice/attention if you feel unwell.
In case of fire: Use carbon dioxide (CO_2), dry chemical, foam, water spray to extinguish.
Store in a well-ventilated place. Keep cool.
Store locked up.
Dispose of contents and container in accordance with all local, regional, national and international regulations.

Supplemental Information

Product can accumulate electrostatic charges that may cause fire by electrical discharges.

Version : 2.2
Date of issue : August 17, 2015

MSDS ID: ETHYLBENZENE
SDS REFERENCE NUMBER: BC0003

SDS Template - TOTAL SDS US (GHS HazCom 2012) TPRI Version 4.02

The information contained in this Safety Data Sheet (SDS) is believed by Total Petrochemicals & Refining USA, Inc. (TPRI) to be accurate on the date issued. However, materials may present unknown hazards and should be used with caution. Final determination of suitability and use of any material is the sole responsibility of the user. Neither TPRI nor any of its subsidiaries or affiliated companies assumes any liability whatsoever for the accuracy or completeness of the information contained herein or reliance thereto. If the material is repackaged, the user is responsible and must ensure that proper health, safety and other necessary information is included with the material and/or on the container. NO WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE MADE REGARDING THE MATERIALS OR THE INFORMATION CONTAINED IN THIS SDS. ALTERATION OF THIS DOCUMENT IS STRICTLY PROHIBITED.

SAFETY DATA SHEET

Vinyl Chloride (Chloroethylene)

Section 1. Identification

GHS product identifier : Vinyl Chloride (Chloroethylene)

Chemical name : vinyl chloride

Other means of identification : chloroethylene; Ethene, chloro-; Vinyl chloride monomer; Chloroethene; Vinyl chloride, monomer; Ethene, chloro- (vinyl chloride); VCM; VC; Monochloroethylene; Monochloroethene

Product use : Synthetic/Analytical chemistry.

Synonym : chloroethylene; Ethene, chloro-; Vinyl chloride monomer; Chloroethene; Vinyl chloride, monomer; Ethene, chloro- (vinyl chloride); VCM; VC; Monochloroethylene; Monochloroethene

SDS # : 001067

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 : FLAMMABLE GASES - Category 1
GASES UNDER PRESSURE - Liquefied gas
CARCINOGENICITY - Category 1
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) (liver) - Category 2

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Extremely flammable gas.
Contains gas under pressure; may explode if heated.
May cause frostbite.
May displace oxygen and cause rapid suffocation.
May cause cancer.
May cause damage to organs through prolonged or repeated exposure. (liver)

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.

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Section 2. Hazards identification

Prevention : Never Put cylinders into unventilated areas of passenger vehicles. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Do not breathe gas. Use and store only outdoors or in a well ventilated place.

Response : Get medical attention if you feel unwell. IF exposed or concerned: Get medical attention. Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.

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

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

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 : vinyl chloride

Other means of identification : chloroethylene; Ethene, chloro-; Vinyl chloride monomer; Chloroethene; Vinyl chloride, monomer; Ethene, chloro- (vinyl chloride); VCM; VC; Monochloroethylene; Monochloroethene

CAS number/other identifiers

CAS number : 75-01-4

Product code : 001067

Ingredient name	%	CAS number
vinyl chloride	100	75-01-4

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.

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 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. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

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

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Section 4. First aid measures

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.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

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
halogenated compounds

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.

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Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

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

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

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

Methods and materials for containment and cleaning up

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

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

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe gas. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Empty containers retain product residue and can be hazardous. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

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

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

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Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
vinyl chloride	**ACGIH TLV (United States, 3/2012).** TWA: 1 ppm 8 hours. **OSHA PEL (United States, 6/2010).** STEL: 5 ppm 15 minutes. TWA: 1 ppm 8 hours. **OSHA PEL 1989 (United States, 3/1989).** STEL: 5 ppm 15 minutes. TWA: 1 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

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

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

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

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

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Section 9. Physical and chemical properties

Appearance

Physical state : Gas. [COLORLESS GAS OR LIQUID (BELOW 7 F) WITH A PLEASANT ODOR AT HIGH CONCENTRATIONS. [NOTE: SHIPPED AS A LIQUEFIED COMPRESSED GAS.]

Color : Colorless.

Molecular weight : 62.5 g/mole

Molecular formula : C2-H3-Cl

Boiling/condensation point : -13.4°C (7.9°F)

Melting/freezing point : -153.8°C (-244.8°F)

Critical temperature : 158.45°C (317.2°F)

Odor : Characteristic.

Odor threshold : Not available.

pH : Not available.

Flash point : Closed cup: -78°C (-108.4°F)

Burning time : Not applicable.

Burning rate : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : Not available.

Lower and upper explosive (flammable) limits : Lower: 3.8%
Upper: 29.3%

Vapor pressure : Not available.

Vapor density : 2.2 (Air = 1)

Specific Volume (ft^3/lb) : 1.0989

Gas Density (lb/ft^3) : 0.91 (20°C / 68 to °F)

Relative density : Not applicable.

Solubility : Not available.

Solubility in water : 1.1 g/l

Partition coefficient: n-octanol/water : 1.38

Auto-ignition temperature : 472°C (881.6°F)

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 : 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.

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Section 10. Stability and reactivity

Incompatibility with various substances : Extremely reactive or incompatible with the following materials: oxidizing 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

Not available.

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Classification

Product/ingredient name	OSHA	IARC	NTP
vinyl chloride	+	1	Known to be a human carcinogen.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Name	Category	Route of exposure	Target organs
vinyl chloride	Category 2	Not determined	liver

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.

Inhalation : No known significant effects or critical hazards.

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Section 11. Toxicological information

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 : May cause damage to organs through prolonged or repeated exposure.

Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.

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
vinyl chloride	1.38	-	low

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Section 12. Ecological information

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 container.

United States - RCRA Toxic hazardous waste "U" List

Ingredient	CAS #	Status	Reference number
Vinyl chloride; Ethene, chloro-	75-01-4	Listed	U043

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1086	UN1086	UN1086	UN1086	UN1086
UN proper shipping name	VINYL CHLORIDE, STABILIZED	VINYL CHLORIDE, STABILIZED	VINYL CHLORIDE, STABILIZED	VINYL CHLORIDE, STABILIZED	VINYL CHLORIDE, STABILIZED
Transport hazard class(es)	2.1	2.1	2.1	2.1	2.1
Packing group	-	-	-	-	-
Environment	No.	No.	No.	No.	No.
Additional information	**Reportable quantity** 1 lbs / 0.454 kg Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements. **Limited quantity** Yes. **Packaging instruction** **Passenger aircraft** Quantity limitation: Forbidden. **Cargo aircraft** Quantity limitation: 150	**Explosive Limit and Limited Quantity Index** 0.125 **ERAP Index** 3000 **Passenger Carrying Road or Rail Index** Forbidden	-	-	**Passenger and Cargo Aircraft** Quantity limitation: 0 Forbidden **Cargo Aircraft Only** Quantity limitation: 150 kg

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Section 14. Transport information

	kg **Special provisions** 21, B44, T50				

"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): This material is listed or exempted.

Clean Water Act (CWA) 307: vinyl chloride

Clean Air Act (CAA) 112 regulated flammable substances: vinyl chloride

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : 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 : Fire hazard
Sudden release of pressure
Delayed (chronic) health hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
vinyl chloride	100	Yes.	Yes.	No.	No.	Yes.

SARA 313

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Section 15. Regulatory information

	Product name	CAS number	%
Form R - Reporting requirements	vinyl chloride	75-01-4	100
Supplier notification	vinyl chloride	75-01-4	100

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : This material is listed.

New York : This material is listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

California Prop. 65

WARNING: This product contains a chemical known to the State of California to cause cancer.

Ingredient name	Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
vinyl chloride	Yes.	No.	Yes.	No.

Canada inventory : This material is listed or exempted.

International regulations

International lists : **Australia inventory (AICS)**: This material is listed or exempted.
China inventory (IECSC): This material is listed or exempted.
Japan inventory: This material is listed or exempted.
Korea inventory: This material is listed or exempted.
Malaysia Inventory (EHS Register): This material is listed or exempted.
New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted.
Philippines inventory (PICCS): This material is listed or exempted.
Taiwan inventory (CSNN): Not determined.

Chemical Weapons Convention List Schedule I Chemicals : Not listed

Chemical Weapons Convention List Schedule II Chemicals : Not listed

Chemical Weapons Convention List Schedule III Chemicals : Not listed

Canada

WHMIS (Canada) : Class A: Compressed gas.
Class B-1: Flammable gas.
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).
Class F: Dangerously reactive material.

CEPA Toxic substances: This material is listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

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Section 16. Other information

Canada Label requirements : Class A: Compressed gas.
Class B-1: Flammable gas.
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).
Class F: Dangerously reactive material.

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

Health	*	1
Flammability		4
Physical hazards		2

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.)

Reprinted with permission from NFPA 704-2001, Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

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.

History

Date of printing : 10/16/2014.

Date of issue/Date of revision : 10/16/2014.

Date of previous issue : 10/13/2014.

Version : 0.03

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

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Section 16. Other information

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.

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Fisher Scientific

Part of Thermo Fisher Scientific

SAFETY DATA SHEET

Creation Date 27-Jan-2010 **Revision Date** 02-Oct-2015 **Revision Number** 2

1. Identification

Product Name **Methylene chloride**

Cat No. : **D37-1; D37-4; D37-20; D37-200; D37-200LC; D37-500; D37FB-19; D37FB-50; D37FB-115; D37FB-200; D37POP-19; D37POPB-50; D37POPB-200; D37RB-19; D37RB-50; D37RB-115; D37RB-200; D37RS-19; D37RS-28; D37RS-50; D37RS-115; D37RS-200; D37SK-4; D37SK-4LC; D37SS-28; D37SS-50; D37SS-115; D37SS-200; D37SS-1350**

Synonyms Dichloromethane; DCM

Recommended Use Laboratory chemicals.

Uses advised against No Information available

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Carcinogenicity	Category 1B
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS), Respiratory system.	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Liver, Kidney, Blood.	

Label Elements

Signal Word
Danger

Hazard Statements
Causes skin irritation
Causes serious eye irritation

May cause respiratory irritation
May cause drowsiness or dizziness
May cause cancer
May cause damage to organs through prolonged or repeated exposure

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Wear eye/face protection
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN: Wash with plenty of soap and water
If skin irritation occurs: Get medical advice/attention
Take off contaminated clothing and wash before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)

WARNING! This product contains a chemical known in the State of California to cause cancer, birth defects or other reproductive harm.

3. Composition / information on ingredients

Component	CAS-No	Weight %
Methylene chloride	75-09-2	>99.5
Methyl alcohol	67-56-1	0 - 0.4
Cyclohexene	110-83-8	0 - 0.01
2-Methyl-2-butene	513-35-9	0 - 0.01

4. First-aid measures

General Advice If symptoms persist, call a physician.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. Obtain medical attention.

Ingestion Do not induce vomiting. Call a physician or Poison Control Center immediately.

Most important symptoms/effects Breathing difficulties. . Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable Extinguishing Media No information available

Flash Point No information available
Method - No information available

Autoignition Temperature 556 °C / 1032.8 °F

Explosion Limits
Upper 23 vol %
Lower 13 vol %
Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Carbon monoxide (CO) Carbon dioxide (CO_2) Hydrogen chloride gas Phosgene
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	1	0	N/A

6. Accidental release measures

Personal Precautions Use personal protective equipment. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing. Keep people away from and upwind of spill/leak.

Environmental Precautions Should not be released into the environment. See Section 12 for additional ecological information.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Use only under a chemical fume hood.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Methylene chloride	TWA: 50 ppm	(Vacated) TWA: 500 ppm (Vacated) STEL: 2000 ppm (Vacated) Ceiling: 1000 ppm TWA: 25 ppm STEL: 125 ppm	IDLH: 2300 ppm
Methyl alcohol	TWA: 200 ppm STEL: 250 ppm Skin	(Vacated) TWA: 200 ppm (Vacated) TWA: 260 mg/m³ (Vacated) STEL: 250 ppm (Vacated) STEL: 325 mg/m³ Skin TWA: 200 ppm TWA: 260 mg/m³	IDLH: 6000 ppm TWA: 200 ppm TWA: 260 mg/m³ STEL: 250 ppm STEL: 325 mg/m³
Cyclohexene	TWA: 300 ppm	(Vacated) TWA: 300 ppm (Vacated) TWA: 1015 mg/m³ TWA: 300 ppm TWA: 1015 mg/m³	IDLH: 2000 ppm TWA: 300 ppm TWA: 1015 mg/m³

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Methylene chloride	TWA: 50 ppm TWA: 174 mg/m³	TWA: 100 ppm TWA: 330 mg/m³ STEL: 500 ppm STEL: 1740 mg/m³	TWA: 50 ppm
Methyl alcohol	TWA: 200 ppm TWA: 262 mg/m³ STEL: 250 ppm STEL: 328 mg/m³ Skin	TWA: 200 ppm TWA: 260 mg/m³ STEL: 250 ppm STEL: 310 mg/m³	TWA: 200 ppm STEL: 250 ppm Skin
Cyclohexene	TWA: 300 ppm TWA: 1010 mg/m³	TWA: 300 ppm TWA: 1015 mg/m³	TWA: 300 ppm

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures Use only under a chemical fume hood. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	sweet
Odor Threshold	No information available
pH	Not applicable
Melting Point/Range	-97 °C / -142.6 °F
Boiling Point/Range	39 °C / 102.2 °F
Flash Point	No information available

Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	23 vol %
Lower	13 vol %
Vapor Pressure	20 mmHg @ 3502°C
Vapor Density	2.93 (Air = 1.0)
Specific Gravity	1.33
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	556 °C / 1032.8 °F
Decomposition Temperature	No information available
Viscosity	No information available
Molecular Formula	C H2 Cl2
Molecular Weight	84.93

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat.

Incompatible Materials Strong oxidizing agents, Strong acids, Amines

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2), Hydrogen chloride gas, Phosgene

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Methylene chloride	> 2000 mg/kg (Rat)	> 2000 mg/kg (Rat)	53 mg/L (Rat) 6 h 76000 mg/m³ (Rat) 4 h
Methyl alcohol	LD50 = 6200 mg/kg (Rat)	LD50 = 15800 mg/kg (Rabbit)	64000 ppm (Rat) 4 h 83.2 mg/L (Rat) 4 h
Cyclohexene	LD50 = 2400 µL/kg (Rat)	>200 mg/kg (Rat)	>21.6 mg/L/4h (rat)
2-Methyl-2-butene	700-2600 mg/kg (Rat)	>2000 mg/kg (Rat)	LC50 > 61000 ppm (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Methylene chloride	75-09-2	Group 2A	Reasonably Anticipated	A3	X	A3
Methyl alcohol	67-56-1	Not listed	Not listed	Not listed	Not listed	Not listed

Cyclohexene	110-83-8	Not listed	Not listed	Not listed	Not listed	Not listed
2-Methyl-2-butene	513-35-9	Not listed	Not listed	Not listed	Not listed	Not listed

IARC: (International Agency for Research on Cancer)

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans

NTP: (National Toxicity Program)

NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

ACGIH: (American Conference of Governmental Industrial Hygienists)

A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)

Mexico - Occupational Exposure Limits - Carcinogens

Mexico - Occupational Exposure Limits - Carcinogens
A1 - Confirmed Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Confirmed Animal Carcinogen
A4 - Not Classifiable as a Human Carcinogen
A5 - Not Suspected as a Human Carcinogen

Mutagenic Effects Mutagenic effects have occured in microorganisms.

Reproductive Effects Experiments have shown reproductive toxicity effects on laboratory animals.

Developmental Effects Developmental effects have occurred in experimental animals.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS) Respiratory system
STOT - repeated exposure Liver Kidney Blood

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting
Endocrine Disruptor Information No information available

Other Adverse Effects Tumorigenic effects have been reported in experimental animals. See actual entry in RTECS for complete information.

12. Ecological information

Ecotoxicity

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Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Methylene chloride	EC50:>660 mg/L/96h	Pimephales promelas: LC50:193 mg/L/96h	EC50: 1 mg/L/24 h EC50: 2.88 mg/L/15 min	EC50: 140 mg/L/48h
Methyl alcohol	Not listed	Pimephales promelas: LC50 > 10000 mg/L 96h	EC50 = 39000 mg/L 25 min EC50 = 40000 mg/L 15 min EC50 = 43000 mg/L 5 min	EC50 > 10000 mg/L 24h
Cyclohexene	Not listed	Poecillia reticulata: 7.1 mg/L/96h	Not listed	Daphnia: EC50: 5.3 mg/L/48h
2-Methyl-2-butene	Not listed	Not listed	Not listed	EC50: = 3 mg/L, 48h (Daphnia magna)

Persistence and Degradability Persistence is unlikely based on information available.
Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Methylene chloride	1.25
Methyl alcohol	-0.74

Cyclohexene	3.27

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Methylene chloride - 75-09-2	U080	-
Methyl alcohol - 67-56-1	U154	-

14. Transport information

DOT

UN-No UN1593
Proper Shipping Name DICHLOROMETHANE
Hazard Class 6.1
Packing Group III

TDG

UN-No UN1593
Proper Shipping Name DICHLOROMETHANE
Hazard Class 6.1
Packing Group III

IATA

UN-No UN1593
Proper Shipping Name Dichloromethane
Hazard Class 6.1
Packing Group III

IMDG/IMO

UN-No UN1593
Proper Shipping Name Dichloromethane
Hazard Class 6.1
Packing Group III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Methylene chloride	X	X	-	200-838-9	-		X	X	X	X	X
Methyl alcohol	X	X	-	200-659-6	-		X	X	X	X	X
Cyclohexene	X	X	-	203-807-8	-		X	X	X	X	X
2-Methyl-2-butene	X	X	-	208-156-3	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Methylene chloride	75-09-2	>99.5	0.1
Methyl alcohol	67-56-1	0 - 0.4	1.0

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Methylene chloride	-	-	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Methylene chloride	X		-
Methyl alcohol	X		-

OSHA Occupational Safety and Health Administration

Component	Specifically Regulated Chemicals	Highly Hazardous Chemicals
Methylene chloride	125 ppm STEL 12.5 ppm Action Level 25 ppm TWA	-

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Methylene chloride	1000 lb 1 lb	-
Methyl alcohol	5000 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Methylene chloride	75-09-2	Carcinogen	200 µg/day 50 µg/day	Carcinogen
Methyl alcohol	67-56-1	Developmental	-	Developmental

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Methylene chloride	X	X	X	X	X
Methyl alcohol	X	X	X	X	X
Cyclohexene	X	X	X	-	X
2-Methyl-2-butene	X	X	X	-	-

U.S. Department of Transportation

Reportable Quantity (RQ):	Y
DOT Marine Pollutant	N
DOT Severe Marine Pollutant	N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class D1B Toxic materials
D2A Very toxic materials

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 27-Jan-2010
Revision Date 02-Oct-2015
Print Date 02-Oct-2015
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer
The information provided on 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 a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as 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 material or in any process, unless specified in the text.

End of SDS

SAFETY DATA SHEET

Toluene

Section 1. Identification

GHS product identifier : Toluene

Chemical name : toluene

Other means of identification : Benzene, methyl-; Methylbenzene; Toluol; toluene, pure

Product use : Synthetic/Analytical chemistry.

Synonym : Benzene, methyl-; Methylbenzene; Toluol; toluene, pure

SDS # : 001063

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 : FLAMMABLE LIQUIDS - Category 2
SKIN CORROSION/IRRITATION - Category 2
TOXIC TO REPRODUCTION (Fertility) - Category 2
TOXIC TO REPRODUCTION (Unborn child) - Category 2
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Narcotic effects) - Category 3
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) - Category 2

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Highly flammable liquid and vapor.
May form explosive mixtures with air.
Causes skin irritation.
Suspected of damaging fertility or the unborn child.
May cause drowsiness and dizziness.
May cause damage to organs through prolonged or repeated exposure.

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

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Section 2. Hazards identification

Prevention : Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Wear protective gloves. Wear eye or face protection. Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Use explosion-proof electrical, ventilating, lighting and all material-handling equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Do not breathe vapor. Wash hands thoroughly after handling.

Response : Get medical attention if you feel unwell. IF exposed or concerned: Get medical attention. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing. If skin irritation occurs: Get medical attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.

Storage : Store locked up. Store in a well-ventilated place. Keep cool.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : toluene

Other means of identification : Benzene, methyl-; Methylbenzene; Toluol; toluene, pure

CAS number/other identifiers

CAS number : 108-88-3

Product code : 001063

Ingredient name	%	CAS number
toluene	100	108-88-3

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.

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 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. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

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Section 4. First aid measures

Ingestion : Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. Never give anything by mouth to an unconscious person. 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.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes skin irritation.

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

Ingestion : Irritating to mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
reduced fetal weight
increase in fetal deaths
skeletal malformations

Skin contact : Adverse symptoms may include the following:
irritation
redness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Ingestion : Adverse symptoms may include the following:
reduced fetal weight
increase in fetal deaths
skeletal malformations

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.

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)

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Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media : Do not use water jet.

Specific hazards arising from the chemical : Highly flammable liquid and vapor. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.

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. 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. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. 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 : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. 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 : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

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Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Avoid exposure during pregnancy. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

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 in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
toluene	**ACGIH TLV (United States, 3/2012).** TWA: 20 ppm 8 hours. **NIOSH REL (United States, 1/2013).** STEL: 560 mg/m³ 15 minutes. STEL: 150 ppm 15 minutes. TWA: 375 mg/m³ 10 hours. TWA: 100 ppm 10 hours. **OSHA PEL 1989 (United States, 3/1989).** STEL: 560 mg/m³ 15 minutes. STEL: 150 ppm 15 minutes. TWA: 375 mg/m³ 8 hours. TWA: 100 ppm 8 hours. **OSHA PEL Z2 (United States, 11/2006).** AMP: 500 ppm 10 minutes. CEIL: 300 ppm TWA: 200 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.

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Section 8. Exposure controls/personal protection

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: chemical splash goggles.

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. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

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

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

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid. [Watery liquid.]

Color : Colorless.

Molecular weight : 92.14 g/mole

Molecular formula : C7-H8

Boiling/condensation point : 110.6°C (231.1°F)

Melting/freezing point : -95°C (-139°F)

Critical temperature : 318.65°C (605.6°F)

Odor : Characteristic.

Odor threshold : Not available.

pH : Not available.

Flash point : Closed cup: 4.4°C (39.9°F)

Burning time : Not applicable.

Burning rate : Not applicable.

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Section 9. Physical and chemical properties

Evaporation rate : 2 (butyl acetate = 1)

Flammability (solid, gas) : Not available.

Lower and upper explosive (flammable) limits : Lower: 1.1%
Upper: 7.1%

Vapor pressure : 3.1 kPa (23.168353815 mm Hg) [room temperature]

Vapor density : 3.1 (Air = 1)

Specific Volume (ft ^{3}/lb) : 1.1494

Gas Density (lb/ft ^{3}) : 0.87 (20°C / 68 to °F)

Relative density : 0.87

Solubility : Not available.

Solubility in water : 0.573 g/l

Partition coefficient: n-octanol/water : 2.73

Auto-ignition temperature : 480°C (896°F)

Decomposition temperature : Not available.

SADT : Not available.

Viscosity : Dynamic (room temperature): 0.56 mPa·s (0.56 cP)

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. Do not allow vapor to accumulate in low or confined areas.

Incompatibility with various substances : Extremely reactive or incompatible with the following materials: oxidizing 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
toluene	LC50 Inhalation Vapor LC50 Inhalation Vapor	Rat Rat	28830 ppm 49 g/m³	1 hours 4 hours

Irritation/Corrosion

Powered by IHS

Section 11. Toxicological information

Product/ingredient name	Result	Species	Score	Exposure	Observation
toluene	Eyes - Mild irritant	Rabbit	-	0.5 minutes 100 milligrams	-
	Eyes - Mild irritant	Rabbit	-	870 Micrograms	-
	Eyes - Severe irritant	Rabbit	-	24 hours 2 milligrams	-
	Skin - Mild irritant	Pig	-	24 hours 250 microliters	-
	Skin - Mild irritant	Rabbit	-	435 milligrams	-
	Skin - Moderate irritant	Rabbit	-	24 hours 20 milligrams	-
	Skin - Moderate irritant	Rabbit	-	500 milligrams	-

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Classification

Product/ingredient name	OSHA	IARC	NTP
toluene	-	3	-

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Name	Category	Route of exposure	Target organs
toluene	Category 2	Not determined	Not determined

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes skin irritation.

Ingestion : Irritating to mouth, throat and stomach.

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Section 11. Toxicological information

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
reduced fetal weight
increase in fetal deaths
skeletal malformations

Skin contact : Adverse symptoms may include the following:
irritation
redness
reduced fetal weight
increase in fetal deaths
skeletal malformations

Ingestion : Adverse symptoms may include the following:
reduced fetal weight
increase in fetal deaths
skeletal malformations

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 : May cause damage to organs through prolonged or repeated exposure.

Carcinogenicity : No known significant effects or critical hazards.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : Suspected of damaging the unborn child.

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.

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Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
toluene	2.73	90	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. 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. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

United States - RCRA Toxic hazardous waste "U" List

Ingredient	CAS #	Status	Reference number
Toluene; Benzene, methyl-	108-88-3	Listed	U220

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1294	UN1294	UN1294	UN1294	UN1294
UN proper shipping name	TOLUENE	TOLUENE	TOLUENE	TOLUENE	TOLUENE
Transport hazard class(es)	3	3	3	3	3
Packing group	II	II	II	II	II

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Section 14. Transport information

Environment	No.	No.	No.	No.	No.
Additional information	**Reportable quantity** 1000 lbs / 454 kg [137.86 gal / 521.84 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements. **Limited quantity** Yes. **Packaging instruction** **Passenger aircraft** Quantity limitation: 5 L **Cargo aircraft** Quantity limitation: 60 L **Special provisions** IB2, T4, TP1	**Explosive Limit and Limited Quantity Index** 1 **Passenger Carrying Road or Rail Index** 5	-	-	**Passenger and Cargo Aircraft**Quantity limitation: 5 L **Cargo Aircraft Only** Quantity limitation: 60 L **Limited Quantities - Passenger Aircraft** Quantity limitation: 1 L

"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): This material is listed or exempted.

Clean Water Act (CWA) 307: toluene

Clean Water Act (CWA) 311: toluene

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : 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) : Listed

SARA 302/304

Composition/information on ingredients

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Section 15. Regulatory information

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Fire hazard
Immediate (acute) health hazard
Delayed (chronic) health hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
toluene	100	Yes.	No.	No.	Yes.	Yes.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	toluene	108-88-3	100
Supplier notification	toluene	108-88-3	100

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : This material is listed.

New York : This material is listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

California Prop. 65

WARNING: This product contains 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
toluene	No.	Yes.	No.	7000 µg/day (ingestion)

Canada inventory : This material is listed or exempted.

International regulations

International lists : **Australia inventory (AICS)**: This material is listed or exempted.
China inventory (IECSC): This material is listed or exempted.
Japan inventory: This material is listed or exempted.
Korea inventory: This material is listed or exempted.
Malaysia Inventory (EHS Register): Not determined.
New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted.
Philippines inventory (PICCS): This material is listed or exempted.
Taiwan inventory (CSNN): Not determined.

Chemical Weapons Convention List Schedule I Chemicals : Not listed

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Section 15. Regulatory information

Chemical Weapons Convention List Schedule II Chemicals : Not listed

Chemical Weapons Convention List Schedule III Chemicals : Not listed

Canada

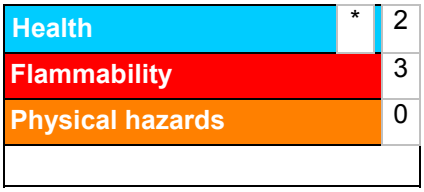
WHMIS (Canada) : Class B-2: Flammable liquid
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

CEPA Toxic substances: This material is not listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class B-2: Flammable liquid
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

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.)

Reprinted with permission from NFPA 704-2001, Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

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.

History

Date of printing : 5/20/2015.

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Section 16. Other information

Date of issue/Date of revision : 5/20/2015.

Date of previous issue : 10/16/2014.

Version : 0.04

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.

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SAFETY DATA SHEET

Benzene

Section 1. Identification

GHS product identifier : Benzene

Chemical name : benzene

Other means of identification : benzene, purebenzol; cyclohexatriene; phenyl hydride; phene; coal naphtha; pyrobenzol

Product use : Synthetic/Analytical chemistry.

Synonym : benzene, purebenzol; cyclohexatriene; phenyl hydride; phene; coal naphtha; pyrobenzol

SDS # : 001062

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 : FLAMMABLE LIQUIDS - Category 2
SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2
GERM CELL MUTAGENICITY - Category 1B
CARCINOGENICITY - Category 1
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) (bone marrow) - Category 1

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Highly flammable liquid and vapor.
May form explosive mixtures with air.
Causes serious eye irritation.
Causes skin irritation.
May cause genetic defects.
May cause cancer.
Causes damage to organs through prolonged or repeated exposure. (bone marrow)

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

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Section 2. Hazards identification

Prevention : Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Wear protective gloves. Wear eye or face protection. Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Use explosion-proof electrical, ventilating, lighting and all material-handling equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Do not breathe vapor. Do not eat, drink or smoke when using this product. Wash hands thoroughly after handling.

Response : Get medical attention if you feel unwell. IF exposed or concerned: Get medical attention. IF SWALLOWED: Call a POISON CENTER or physician if you feel unwell. Rinse mouth. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing. If skin irritation occurs: Get medical attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.

Storage : Store locked up. Store in a well-ventilated place. Keep cool.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : benzene

Other means of identification : benzene, purebenzol; cyclohexatriene; phenyl hydride; phene; coal naphtha; pyrobenzol

CAS number/other identifiers

CAS number : 71-43-2

Product code : 001062

Ingredient name	%	CAS number
benzene	100	71-43-2

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.

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 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.

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Section 4. First aid measures

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. If necessary, call a poison center or physician. Never give anything by mouth to an unconscious person. 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.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes skin irritation.

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

Ingestion : Harmful if swallowed. Irritating to mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:
irritation
redness

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.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

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Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media : Do not use water jet.

Specific hazards arising from the chemical : Highly flammable liquid and vapor. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.

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. 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. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. 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 : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. 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 : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

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Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

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 in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
benzene	**ACGIH TLV (United States, 3/2012).** **Absorbed through skin.** STEL: 8 mg/m³ 15 minutes. STEL: 2.5 ppm 15 minutes. TWA: 1.6 mg/m³ 8 hours. TWA: 0.5 ppm 8 hours. **NIOSH REL (United States, 1/2013).** STEL: 1 ppm 15 minutes. TWA: 0.1 ppm 10 hours. **OSHA PEL (United States, 6/2010).** STEL: 5 ppm 15 minutes. TWA: 1 ppm 8 hours. **OSHA PEL 1989 (United States, 3/1989).** STEL: 5 ppm 15 minutes. TWA: 1 ppm 8 hours. **OSHA PEL Z2 (United States, 11/2006).** AMP: 50 ppm 10 minutes. CEIL: 25 ppm TWA: 10 ppm 8 hours.

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Section 8. Exposure controls/personal protection

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: chemical splash goggles.

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. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

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

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

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid. [Watery liquid.]

Color : Colorless. Yellowish.

Molecular weight : 78.12 g/mole

Molecular formula : C6-H6

Boiling/condensation point : 80.09°C (176.2°F)

Melting/freezing point : 5.49°C (41.9°F)

Critical temperature : 288.95°C (552.1°F)

Odor : Characteristic.

Odor threshold : Not available.

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Section 9. Physical and chemical properties

pH	:	Not available.
Flash point	:	Closed cup: -11°C (12.2°F)
Burning time	:	Not applicable.
Burning rate	:	Not applicable.
Evaporation rate	:	3.5 (butyl acetate = 1)
Flammability (solid, gas)	:	Not available.
Lower and upper explosive (flammable) limits	:	Lower: 1.2% Upper: 7.8%
Vapor pressure	:	10 kPa (75.006094245 mm Hg) [room temperature]
Vapor density	:	2.7 (Air = 1)
Specific Volume (ft^3/lb)	:	1.1403
Gas Density (lb/ft^3)	:	0.877 (20°C / 68 to °F)
Relative density	:	0.88
Solubility	:	Not available.
Solubility in water	:	1.88 g/l
Partition coefficient: n-octanol/water	:	2.13
Auto-ignition temperature	:	498°C (928.4°F)
Decomposition temperature	:	Not available.
SADT	:	Not available.
Viscosity	:	Dynamic (room temperature): 0.604 mPa·s (0.604 cP)

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. Do not allow vapor to accumulate in low or confined areas.
Incompatibility with various substances	:	Highly reactive or incompatible with the following materials: oxidizing 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.

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Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
benzene	LC50 Inhalation Gas. LD50 Oral	Rat Rat	10000 ppm 930 mg/kg	7 hours -

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
benzene	Eyes - Moderate irritant Eyes - Severe irritant Skin - Mild irritant Skin - Mild irritant Skin - Moderate irritant	Rabbit Rabbit Rat Rabbit Rabbit	- - - - -	88 milligrams 24 hours 2 milligrams 8 hours 60 microliters 24 hours 15 milligrams 24 hours 20 milligrams	- - - - -

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Classification

Product/ingredient name	OSHA	IARC	NTP
benzene	+	1	Known to be a human carcinogen.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Name	Category	Route of exposure	Target organs
benzene	Category 1	Not determined	bone marrow

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : No known significant effects or critical hazards.

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Section 11. Toxicological information

Skin contact : Causes skin irritation.

Ingestion : Harmful if swallowed. Irritating to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:
irritation
redness

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 : Causes damage to organs through prolonged or repeated exposure.

Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : May cause genetic defects.

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

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Section 12. Ecological information

Product/ingredient name	$LogP_{ow}$	BCF	Potential
benzene	2.13	11	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. 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. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

United States - RCRA Toxic hazardous waste "U" List

Ingredient	CAS #	Status	Reference number
Benzene (I,T)	71-43-2	Listed	U019

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1114	UN1114	UN114	UN1114	UN1114
UN proper shipping name	BENZENE	BENZENE	BENZENE	BENZENE	BENZENE
Transport hazard class(es)	3	3	3	3	3
Packing group	II	II	II	II	II
Environment	No.	No.	No.	No.	No.
Additional information	**Reportable quantity** 10 lbs / 4.54 kg [1.3675 gal / 5.1767 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements.	**Explosive Limit and Limited Quantity Index** 1 **Passenger Carrying Road or Rail Index** 5	-	-	**Passenger and Cargo Aircraft**Quantity limitation: 5 L **Cargo Aircraft Only** Quantity limitation: 60 L **Limited Quantities - Passenger Aircraft** Quantity limitation: 1 L

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Section 14. Transport information

	Limited quantity Yes. **Packaging instruction** **Passenger aircraft** Quantity limitation: 5 L **Cargo aircraft** Quantity limitation: 60 L **Special provisions** IB2, T4, TP1				

"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): This material is listed or exempted.

Clean Water Act (CWA) 307: benzene

Clean Water Act (CWA) 311: benzene

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : 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 : Fire hazard
Immediate (acute) health hazard
Delayed (chronic) health hazard

Composition/information on ingredients

Powered by IHS

Section 15. Regulatory information

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
benzene	100	Yes.	No.	No.	Yes.	Yes.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	benzene	71-43-2	100
Supplier notification	benzene	71-43-2	100

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : This material is listed.

New York : This material is listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

California Prop. 65

WARNING: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

Ingredient name	Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
benzene	Yes.	Yes.	6.4 µg/day (ingestion) 13 µg/day (inhalation)	24 µg/day (ingestion) 49 µg/day (inhalation)

Canada inventory : This material is listed or exempted.

International regulations

International lists : **Australia inventory (AICS)**: This material is listed or exempted.
China inventory (IECSC): This material is listed or exempted.
Japan inventory: This material is listed or exempted.
Korea inventory: This material is listed or exempted.
Malaysia Inventory (EHS Register): Not determined.
New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted.
Philippines inventory (PICCS): This material is listed or exempted.
Taiwan inventory (CSNN): Not determined.

Chemical Weapons Convention List Schedule I Chemicals : Not listed

Chemical Weapons Convention List Schedule II Chemicals : Not listed

Chemical Weapons Convention List Schedule III Chemicals : Not listed

Canada

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Section 15. Regulatory information

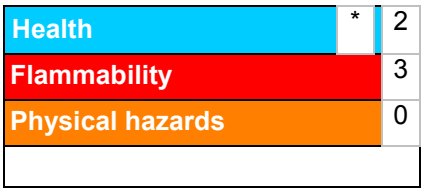
WHMIS (Canada) : Class B-2: Flammable liquid
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

CEPA Toxic substances: This material is listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class B-2: Flammable liquid
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

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.)

Reprinted with permission from NFPA 704-2001, Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

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.

History

Date of printing : 4/26/2015.

Date of issue/Date of revision : 4/26/2015.

Date of previous issue : 10/16/2014.

Version : 0.03

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Section 16. Other information

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United 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.

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SAFETY DATA SHEET

Xylenes

Section 1. Identification

GHS product identifier : Xylenes

Chemical name : xylene

Other means of identification : Benzene, dimethyl-; Xylol; Benzene, dimethyl-, mixed isomers; xylene, mixed isomers, pure; Benzene, dimethyl-,; Xylene (mixed)

Product use : Synthetic/Analytical chemistry.

Synonym : Benzene, dimethyl-; Xylol; Benzene, dimethyl-, mixed isomers; xylene, mixed isomers, pure; Benzene, dimethyl-,; Xylene (mixed)

SDS # : 001064

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 : FLAMMABLE LIQUIDS - Category 3
ACUTE TOXICITY (dermal) - Category 4
ACUTE TOXICITY (inhalation) - Category 4
SKIN CORROSION/IRRITATION - Category 2

GHS label elements

Hazard pictograms :

Signal word : Warning

Hazard statements : Flammable liquid and vapor.
May displace oxygen and cause rapid suffocation.
Harmful in contact with skin or if inhaled.
Causes skin irritation.

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

Prevention : Wear protective gloves. Wear eye or face protection. Wear protective clothing. Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Use explosion-proof electrical, ventilating, lighting and all material-handling equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Use only outdoors or in a well-ventilated area. Avoid breathing vapor. Wash hands thoroughly after handling.

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Section 2. Hazards identification

Response : IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or physician if you feel unwell. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. IF ON SKIN: Wash with plenty of soap and water. Call a POISON CENTER or physician if you feel unwell. Take off contaminated clothing. If skin irritation occurs: Get medical attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.

Storage : Store in a well-ventilated place. Keep cool.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : xylene

Other means of identification : Benzene, dimethyl-; Xylol; Benzene, dimethyl-, mixed isomers; xylene, mixed isomers, pure; Benzene, dimethyl-,; Xylene (mixed)

CAS number/other identifiers

CAS number : 1330-20-7

Product code : 001064

Ingredient name	%	CAS number
xylene	100	1330-20-7

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.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. 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 necessary, call a poison center or physician. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Wash with plenty of soap and water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. If necessary, call a poison center or physician. Wash clothing before reuse. Clean shoes thoroughly before reuse.

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Section 4. First aid measures

Ingestion : Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention if adverse health effects persist or are severe. Never give anything by mouth to an unconscious person. 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.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : Harmful if inhaled.

Skin contact : Harmful in contact with skin. Causes skin irritation.

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

Ingestion : Irritating to mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:
irritation
redness

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.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media : Do not use water jet.

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Section 5. Fire-fighting measures

Specific hazards arising from the chemical : Flammable liquid and vapor. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.

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. 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. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. 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 : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. 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 : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

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Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapor or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

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 in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
xylene	**ACGIH TLV (United States, 3/2012).** STEL: 651 mg/m³ 15 minutes. STEL: 150 ppm 15 minutes. TWA: 434 mg/m³ 8 hours. TWA: 100 ppm 8 hours. **OSHA PEL (United States, 6/2010).** TWA: 435 mg/m³ 8 hours. TWA: 100 ppm 8 hours. **OSHA PEL 1989 (United States, 3/1989).** STEL: 655 mg/m³ 15 minutes. STEL: 150 ppm 15 minutes. TWA: 435 mg/m³ 8 hours. TWA: 100 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.

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Section 8. Exposure controls/personal protection

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: chemical splash goggles.

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. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

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

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

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid. [COLORLESS LIQUID WITH AROMATIC ODOR]

Color : Colorless.

Molecular weight : 106.17 g/mole

Molecular formula : C8-H10

Boiling/condensation point : 136.16°C (277.1°F)

Melting/freezing point : -94.96°C (-138.9°F)

Critical temperature : Not available.

Odor : Aromatic.

Odor threshold : Not available.

pH : Not available.

Flash point : Closed cup: 18°C (64.4°F)

Burning time : Not applicable.

Burning rate : Not applicable.

Evaporation rate : 0.77 (butyl acetate = 1)

Flammability (solid, gas) : Not available.

Lower and upper explosive (flammable) limits : Lower: 0.8%
Upper: 6.7%

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Section 9. Physical and chemical properties

Vapor pressure : 0.89 kPa (6.7 mm Hg) [room temperature]

Vapor density : 3.7 (Air = 1)

Specific Volume (ft ^{3}/lb) : 1.1628

Gas Density (lb/ft ^{3}) : 0.86 (25°C / 77 to °F)

Relative density : 0.861

Solubility : Not available.

Solubility in water : 0.146 g/l

Partition coefficient: n-octanol/water : 3.12

Auto-ignition temperature : 432°C (809.6°F)

Decomposition temperature : Not available.

SADT : Not available.

Viscosity : Dynamic (room temperature): 0.581 mPa·s (0.581 cP)

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. Do not allow vapor to accumulate in low or confined areas.

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
xylene	LC50 Inhalation Gas. LD50 Oral	Rat Rat	5000 ppm 4300 mg/kg	4 hours -

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
xylene	Skin - Mild irritant	Rat	-	8 hours 60 microliters	-
	Skin - Moderate irritant	Rabbit	-	24 hours 500 milligrams	-
	Skin - Moderate irritant	Rabbit	-	100 Percent	-

Sensitization

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Section 11. Toxicological information

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Classification

Product/ingredient name	OSHA	IARC	NTP
xylene	-	3	-

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 : Causes serious eye irritation.

Inhalation : Harmful if inhaled.

Skin contact : Harmful in contact with skin. Causes skin irritation.

Ingestion : Irritating to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:
irritation
redness

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

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Section 11. Toxicological information

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
xylene	3.12	8.1 to 25.9	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. 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. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere

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Section 13. Disposal considerations

inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

United States - RCRA Toxic hazardous waste "U" List

Ingredient	CAS #	Status	Reference number
Xylene	1330-20-7	Listed	U239

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1307	UN1307	UN1307	UN1307	UN1307
UN proper shipping name	XYLENES	XYLENES	XYLENES	XYLENES	XYLENES
Transport hazard class(es)	3	3	3	3	3
Packing group	III	III	III	III	III
Environment	No.	No.	No.	No.	No.
Additional information	**Reportable quantity** 100 lbs / 45.4 kg [13.946 gal / 52.791 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements. **Limited quantity** Yes. **Packaging instruction** **Passenger aircraft** Quantity limitation: 5 L **Cargo aircraft** Quantity limitation: 60 L **Special provisions** IB2, T4, TP1	-	-	-	**Passenger and Cargo Aircraft** Quantity limitation: 5 L **Cargo Aircraft Only** Quantity limitation: 60 L **Limited Quantities - Passenger Aircraft** Quantity limitation: 1 L

"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.

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Section 15. Regulatory information

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

United States inventory (TSCA 8b): This material is listed or exempted.

Clean Water Act (CWA) 311: xylene

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : 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 : Fire hazard
Immediate (acute) health hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
xylene	100	Yes.	No.	No.	Yes.	No.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	xylene	1330-20-7	100
Supplier notification	xylene	1330-20-7	100

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : This material is listed.

New York : This material is listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

Canada inventory : This material is listed or exempted.

International regulations

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Section 15. Regulatory information

International lists : **Australia inventory (AICS)**: This material is listed or exempted.
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Taiwan inventory (CSNN): Not determined.

Chemical Weapons Convention List Schedule I Chemicals : Not listed

Chemical Weapons Convention List Schedule II Chemicals : Not listed

Chemical Weapons Convention List Schedule III Chemicals : Not listed

Canada

WHMIS (Canada) : Class B-2: Flammable liquid
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

CEPA Toxic substances: This material is not listed.
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Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class B-2: Flammable liquid
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

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

Health	*	2
Flammability		3
Physical hazards		0

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

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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.

History

Date of printing : 10/16/2014.

Date of issue/Date of revision : 10/16/2014.

Date of previous issue : 10/12/2014.

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 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

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Section 16. Other information

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SAFETY DATA SHEET

Methane

Section 1. Identification

GHS product identifier : Methane

Chemical name : methane

Other means of identification : Methane or natural gas; Marsh gas; Methyl hydride; CH4; Fire Damp;

Product use : Synthetic/Analytical chemistry.

Synonym : Methane or natural gas; Marsh gas; Methyl hydride; CH4; Fire Damp;

SDS # : 001033

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 : FLAMMABLE GASES - Category 1
GASES UNDER PRESSURE - Compressed gas

GHS label elements

Hazard pictograms :

Signal word : Danger

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

Precautionary statements

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

Prevention : Never Put cylinders into unventilated areas of passenger vehicles. Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Use and store only outdoors or in a well ventilated place.

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

Disposal : Not applicable.

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Section 2. Hazards identification

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

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : methane

Other means of identification : Methane or natural gas; Marsh gas; Methyl hydride; CH4; Fire Damp;

CAS number/other identifiers

CAS number : 74-82-8

Product code : 001033

Ingredient name	%	CAS number
methane	100	74-82-8

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

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

Section 4. First aid measures

Description of necessary first aid measures

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

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

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

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

Most important symptoms/effects, acute and delayed

Potential acute health effects

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

Inhalation : No known significant effects or critical hazards.

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

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

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

Over-exposure signs/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

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Section 4. First aid measures

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.

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

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

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

Unsuitable extinguishing media : None known.

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

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

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

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

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

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

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

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

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Section 6. Accidental release measures

Methods and materials for containment and cleaning up

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

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

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid contact with eyes, skin and clothing. Avoid breathing gas. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Empty containers retain product residue and can be hazardous. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

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

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

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
methane	**ACGIH TLV (United States, 3/2012).** TWA: 1000 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

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Section 8. Exposure controls/personal protection

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. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

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

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

Section 9. Physical and chemical properties

Appearance

Physical state : Gas. [Compressed gas.]

Color : Colorless.

Molecular weight : 16.05 g/mole

Molecular formula : C-H4

Boiling/condensation point : -161.48°C (-258.7°F)

Melting/freezing point : -187.6°C (-305.7°F)

Critical temperature : -82.45°C (-116.4°F)

Odor : Odorless.

Odor threshold : Not available.

pH : Not available.

Flash point : Closed cup: -188.15°C (-306.7°F)

Burning time : Not applicable.

Burning rate : Not applicable.

Evaporation rate : Not available.

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

Lower and upper explosive (flammable) limits : Lower: 1.8%
Upper: 8.4%

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Section 9. Physical and chemical properties

Vapor pressure : Not available.

Vapor density : 0.55 (Air = 1) Liquid Density@BP: 26.5 lb/ft3 (424.5 kg/m3)

Specific Volume (ft ^{3}/lb) : 2.3641

Gas Density (lb/ft ^{3}) : 0.423 (25°C / 77 to °F)

Relative density : Not applicable.

Solubility : Not available.

Solubility in water : 0.0244 g/l

Partition coefficient: n-octanol/water : 1.09

Auto-ignition temperature : 287°C (548.6°F)

Decomposition temperature : Not available.

SADT : Not available.

Viscosity : Not applicable.

Section 10. Stability and reactivity

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

Chemical stability : The product is stable.

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

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

Incompatibility with various substances : Extremely reactive or incompatible with the following materials: oxidizing 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

Not available.

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

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Section 11. Toxicological information

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 : 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

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.

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Section 11. Toxicological information

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
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 container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1971	UN1971	UN1971	UN1971	UN1971
UN proper shipping name	Methane, compressed	Methane, compressed or Methane or Natural gas, compressed (with high methane content)	Methane, compressed	Methane, compressed	Methane, compressed
Transport hazard class(es)	2.1	2.1	2.1	2.1	2.1

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Section 14. Transport information

Packing group	-	-	-	-	-
Environment	No.	No.	No.	No.	No.
Additional information	-	**Explosive Limit and Limited Quantity Index** 0.125 **ERAP Index** 3000 **Passenger Carrying Ship Index** Forbidden **Passenger Carrying Road or Rail Index** Forbidden	-	-	**Passenger and Cargo Aircraft**Quantity limitation: 0 Forbidden **Cargo Aircraft Only** Quantity limitation: 150 kg

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

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

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): This material is listed or exempted.

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

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 : Fire hazard
Sudden release of pressure

Composition/information on ingredients

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Section 15. Regulatory information

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
methane	100	Yes.	Yes.	No.	No.	No.

State regulations

Massachusetts : This material is listed.

New York : This material is not listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

Canada inventory : This material is listed or exempted.

International regulations

International lists : **Australia inventory (AICS)**: This material is listed or exempted.
China inventory (IECSC): This material is listed or exempted.
Japan inventory: This material is listed or exempted.
Korea inventory: This material is listed or exempted.
Malaysia Inventory (EHS Register): Not determined.
New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted.
Philippines inventory (PICCS): This material is listed or exempted.
Taiwan inventory (CSNN): Not determined.

Chemical Weapons Convention List Schedule I Chemicals : Not listed

Chemical Weapons Convention List Schedule II Chemicals : Not listed

Chemical Weapons Convention List Schedule III Chemicals : Not listed

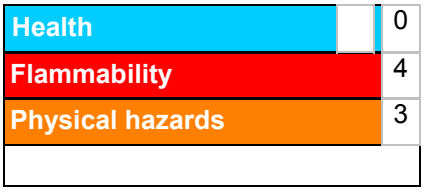
Canada

WHMIS (Canada) : Class A: Compressed gas.
Class B-1: Flammable gas.
CEPA Toxic substances: This material is listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class A: Compressed gas.
Class B-1: Flammable gas.

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



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Section 16. Other information

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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History

Date of printing : 5/20/2015.

Date of issue/Date of revision : 5/20/2015.

Date of previous issue : 1/27/2015.

Version : 0.04

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Inh – Inhalation
LC – Lethal concentration
LD – Lethal dosage
NDSL – Non-Domestic Substances List
NIOSH – National Institute for Occupational Safety and Health

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Section 16. Other information

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.

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24-HOUR EMERGENCY TELEPHONE

SPRAGUE: 603-431-1000 CHEMTREC: 800-424-9300

SDS – SAFETY DATA SHEET

1. Identification

Product Identifier: ULTRA LOW SULFUR DIESEL FUEL # 2
Synonyms: HIGHWAY DIESEL FUEL OIL, #2, FUEL OIL (ULTRA LOW SULFUR DIESEL)
Chemical Formula: Not applicable to mixtures
Recommended Use of the Chemical and Restrictions On Use: Fuel
Manufacturer / Supplier: Sprague Operating Resources LLC **Phone:** 603-431-1000
185 International Drive, Portsmouth, NH 03801
Emergency Phone Number: SPRAGUE: 603-431-1000; CHEMTREC: 800-424-9300

2. Hazard(s) Identification

Classification of the Substance or Mixture:
Flammable Liquids - Category 4
Carcinogenicity - Category 2
Specific Target Organ Toxicity (Single Exposure) – Category 3
Aspiration Hazard – Category 1
Acute Aquatic Toxicity – Category 3

Risk Phrases:
R40: Limited evidence of a carcinogenic effect.
R52: Harmful to aquatic organisms.
R65: Harmful: may cause lung damage if swallowed.
R67: Vapors may cause drowsiness and dizziness.

Label Elements:

Trade Name: ULTRA LOW SULFUR DIESEL FUEL # 2

Signal Word: Warning

Hazard Statements:
H227: Combustible liquid.
H304: May be fatal if swallowed and enters airways.
H336: May cause drowsiness or dizziness.
H351: Suspected of causing cancer.
H402: Harmful to aquatic life.

Precautionary Statements:
P261: Avoid breathing dust / fume / gas / mist / vapors / spray.
P281: Wear protective equipment as required.
P301 + 310: IF SWALLOWED: Immediately call a POISON CENTER or doctor / physician.
P331: Do NOT induce vomiting.

3. Composition / Information on Ingredients

CAS Number: Not applicable to mixtures
EC Number: Not applicable to mixtures
Index Number: Not applicable to mixtures
Molecular Weight: Not applicable to mixtures

Ingredient	CAS Number	Percent	Hazardous	Chemical Characterization
Fuel, Diesel	68476-34-6	99%	Yes	Substance
Polycyclic Hydrocarbons	08-007-452	< 1%	Yes	Substance

4. First-aid Measures

Inhalation: Remove from vapor to fresh air. If breathing has stopped, give artificial respiration. Get medical Immediately.

Ingestion: DO NOT INDUCE VOMITING or give anything by mouth to an unconscious person. If more than 1 mg/kg of petroleum distillates are swallowed, remove by gastric ravage by qualified medical personnel. If vomiting occurs, keep person's head lower than hips to help prevent pulmonary aspiration. After vomiting stops, give 30-60 ml of Fleet's Phosphor-Soda diluted 1:4 in water. Get medical attention immediately.

Skin Contact: Remove contaminated clothing. Wipe off excess oil with a dry cloth and then wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains (approximately 15-20 minutes.) If irritation develops, seek medical aid.

Eye Contact: Check for and remove any contact lenses. Flush eyes immediately with large amounts of water, occasionally lifting upper and lower lids until no evidence of chemical remains (approximately 15-20 minutes). Get medical attention if symptoms occur.

5. Fire-fighting Measures

Fire: Flammable Liquid and Vapor!

Explosion: Do not mix or store with strong oxidants. Do not store or pour near sources of ignition. Do not pressurize, cut, heat, weld, or expose empty containers to sources of ignition. Vapors are heavier than air and may travel a considerable distance to a source of ignition and flash back.

Fire Extinguishing Media*:* Foam, Carbon Dioxide, Dry Chemical, and for larger fires, Water Spray, Fog, or Foam.

Special Information: Use supplied-air breathing equipment for enclosed areas. Cool exposed containers with water spray. Continue water spray until entire container contents are cool. Withdraw immediately in the event of rising sound from venting safety device or any discoloration of storage tank due to fire (subject to the fire chief's directions.)

6. Accidental Release Measures

Personal Precautions, Protective Equipment and Emergency Procedures: No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment as per Section 8.

Environmental Precautions and Methods and Materials for Containment and Cleaning Up: Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Observe local, state and federal governmental spill and water quality regulations.

If properly trained, proceed with the following measures:

1. For small spills: Stop leak if without risk. Move containers from spill area. take up with sand or other absorbent material and place into containers for alter disposal.
2. For large spills: Stop leak if without risk. Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Dike far ahead of spill to prevent entrance into watercourses and / or ground water.

Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product.

7. Handling and Storage

Precautions for Safe Handling and Conditions for Safe Storage, Including Any Incompatibilities:

Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use non-sparking tools. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Use appropriate containment to avoid environmental contamination.

8. Exposure Controls / Personal Protection

Airborne Exposure Limits:
ACGIH Threshold Limit Value (TWA): 100 mg/m3 (measured as total hydrocarbons) 8 h (skin)

Ventilation System: 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. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved): A respirator is not needed under normal and intended conditions of use. If the exposure limit is exceeded and engineering controls are not feasible, use a mask with an organic vapor cartridge or positive pressure air supplied (SCBA) unit. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134).

Skin Protection: Gloves – Neoprene, PVC. Disposable outer garments or impervious garments of equal or greater protection should be worn.

Eye Protection: Use chemical safety goggles and / or a full face shield where splashing is possible.

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.

9. Physical and Chemical Properties

Appearance: Clear, slightly viscous liquid
Odor: Gasoline-like, diesel fuel odor

Odor Threshold: Not determined
pH: No information found
% Volatiles by volume @ 21C (70F): Greater than 50%
Melting Point: Not determined
Boiling Point / Boiling Range: 200 - 350C (392 - 662F) at 1,013 hPa (750 mm Hg)
Flash Point: 50 - 80C (122 - 176F) Closed Cup
Evaporation Rate (BuAC=1): Not determined
Flammability: Combustible
Upper / Lower Flammability or Explosive Limits: Upper - 10.0 / Lower – 0.6
Vapor Pressure (mm Hg): 1 mm Hg @ 20C (68F)
Vapor Density (Air=1): Greater than 5
Relative Density: 0.86
Solubility: Insoluble
Partition Coefficient: n-octanol / water: Not determined
Auto-ignition Temperature: > 260C (500F)
Decomposition Temperature: Not determined
Viscosity: Not determined

10. Stability and Reactivity

Reactivity and / or Chemical Stability: Stable under ordinary conditions of use and storage at normal temperatures and pressures.

Possibility of Hazardous Reactions and Conditions to Avoid: Heat, flames, ignition sources and incompatibles.

Incompatible Materials: Reactive or incompatible with oxidizing materials.

Hazardous Decomposition Products: Thermal decomposition may release various hydrocarbons and hydrocarbon derivatives including carbon dioxide, water, organic acids, and aldehydes.

11. Toxicological Information

Emergency Overview: WARNING! COMBUSTIBLE. CAUSES RESPIRATORY TRACT, EYE AND SKIN IRRITATION. HARMFUL IF INGESTED. ASPIRATION HAZARD.

Combustible liquid. Keep away from heat, sparks and flame. Avoid exposure - obtain special instructions before use. Do not breathe vapor or mist. Do not ingest. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

Potential Health Effects:

Inhalation: Mist or vapor may cause respiratory tract irritation. CNS depressant. High levels may cause giddiness, headache, dizziness, nausea, vomiting, and loss of coordination, narcosis, stupor, coma, and unconsciousness.

Ingestion: Irritation, giddiness, vertigo, headache, anesthetic stupor, CNS depression, coma and death.

Skin Contact: Drying, cracking, and defatting dermatitis. Direct contact may cause extreme irritation with severe erythema and edema with blistering and open sores. Absorption of large amounts may result in narcosis.

Eye Contact: Moderately irritating to eyes.

Chronic Exposure:

Inhalation: Prolonged exposure may cause dizziness, weakness, weight loss, anemia, nervousness, and pain in the limbs, peripheral numbness, and paresthesia. Renal failure possible. Degenerative changes of liver and kidneys may occur after prolonged exposure to high concentrations.

Skin Contact: Repeated or prolonged exposure may cause irritation, dermatitis, and a rash of pimples and spots.

Carcinogenicity:
For Fuel, Diesel:
ACGIH: A3 - Animal carcinogen. “Available evidence suggests that the agent is not likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure.”
IARC: 3 - The agent (mixture, exposure circumstance) is not classifiable as to its carcinogenicity to humans.

Reproductive Toxicity: This product is not reported to have any reproductive toxicity effects.

Specific Target Organ Toxicity - Single Exposure (Globally Harmonized System:) May cause drowsiness or dizziness.

Specific Target Organ Toxicity - Repeated Exposure (Globally Harmonized System:) No data available.

Aspiration Respiratory Organs Hazard: The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs,) severe lung damage, respiratory failure and even death.

Acute Toxicity: Oral LD50: > 5000 mg/kg (rat)

12. Ecological Information

Ecotoxicity: Very toxic to aquatic life with long lasting effects. 96 h LC50 Pimephales promelas - 35 mg/L (flow-through)

Persistence and Degradability: No information available

Bioaccumulative Potential: No information available

Mobility in Soil: No information available

Other adverse effects: No information available

13. Disposal Considerations

The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal should be in accordance with applicable regional, national, state, and local laws and regulations. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

14. Transport Information

Packing Group: III

DOT **IMDG** **IATA**

Land Transport ADR/RID and GGVS/GGVE (Cross Border / Domestic)
UN Number: UN1993
UN Proper Shipping Name: COMBUSTIBLE - LIQUID, N.O.S. (FUEL, DIESEL)
Transport Hazard Class(es): Combustible Liquid

Maritime Transport IMDG/GGVSea
UN Number: UN1202
UN Proper Shipping Name: FLAMMABLE LIQUID, N.O.S. (FUEL, DIESEL)
Not regulated if flashpoint is > 60C
Transport Hazard Class(es): 3
Marine Pollutant: Yes

Air Transport ICAO-TI and IATA-DGR
UN Number: UN1202
UN Proper Shipping Name: FLAMMABLE LIQUID, N.O.S. (FUEL, DIESEL)
Not regulated if flashpoint is > 60C
Transport Hazard Class(es): 3

Transport in Bulk according to Annex II of MARPOL 73/78 and the IBC Code

Special Precautions for User: No additional information

15. Regulatory Information

HCS Classification: Combustible liquid
Carcinogen

U.S. Federal Regulations:
TSCA 4(a) final test rules: No products listed.
TSCA 8(a) PAIR: No products listed.
United States inventory (TSCA 8b): All components are listed or exempted.
TSCA 12(b): No products listed.
SARA 302/304/311/312 extremely hazardous substances: No products listed.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: No products listed.
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: No products listed.
Clean Water Act (CWA) 307: Ethylbenzene
Clean Water Act (CWA) 311: Ethylbenzene
Clean Air Act (CAA) 112 accidental release prevention: No products were found.
Clean Air Act (CAA) 112 regulated flammable substances: No products listed.
Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

SARA 313
Form R – Reporting Requirements and Supplier Notification: No products listed.
SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State Regulations:
Connecticut Carcinogen Reporting: None of the components are listed.
Connecticut Hazardous Material Survey: None of the components are listed.
Florida substances: None of the components are listed.
Illinois Chemical Safety Act: None of the components are listed.
Illinois Toxic Substances Disclosure to Employee Act: None listed.
Louisiana Reporting: None of the components are listed.
Louisiana Spill: None of the components are listed.
Massachusetts Spill: None of the components are listed.
Massachusetts Substances: None of the components are listed.
Michigan Critical Material: None of the components are listed.
Minnesota Hazardous Substances: None of the components are listed.
New Jersey Hazardous Substances: The following components are listed: Diesel Fuel
New Jersey Spill: None of the components are listed.
New Jersey Toxic Catastrophe Prevention Act: None of the components are listed.
New York Acutely Hazardous Substances: None of the components are listed.
New York Toxic Chemical Release Reporting: None of the components are listed.

Pennsylvania RTK Hazardous Substances: None of the components are listed.
Rhode Island Hazardous Substances: None of the components are listed.

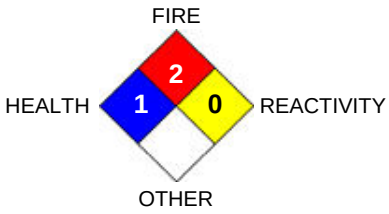
California Prop. 65 Ingredient Name	Cancer	Reproductive	No significant Risk Level	Maximum Acceptable Dosage Level
Ethylbenzene	Yes	No	No	No

International Lists: This product, (and its ingredients) is (are) listed on national inventories, or is (are) exempted from being listed, in Australia (AICS), in Europe (EINECS/ELINCS), in Korea (TCCL), in Japan (METI), in the Philippines (RA6969.)

16. Other Information

HMIS / NFPA Hazard Rating:

4=EXTREME
3= SERIOUS
2= MODERATE
1=SLIGHT
0=MINIMAL



Effective Date: 11/01/13 – Standardized for GHS and REACH
Previous Revisions: 11/02, 06/05, 10/08, 1/11

The information contained herein is based on data available at this time and is believed to be accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Since information contained herein may be applied under conditions beyond our control and with which we may be unfamiliar, no responsibility is assumed for the results of its use. The person receiving this information shall make his / her own determination of the suitability of the material for his / her particular purposes.

Acetone

Safety Data Sheet 75004

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 11/12/1998 Revision date: 10/01/2013 Supersedes: 06/11/2013 Version: 1.1

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form	:	Substance
Substance name	:	Acetone
CAS No	:	67-64-1
Product code	:	LC10420, LC10425
Formula	:	C3H6O
Synonyms	:	2-propanone / beta-ketopropane / dimethyl formaldehyde / dimethyl ketone / dimethylketal / DMK (=dimethyl ketone) / keto propane / methyl ketone / pyroacetic acid / pyroacetic ether / pyroacetic spirit
BIG no	:	10001

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture	:	Solvent Cleansing product Chemical raw material

1.3. Details of the supplier of the safety data sheet

LabChem Inc
Jackson's Pointe Commerce Park Building 1000, 1010 Jackson's Pointe Court
Zelienople, PA 16063 - USA
T 412-826-5230 - F 724-473-0647
info@labchem.com - www.labchem.com

1.4. Emergency telephone number

Emergency number	:	CHEMTREC: 1-800-424-9300 or 011-703-527-3887

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Flam. Liq. 2 H225
Eye Irrit. 2A H319
STOT SE 3 H336

2.2. Label elements

GHS-US labelling

Hazard pictograms (GHS-US) :

GHS02 GHS07

Signal word (GHS-US) : Danger

Hazard statements (GHS-US) :
H225 - Highly flammable liquid and vapour
H319 - Causes serious eye irritation
H336 - May cause drowsiness or dizziness

Precautionary statements (GHS-US) :
P210 - Keep away from heat, hot surfaces, open flames, sparks. - No smoking
P233 - Keep container tightly closed
P240 - Ground/bond container and receiving equipment
P241 - Use explosion-proof electrical, lighting, ventilating equipment
P242 - Use only non-sparking tools
P243 - Take precautionary measures against static discharge
P261 - Avoid breathing mist, spray, vapours
P264 - Wash exposed skin thoroughly after handling
P271 - Use only outdoors or in a well-ventilated area
P280 - Wear eye protection, face protection, protective clothing, protective gloves
P303+P361+P353 - IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P304+P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing
P305+P351+P338 - If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P312 - Call a POISON CENTER/doctor/…/if you feel unwell
P337+P313 - If eye irritation persists: Get medical advice/attention
P370+P378 - In case of fire: Use dry chemical powder, alcohol-resistant foam, carbon dioxide (CO2) for extinction
P403+P233 - Store in a well-ventilated place. Keep container tightly closed

P405 - Store locked up
P501 - Dispose of contents/container to comply with local, state and federal regulations
P235 - Keep cool

2.3. Other hazards

Other hazards not contributing to the classification : None.

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substances

Name	Product identifier	%	GHS-US classification
Acetone (Main constituent)	(CAS No) 67-64-1	100	Flam. Liq. 2, H225 Eye Irrit. 2A, H319 STOT SE 3, H336

Full text of H-phrases: see section 16

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with laboured breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain. Depending on the victim's condition: doctor/hospital.

First-aid measures after inhalation : Remove the victim into fresh air. Respiratory problems: consult a doctor/medical service.

First-aid measures after skin contact : Wash immediately with lots of water. Soap may be used. Do not apply (chemical) neutralizing agents. Remove clothing before washing. Take victim to a doctor if irritation persists.

First-aid measures after eye contact : Rinse immediately with plenty of water. Do not apply neutralizing agents. Take victim to an ophthalmologist if irritation persists.

First-aid measures after ingestion : Rinse mouth with water. Immediately after ingestion: give lots of water to drink. Do not give milk/oil to drink. Do not induce vomiting. Give activated charcoal. Call Poison Information Centre (www.big.be/antigif.htm). Consult a doctor/medical service if you feel unwell. Ingestion of large quantities: immediately to hospital. Doctor: gastric lavage.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries : Not expected to present a significant hazard under anticipated conditions of normal use.

Symptoms/injuries after inhalation : EXPOSURE TO HIGH CONCENTRATIONS: Feeling of weakness. Irritation of the respiratory tract. Nausea. Vomiting. Headache. Central nervous system depression. Dizziness. Narcosis. Excited/restless. Drunkenness. Disturbed motor response. Respiratory difficulties. Disturbances of consciousness.

Symptoms/injuries after skin contact : ON CONTINUOUS EXPOSURE/CONTACT: Dry skin. Cracking of the skin.

Symptoms/injuries after eye contact : Irritation of the eye tissue.

Symptoms/injuries after ingestion : Dry/sore throat. Risk of aspiration pneumonia. Symptoms similar to those listed under inhalation. AFTER ABSORPTION OF HIGH QUANTITIES: Irritation of the gastric/intestinal mucosa. Change in the haemogramme/blood composition. Change in urine output. Affection of the renal tissue. Enlargement/affection of the liver.

Symptoms/injuries upon intravenous administration : Not available.

Chronic symptoms : ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: Red skin. Skin rash/inflammation. Dry/sore throat. Headache. Nausea. Feeling of weakness. Loss of weight. Possible inflammation of the respiratory tract.

4.3. Indication of any immediate medical attention and special treatment needed

Obtain medical assistance.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Preferably: alcohol resistant foam. Water spray. Polyvalent foam. BC powder. Carbon dioxide.

Unsuitable extinguishing media : Solid water jet ineffective as extinguishing medium.

5.2. Special hazards arising from the substance or mixture

Fire hazard : DIRECT FIRE HAZARD. Highly flammable. Gas/vapour flammable with air within explosion limits. INDIRECT FIRE HAZARD. May be ignited by sparks. Gas/vapour spreads at floor level: ignition hazard. Reactions involving a fire hazard: see "Reactivity Hazard".

Explosion hazard	:	DIRECT EXPLOSION HAZARD. Gas/vapour explosive with air within explosion limits. INDIRECT EXPLOSION HAZARD. Heat may cause pressure rise in tanks/drums: explosion risk. may be ignited by sparks. Reactions with explosion hazards: see "Reactivity Hazard".
Reactivity	:	Upon combustion: CO and CO2 are formed. Violent to explosive reaction with many compounds. Prolonged storage: on exposure to light: release of harmful gases/vapours. Reacts violently with (strong) oxidizers: peroxidation resulting in increased fire or explosion risk.

5.3. Advice for firefighters

Firefighting instructions	:	Cool tanks/drums with water spray/remove them into safety. Physical explosion risk: extinguish/cool from behind cover. Do not move the load if exposed to heat. After cooling: persistant risk of physical explosion.
Protection during firefighting	:	Heat/fire exposure: compressed air/oxygen apparatus.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

Protective equipment	:	Gloves. Protective goggles. Protective clothing. Large spills/in enclosed spaces: compressed air apparatus.
Emergency procedures	:	Keep upwind. Mark the danger area. Consider evacuation. Seal off low-lying areas. Close doors and windows of adjacent premises. Stop engines and no smoking. No naked flames or sparks. Spark- and explosionproof appliances and lighting equipment. Keep containers closed. Wash contaminated clothes.

6.1.2. For emergency responders

Protective equipment	:	Equip cleanup crew with proper protection.
Emergency procedures	:	Ventilate area.

6.2. Environmental precautions

Prevent spreading in sewers.

6.3. Methods and material for containment and cleaning up

For containment	:	Contain released substance, pump into suitable containers. Consult "Material-handling" to select material of containers. Plug the leak, cut off the supply. Dam up the liquid spill. Try to reduce evaporation. Measure the concentration of the explosive gas-air mixture. Dilute/disperse combustible gas/vapour with water curtain. Provide equipment/receptacles with earthing. Do not use compressed air for pumping over spills.
Methods for cleaning up	:	Take up liquid spill into inert absorbent material, e.g.: sand, earth, vermiculite. Scoop absorbed substance into closing containers. See "Material-handling" for suitable container materials. Spill must not return in its original container. Carefully collect the spill/leftovers. Damaged/cooled tanks must be emptied. Do not use compressed air for pumping over spills. Clean contaminated surfaces with an excess of water. Take collected spill to manufacturer/competent authority. Wash clothing and equipment after handling.

6.4. Reference to other sections

See Heading 8. Exposure controls and personal protection.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling	:	Comply with the legal requirements. Remove contaminated clothing immediately. Clean contaminated clothing. Handle uncleaned empty containers as full ones. Thoroughly clean/dry the installation before use. Do not discharge the waste into the drain. Do not use compressed air for pumping over. Use spark-/explosionproof appliances and lighting system. Take precautions against electrostatic charges. Keep away from naked flames/heat. Keep away from ignition sources/sparks. Avoid prolonged and repeated contact with skin. Keep container tightly closed. Measure the concentration in the air regularly. Work under local exhaust/ventilation.
Hygiene measures	:	Do not eat, drink or smoke when using this product. Wash contaminated clothing before reuse. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions	:	Keep only in the original container in a cool, well ventilated place away from : Heat sources, Direct sunlight, incompatible materials. Keep container closed when not in use.
Incompatible products	:	Strong bases. Strong acids.
Incompatible materials	:	Sources of ignition. Direct sunlight.
Storage temperature	:	15 - 20 °C
Heat and ignition sources	:	KEEP SUBSTANCE AWAY FROM: heat sources. ignition sources.
Prohibitions on mixed storage	:	KEEP SUBSTANCE AWAY FROM: oxidizing agents. reducing agents. (strong) acids. (strong) bases. halogens. amines.

Storage area	:	Store in a cool area. Keep out of direct sunlight. Store in a dry area. Store in a dark area. Ventilation at floor level. Fireproof storeroom. Provide for an automatic sprinkler system. Provide for a tub to collect spills. Provide the tank with earthing. Meet the legal requirements.
Special rules on packaging	:	SPECIAL REQUIREMENTS: closing. with pressure relief valve. clean. opaque. correctly labelled. meet the legal requirements. Secure fragile packagings in solid containers.
Packaging materials	:	SUITABLE MATERIAL: steel. stainless steel. carbon steel. aluminium. iron. copper. nickel. bronze. glass. MATERIAL TO AVOID: synthetic material.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Acetone (67-64-1)		
USA ACGIH	ACGIH TWA (ppm)	500 ppm
USA ACGIH	ACGIH STEL (ppm)	750 ppm
USA OSHA	OSHA PEL (TWA) (mg/m³)	2400 mg/m³
USA OSHA	OSHA PEL (TWA) (ppm)	1000 ppm

8.2. Exposure controls

Appropriate engineering controls	:	Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.
Materials for protective clothing	:	GIVE EXCELLENT RESISTANCE: No data available. GIVE GOOD RESISTANCE: butyl rubber. tetrafluoroethylene. GIVE LESS RESISTANCE: chlorosulfonated polyethylene. natural rubber. neoprene. polyurethane. PVA. styrene-butadiene rubber. GIVE POOR RESISTANCE: nitrile rubber. polyethylene. PVC. viton. nitrile rubber/PVC.
Hand protection	:	Gloves.
Eye protection	:	Protective goggles.
Skin and body protection	:	Head/neck protection. Protective clothing.
Respiratory protection	:	Wear gas mask with filter type A if conc. in air > exposure limit.
Other information	:	Do not eat, drink or smoke during use.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	:	Liquid
Appearance	:	Liquid.
Molecular mass	:	58.08 g/mol
Colour	:	Colourless.
Odour	:	Aromatic odour. Sweet odour. Fruity odour.
Odour threshold	:	306 - 653 ppm 737 - 1574 mg/m³
pH	:	7
Relative evaporation rate (butylacetate=1)	:	6
Relative evaporation rate (ether=1)	:	2
Melting point	:	-95 °C
Freezing point	:	No data available
Boiling point	:	56 °C
Flash point	:	-18 °C
Critical temperature	:	235 °C
Self ignition temperature	:	465 °C
Decomposition temperature	:	No data available
Flammability (solid, gas)	:	No data available
Vapour pressure	:	247 hPa
Vapour pressure at 50 °C	:	828 hPa
Critical pressure	:	47010 hPa
Relative vapour density at 20 °C	:	2.0
Relative density	:	0.79
Relative density of saturated gas/air mixture	:	1.2
Density	:	786 kg/m³

Solubility	:	Soluble in water. Soluble in ethanol. Soluble in ether. Soluble in dimethyl ether. Soluble in petroleum spirit. Soluble in chloroform. Soluble in dimethylformamide. Soluble in oils/fats. Water: Complete Ethanol: Complete Ether: Complete
Log Pow	:	-0.24 (Test data)
Log Kow	:	No data available
Viscosity, kinematic	:	0.417 mm²/s
Viscosity, dynamic	:	0.00033 Pa.s
Explosive properties	:	No data available.
Oxidising properties	:	None.
Explosive limits	:	2 - 12.8 vol % 60 - 310 g/m³

9.2. Other information

Minimum ignition energy	:	1.15 mJ
Specific conductivity	:	500000 pS/m
Saturation concentration	:	589 g/m³
VOC content	:	100 %
Other properties	:	Gas/vapour heavier than air at 20°C. Clear. Highly volatile. Substance has neutral reaction.

SECTION 10: Stability and reactivity

10.1. Reactivity

Upon combustion: CO and CO2 are formed. Violent to explosive reaction with many compounds. Prolonged storage: on exposure to light: release of harmful gases/vapours. Reacts violently with (strong) oxidizers: peroxidation resulting in increased fire or explosion risk.

10.2. Chemical stability

Unstable on exposure to light.

10.3. Possibility of hazardous reactions

Not established.

10.4. Conditions to avoid

Direct sunlight. Extremely high or low temperatures.

10.5. Incompatible materials

Strong acids. Strong bases.

10.6. Hazardous decomposition products

fume. Carbon monoxide. Carbon dioxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Acetone (\f)67-64-1	
LD50 oral rat	5800 mg/kg (Rat; Experimental value,Rat; Experimental value)
LD50 dermal rabbit	20000 mg/kg (Rabbit; Experimental value,Rabbit; Experimental value)
LC50 inhalation rat (mg/l)	71 mg/l/4h (76 mg/l/4h; Rat; Rat; Experimental value; Experimental value,76 mg/l/4h; Rat; Rat; Experimental value; Experimental value)
LC50 inhalation rat (ppm)	30000 ppm/4h (Rat; Experimental value,Rat; Experimental value)

Skin corrosion/irritation	:	Not classified pH: 7
Serious eye damage/irritation	:	Causes serious eye irritation. pH: 7
Respiratory or skin sensitisation	:	Not classified
Germ cell mutagenicity	:	Not classified Based on available data, the classification criteria are not met
Carcinogenicity	:	Not classified
Reproductive toxicity	:	Not classified Based on available data, the classification criteria are not met
Specific target organ toxicity (single exposure)	:	May cause drowsiness or dizziness.

Specific target organ toxicity (repeated exposure)	:	Not classified Based on available data, the classification criteria are not met
Aspiration hazard	:	Not classified Based on available data, the classification criteria are not met
Potential Adverse human health effects and symptoms	:	Based on available data, the classification criteria are not met.
Symptoms/injuries after inhalation	:	EXPOSURE TO HIGH CONCENTRATIONS: Feeling of weakness. Irritation of the respiratory tract. Nausea. Vomiting. Headache. Central nervous system depression. Dizziness. Narcosis. Excited/restless. Drunkenness. Disturbed motor response. Respiratory difficulties. Disturbances of consciousness.
Symptoms/injuries after skin contact	:	ON CONTINUOUS EXPOSURE/CONTACT: Dry skin. Cracking of the skin.
Symptoms/injuries after eye contact	:	Irritation of the eye tissue.
Symptoms/injuries after ingestion	:	Dry/sore throat. Risk of aspiration pneumonia. Symptoms similar to those listed under inhalation. AFTER ABSORPTION OF HIGH QUANTITIES: Irritation of the gastric/intestinal mucosa. Change in the haemogramme/blood composition. Change in urine output. Affection of the renal tissue. Enlargement/affection of the liver.
Symptoms/injuries upon intravenous administration	:	Not available.
Chronic symptoms	:	ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: Red skin. Skin rash/inflammation. Dry/sore throat. Headache. Nausea. Feeling of weakness. Loss of weight. Possible inflammation of the respiratory tract.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general	:	Classification concerning the environment: not applicable.
Ecology - air	:	TA-Luft Klasse 5.2.5.
Ecology - water	:	Not harmful to fishes (LC50(96h) >1000 mg/l). Not harmful to invertebrates (Daphnia). Not harmful to algae (EC50 >1000 mg/l). Not harmful to plankton. Inhibition of activated sludge.

Acetone (67-64-1)	
LC50 fishes 1	6210 mg/l (96 h; Pimephales promelas; NOMINAL CONCENTRATION)
EC50 Daphnia 1	8800 mg/l (48 h; Daphnia pulex)
LC50 fish 2	5540 mg/l 96 h; Salmo gairdneri (Oncorhynchus mykiss)
TLM fish 1	13000 ppm (96 h; Gambusia affinis; TURBULENT WATER)
TLM fish 2	> 1000 ppm (96 h; Pisces)
Threshold limit other aquatic organisms 1	3000 mg/l (Plankton)
Threshold limit other aquatic organisms 2	28 mg/l (Protozoa)
Threshold limit algae 1	7500 mg/l (Scenedesmus quadricauda; PH = 7)
Threshold limit algae 2	3400 mg/l (48 h; Chlorella sp.)

12.2. Persistence and degradability

Acetone (67-64-1)	
Persistence and degradability	Readily biodegradable in water. Biodegradable in the soil. Biodegradable in the soil under anaerobic conditions. No (test)data on mobility of the substance available.
Biochemical oxygen demand (BOD)	1.43 g O^2/g substance
Chemical oxygen demand (COD)	1.92 g O^2/g substance
ThOD	2.20 g O^2/g substance

12.3. Bioaccumulative potential

Acetone (67-64-1)	
BCF fish 1	0.69 (Pisces)
BCF other aquatic organisms 1	3
Log Pow	-0.24 (Test data)
Bioaccumulative potential	Not bioaccumulative.

12.4. Mobility in soil

Acetone (67-64-1)	
Surface tension	0.0237 N/m

12.5. Other adverse effects

Other information	:	Avoid release to the environment.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Remove waste in accordance with local and/or national regulations. Hazardous waste shall not be mixed together with other waste. Different types of hazardous waste shall not be mixed together if this may entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. All entities that store, transport or handle hazardous waste shall take the necessary measures to prevent risks of pollution or damage to people or animals. Recycle by distillation. Remove to an authorized waste incinerator for solvents with energy recovery. Do not discharge into drains or the environment.

Additional information : LWCA (the Netherlands): KGA category 03. Hazardous waste according to Directive 2008/98/EC.

Ecology - waste materials : Avoid release to the environment.

SECTION 14: Transport information

In accordance with DOT

14.1. UN number

UN-No.(DOT) : 1090

DOT NA no. UN1090

14.2. UN proper shipping name

DOT Proper Shipping Name : Acetone

Department of Transportation (DOT) Hazard Classes : 3 - Class 3 - Flammable and combustible liquid 49 CFR 173.120

Hazard labels (DOT) : 3 - Flammable liquids

Packing group (DOT) : II - Medium Danger

DOT Special Provisions (49 CFR 172.102) : IB2 - Authorized IBCs: Metal (31A, 31B and 31N); Rigid plastics (31H1 and 31H2); Composite (31HZ1). Additional Requirement: Only liquids with a vapor pressure less than or equal to 110 kPa at 50 C (1.1 bar at 122 F), or 130 kPa at 55 C (1.3 bar at 131 F) are authorized.
T4 - 2.65 178.274(d)(2) Normal..... 178.275(d)(3)
TP1 - The maximum degree of filling must not exceed the degree of filling determined by the following: Degree of filling = 97 / (1 + a (tr - tf)) Where: tr is the maximum mean bulk temperature during transport, and tf is the temperature in degrees celsius of the liquid during filling.

DOT Packaging Exceptions (49 CFR 173.xxx) : 150

DOT Packaging Non Bulk (49 CFR 173.xxx) : 202

DOT Packaging Bulk (49 CFR 173.xxx) : 242

14.3. Additional information

Other information : No supplementary information available.

State during transport (ADR-RID) : as liquid.

Overland transport

Packing group (ADR) : II

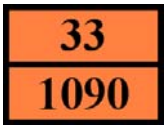
Class (ADR) : 3 - Flammable liquids

Hazard identification number (Kemler No.) : 33

Classification code (ADR) : F1

Danger labels (ADR) : 3 - Flammable liquids

Orange plates :



Tunnel restriction code : D/E

Transport by sea

DOT Vessel Stowage Location : B - (i) The material may be stowed ''on deck'' or ''under deck'' on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers, or one passenger per each 3 m of overall vessel length; and (ii) ''On deck only'' on passenger vessels in which the number of passengers specified in paragraph (k)(2)(i) of this section is exceeded.

EmS-No. (1) : F-E

EmS-No. (2) : S-D

Air transport

DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27) : 5 L

DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75) : 60 L

SECTION 15: Regulatory information

15.1. US Federal regulations

Acetone (67-64-1)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
RQ (Reportable quantity, section 304 of EPA's List of Lists) :	5000 lb

15.2. International regulations

CANADA

Acetone (67-64-1)	
Listed on the Canadian DSL (Domestic Sustances List) inventory.	
WHMIS Classification	Class B Division 2 - Flammable Liquid Class D Division 2 Subdivision B - Toxic material causing other toxic effects

EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Flam. Liq. 2 H225
Eye Irrit. 2 H319
STOT SE 3 H336

Full text of H-phrases: see section 16

Classification according to Directive 67/548/EEC or 1999/45/EC

F; R11
Xi; R36
R66
R67

Full text of R-phrases: see section 16

15.2.2. National regulations

Acetone (67-64-1)
Listed on the Canadian Ingredient Disclosure List

15.3. US State regulations

No additional information available

SECTION 16: Other information

Indication of changes : Revision - See : *.

Other information : None.

Full text of H-phrases: see section 16:

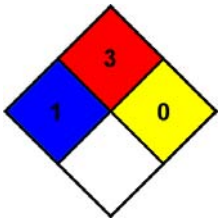
Eye Irrit. 2A	Serious eye damage/eye irritation, Category 2A
Flam. Liq. 2	Flammable liquids, Category 2

STOT SE 3	Specific target organ toxicity — Single exposure, Category 3, Narcosis
H225	Highly flammable liquid and vapour
H319	Causes serious eye irritation
H336	May cause drowsiness or dizziness

NFPA health hazard : 1 - Exposure could cause irritation but only minor residual injury even if no treatment is given.

NFPA fire hazard : 3 - Liquids and solids that can be ignited under almost all ambient conditions.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health : 1 Slight Hazard - Irritation or minor reversible injury possible

Flammability : 3 Serious Hazard

Physical : 0 Minimal Hazard

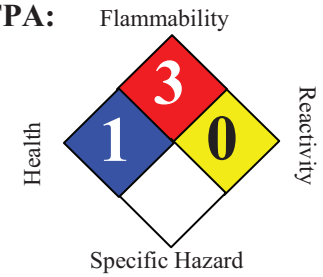
Personal Protection : C

SDS US (GHS HazCom 2012)

Information in this SDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc assumes no liability resulting from the use of this SDS. The user must determine suitability of this information for his application.

Safety Data Sheet
Gasoline, Unleaded

NFPA:



TESORO

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	Gasoline, Unleaded			
Synonyms	:	Blend of Highly Flammable Petroleum Distillates, Regular, Mid-Grade, Premium, 888100008809			
SDS Number	:	888100008809	**Version**	:	1.1
Product Use Description	:	Fuel			
Company	:	For: Tesoro Refining & Marketing Co. 19100 Ridgewood Parkway, San Antonio, TX 78259			
Tesoro Call Center	:	(877) 783-7676	**Chemtrec (Emergency Contact)**	:	(800) 424-9300

SECTION 2. HAZARDS IDENTIFICATION

Classifications :

Flammable Liquid – Category 1 or 2 depending on formulation.
Aspiration Hazard – Category 1
Carcinogenicity – Category 2
Specific Target Organ Toxicity (Repeated Exposure) – Category 2
Specific Target Organ Toxicity (Single Exposure) – Category 3
Skin Irritation – Category 2
Eye Irritation – Category 2B
Chronic Aquatic Toxicity – Category 2

Pictograms :

Signal Word : **Danger**

Hazard Statements

Extremely flammable liquid and vapor.
May be fatal if swallowed and enters airways – do not siphon gasoline by mouth.
Suspected of causing blood cancer if repeated over-exposure by inhalation and/or skin contact occurs.
May cause damage to liver, kidneys and nervous system by repeated and prolonged inhalation or skin contact. Causes eye irritation. Can be absorbed through skin.
May cause drowsiness or dizziness. Extreme exposure such as intentional inhalation may cause unconsciousness, asphyxiation and death.
Repeated or prolonged skin contact can cause irritation and dermatitis.

Harmful to aquatic life.

Precautionary statements

Prevention : Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Keep away from heat, sparks, open flames, welding and hot surfaces.
No smoking.
Keep container tightly closed.
Ground and/or bond container and receiving equipment.
Use explosion-proof electrical equipment.
Use only non-sparking tools (if tools are used in flammable atmosphere).
Take precautionary measures against static discharge.
Wear gloves, eye protection and face protection (as needed to prevent skin and eye contact with liquid).
Wash hands or liquid-contacted skin thoroughly after handling.
Do not eat, drink or smoke when using this product.
Do not breathe vapors.
Use only outdoors or in a well-ventilated area.

Response : In case of fire: Use dry chemical, CO2, water spray or fire fighting foam to extinguish.
If swallowed: Immediately call a poison center, doctor, hospital emergency room, medical clinic or 911. Do NOT induce vomiting. Rinse mouth.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
If in eye: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
If skin or eye irritation persists, get medical attention.
If inhaled: Remove person to fresh air and keep comfortable for breathing.
Get medical attention if you feel unwell.

Storage : Store in a well ventilated place. Keep cool. Store locked up. Keep container tightly closed . Use only approved containers. Some containers not approved for gasoline may dissolve and release flammable gasoline liquid and vapors.

Disposal : Dispose of contents/containers to approved disposal site in accordance with local, regional, national, and/or international regulations.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS-No.	Weight %
Gasoline, natural; Low boiling point naphtha	8006-61-9	10 - 30%
Toluene	108-88-3	10 - 30%
Xylene	1330-20-7	10 - 30%
Ethanol; ethyl alcohol	64-17-5	0-8.2%
Trimethylbenzene	25551-13-7	1 - 5%
Isopentane; 2-methylbutane	78-78-4	1 - 5%

Naphthalene	91-20-3	1 - 5%
Benzene	71-43-2	Less than 1.3%
Pentane	109-66-0	1 - 5%
Cyclohexane	110-82-7	1 - 5%
Ethylbenzene	100-41-4	1 - 5%
Butane	106-97-8	1 - 20%
Heptane [and isomers]	142-82-5	0.5 - 0.75%
N-hexane	110-54-3	0.5 - 0.75%

SECTION 4. FIRST AID MEASURES

Inhalation : If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Seek medical attention immediately.

Skin contact : In case of contact, immediately flush skin with plenty of water. Take off contaminated clothing and shoes immediately. Wash contaminated clothing before re-use. Contaminated leather, particularly footwear, must be discarded. Note that contaminated clothing may be a fire hazard. Seek medical advice if symptoms persist or develop.

Eye contact : Remove contact lenses. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Seek medical advice if symptoms persist or develop.

Ingestion : Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Obtain medical attention.

Notes to physician : Symptoms: Dizziness, Discomfort, Headache, Nausea, Kidney disorders, Liver disorders. Aspiration may cause pulmonary edema and pneumonitis. Swallowing gasoline is more likely to be fatal for small children than adults, even if aspiration does not occur.

SECTION 5. FIRE-FIGHTING MEASURES

Suitable extinguishing media : SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray or fire fighting foam. LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers. Keep containers and surroundings cool with water spray.

Specific hazards during fire fighting : Extremely flammable liquid and vapor. This material is combustible/flammable and is sensitive to fire, heat, and static discharge.

Special protective equipment for fire-fighters : Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

Further information	:	Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam. Exposure to decomposition products may be a hazard to health. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. Use water spray to cool unopened containers. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions	:	Evacuate personnel to safe areas. Ventilate the area. Remove all sources of ignition. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).
Environmental precautions	:	Discharge into the environment must be avoided. If the product contaminates rivers and lakes or drains inform respective authorities.
Methods for cleaning up	:	Contain and collect spillage with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations.

SECTION 7. HANDLING AND STORAGE

Precautions for safe handling :

Keep away from fire, sparks and heated surfaces. No smoking near areas where material is stored or handled. The product should only be stored and handled in areas with intrinsically safe electrical classification.

Hydrocarbon liquids including this product can act as a non-conductive flammable liquid (or static accumulators), and may form ignitable vapor-air mixtures in storage tanks or other containers. Precautions to prevent static-initated fire or explosion during transfer, storage or handling, include but are not limited to these examples:

(1) Ground and bond containers during product transfers. Grounding and bonding may not be adequate protection to prevent ignition or explosion of hydrocarbon liquids and vapors that are static accumulators.

(2) Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil or diesel) is loaded into tanks previously containing low flash point products (such gasoline or naphtha).

(3) Storage tank level floats must be effectively bonded.

For more information on precautions to prevent static-initated fire or explosion, see NFPA 77, Recommended Practice on Static Electricity (2007), and API Recommended Practice 2003, Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents (2008).

Conditions for safe storage, including incompatibilities : Keep away from flame, sparks, excessive temperatures and open flame. Use approved containers. Keep containers closed and clearly labeled. Empty or partially full product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose containers to sources of ignition. Store in a well-ventilated area. The storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

Reports suggest that government-mandated ethanol, if present, may not be compatible with fiberglass gasoline tanks. Ethanol may dissolve fiberglass resin, causing engine damage and possibly allow leakage of explosive gasoline.

Keep away from food, drink and animal feed. Incompatible with oxidizing agents. Incompatible with acids.

No decomposition if stored and applied as directed. Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Store only in containers approved and labeled for gasoline.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines

List	Components	CAS-No.	Type:	Value
OSHA	Benzene	71-43-2	TWA	1 ppm
		71-43-2	STEL	5 ppm
		71-43-2	OSHA_ACT	0.5 ppm
OSHA Z1	Xylene	1330-20-7	PEL	100 ppm 435 mg/m3
	Ethanol; Ethyl alcohol	64-17-5	PEL	1,000 ppm 1,900 mg/m3
	Naphthalene	91-20-3	PEL	10 ppm 50 mg/m3
	Cyclohexane	110-82-7	PEL	300 ppm 1,050 mg/m3
	Ethylbenzene	100-41-4	PEL	100 ppm 435 mg/m3
	Heptane [and isomers]	142-82-5	PEL	500 ppm 2,000 mg/m3
	N-hexane	110-54-3	PEL	500 ppm 1,800 mg/m3
ACGIH	Toluene	108-88-3	TWA	50 ppm
	Xylene	1330-20-7	TWA	100 ppm
		1330-20-7	STEL	150 ppm
	Ethanol; Ethyl alcohol	64-17-5	TWA	1,000 ppm
	Trimethylbenzene	25551-13-7	TWA	25 ppm
	Isopentane; 2-Methylbutane	78-78-4	TWA	600 ppm
	Naphthalene	91-20-3	TWA	10 ppm
		91-20-3	STEL	15 ppm
	Benzene	71-43-2	TWA	0.5 ppm
		71-43-2	STEL	2.5 ppm
	Pentane	109-66-0	TWA	600 ppm
	Cyclohexane	110-82-7	TWA	100 ppm
	Ethylbenzene	100-41-4	TWA	100 ppm
		100-41-4	STEL	125 ppm
	Heptane [and isomers]	142-82-5	TWA	400 ppm
		142-82-5	STEL	500 ppm

	N-hexane	110-54-3	TWA	50 ppm

Engineering measures : Use adequate ventilation to keep gas and vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces. Use only intrinsically safe electrical equipment approved for use in classified areas.

Eye protection : Safety glasses or goggles are recommended where there is a possibility of splashing or spraying. Ensure that eyewash stations and safety showers are close to the workstation location.

Hand protection : Gloves constructed of nitrile or neoprene are recommended. Consult manufacturer specifications for further information.

Skin and body protection : If needed to prevent skin contact, chemical protective clothing such as of DuPont TyChem®, Saranex or equivalent recommended based on degree of exposure. Flame resistant clothing such as Nomex ® is recommended in areas where material is stored or handled.

Respiratory protection : A NIOSH/ MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, ANSI Z88.2-1992, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection. Use a NIOSH/ MSHA-approved positive-pressure supplied-air respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

Work / Hygiene practices : Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance : Clear to straw colored liquid

Odor : Characteristic hydrocarbon-like

Odor threshold 0.5 - 1.1 ppm

pH : Not applicable

Melting point/freezing point About -101°C (-150°F)

Initial boiling point & range Boiling point varies: 30 – 200°C (85 – 392°F)

Flash point < -21°C (-5.8°F)

Evaporation rate : Higher initially and declining as lighter components evaporate

Flammability (solid, gas) : Flammable vapor released by liquid

Upper explosive limit	7.6 %(V)
Lower explosive limit	1.3 %(V)
Vapor pressure	345 - 1,034 hPa at 37.8 °C (100.0 °F)
Vapor density (air = 1)	Approximately 3 to 4
Relative density (water = 1)	0.8 g/mL
Solubility (in water)	Negligible
Partition coefficient (n-octanol/water)	2 – 7 as log Pow
Auto-ignition temperature	Approximately 250°C (480°F)
Decomposition temperature	Will evaporate or boil and possibly ignite before decomposition occurs.
Kinematic viscosity	0.64 to 0.88 mm²/s range reported for gasoline
Conductivity (conductivity can be reduced by environmental factors such as a decrease in temperature)	: Hydrocarbon liquids without static dissipater additive may have conductivity below 1 picoSiemens per meter (pS/m). The highest electro-static ignition risks are associated with "ultra-low conductivities" below 5 pS/m. See Section 7 for sources of information on defining safe loading and handling procedures for low conductivity products.

SECTION 10. STABILITY AND REACTIVITY

Reactivity	: Vapors may form explosive mixture with air. Hazardous polymerization does not occur.
Chemical stability	: Stable under normal conditions.
Possibility of hazardous reactions	Can react with strong oxidizing agents, peroxides, alkaline products and strong acids. Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.
Conditions to avoid	: Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources. Avoid static charge accumulation and discharge (see Section 7).
Hazardous decomposition products	: Ignition and burning can release carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

SECTION 11. TOXICOLOGICAL INFORMATION

Skin contact	: Irritating to skin. Can be partially absorbed through skin.
Eye contact	: Irritating to eyes.
Ingestion	: Aspiration hazard if liquid is inhaled into lungs, particularly from vomiting after ingestion. Aspiration may result in chemical pneumonia, severe lung damage, respiratory failure and even death. Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest and death may occur.

Inhalation and further information

Acute toxicity of benzene results primarily from depression of the central nervous system (CNS). Inhalation of concentrations over 50 ppm can produce headache, lassitude, weariness, dizziness, drowsiness, over excitation. Exposure to very high levels can result in unconsciousness and death.

Repeated over-exposure may cause liver and kidney injuries.
Components of the product may affect the nervous system.

IARC has determined that gasoline and gasoline exhaust are possibly carcinogenic in humans. Inhalation exposure to completely vaporized unleaded gasoline caused kidney cancers in male rats and liver tumors in female mice. The U.S. EPA has determined that the male kidney tumors are species-specific and are irrelevant for human health risk assessment. The significance of the tumors seen in female mice is not known. Exposure to light hydrocarbons in the same boiling range as this product has been associated in animal studies with effects to the central and peripheral nervous systems, liver, and kidneys. The significance of these animal models to predict similar human response to gasoline is uncertain.
This product contains benzene. Human health studies indicate that prolonged and/or repeated overexposure to benzene may cause damage to the blood-forming system (particularly bone marrow), and serious blood disorders such as aplastic anemia and leukemia. Benzene is listed as a human carcinogen by the NTP, IARC, OSHA and ACGIH.

Component:

Gasoline, natural; Low boiling point naphtha	8006-61-9	Acute oral toxicity: LD50 rat Dose: 18.8 mg/kg Acute inhalation toxicity: LC50 rat Dose: 20.7 mg/l Exposure time: 4 h Skin irritation: Classification: Irritating to skin. Result: Mild skin irritation Eye irritation: Classification: Irritating to eyes. Result: Moderate eye irritation
Toluene	108-88-3	Acute oral toxicity: LD50 rat Dose: 636 mg/kg Acute dermal toxicity: LD50 rabbit Dose: 12,124 mg/kg Acute inhalation toxicity: LC50 rat Dose: 49 mg/l Exposure time: 4 h Skin irritation: Classification: Irritating to skin. Result: Mild skin irritation Prolonged skin contact may defat the skin and produce dermatitis. Eye irritation: Classification: Irritating to eyes. Result: Mild eye irritation
Xylene	1330-20-7	Acute oral toxicity: LD50 rat Dose: 2,840 mg/kg Acute dermal toxicity: LD50 rabbit Dose: ca. 4,500 mg/kg Acute inhalation toxicity: LC50 rat Dose: 6,350 mg/l Exposure time: 4 h Skin irritation: Classification: Irritating to skin. Result: Mild skin irritation

		Repeated or prolonged exposure may cause skin irritation and dermatitis, due to degreasing properties of the product. Eye irritation: Classification: Irritating to eyes. Result: Mild eye irritation
Ethanol; Ethyl alcohol	64-17-5	Acute oral toxicity: LD50 rat Dose: 6,200 mg/kg Acute dermal toxicity: LD50 rabbit Dose: 19,999 mg/kg Acute inhalation toxicity: LC50 rat Dose: 8,001 mg/l Exposure time: 4 h Skin irritation: Classification: Irritating to skin. Result: Mild skin irritation Prolonged skin contact may cause skin irritation and/or dermatitis. Eye irritation: Classification: Irritating to eyes. Result: Mild eye irritation Mild eye irritation
Naphthalene	91-20-3	Acute oral toxicity: LD50 rat Dose: 2,001 mg/kg Acute dermal toxicity: LD50 rat Dose: 2,501 mg/kg Acute inhalation toxicity: LC50 rat Dose: 101 mg/l Exposure time: 4 h Skin irritation: Classification: Irritating to skin. Result: Mild skin irritation Eye irritation: Classification: Irritating to eyes. Result: Mild eye irritation Carcinogenicity: N11.00422130
Benzene	71-43-2	Acute oral toxicity: LD50 rat Dose: 930 mg/kg Acute inhalation toxicity: LC50 rat Dose: 44 mg/l Exposure time: 4 h Skin irritation: Classification: Irritating to skin. Result: Mild skin irritation Repeated or prolonged exposure may cause skin irritation and dermatitis, due to degreasing properties of the product. Eye irritation: Classification: Irritating to eyes. Result: Risk of serious damage to eyes.
Pentane	109-66-0	Acute oral toxicity: LD50 rat Dose: 2,001 mg/kg Acute inhalation toxicity: LC50 rat Dose: 364 mg/l Exposure time: 4 h Skin irritation: Repeated or prolonged exposure may cause skin irritation and dermatitis, due to degreasing properties of the product. Eye irritation: Classification: Irritating to eyes. Result: Mild eye irritation
Cyclohexane	110-82-7	Acute dermal toxicity: LD50 rabbit Dose: 2,001 mg/kg Acute inhalation toxicity: LC50 rat Dose: 14 mg/l Exposure time: 4 h

		Skin irritation: Classification: Irritating to skin. Result: Skin irritation Eye irritation: Classification: Irritating to eyes. Result: Mild eye irritation
Ethylbenzene	100-41-4	Acute oral toxicity: LD50 rat Dose: 3,500 mg/kg Acute dermal toxicity: LD50 rabbit Dose: 15,500 mg/kg Acute inhalation toxicity: LC50 rat Dose: 18 mg/l Exposure time: 4 h Skin irritation: Classification: Irritating to skin. Result: Mild skin irritation Eye irritation: Classification: Irritating to eyes. Result: Risk of serious damage to eyes.
Heptane [and isomers]	142-82-5	Acute oral toxicity: LD50 rat Dose: 15,001 mg/kg Acute inhalation toxicity: LC50 rat Dose: 103 g/m3 Exposure time: 4 h Skin irritation: Classification: Irritating to skin. Result: Skin irritation Repeated or prolonged exposure may cause skin irritation and dermatitis, due to degreasing properties of the product. Eye irritation: Classification: Irritating to eyes. Result: Mild eye irritation
N-hexane	110-54-3	Acute oral toxicity: LD50 rat Dose: 25,000 mg/kg Acute dermal toxicity: LD50 rabbit Dose: 2,001 mg/kg Acute inhalation toxicity: LC50 rat Dose: 171.6 mg/l Exposure time: 4 h Skin irritation: Classification: Irritating to skin. Result: Skin irritation Eye irritation: Classification: Irritating to eyes. Result: Mild eye irritation Teratogenicity: N11.00418960

Carcinogenicity

NTP	:	Naphthalene (CAS-No.: 91-20-3) Benzene (CAS-No.: 71-43-2)
IARC	:	Gasoline, natural; Low boiling point naphtha (CAS-No.: 8006-61-9) Naphthalene (CAS-No.: 91-20-3) Benzene (CAS-No.: 71-43-2) Ethylbenzene (CAS-No.: 100-41-4)
OSHA	:	Benzene (CAS-No.: 71-43-2)
CA Prop 65	:	WARNING! This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Toluene (CAS-No.: 108-88-3)

Benzene (CAS-No.: 71-43-2)

SECTION 12. ECOLOGICAL INFORMATION

Additional ecological information : Keep out of sewers, drainage areas, and waterways. Report spills and releases, as applicable, under Federal and State regulations.

Component:

Toluene	108-88-3	Toxicity to fish: LC50 Species: Carassius auratus (goldfish) Dose: 13 mg/l Exposure time: 96 h Acute and prolonged toxicity for aquatic invertebrates: EC50 Species: Daphnia magna (Water flea) Dose: 11.5 mg/l Exposure time: 48 h Toxicity to algae: IC50 Species: Selenastrum capricornutum (green algae) Dose: 12 mg/l Exposure time: 72 h
Ethanol; Ethyl alcohol	64-17-5	Toxicity to fish: LC50 Species: Leuciscus idus (Golden orfe) Dose: 8,140 mg/l Exposure time: 48 h Acute and prolonged toxicity for aquatic invertebrates: EC50 Species: Daphnia magna (Water flea) Dose: 9,268 - 14,221 mg/l Exposure time: 48 h
Isopentane; 2-Methylbutane	78-78-4	Toxicity to fish: LC50 Species: Oncorhynchus mykiss (rainbow trout) Dose: 3.1 mg/l Exposure time: 96 h Acute and prolonged toxicity for aquatic invertebrates: EC50 Species: Daphnia magna (Water flea) Dose: 2.3 mg/l Exposure time: 96 h
Naphthalene	91-20-3	Toxicity to algae: EC50 Species: Dose: 33 mg/l Exposure time: 24 h
Pentane	109-66-0	Acute and prolonged toxicity for aquatic invertebrates: EC50 Species: Daphnia magna (Water flea) Dose: 9.74 mg/l Exposure time: 48 h
Cyclohexane	110-82-7	Acute and prolonged toxicity for aquatic invertebrates: EC50 Species: Daphnia magna (Water flea) Dose: 3.78 mg/l Exposure time: 48 h

Heptane [and isomers]	142-82-5	Toxicity to fish: LC50 Species: Carassius auratus (goldfish) Dose: 4 mg/l Exposure time: 24 h Acute and prolonged toxicity for aquatic invertebrates: EC50 Species: Daphnia magna (Water flea) Dose: 1.5 mg/l Exposure time: 48 h
N-hexane	110-54-3	Toxicity to fish: LC50 Species: Pimephales promelas (fathead minnow) Dose: 2.5 mg/l Exposure time: 96 h Acute and prolonged toxicity for aquatic invertebrates: EC50 Species: Daphnia magna (Water flea) Dose: 2.1 mg/l Exposure time: 48 h

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal : Dispose of container and unused contents in accordance with federal, state and local requirements.

SECTION 14. TRANSPORT INFORMATION

CFR

Proper shipping name	: Petrol
UN-No.	: 1203
Class	: 3
Packing group	: II

TDG

Proper shipping name	: Gasoline
UN-No.	: UN1203
Class	: 3
Packing group	: II

IATA Cargo Transport

UN UN-No.	: UN1203
Description of the goods	: Gasoline
Class	: 3
Packaging group	: II
ICAO-Labels	: 3
Packing instruction (cargo aircraft)	: 364
Packing instruction (cargo aircraft)	: Y341

IATA Passenger Transport

UN UN-No.	: UN1203
Description of the goods	: Gasoline
Class	: 3

Packaging group	:	II
ICAO-Labels	:	3
Packing instruction (passenger aircraft)	:	353
Packing instruction (passenger aircraft)	:	Y341

IMDG-Code

UN-No.	:	UN 1203
Description of the goods	:	Gasoline
Class	:	3
Packaging group	:	II
IMDG-Labels	:	3
EmS Number	:	F-E S-E
Marine pollutant	:	No

SECTION 15. REGULATORY INFORMATION

OSHA Hazards : Flammable liquid
Highly toxic by ingestion
Moderate skin irritant
Severe eye irritant
Carcinogen

TSCA Status : On TSCA Inventory

DSL Status : . All components are on the Canadian DSL list.

SARA 311/312 Hazards : Fire Hazard
Acute Health Hazard
Chronic Health Hazard

CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIROMENT)
The CERCLA definition of hazardous substances contains a "petroleum exclusion" clause which exempts crude oil. Fractions of crude oil, and products (both finished and intermediate) from the crude oil refining process and any indigenous components of such from the CERCLA Section 103 reporting requirements. However, other federal reporting requirements, including SARA Section 304, as well as the Clean Water Act may still apply.

California Prop. 65 : WARNING! This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

Toluene	108-88-3
Benzene	71-43-2

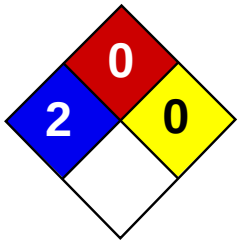
SECTION 16. OTHER INFORMATION

Further information

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.

Revision Date : 08/09/2012

6, 8, 10, 12, 14, 16, 64, 68, 91, 112, 306, 1092, 1106, 1500, 1570, 1571, 1651, 1652, 1654, 1700, 1701, 1702, 1710, 1711, 1714, 1726, 1729, 1730, 1732, 1733, 1826, 1848, 1880, 1950



Material Safety Data Sheet
Carbon tetrachloride MSDS

Section 1: Chemical Product and Company Identification

Product Name: Carbon tetrachloride

Catalog Codes:

CAS#: 56-23-5

RTECS: FG4900000

TSCA: TSCA 8(b) inventory: Carbon tetrachloride

CI#: Not available.

Synonym: Tetrachloromethane

Chemical Formula: CCl4

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Carbon tetrachloride	56-23-5	100

Toxicological Data on Ingredients: Carbon tetrachloride: ORAL (LD50): Acute: 2350 mg/kg [Rat]. 8263 mg/kg [Mouse]. 6380 mg/kg [Rabbit]. DERMAL (LD50): Acute: 15000 mg/kg [Rabbit]. 5070 mg/kg [Rat]. VAPOR (LC50): Acute: 8000 ppm 4 hour(s) [Rat]. 13471.8 ppm 4 hour(s) [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Extremely hazardous in case of ingestion, of inhalation. Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant).

Potential Chronic Health Effects:
Very hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation. CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified 2B (Possible for human.) by IARC. Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, lungs, the nervous system, liver, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged inhalation of vapors may lead to chronic respiratory irritation.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up Do not ingest. Do not breathe gas/fumes/ vapour/spray. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:
Carcinogenic, teratogenic or mutagenic materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 10 CEIL: 20 (ppm) TWA: 65 CEIL: 130 (mg/m3)Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 153.82 g/mole

Color: Not available.

pH (1% soln/water): Not available.

Boiling Point: 76.54°C (169.8°F)

Melting Point: -23°C (-9.4°F)

Critical Temperature: Not available.

Specific Gravity: 1.594 (Water = 1)

Vapor Pressure: 91.3 mm of Hg (@ 20°C)

Vapor Density: 5.3 (Air = 1)

Volatility: Not available.

Odor Threshold: 50 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2350 mg/kg [Rat]. Acute dermal toxicity (LD50): 5070 mg/kg [Rat]. Acute toxicity of the vapor (LC50): 8000 ppm 4 hour(s) [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified 2B (Possible for human.) by IARC. Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP. The substance is toxic to kidneys, lungs, the nervous system, liver, mucous membranes.

Other Toxic Effects on Humans:
Extremely hazardous in case of ingestion, of inhalation. Hazardous in case of skin contact (irritant, permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Embryotoxic and/or foetotoxic in animal. Detected in maternal milk in human.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Carbon Tetrachloride : UN1846 PG: II

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Carbon tetrachloride California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Carbon tetrachloride Pennsylvania RTK: Carbon tetrachloride Massachusetts RTK: Carbon tetrachloride TSCA 8(b) inventory: Carbon tetrachloride CERCLA: Hazardous substances.: Carbon tetrachloride

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R36/38- Irritating to eyes and skin. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:36 PM

Last Updated: 11/01/2010 12:00 PM

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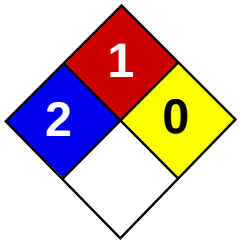

Material Safety Data Sheet
Trichloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Trichloroethylene

Catalog Codes: SLT3310, SLT2590

CAS#: 79-01-6

RTECS: KX4560000

TSCA: TSCA 8(b) inventory: Trichloroethylene

CI#: Not available.

Synonym:

Chemical Formula: C2HCl3

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Trichloroethylene	79-01-6	100

Toxicological Data on Ingredients: Trichloroethylene: ORAL (LD50): Acute: 5650 mg/kg [Rat]. 2402 mg/kg [Mouse]. DERMAL (LD50): Acute: 20001 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 420°C (788°F)

Flash Points: Not available.

Flammable Limits: LOWER: 8% UPPER: 10.5%

Products of Combustion: These products are carbon oxides (CO, CO2), halogenated compounds.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/

spray. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Carcinogenic, teratogenic or mutagenic materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 50 STEL: 200 (ppm) from ACGIH (TLV) TWA: 269 STEL: 1070 (mg/m3) from ACGIH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 131.39 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 86.7°C (188.1°F)

Melting Point: -87.1°C (-124.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.4649 (Water = 1)

Vapor Pressure: 58 mm of Hg (@ 20°C)

Vapor Density: 4.53 (Air = 1)

Volatility: Not available.

Odor Threshold: 20 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:
Easily soluble in methanol, diethyl ether, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity:
Extremely corrosive in presence of aluminum. Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 2402 mg/kg [Mouse]. Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Passes through the placental barrier in human. Detected in maternal milk in human.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Trichloroethylene : UN1710 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Trichloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Trichloroethylene Pennsylvania RTK: Trichloroethylene Florida: Trichloroethylene Minnesota: Trichloroethylene Massachusetts RTK: Trichloroethylene New Jersey: Trichloroethylene TSCA 8(b) inventory: Trichloroethylene CERCLA: Hazardous substances.: Trichloroethylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R36/38- Irritating to eyes and skin. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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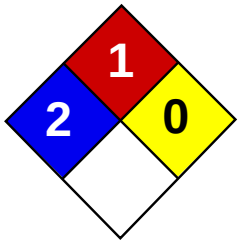

Health	2
Fire	1
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
1,1,1-Trichloroethane MSDS

Section 1: Chemical Product and Company Identification

Product Name: 1,1,1-Trichloroethane

Catalog Codes: SLT4180, SLT2167, SLT3460

CAS#: 71-55-6

RTECS: KJ2975000

TSCA: TSCA 8(b) inventory: 1,1,1-Trichloroethane

CI#: Not available.

Synonym:

Chemical Formula: CH3CCl3

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{1,1,1-}Trichloroethane	71-55-6	100

Toxicological Data on Ingredients: 1,1,1-Trichloroethane: ORAL (LD50): Acute: 9600 mg/kg [Rat]. 6000 mg/kg [Mouse]. DERMAL (LD50): Acute: 15800 mg/kg [Rabbit]. VAPOR (LC50): Acute: 18000 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of eye contact (irritant), of ingestion. Hazardous in case of skin contact (irritant, permeator), of inhalation. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs, the nervous system, liver, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 537°C (998.6°F)

Flash Points: Not available.

Flammable Limits: LOWER: 7.5% UPPER: 12.5%

Products of Combustion: These products are carbon oxides (CO, CO2), halogenated compounds.

Fire Hazards in Presence of Various Substances: Slightly flammable to flammable in presence of oxidizing materials, of acids, of alkalis.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive to explosive in presence of oxidizing materials, of acids, of alkalis.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 350 STEL: 440 CEIL: 440 (ppm) from ACGIH (TLV) [1995] TWA: 1900 STEL: 2460 CEIL: 2380 (mg/m3) from ACGIH [1995]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 133.41 g/mole

Color: Not available.

pH (1% soln/water): Not available.

Boiling Point: 74.1°C (165.4°F)

Melting Point: -32.5°C (-26.5°F)

Critical Temperature: Not available.

Specific Gravity: 1.3376 (Water = 1)

Vapor Pressure: 100 mm of Hg (@ 20°C)

Vapor Density: 4.6 (Air = 1)

Volatility: Not available.

Odor Threshold: 400 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 6000 mg/kg [Mouse]. Acute dermal toxicity (LD50): 15800 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 18000 ppm 4 hour(s) [Rat].

Chronic Effects on Humans: The substance is toxic to lungs, the nervous system, liver, mucous membranes.

Other Toxic Effects on Humans:
Very hazardous in case of ingestion. Hazardous in case of skin contact (irritant, permeator), of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Detected in maternal milk in human.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : 1,1,1-Trichloroethane : UN2831 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: 1,1,1-Trichloroethane Massachusetts RTK: 1,1,1-Trichloroethane TSCA 8(b) inventory: 1,1,1-Trichloroethane SARA 313 toxic chemical notification and release reporting: 1,1,1-Trichloroethane CERCLA: Hazardous substances.: 1,1,1-Trichloroethane

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC).

DSCL (EEC):
R38- Irritating to skin. R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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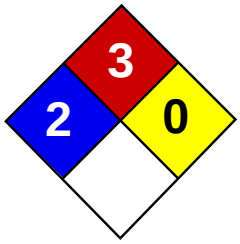

Material Safety Data Sheet
1,2-Dichloroethane MSDS

Section 1: Chemical Product and Company Identification

Product Name: 1,2-Dichloroethane

Catalog Codes: SLD2521, SLD3721

CAS#: 107-06-2

RTECS: KH9800000

TSCA: TSCA 8(b) inventory: 1,2-Dichloroethane

CI#: Not available.

Synonym: Ethylene dichloride

Chemical Formula: C2H4CL2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{1,2-}Dichloroethane	107-06-2	100

Toxicological Data on Ingredients: 1,2-Dichloroethane: ORAL (LD50): Acute: 670 mg/kg [Rat]. 413 mg/kg [Mouse]. DERMAL (LD50): Acute: 2800 mg/kg [Rabbit]. VAPOR (LC50): Acute: 1414.2 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Extremely hazardous in case of ingestion. Very hazardous in case of eye contact (irritant), of inhalation. Hazardous in case of skin contact (irritant). Corrosive to skin and eyes on contact. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:
Very hazardous in case of ingestion, of inhalation. CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified 2B (Possible for human.) by IARC. Classified 2 (Reasonably anticipated.) by NTP. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs, the nervous system, liver, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
If the chemical got onto the clothed portion of the body, remove the contaminated clothes as quickly as possible, protecting your own hands and body. Place the victim under a deluge shower. If the chemical got on the victim's exposed skin, such as the hands : Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 413°C (775.4°F)

Flash Points: CLOSED CUP: 13°C (55.4°F). OPEN CUP: 18°C (64.4°F).

Flammable Limits: LOWER: 6.2% UPPER: 15.6%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Flammable in presence of open flames and sparks. Slightly flammable to flammable in presence of oxidizing materials.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive to explosive in presence of oxidizing materials.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid. Corrosive liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep container dry. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Never add water to this product In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 10 CEIL: 75 (ppm) from ACGIH (TLV) TWA: 40 CEIL: 300 (mg/m3) from ACGIHConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 98.96 g/mole

Color: Not available.

pH (1% soln/water): Not available.

Boiling Point: 83.5°C (182.3°F)

Melting Point: -35.3°C (-31.5°F)

Critical Temperature: Not available.

Specific Gravity: 1.2351 (Water = 1)

Vapor Pressure: 61 mm of Hg (@ 20°C)

Vapor Density: 3.42 (Air = 1)

Volatility: Not available.

Odor Threshold: 26 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, n-octanol, acetone.

Solubility:
Easily soluble in methanol, diethyl ether, n-octanol, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 413 mg/kg [Mouse]. Acute dermal toxicity (LD50): 2800 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 1414.2 ppm 4 hour(s) [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified 2B (Possible for human.) by IARC. Classified 2 (Reasonably anticipated.) by NTP. The substance is toxic to lungs, the nervous system, liver, mucous membranes.

Other Toxic Effects on Humans:
Extremely hazardous in case of ingestion. Very hazardous in case of inhalation. Hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Passes through the placental barrier in animal. Excreted in maternal milk in human.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : Ethylene dichloride : UN1184 PG: II

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: 1,2-Dichloroethane California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: 1,2-Dichloroethane Pennsylvania RTK: 1,2-Dichloroethane Massachusetts RTK: 1,2-Dichloroethane TSCA 8(b) inventory: 1,2-Dichloroethane CERCLA: Hazardous substances.: 1,2-Dichloroethane

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):
R11- Highly flammable. R20/22- Harmful by inhalation and if swallowed. R38- Irritating to skin. R41- Risk of serious damage to eyes. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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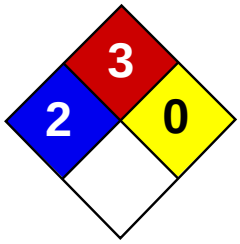

Material Safety Data Sheet
1,1-Dichloroethane MSDS

Section 1: Chemical Product and Company Identification

Product Name: 1,1-Dichloroethane

Catalog Codes: SLD3280

CAS#: 75-34-3

RTECS: KI0175000

TSCA: TSCA 8(b) inventory: 1,1-Dichloroethane

CI#: Not available.

Synonym:

Chemical Name: 1,1-Dichloroethane

Chemical Formula: C2-H4-Cl2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{1,1-}Dichloroethane	75-34-3	100

Toxicological Data on Ingredients: 1,1-Dichloroethane: ORAL (LD50): Acute: 725 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified 2 (Reasonably anticipated.) by NTP. A4 (Not classifiable for human or animal.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE]. The substance is toxic to kidneys, lungs, liver, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 458°C (856.4°F)

Flash Points: CLOSED CUP: -17°C (1.4°F). OPEN CUP: -6°C (21.2°F).

Flammable Limits: LOWER: 5.6% UPPER: 11.4%

Products of Combustion: These products are carbon oxides (CO, CO2), halogenated compounds.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes Keep away from incompatibles such as oxidizing agents, alkalis.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 100 STEL: 250 (ppm) from ACGIH (TLV) [1999] TWA: 100 (ppm) from OSHA (PEL) Australia: TWA: 200 (ppm) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Oily liquid.)

Odor: Chloroform like odor (Slight.)

Taste: Not available.

Molecular Weight: 98.96 g/mole

Color: Colorless.

pH (1% soln/water): Not available.

Boiling Point: 57.3°C (135.1°F)

Melting Point: -96.9°C (-142.4°F)

Critical Temperature: 261.5°C (502.7°F)

Specific Gravity: 1.175 (Water = 1)

Vapor Pressure: 180 mm of Hg (@ 20°C)

Vapor Density: 3.44 (Air = 1)

Volatility: Not available.

Odor Threshold: 120 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties:
Partially dispersed in diethyl ether. See solubility in water, diethyl ether.

Solubility: Partially soluble in diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents, alkalis.

Corrosivity: Corrosive in presence of aluminum.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Will attack some forms of plastic and rubber

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 725 mg/kg [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 2 (Reasonably anticipated.) by NTP. A4 (Not classifiable for human or animal.) by ACGIH. DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE]. The substance is toxic to kidneys, lungs, liver, central nervous system (CNS).

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification:
CLASS 3: Combustible liquid with a flash point greater than 37.8C (100F). Marine pollutant

Identification: : 1,1-Dichloroethane : UN2362 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65 (no significant risk level): 1,1-Dichloroethane California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: 1,1-Dichloroethane Rhode Island RTK hazardous substances: 1,1-Dichloroethane Pennsylvania RTK: 1,1-Dichloroethane Florida: 1,1-Dichloroethane Minnesota: 1,1-Dichloroethane Massachusetts RTK: 1,1-Dichloroethane New Jersey: 1,1-Dichloroethane New Jersey spill list: 1,1-Dichloroethane TSCA 8(b) inventory: 1,1-Dichloroethane TSCA 8(a) PAIR: 1,1-Dichloroethane TSCA 8(d) H and S data reporting: 1,1-Dichloroethane: June 1999 TSCA 12(b) one time export: 1,1-Dichloroethane SARA 313 toxic chemical notification and release reporting: 1,1-Dichloroethane: 1% CERCLA: Hazardous substances.: 1,1-Dichloroethane: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R11- Highly flammable. R22- Harmful if swallowed. R37/38- Irritating to respiratory system and skin. R41- Risk of serious damage to eyes. R52- Harmful to aquatic organisms.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Last Updated: 11/01/2010 12:00 PM

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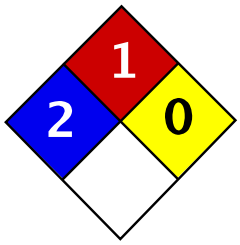

Health	2
Fire	1
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
1,1,1-Trichloroethane MSDS

Section 1: Chemical Product and Company Identification

Product Name: 1,1,1-Trichloroethane

Catalog Codes: SLT4180, SLT2167, SLT3460

CAS#: 71-55-6

RTECS: KJ2975000

TSCA: TSCA 8(b) inventory: 1,1,1-Trichloroethane

CI#: Not available.

Synonym:

Chemical Formula: CH3CCl3

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{1,1,1-}Trichloroethane	71-55-6	100

Toxicological Data on Ingredients: 1,1,1-Trichloroethane: ORAL (LD50): Acute: 9600 mg/kg [Rat]. 6000 mg/kg [Mouse]. DERMAL (LD50): Acute: 15800 mg/kg [Rabbit]. VAPOR (LC50): Acute: 18000 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of eye contact (irritant), of ingestion. Hazardous in case of skin contact (irritant, permeator), of inhalation. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to lungs, the nervous system, liver, mucous membranes.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 537°C (998.6°F)

Flash Points: Not available.

Flammable Limits: LOWER: 7.5% UPPER: 12.5%

Products of Combustion: These products are carbon oxides (CO, CO2), halogenated compounds.

Fire Hazards in Presence of Various Substances: Slightly flammable to flammable in presence of oxidizing materials, of acids, of alkalis.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.
Slightly explosive to explosive in presence of oxidizing materials, of acids, of alkalis.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 350 STEL: 440 CEIL: 440 (ppm) from ACGIH (TLV) [1995]
TWA: 1900 STEL: 2460 CEIL: 2380 (mg/m3) from ACGIH [1995]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 133.41 g/mole

Color: Not available.

pH (1% soln/water): Not available.

Boiling Point: 74.1°C (165.4°F)

Melting Point: -32.5°C (-26.5°F)

Critical Temperature: Not available.

Specific Gravity: 1.3376 (Water = 1)

Vapor Pressure: 100 mm of Hg (@ 20°C)

Vapor Density: 4.6 (Air = 1)

Volatility: Not available.

Odor Threshold: 400 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 6000 mg/kg [Mouse].
Acute dermal toxicity (LD50): 15800 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 18000 ppm 4 hour(s) [Rat].

Chronic Effects on Humans: The substance is toxic to lungs, the nervous system, liver, mucous membranes.

Other Toxic Effects on Humans:
Very hazardous in case of ingestion.
Hazardous in case of skin contact (irritant, permeator), of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Detected in maternal milk in human.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : 1,1,1-Trichloroethane : UN2831 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: 1,1,1-Trichloroethane
Massachusetts RTK: 1,1,1-Trichloroethane
TSCA 8(b) inventory: 1,1,1-Trichloroethane
SARA 313 toxic chemical notification and release reporting: 1,1,1-Trichloroethane
CERCLA: Hazardous substances.: 1,1,1-Trichloroethane

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC).

DSCL (EEC):
R38- Irritating to skin.
R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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TETRACHLOROETHENE, 0-663

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Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
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Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
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Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

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Section 1 - Product and Company Identification
TETRACHLOROETHENE, 0-663

Product Identification: TETRACHLOROETHENE, 0-663
Date of MSDS: 07/01/1988 **Technical Review Date:** 11/03/1994
FSC: 6810 **NIIN: LIIN:** 00N054677
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: CHEM SERVICE INC
Post Office Box: 3108
Manufacturer's Address1:
Manufacturer's Address2: WEST CHESTER, PA 19381
Manufacturer's Country: US

General Information Telephone: 215-692-3026
Emergency Telephone: 215-692-3026
Emergency Telephone: 215-692-3026
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: N
Published: Y
CAGE: 84898
Special Project Code: N

Contractor Information

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

Contractor Information

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

Section 2 - Compositon/Information on Ingredients
TETRACHLOROETHENE, 0-663

Ingredient Name: ETHYLENE, TETRACHLORO-; (TETRACHLOROETHYLENE) (SARA III)
Ingredient CAS Number: 127-18-4 **Ingredient CAS Code:** M
RTECS Number: KX3850000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K

% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: 25 PPM **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 25 PPM;100 PPM STEL **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 100 LBS
DOT Reporting Quantity: 100 LBS
Ozone Depleting Chemical: N

Ingredient Name: EYE PROTECTION: FULL LENGTH FACESHIELD (FP N).
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ING 2: ARRIVED. INGESTION: CALL MD IMMEDIATELY (FP N).
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:

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

Ingredient Name: SUPP DATA: RESPS. IF PATIENT IS IN CARD ARREST ADMIN CPR. CONTINUE LIFE SUPPORTING MEASURES UNTIL MED ASSIST HAS (ING 3)
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: 9999999ZZ **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Section 3 - Hazards Identification, Including Emergency Overview
TETRACHLOROETHENE, 0-663

Health Hazards Acute & Chronic: CONT LENSES SHOULD NOT BE WORN IN LAB. ALL CHEMS SHOULD BE CONSIDERED HAZ-AVOID DIRECT PHYS CONT! CAN BE HARMFUL IF ABSORB THRU SKIN. CAN BE HARMFUL IF INHALED. CAN BE FATAL IF ABSORB THRU SKIN! CAN B E FATAL IF

INHALED! MAY BE FATAL IF SWALLOWED! SUSPECTED CARCIN-MAY PRDCE CANCER. LACHRYMATOR-CAUSES (EFTS OF OVEREXP)

Signs & Symptoms of Overexposure:
HLTH HAZ: SEV EYE IRRIT. VAPS &/OR DIRECT EYE CONT CAN CAUSE SEV EYE BURNS. CAN CAUSE EYE IRRIT. VAPS &/OR DIRECT EYE CONT CAN CAUSE SEV EYE BURNS. CAN CAUSE EYE IRRIT. CAN CAUSE SKIN IRRIT. CAN CAUSE SKIN BURNS. CAN CAUSE SEV SKIN BURNS. CAN BE HARMFUL IF SWALLOWED. CAN CAUSE LIVER INJ. CAN CAUSE KIDNEY INJ. (SUPDAT)

Medical Conditions Aggravated by Exposure:
NONE SPECIFIED BY MANUFACTURER.

LD50 LC50 Mixture: LD50 (ORAL,RAT): 8850 MG/KG.
Route of Entry Indicators:
Inhalation: YES
Skin: YES
Ingestion: YES
Carcenogenicity Indicators
NTP: YES
IARC: YES
OSHA: NO
Carcinogenicity Explanation: TETRACHLOROETHYLENE: IARC MONOGRAPHS SUPP, VOL 7, PG 355, 1987: GRP 2B. NTP 7TH ANNUAL REPORT ON CARCINS, 1994: (SUPDAT)

Section 4 - First Aid Measures
TETRACHLOROETHENE, 0-663

First Aid:
AN ANTIDOTE IS SUBSTANCE INTENDED TO COUNTERACT EFT OF POIS. IT SHOULD BE ADMIN ONLY BY PHYS/TRAINED EMER PERS. MED ADVICE CAN BE OBTAINED FROM POIS CNTRL CNTR. EYE: FLUSH CONTINUOUSLY W/WATER FOR AT LST 15-20 MINS. SKIN: FLUSH W/WATER FOR15-20 MINS. IF NO BURNS HAVE OCCURRED-USE SOAP & WATER TO CLEANSE SKIN. INHAL: REMOVE PATIENT TO FRESH AIR. ADMIN OXYGEN IF PATIENT IS HAVING DFCLTY (SUPDAT)

Section 5 - Fire Fighting Measures
TETRACHLOROETHENE, 0-663

Fire Fighting Procedures:
WEAR NIOSH/MSHA APPROVED SCBA AND FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire or Explosion Hazard:
NONE SPECIFIED BY MANUFACTURER.

Extinguishing Media:
CARBON DIOXIDE, DRY CHEMICAL POWDER OR SPRAY.
Flash Point: Flash Point Text: NON-FLAMMABLE
Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): N/A
Upper Limit(s): N/A

Section 6 - Accidental Release Measures
TETRACHLOROETHENE, 0-663

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

Section 7 - Handling and Storage
TETRACHLOROETHENE, 0-663

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
TETRACHLOROETHENE, 0-663

Repiratory Protection:
WEAR NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN (FP N).
Ventilation:
CHEMICAL SHOULD BE HANDLED ONLY IN HOOD.
Protective Gloves:
IMPERVIOUS GLOVES (FP N).
Eye Protection: ANSI APPRVD CHEM WORKERS GOGG & (ING 4)
Other Protective Equipment: USE APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.EMER EYEWASH & DELUGE SHOWER WHICH MEET ANSI DESIGN CRITERIA (FP N).
Work Hygenic Practices: NONE SPECIFIED BY MANUFACTURER.
Supplemental Health & Safety Information: EXPLAN OF CARCIN: ANTIC TO BE CARCIN. ANIMAL: LIVER TUMORS. EFTS OF OVEREXP: CAN BE IRRIT TO MUC MEMB. PRLNGD EXPOS MAY CAUSE NAUS/HDCH, DIZZ &/OR EYE DMG. AVOID CONSUMPTION OF ALCOHOL BEFORE & AFTER HNDLG OF CMPD BECAUSE IT WILL INCR TOX OF CMPD. FIRST AID PROC: BRTHG. IF PATIENT HAS STOPPED BRTHG ADMIN ARTF (ING 2)

Section 9 - Physical & Chemical Properties
TETRACHLOROETHENE, 0-663

HCC:
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 250F,121C
Melting/Freezing Point: Melting/Freezing Text: 71.6F,22C
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: 14 @ 20C **Vapor Density:** N/A
Percent Volatile Organic Content:
Specific Gravity: 1.623
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: NOT APPLICABLE
Solubility in Water: INSOLUBLE
Appearance and Odor: COLORLESS LIQUID.
Percent Volatiles by Volume: N/K
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
TETRACHLOROETHENE, 0-663

Stability Indicator: YES
Materials to Avoid:
STRONG BASES, OXIDIZING AGENTS.
Stability Condition to Avoid:
NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products:
DECOMPOSITION LIBERATES TOXIC FUMES. DECOMPOSITION PRODUCTS ARE CORROSIVE.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT.

Section 11 - Toxicological Information
TETRACHLOROETHENE, 0-663

Toxicological Information:
N/P

Section 12 - Ecological Information
TETRACHLOROETHENE, 0-663

Ecological Information:
N/P

Section 13 - Disposal Considerations
TETRACHLOROETHENE, 0-663

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

Section 14 - MSDS Transport Information
TETRACHLOROETHENE, 0-663

Transport Information:
N/P

Section 15 - Regulatory Information
TETRACHLOROETHENE, 0-663

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

Section 16 - Other Information
TETRACHLOROETHENE, 0-663

Other Information:
N/P

HAZCOM Label Information

Product Identification: TETRACHLOROETHENE, 0-663
CAGE: 84898
Assigned Individual: N
Company Name: CHEM SERVICE INC
Company PO Box: 3108
Company Street Address1: N/K
Company Street Address2: WEST CHESTER, PA 19381 US
Health Emergency Telephone: 215-692-3026
Label Required Indicator: Y
Date Label Reviewed: 11/03/1994
Status Code: C
Manufacturer's Label Number:
Date of Label: 11/03/1994

Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: WARNING
Health Hazard: Moderate
Contact Hazard: Moderate
Fire Hazard: None
Reactivity Hazard: None

MATERIAL SAFETY DATA SHEET

SRM Supplier: National Institute of Standards and Technology
Standard Reference Materials Group
100 Bureau Drive, Mail Stop 2321
Gaithersburg, Maryland 20899

SRM Number: 1867a
MSDS Number: 1867a
SRM Name: Uncommon Commercial Asbestos
Date of Issue: 12 March 2003

MSDS Coordinator: Carmen S. Davis
Phone: (301) 975-6776
ChemTrec: 1-800-424-9300

FAX: (301) 926-4751
E-mail: SRMMSDS@nist.gov

SECTION I. MATERIAL IDENTIFICATION

Material Name: Uncommon Commercial Asbestos

Description: This standard reference material (SRM) is comprised of three uncommon commercial asbestos materials (tremolite asbestos, actinolite asbestos, and anthophyllite asbestos. Each unit of SRM 1867a consists of a set of three bottles, each containing several grams of one of the three mine-grade asbestos materials.

Other Designations: **Actinolite** (actinolite asbestos)

Anthophyllite (azbolen asbestos; anthophylite asbestos)

Tremolite (tremolite asbestos)

Chemical Name	Chemical Formula	CAS Registry Number
Actinolite	Not Available	77536-66-4
Anthophyllite	$(MgFe)_7Si_8O_{22}(OH)_2$ (idealized molecule)	77536-67-5
Tremolite	$Ca_2Mg_5Si_8O_{22}(OH)_2$ (idealized molecuke)	77536-68-6

DOT Classification: Miscellaneous (Class 9) Asbestos
ID #: NA 2212

Manufacturer/Supplier: Available from a number of suppliers

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Components	Nominal Concentration (%)	Exposure Limits and Toxicity Data
Actinolite	100	ACGIH TWA: 0.1 fibers/cc
		OSHA TWA: 0.1 fibers/cc
		Rat, Intraperitonral: TD_{LO}: 50 mg/kg (tumorigenic)
Anthophyllite	100	ACGIH TWA: 0.1 fibers/cc
		OSHA TWA: 0.1 fibers/cc
		Rat, Intraperitonral: TD_{LO}: 250 mg/kg (tumorigenic)
Tremolite	100	ACGIH TWA: 0.1 fibers/cc
		OSHA TWA: 0.1 fibers/cc
		Rat, Intrapleural: TD_{LO}: 100 mg/kg (tumorigenic)

SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Actinolite	Anthophyllite	Tremolite
Appearance and Odor: white to green; odorless	**Appearance and Odor:** tan; odorless	**Appearance and Odor:** white to pale green; odorless
Relative Molecular Mass: complex molecule	**Relative Molecular Mass:** complex molecule	**Relative Molecular Mass:** complex molecule
Specific Gravity (water=1): 3.0 to 3.2	**Specific Gravity (water=1):** 2.9 to 3.2	**Specific Gravity (water=1):** 2.9 to 3.2
Vapor Density: not applicable	**Vapor Density:** not applicable	**Vapor Density:** not applicable
Vapor Pressure: not applicable	**Vapor Pressure:** not applicable	**Vapor Pressure:** not applicable
Melting Point: not applicable	**Melting Point:** decomposes	**Melting Point:** not applicable
Boiling Point: not applicable	**Boiling Point:** not applicable	**Boiling Point:** not applicable
Viscosity: not applicable	**Viscosity:** not applicable	**Viscosity:** not applicable
Water Solubility: insoluble	**Water Solubility:** insoluble	**Water Solubility**: insoluble
Solvent Solubility: insoluble in organic solvents	**Solvent Solubility: insoluble** in organic solvents	**Solvent Solubility: insoluble** in organic solvents

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Asbestos
Flash Point: Not applicable **Method Used:** Not applicable **Autoignition Temperature:** Not applicable

Flammability Limits in Air (Volume %): **UPPER:** Not applicable
LOWER: Not applicable

Unusual Fire and Explosion Hazards: Asbestos materials are negligible fire hazards.

Extinguishing Media: Use extinguishing media that is appropriate to the surrounding fire.

Special Fire Procedures: Fire fighters should wear full protective clothing and self-contained breathing apparatus when this material is involved in a fire.

SECTION V. REACTIVITY DATA

Stability: **X** **Stable** _____ **Unstable**

Conditions to Avoid: Avoid temperatures in excess of 600 °C.

Incompatibility (Materials to Avoid): Asbestos materials are incompatible with acids and bases.

See Section IV: *Fire and Explosion Hazard Data*

Hazardous Decomposition or Byproducts: Thermal decomposition of asbestos may release toxic and/or hazardous gases.

Hazardous Polymerization _____ **Will Occur** **X** **Will Not Occur**

SECTION VI. HEALTH HAZARD DATA

Route of Entry: X **Inhalation** X **Skin** X **Ingestion**

Actinolite, Anthopyllite, Tremolite Asbestos: Exposure to asbestos dusts may be irritating, producing a severe cough and chest pain. Animal studies indicate that lung tumors or mesotheliomas have occurred with exposure as short as one day. Repeated or prolonged exposure may cause asbestosis, an intetrstitial fibrosis of the lung tissue, which may develop fully within four to nine years; however, onset is typically delayed 20 years to 40 years after the initial exposure. Fatal exposures may be as brief as 3 months during childhood. The initial symptom is a progressive exerttional dyspnea, followed by dry cough and expectoration, chest pain, decreased vital capacity, tachypnea, persistent dry rales, cyanosis, anorexia, malaise, weakness, backache, weight loss, and cor pulmonale. In some cases, clubbing of the fingers and toes has been reported. Secondary lung infections may also occur. Radiologic studies may show a diffuse increase in lung density, pleural plaques, and pleural calcification. Death from asbestosis may be due to respiratory or cardiac failure. Asbestos workers show an increase in pleural and peritoneal mesothelimoas, bronchogenic carcinoma, lung cancer, cancers of the gastrointestinal tract including the esophagus, stomach, colon, and rectum, and also cancer of the larynx. Mesothelial tumors are characterized by bloody effusion with pain, dyspnea, cough, swelling, weight loss, fatigue, hypoatremia, and death due to pulmonary insufficiency. The latent period for mesothelioma is 3.5 years to 40 years; for lung cancer it is 15 years to 30 years. Smoking enhances the risk of lung cancer. Some studies indicate that lymposarcoma and malignant lympoma, renal cancer, and an increased incidence of ovarian cancer may be associated with exposure to asbestos. In addition, cancers of the liver and mammary glands have been reported in rats.

Skin and/or eye contact with asbestos may cause irritation. Asbestos fibers may penetrate the skin and result in asbestos corns, due to the thickening of the skin around the implanted fiber. These usually occur on the hands and forearms. These corns do not lead to skin tumors and are of minor health significance. They disappear on removal of the fibers.

Ingestion of asbestos may cause gastrointestinal irritation. Repeated or prolonged ingestion of asbestos fibers may be involved in cancers of the buccal cavity and pharynx, esophagus, stomach, colon, and rectum. Ingestion of asbestos-contaminated rice has been suggested as the cause for a high incidence of stomach cancer in Japan.

Medical Conditions Generally Aggravated by Exposure: Not Available

Listed as a Carcinogen/Potential Carcinogen (Actinolite, Anthopyllite, Tremolite Asbestos):

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	X	
In the International Agency for Research on Cancer (IARC) Monographs	X	
By the Occupational Safety and Health Administration (OSHA)	X	

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with copious amounts of water for at least 15 minutes while removing contaminated clothing. Obtain medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Obtain medical assistance if necessary.

Inhalation: Immediately remove victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. Lay victim with head and chest lower than hips to improve drainage of fluids from the lungs. Obtain medical assistance.

Ingestion: If ingested, wash out mouth with water. Obtain medical assistance immediately.

TARGET ORGAN(S) OF ATTACK: upper respiratory tract (URT) and gastrointestinal tract

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material Is Released: Notify safety personnel of major spills and/or leaks. Evacuate nonessential personnel. Collect material and place into containers for disposal.

Waste Disposal: Follow all federal, state, and local laws governing disposal.

Handling and Storage: Persons handling this material must wear protective eyewear, clothing, and gloves to prevent contact with this material.

> **NOTE:** Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the laboratory.

Store in well ventilated areas.

SECTION VIII. SOURCE DATA/OTHER COMMENTS

Source: MDL Information Systems, Inc., MSDS *Actinolite*, 11 December 2001.
MDL Information Systems, Inc., MSDS *Anthophyllite*, 11 December 2001.
MDL Information Systems, Inc., MSDS *Tremolite*, 11 December 2001.
SRMP, MSDS *Bulk Asbestos (Uncommon)*, August 1993.
Merck Index, 11th Ed., 1989.
The Sigma Aldrich Library of Chemical Safety Data, Ed. II, 1988.

Disclaimer: Physical and chemical data contained in this MSDS are provided for use in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references, however NIST does not certify the data on the MSDS. The certified values for this material are given only on the NIST Certificate of Analysis.

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

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

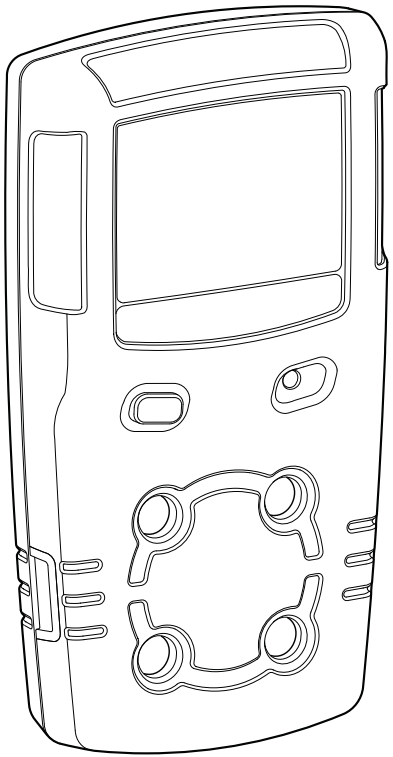
EXPOSED EMPLOYEE MEDICAL RELEASE:

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

SAFETY EQUIPMENT USER MANUAL



GasAlert MicroClip XT

GasAlert MicroClip XL

GasAlert MicroClip X3

1, 2, 3, and 4 Gas Detector

User Manual

BW Technologies
by Honeywell

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Introduction

⚠ Warning

To ensure personal safety, read Safety Information - Read First and the Cautions before using the detector.

The GasAlertMicroClip XT, XL and X3 ("the detector") warns of hazardous gas at levels above user-defined alarm setpoints.

The detector is a personal safety device. It is your responsibility to respond properly to the alarm.

Table 1. lists the gases monitored.

Zeroing the Sensors

To zero the sensors, refer to steps #1-3 in Connecting to the IR Link.

Table 1. Gases Monitored

Gas Detected	Unit of Measure
Hydrogen sulfide (H_2S)	parts per million (ppm)
Carbon monoxide (CO)	parts per million (ppm)
Oxygen (O_2)	percent by volume (%)
Combustible gases (LEL) Field selectable for:	1. percent of lower explosive limit (% LEL) 2. percent by volume methane 0-5.0% v/v

Contacting BW Technologies by Honeywell

To contact BW Technologies by Honeywell, call

USA: 1-888-749-8878
Canada: 1-800-663-4164
Europe: 00800-333-22244
Other countries: +1-403-248-9226

Address correspondence to

BW Technologies by Honeywell
Suite 110 4411-6 Street SE
Calgary Alberta
Canada, T2G 4E8

Email: info@gasmonitors.com

BW Technologies by Honeywell's website: www.honeywellanalytics.com

ISO 9001

Safety Information - Read First

Use the detector only as specified in this guide and the operator's manual, otherwise the protection provided by the detector may be impaired.

International symbols on the detector and in this manual are explained in Table 2.

Read the **Cautions** on the following pages before using the detector.

Warning

This instrument contains a lithium polymer battery. Dispose of lithium cells immediately. Do not disassemble and do not dispose of in fire. Do not mix with the solid waste stream. Spent batteries must be disposed of by a qualified recycler or hazardous materials handler.

⚠ Cautions

- ***Warning:*** **Substitution of components may impair Intrinsic Safety.**
- **Before using the detector, refer to Sensor Poisons and Contaminants.**
- ***Warning:*** **For safety reasons, this equipment must be operated and serviced by qualified personnel only. Read and understand the user manual completely before operating or servicing.**
- **Do not use the detector if it is damaged. Inspect the detector before using. Look for cracks and/or missing parts.**
- **If the detector is damaged or parts are missing, contact BW Technologies by Honeywell immediately.**
- **Only use sensor(s) that are specifically designed for the GasAlertMicroClip. Refer to Replacement Parts and Accessories.**

- **Calibrate the detector before first-time use and then on a regular schedule, depending on use and sensor exposure to poisons and contaminants. BW recommends calibrating at least once every 180 days (6 months).**
- **BW recommends to "bump test" the sensors before each day's use to confirm their ability to respond to gas by exposing the detector to a gas concentration that exceeds the alarm setpoints. Manually verify that the audible and visual alarms are activated. Calibrate if the readings are not within the specified limits.**
- **BW recommends the combustible sensor be checked with a known concentration of calibration gas after any known exposure to catalyst contaminants/poisons (sulfur compounds, silicon vapors, halogenated compounds, etc).**
- **The combustible sensor is factory calibrated to 50% LEL methane. If monitoring a different combustible gas in the % LEL range, calibrate the sensor using the appropriate gas.**
- **Caution: High off-scale readings may indicate an explosive concentration.**
- **Only the combustible gas detection portion of this instrument has been assessed for performance by CSA International.**
- **Protect the combustible sensor from exposure to lead compounds, silicones, and chlorinated hydrocarbons.**
- **Sensor exposure to certain organic vapors (such as leaded gasoline and halogenated hydrocarbons) may temporarily inhibit sensor performance. After exposure, a bump test or calibration is recommended.**
- **For use only in potentially explosive atmospheres where oxygen concentrations do not exceed 20.9% (v/v).**
- **Any rapid up-scaling reading followed by a declining or erratic reading may indicate a gas concentration beyond upper scale limit, which may be hazardous.**
- **Only calibrate the detector in a fresh air environment and in a safe area.**
- **Use only BW approved batteries for the GasAlertMicroClip detector. Refer to Specifications.**
- **Charge the detector before first-time use. BW recommends the detector be charged after every workday.**
- **Charge the detector using the recommended charging adapter only. Do not use any other charging adapter. Failure to adhere to this caution can lead to fire and/or explosion.**
- **Extended exposure of the detector to certain concentrations of combustible gases and air may stress a detector element that can seriously affect its performance. If an alarm occurs due to high concentration of combustible gases, calibrate the detector. If necessary, replace the sensor.**
- **Do not test the combustible sensor's response with a butane cigarette lighter; doing so will damage the sensor.**
- **Do not expose the detector to electrical shock and/or severe continuous mechanical shock.**
- **Do not attempt to disassemble, adjust, or service the detector unless instructions for that procedure are provided in the technical reference guide, and/or that part is listed as a replacement part. Use only BW Technologies by Honeywell replacement parts. Refer to Replacement Parts and Accessories.**
- **The detector warranty will be voided if customers, personnel, or third parties damage the detector during repair attempts. Non-BW Technologies by Honeywell repair/service attempts void this warranty.**

Table 2. International Symbols

Symbols	Description
	Approved to both U.S. and Canadian Standards by CSA International
	European Explosive Protection
CE	Conforms to European Union Directives
ATEX	Conforms to European ATEX Directives
IECEx	International Electrotechnical Commission Scheme for Certification to Standards for Electrical Equipment for Explosive Atmospheres
	Conforms to Korea Testing Laboratory (KTL) Certification
	Natural Institute of Metrology, Quality, and Technology. Conforms to Brazilian INMETRO Certification.
	Australian Regulatory Compliance Mark

Sensor Poisons and Contaminants

Several cleaners, solvents, and lubricants can contaminate and cause permanent damage to sensors. Before using cleaners, solvents, and lubricants in close proximity to the detector sensors, read the following cautions and refer to the lists below.

⚠ Caution

Use only the following BW Technologies by Honeywell recommended products and procedures:

- **Use water based cleaners.**
- **Use non-alcohol based cleaners.**
- **Clean the exterior of the detector with a soft, damp cloth.**
- **Do not use soaps, polishes, or solvents.**

Below are common products to avoid using around sensors.

Cleaners and Lubricants

- Brake cleaners
- Lubricants
- Rust inhibitors
- Window and glass cleaners
- Dishsoaps
- Citrus based cleaners
- Alcohol based cleaners
- Hand sanitizers
- Anionic detergents
- Methanol (fuels and antifreezes)

Silicones

- Silicone cleaners and protectants
- Silicone based adhesives, sealants, and gels
- Hand/body and medicinal creams containing silicone
- Tissues containing silicone
- Mold releasing agents
- Polishes

Aerosols

- Bug repellents and sprays
- Lubricants
- Rust inhibitors
- Window cleaners

Getting Started

The list below provides the standard items included with the detector. If the detector is damaged or parts are missing, contact the place of purchase immediately.

- Sensors: H_2S, CO, O_2, and combustible (LEL)
- Calibration cap and hose
- Charging adapter
- Printed Operator‘s Manual
- Supplementary Booklet, including a Quick Reference Card
- CD-ROM, including translated operator‘s manuals

Configuration Software: The detector is configured with Fleet Manager II software. It can be downloaded for free from BW Technologies by Honeywell website: www.gasmonitors.com.

Fleet Manager II CD-ROM is shipped with the MicroDock II base station and IR Link kit.

The detector is shipped with the sensors and rechargeable battery installed.

Battery Replacement: To replace the battery, contact BW Technologies by Honeywell. The battery can only be replaced by the manufacturer.

Charge Battery and Replace Sensors: To charge the battery and replace the sensors and/or sensor filter, refer to the following:

- Battery Cautions
- Replacing a Sensor or Sensor Filter

To order replacement parts, refer to Replacement Parts and Accessories.

To become oriented with the features and functions of the detector, refer to the following figures and tables:

- Figure 1. and Table 3. describes the detector’s components.
- Figure 2. and Table 4. describes the detector’s display elements.
- Table 5. describes the detector’s pushbutton.

Parts of the GasAlertMicroClip

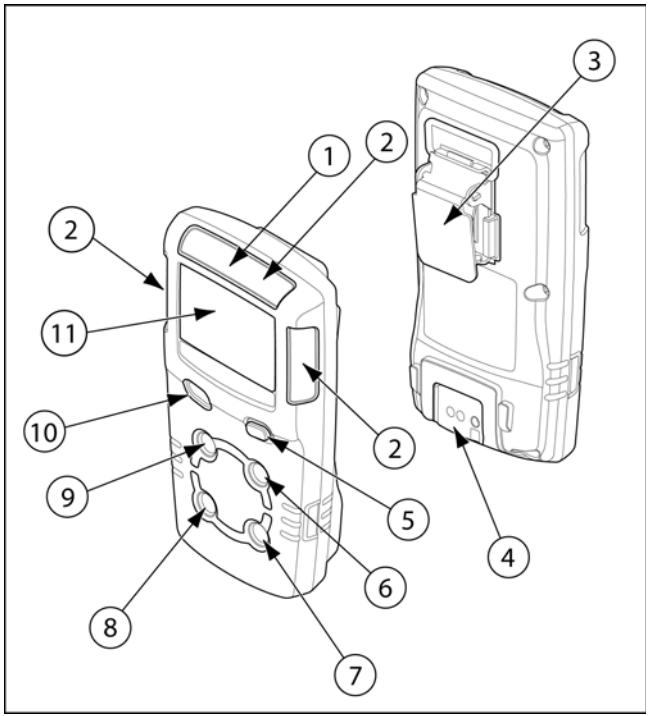


Figure 1. Parts of the GasAlertMicroClip

Table 3. Parts of the GasAlertMicroClip

Item	Description
1	IntelliFlash
2	Visual alarm indicators (LEDs)
3	Alligator clip
4	Charging connector / IR interface
5	Pushbutton (◯)
6	Carbon monoxide (CO) sensor
7	Hydrogen sulfide (H_2S) sensor
8	Oxygen (O_2) sensor
9	Combustible (LEL) sensor
10	Audible alarm
11	Liquid crystal display (LCD)

Display Elements

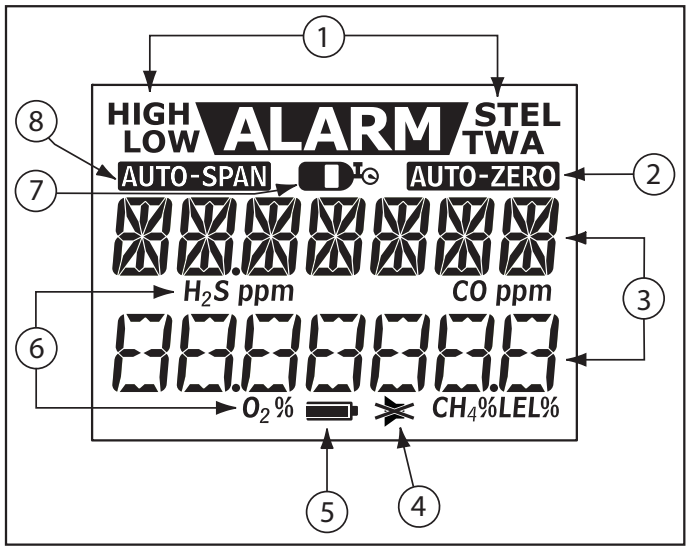


Figure 2. Display Elements

Table 4. Display Elements

Item	Description
1	Alarm condition
2	Automatically zero sensor
3	Numeric value
4	Stealth mode
5	Battery life indicator
6	Gas identifier bars
7	Gas cylinder
8	Automatically span sensor

Pushbutton

Table 5. Pushbutton

Pushbutton	Description
	• To activate the detector press ◯. • To deactivate the detector, press and hold ◯ until the **OFF** countdown is complete and the LCD deactivates. • To view the TWA, STEL, and peak (maximum) readings, press ◯ twice. To clear the TWA, STEL, and peak readings, press ◯ when the LCD displays **RESET**. • To initiate calibration, deactivate the detector. Press and hold ◯ while the detector performs the **OFF** countdown. Continue holding ◯ while the LCD briefly deactivates. The LCD reactivates and then begins the **CAL** countdown. Release ◯ when the **CAL** countdown is complete. • To activate the backlight in normal operation, press ◯. • To acknowledge latched alarms, press ◯. • To acknowledge a low alarm and disable the audible alarm, press ◯ (if the **Low Alarm Acknowledge** option is enabled).

Activating the Detector

⚠ Caution

Only activate the detector in a fresh air environment and in a safe area.

To activate the detector, press ◯.

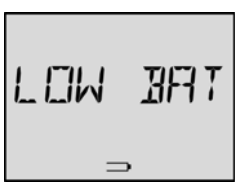
Self-Test

The following startup tests are written as startup performance is intended. If an error occurs, refer to Startup Troubleshooting.

When the detector is activated, it performs several startup tests. Confirm the following tests occur.

Battery Test

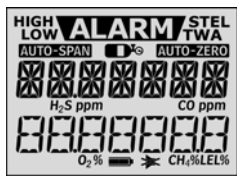
The detector performs a battery test during startup. If the battery has insufficient power to operate, the following screen displays.



Charge the battery for 2-3 hours before restarting the detector. Refer to Charging the Battery.

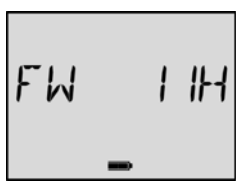
Audible/Visual Test

1. All of the LCD elements display simultaneously as the detector beeps, flashes, vibrates, and activates the backlight.



Detector Version

2. The current firmware version of the detector then displays on the LCD.



Startup Message

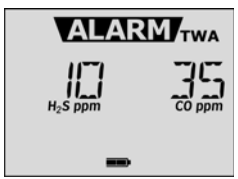
3. If data is entered in the **Startup Message** option (25 characters maximum) of Fleet Manager II, that data will display during the startup self-test. To enter a startup message, refer to Detector Identification or the *Fleet Manager II Operator's Manual*.

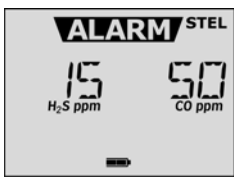
Alarm Setpoints

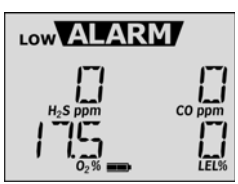
4. Next, the TWA, STEL, low, and high alarm setpoints display.

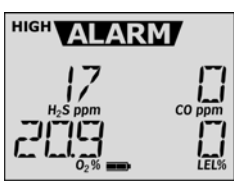
Note

Alarm setpoints may vary by region. Refer to Factory Gas Alarm Setpoints.









Sensor and Power Test

5. The detector then tests the sensors.

After testing the sensors, the following screen displays to verify all sensors have passed.

If an error message displays, refer to Startup Troubleshooting.

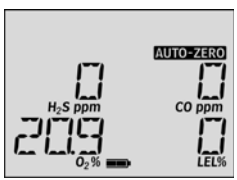
Note

The sensors are tested continuously while the detector is activated.

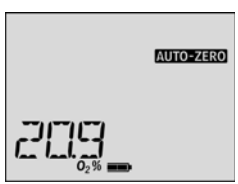
Automatic Zero and O_2 Calibration (optional)

6. **Auto-Zero on Startup:** If enabled, the H_2S, CO, and LEL sensors are automatically zeroed during startup. Each sensor is enabled individually. The auto-zero option is enabled for each sensor upon shipment.

   O_2 Auto-Calibration on Startup: If enabled, the O_2 sensor is automatically calibrated during startup. The auto-calibration option is enabled for the O_2 sensor upon shipment.



If the **O_2 Auto-Calibration on Startup** option is enabled, and the **Auto-Zero on Startup** option is disabled for all sensors, the following screen displays.



Note

If oxygen is configured to measure 20.8% vol., the oxygen calibration screen displays **20.8% O_2**.

Calibration Due Date (optional)

7. The following screen displays the number of days remaining before calibration is due. The number of days that displays is when the next sensor calibration should be performed.

Note

If the **Calibration Interval** *option is defined as* **0**, *the calibration due date is bypassed during startup.*

Last Calibration Failed (optional)

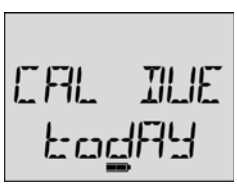
If any sensor failed the last calibration, **CAL FAILURE** displays on the screen.

Note

When the CAL FAILURE displays, the previous calibration has failed but the calibration is still valid until the next calibration due date.

Overdue Calibration

If any sensor is past due for calibration, the detector beeps, flashes, vibrates, and the following screen displays.



If calibration is overdue and the **Force Calibration When Overdue** option is enabled, a calibration must be performed to enter normal operation. Refer to Calibration.

Note

If calibration is not performed, or ◯ is not pressed within 2 minutes, the detector automatically deactivates.

If the **Force Calibration When Overdue** is disabled, press ◯ to acknowledge the warning. The detector continues with the startup self-tests and then enters normal operation.

Cal IR Lock

If the **Cal Lock** option is enabled, the following screen displays.

Refer to Startup Troubleshooting.

Bump Test

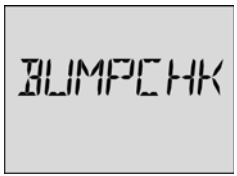
Note

A bump test cannot be conducted if the detector has just been calibrated. If the Bump Interval option is defined as **0** *in Fleet Manager II, the bump test is bypassed.*

BW recommends to "bump test" the sensors, before each day's use, to confirm their ability to respond to gas by exposing the detector to a gas concentration that exceeds the alarm setpoints.

Last Bump Test Failed

If any sensor failed the last calibration, **CAL FAILURE** displays on the screen.



Note

When the **BUMPCHK FAILURE** *displays, the previous calibration has failed but the calibration is still valid until the next bump test due date.*

Force Bump (optional)

8. If the **Force Bump** option is enabled and the sensors are due have a bump test, the following screen displays.

A bump test must be performed to enter normal operation. Apply gas to the sensors. Ensure the visual, audible, and vibrator alarms activate. When the gas is removed, the detector briefly remains in alarm until the gas has cleared from the sensors.

When the sensors successfully pass the bump check, the following screen displays showing the number of days remaining until the next bump check is due (**I d** = 1 day).

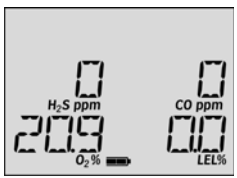
If **Force Bump** is disabled, press ◯ to continue with the startup self-tests.

Note

If **BUMPCHK todAY** *displays again after performing a bump check, refer to Startup Troubleshooting.*

Self-Test Pass

When the detector has passed all startup self-tests, it enters normal operation. The LCD displays the ambient gas readings.

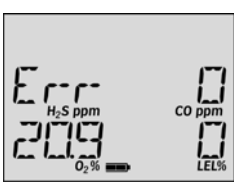


The detector automatically begins

- recording the peak (maximum) gas exposure,
- calculating the short-term exposure level (STEL), and
- calculating the time-weighted average (TWA) exposures.

Self-Test Fail

If the following error message displays after entering normal operation, refer to Startup Troubleshooting.



Battery Test

The battery is tested when the detector is activated and continuously thereafter. See Specifications for Battery Runtimes.

- Battery power is continually displayed during normal operation. If battery power is low, ALARM and ▭ flashes. The detector performs a sequence of 10 rapid sirens and alternating flashes with 7 seconds of silence in between (continues for 15 minutes).
- If battery power becomes critically low, ALARM and **LOW BAT** display. The detector performs a sequence of 10 rapid sirens with 1 second of silence in between (sequence reactivates seven times). The detector then displays **OFF** and the detector deactivates.

Note

If enabled, **Confidence Beep** *and* **IntelliFlash** *automatically deactivate during a low battery alarm. Refer to Confidence Beep*

Backlight

The backlight automatically activates

- during startup,
- when the pushbutton is pressed (then deactivates after 5 seconds), and
- when there is an alarm condition (unless **Stealth** is enabled).

Deactivating the Detector

To deactivate the detector, press and hold ◯. The detector

- performs a sequence of two sirens with alternating flashes,
- vibrates,
- initiates the deactivation countdown, and
- displays **OFF**.

Note

If ◯ is released before the countdown is complete, the detector will not deactivate.

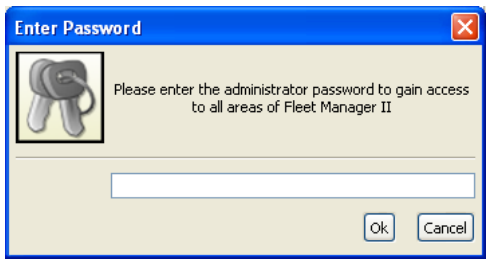
Installing Fleet Manager II

Fleet Manager II is required to configure the detector and sensors. And IR Link is also required. To purchase contact BW Technologies by Honeywell.

To install Fleet Manager II complete the following:

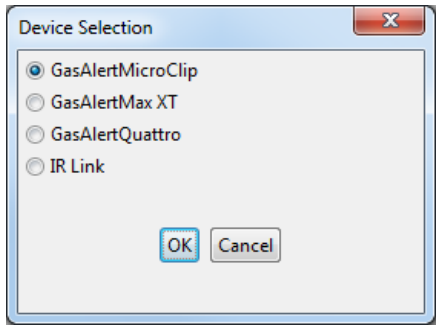
1. Install Fleet Manager II using the Fleet Manager CD-ROM (available with MicroDock II and the IR Link), or download (at no cost) from BW Technologies by Honeywell website: www.gasmonitors.com.
2. Follow the installation wizard.
3. When installation is complete, open Fleet Manager II.
4. Click **Administration** located on the left toolbar.
5. Click the Login/Logout button.

6. When the Password dialog box displays, enter **Admin** (password is case sensitive).



7. Click **OK**.
8. From the Devices toolbar, click **Configure Device via IR Link**.

9. When the Device Selection dialog box displays, select **GasAlertMicroClip Series** and click **OK**.



Fleet Manager II displays the **Sensors** tab that includes the following sections:

- Detector Identification
- CO, O_2, H_2S, LEL Sensor Configuration
- User Options
- Language Menu

Using Fleet Manager II to Configure the Detector

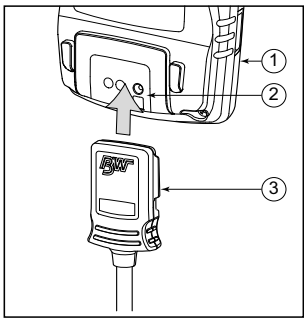


Table 6: Connecting to the IR Link

Item	Description
1	Detector
2	IR and charger interface
3	IR Link

1. Activate the detector and wait for the startup tests to complete.
2. Connect the USB cable to the USB port on the computer.
3. Connect the USB cable to the IR Link.
4. Insert the IR link onto the IR interface on the back of the detector.
5. Open Fleet Manager II and access the **Sensors** tab. Refer to Installing Fleet Manager II.
6. From the **Sensors** tab, click **Retrieve from Device** at the bottom of the window.

   The fields will populate with the detector's current configurations.
7. Refer to the descriptions in the following sections to define settings and enable/disable options:
   - Detector Identification
   - Sensor Configuration (CO, O_2, H_2S, and LEL)
   - User Options
   - Language Menu
8. When configuration of new settings is complete, click **Save to Device** at the bottom of the window. The detector automatically updates with the new settings.

Detector Identification

The **Detector Identification** section provides information about the detector, current firmware revision, and hardware revision. Data can also be entered (25 characters per line) to display as a startup message on the detector LCD each time it is activated.

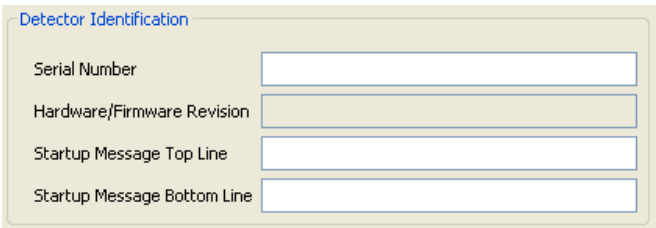


Figure 3. Detector Identification

Serial Number

Enter the serial number of the detector. The serial number is located on the back of the detector. The serial number is listed above the **S:** bar code. This cannot be altered.

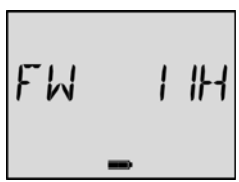
Note

GasAlertMicroClip serial numbers use the KA serial number prefix.

Hardware/Firmware Revision

Hardware/Firmware Revision cannot be altered. The field automatically populates when data is retrieved from the detector. If new firmware is downloaded to the detector, the field automatically updates when data is retrieved.

The firmware version displays on the detector LCD during the startup self-tests.



Startup Message

Enter text (25 characters per line) to display on the detector LCD during startup. Enter information such as employee name, plant, area, emergency numbers, etc.

Depending upon the length of the message, it will either

a) display on the LCD for 3 seconds (shorter message), or

b) scroll twice on the LCD (longer message).

Sensor Configuration

Settings for the sensors are configured individually. Enter values or enable/disable options. Refer to Factory Gas Alarm Setpoints for setpoint values.

Note

Depending upon the sensor, the options may vary.

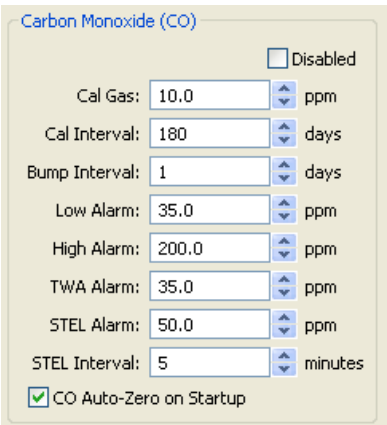


Figure 4. CO Sensor Configuration

Sensor Disabled

⚠ Warning

Use extreme caution when disabling a sensor. The disabled sensor cannot detect and alarm against the applicable gas.

1. Click **Retrieve from Device** to populate the fields with the current detector settings.
2. Click the **Disabled** checkbox for the required sensor.

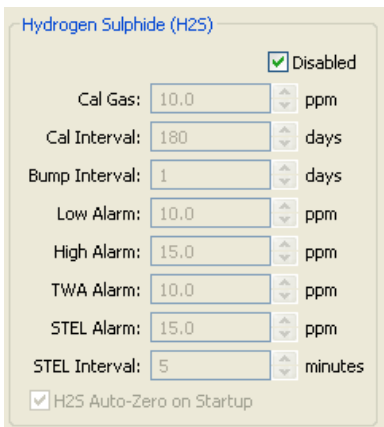
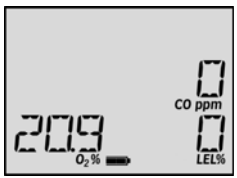


Figure 5. Disabled Sensor

The fields for the applicable sensor become inactive (greyed out) until the sensor is again enabled.

3. Click the **Save to Device** button located at the bottom of the window.
4. The detector LCD automatically updates. The gas type and sensor readings no longer display on the LCD for the applicable sensor.



5. Enable the sensor as soon as possible. If the sensor is damaged, replace it immediately. Refer to Replacing a Sensor or Sensor Filter.

Calibration Gas Concentration

⚠ Caution

The gas concentration value entered in Fleet Manager II must match the gas concentration value on the gas cylinder.

1. Refer to the following list of recommended gas mixtures:
   - CO: 100 ppm balance N_2
   - H_2S: 25 ppm balance N_2
   - LEL: 50% LEL or 2.5% by vol. methane balance air
   - O_2: 20.9% balanced with N_2
2. Select/enter the gas concentration value in the **Calibration Gas** field of the applicable sensor.

Calibration Interval

⚠ Caution

BW recommends that the sensors be calibrated once every 180 days (6 months).

Define how often a sensor should be calibrated in the **Calibration Interval** field. A different calibration interval can be defined for each sensor.

1. Enter the value (**0**-**365** days) for each sensor.
2. Enter **0** to disable the calibration interval option. Entering zero automatically deactivates the **Force Calibration When Overdue** user option.

The detector is shipped with the factory default set to **180** days.

Bump Interval

Define how often a bump check should be performed for each sensor in the **Bump Interval** field. A different bump interval can be defined for each sensor.

1. Enter the value (**0**-**365** days) for each sensor.
2. Enter **0** to disable the **Bump Interval** option. Entering **0** automatically disables the **Force Bump When Overdue** option.

The detector is shipped with the factory default set to **0** days.

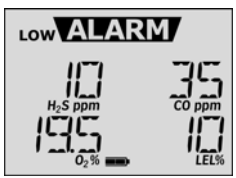
Note

BW recommends to bump test the sensors before each day's use to confirm their ability to respond to gas by exposing the detector to a gas concentration that exceeds the alarm setpoints. Verify that the audible and visual alarms activate. Calibrate if the readings are not within the specified limits.

Low Alarm

Enter the low alarm setpoints for each sensor. Refer to Factory Gas Alarm Setpoints for factory defined alarm setpoints.

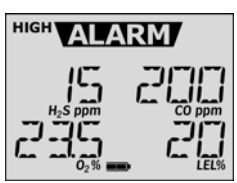
Applicable to all sensors.



High Alarm

Enter the high alarm setpoints for each sensor. Refer to Factory Gas Alarm Setpoints for factory defined alarm setpoints.

Applicable to all sensors.



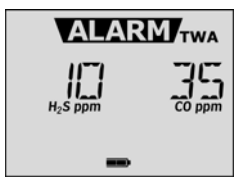
TWA Alarm

The time-weighted average (TWA) is a safety measure used to determine accumulated average exposure to gases. An average is determined using the US Occupational Safety and Health Administration (OSHA) method to ensure the worker is warned when the maximum average is accumulated.

The US OSHA method is defined as a moving average that accumulates over an 8-hour average. If the worker is in the field longer, the oldest accumulated values (first hour) are replaced by the newest values (ninth hour). This continues for the duration of the work shift until the detector is deactivated.

TWA Alarm applies to CO and H_2S sensors only.

1. Refer to Factory Gas Alarm Setpoints for the factory alarm setpoints.
2. Enter the setpoint in the **TWA Alarm** field.



STEL Alarm

The short-term exposure limit (STEL) is the maximum permissible gas concentration a worker can safely be exposed to for short periods of time (5-15 minutes maximum).

STEL Alarm applies to CO and H_2S sensors only.

Note

Standard factory Alarm Setpoints vary by region. Refer to Factory Gas Alarm Setpoints for OSHA factory settings.

1. Refer to the applicable regulatory requirements in your area for defining STEL alarm setpoints.

2. Enter the setpoint for the CO and H_2S sensor in the **STEL Alarm** field. Proceed to STEL Interval.

STEL Interval

STEL Interval provides protection for workers from over exposure to high concentrations of gas, and is based on used-defined **5**-**15** minute intervals. When the maximum STEL is reached, the detector alarms to notify the worker.

⚠ Caution

Follow all safety procedures as defined by your employer.

Enter the interval (**5**-**15** minutes) in the **STEL Interval** field. The detector is shipped with the factory default setting of **15** minutes.

Auto Zero on Startup

When enabled, the sensors automatically zero during the startup self-tests. The **Auto-Zero on Start-up** option is available for the CO, H_2S, and LEL sensors. Not applicable to O_2.

1. Click the checkbox of each sensor that will be auto zeroed during startup.

   The detector is shipped with the **Auto-Zero on Start-up** option enabled for the CO, H_2S, and LEL sensor.

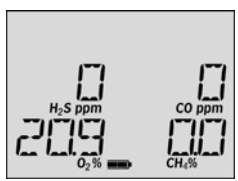
O_2 Auto-Calibration on Startup (Automatic O_2 Calibration)

When enabled, the O_2 sensor is automatically calibrated during the startup self-tests.

The detector is shipped with the ***O_2*** **Auto-Calibration on Startup** option enabled.

LEL By Vol CH_4

When enabled, the detector displays the LEL value as **CH_4%**, assuming a methane environment.



The **LEL By Vol CH_4** option is applicable to the LEL sensor only. The detector is shipped with the **LEL by Vol CH_4** disabled.

User Options

The user options section provides detector features that can be enabled or disabled. The green checkmark indicates the option is enabled. Click the checkbox to disable the option.

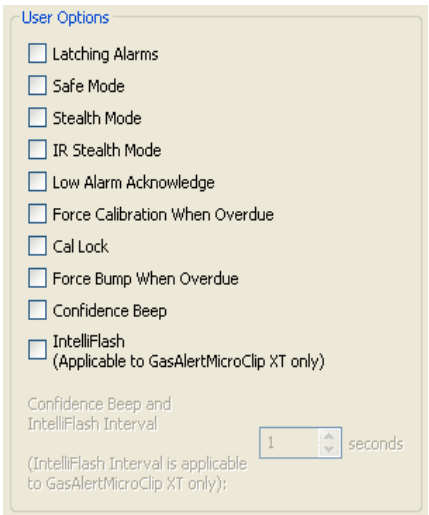


Figure 6. Fleet Manager II IR Link User Options

Latching Alarms

When enabled, a low alarm persists until the alarm is acknowledged and gas concentrations are below the low alarm setpoint. The audible alarm can be temporarily deactivated by pressing ◯, but the LCD continues to display the peak concentration values until the alarm condition no longer exists.

The detector is shipped with **Latching Alarms** disabled.

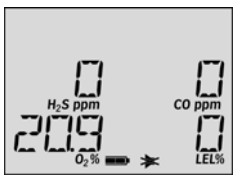
Safe Mode

When enabled, **SAFE** displays continuously on the LCD unless an alarm condition occurs. **Safe Mode** provides visual confirmation that no (monitored) hazardous gas is present.

The detector is shipped with **Safe Mode** disabled.

Stealth Mode

When enabled, the backlight, visual alarms, and audible alarms are disabled. displays continuously on the LCD.



During an alarm, the vibrator activates and readings display on the LCD.

The detector is shipped with **Stealth Mode** disabled.

Low Alarm Acknowledge

When enabled, the audible alarm can be deactivated during a low alarm for the CO, H_2S, and LEL sensors. The LED and visual alarm indicators remain active until the alarm condition changes or the detector deactivates.

Press ◯ to acknowledge the low alarm and deactivate the audible alarm.

Note

Low Alarm Acknowledge *is not applicable to* O_2.

The detector is shipped with **Low Alarm Acknowledge** disabled.

Force Calibration When Overdue

When enabled, if a sensor(s) is past due, the sensor(s) must be calibrated immediately, otherwise the detector deactivates.

Enable **Force Calibration When Overdue** to ensure calibrations are performed regularly and sensors are operating correctly. The following screen displays during the startup sequence when the option is enabled and the sensor(s) is overdue.

To enable **Force Calibration When Overdue**, complete the following:

1. Click the **Force Calibration When Overdue** checkbox to enable.
2. Enter a value (**1**-**365** days) in the Calibration Interval (**Cal Interval**) field.

⚠ Caution

If 0 (zero) is entered in the Cal Interval field, the Force Calibration When Overdue option is automatically disabled.

The detector is shipped with **Force Calibration When Overdue** disabled.

For more information, refer to Calibration.

Cal Lock (Calibration IR Lock)

When enabled, the sensors can only be calibrated using an infrared (IR) device to ensure calibrations are recorded. The following are IR devices:

- IR Link with Fleet Manager (refer to Connecting to the IR Link),
- MicroDock II base station (refer to the *MicroDock II User Manual*).

If **Cal Lock** is enabled and calibration is attempted, the following screen displays.

Note

If **Cal Lock** *is enabled, the detector will still auto zero the sensors.*

The detector is shipped with **Cal Lock** *disabled.*

Force Bump When Overdue

When enabled, if a sensor(s) is past due for a bump test, the sensor(s) must be bump tested immediately, otherwise the detector deactivates.

A bump test should be performed regularly to ensure the sensors are responding correctly to gas. The following screen displays when the option is enabled and the sensor(s) is overdue.

To enable **Force Bump When Overdue**, complete the following:

1. Click the **Force Bump When Overdue** checkbox to enable.
2. Enter a value (**1**-**365** days) in the Bump Interval field.

⚠ Caution

If 0 is entered in the Bump Interval field, the Force Bump When Overdue option is automatically disabled.

The detector is shipped with **Force Bump When Overdue** disabled.

For information and procedures, refer to Bump Test.

Confidence Beep

When enabled, the confidence beep provides continuous audible confirmation that the detector is operating correctly by beeping once every second.

Note

Confidence beep automatically disables during a low battery alarm, a self-test fail, a calibration fail, a bump test fail, or during an alarm event.

To define how often Confidence Beep occurs (**1-60** seconds), refer to Confidence Beep and IntelliFlash Interval. Default setting is 1 second.

The detector is shipped with the **Confidence Beep** disabled.

IntelliFlash

When enabled, the green LED flashes to provide continuous visual confirmation that the detector is operating correctly.

Note

IntelliFlash is only applicable to GasAlertMicroClip XT, XL and X3.

IntelliFlash automatically deactivates during a low battery alarm, a self-test fail, a calibration fail, a bump test fail, or during an alarm event.

To define how often IntelliFlash occurs (**1**-**60** seconds), refer to Confidence Beep and IntelliFlash Interval. Default interval is **1** second.

The detector is shipped with **IntelliFlash** enabled.

Datalog Interval

Enter a value (**1**-**120** seconds). The default datalog interval is one reading every **15** seconds.

Confidence Beep and IntelliFlash Interval

Enter a value (**1**-**60** seconds) to define how often IntelliFlash occurs and the detector beeps. Intelliflash and/or Confidence Beep must be enabled in order to define Confidence Beep and IntelliFlash Interval.

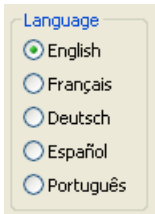
Refer to Confidence Beep and IntelliFlash Interval. Default interval is **1** second.

Note

IntelliFlash and IntelliFlash Interval are only applicable to GasAlertMicroClip XT, XL and X3.

Language Menu

The detector can display warnings and notifications in five different languages. Refer to the following illustration.



Click a language. When the settings are saved to the detector, the LCD displays warnings and notifications in the selected language.

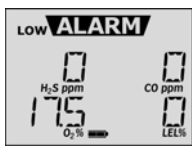
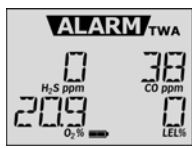
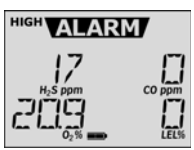
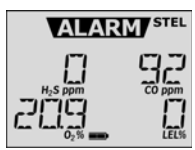
The detector is shipped with **English** as the default language.

Alarms

Table 7. describes the detector alarms and corresponding screens. During an alarm condition, the detector activates the backlight, audible/visual/vibrator alarms, and displays the current ambient readings. If more than one type or level of alarm occurs simultaneously, a multi-gas alarm results. If Stealth is enabled, the audible and visual alarms are disabled, and only the vibrator alarm activates.

To change the factory-defined alarm setpoints, refer to Low Alarm, High Alarm, TWA Alarm, and STEL Alarm.

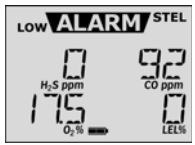
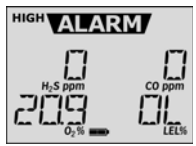
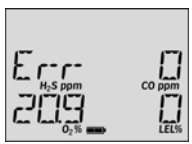
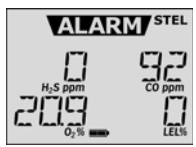
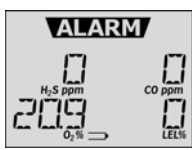
Table 7. Alarms

Alarm	Screen	Alarm	Screen
Low Alarm • Slow siren • Slow alternating flash • ALARM and gas bar flash • Vibrator alarm activates		**TWA Alarm** • Slow siren • Slow alternating flash • ALARM and gas bar flash • Vibrator alarm activates	
High Alarm • Fast siren • Fast alternating flash • ALARM and gas bar flash • Vibrator alarm activates		**STEL Alarm** • Fast siren • Fast alternating flash • ALARM and gas bar flash • Vibrator alarm activates	

Note

If **Low Alarm Acknowledge** *is enabled, the audible alarm can be disabled during a low alarm condition. The vibrator and visual alarm indicators remain active until the alarm condition changes or the detector deactivates. Press ◯ to acknowledge the low alarm and deactivate the audible alarm. If the alarm escalates to a high, TWA, or STEL alarm, the audible alarm reactivates.*

If enabled, **Latched Alarms** *causes the low and high gas alarms (audible, visual, and vibrator) to persist until the alarm is acknowledged (by pressing ◯) and the gas concentration is below the low alarm setpoint. The LCD displays the peak concentration and the audible, visual, and vibrator indicators persist until the alarm condition no longer exists. Enable/disable* **Latching Alarms** *in Fleet Manager II. Local regulations may require* **Latching Alarms** *be enabled.*

Alarm	Screen	Alarm	Screen
Multi-Gas Alarm • Sequence alternating low and high alarm siren and flash • ALARM and gas bars flash • Vibrator alarm activates		**Over Limit (OL) Alarm** • Fast siren and alternating flash • ALARM and gas bar flash • Vibrator alarm activates • **OL** displays	
Sensor Alarm • **During startup sequence Error** [sensor name] displays • **During normal operation Err** displays (must be acknowledged by press ◯)		**Confidence Beep and IntelliFlash** • One beep and flash every second *Note* *The detector is shipped with Confidence Beep disabled and IntelliFlash enabled*	
Low Battery Alarm • Sequence of 10 rapid sirens and alternating flashes with 7 seconds of silence in between (continues for 15 minutes) • ▭ and ALARM flash, **LOW BAT** displays, and the vibrator alarm activates • After 15 minutes, of the Low Battery alarm, the Automatic Shutdown Alarm sequence begins • **OFF** displays before deactivating		**Automatic Shutdown Alarm** • Sequence of 10 rapid sirens and alternating flashes with 1 second of silence in between (sequence reactivates seven times) • **LOW BAT** and ALARM display • Vibrator alarm activates • **OFF** displays before deactivating	
		Normal Shutdown • Sequence of two sirens and alternating flashes • Vibrator alarm activates • Countdown initiates • **OFF** displays	

Computed Gas Exposures

⚠ Warning

To avoid possible personal injury, do not deactivate the detector during a work shift. TWA, STEL, and MAX readings reset once the detector is deactivated.

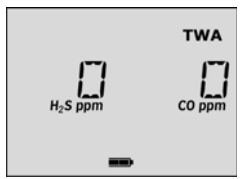
Table 8. Computed Gas Exposures

Gas Exposures	Description
TWA (H_2S and CO only)	Time-weighted average (TWA) based on accumulated exposure to toxic gases averaged over a workday according to US OSHA method. OSHA: 8 hour moving average
STEL (H_2S and CO only)	Short-term exposure limit (STEL) to gas based on a 5-15 minute user-defined period.
Peak* (maximum)	Peak concentration encountered during work shift.

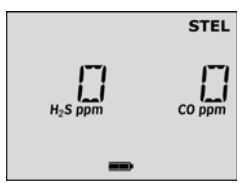
* For oxygen, it is the highest or the lowest concentration encountered.

Viewing Gas Exposures

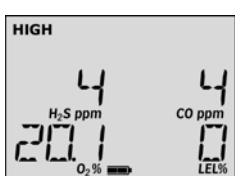
To view the TWA, STEL, and peak (maximum) readings, press ○ twice. The LCD first displays the TWA gas exposures.



Then the LCD displays the STEL gas exposures.



Finally the LCD displays the peak (maximum) readings.



Clearing Gas Exposures

⚠ Caution

Follow all safety procedures as defined by your employer.

Confirm with your supervisor before clearing TWA and STEL alarms.

To clear the TWA, STEL, and peak exposure readings, press ○ when the LCD displays **RESET**.

Gas Alarm Setpoints

Gas alarms are activated when detected gas concentrations are above or below the user-defined setpoints. Gas alarms are described below.

Table 9. Gas Alarm Setpoints

Alarm	Condition
Low	*Toxics and combustibles:* Ambient gas level above low alarm setpoint. *Oxygen:* Ambient gas level may be set above or below 20.9% (or 20.8%).
High	*Toxics and combustibles:* Ambient gas level above high alarm setpoint. *Oxygen:* Ambient gas level may be set above or below 20.9% (or 20.8%).
TWA	*Toxics only:* Accumulated value above the TWA alarm setpoint.
STEL	*Toxics only:* Accumulated value above the STEL alarm setpoint.
Downscale	*Toxics only:* If sensor reading is negative (half of the TWA setpoint)
Multi-gas	Two or more gas alarm conditions.

Alarm	Condition
Over Limit (OL)	**OL** displays when readings are above or below the sensor detection range. Refer to Specifications for detection ranges.

Factory Gas Alarm Setpoints

Note

Standard factory alarm setpoints may vary by region.

Table 10. lists the factory alarm setpoints as defined by Occupational Safety and Health Association (OSHA).

Table 10. Sample Factory Alarm Setpoints

Gas	TWA	STEL	Low	High
O_2	N/A	N/A	19.5% vol.	23.5% vol.
LEL	N/A	N/A	10% LEL	20% LEL
CO	35 ppm	50 ppm	35 ppm	200 ppm
H_2S	10 ppm	15 ppm	10 ppm	15 ppm

Note

To disable an alarm, set the alarm setpoint to **0** *(zero) in Fleet Manager II. Refer to Using Fleet Manager II to Configure the Detector for complete instructions.*

Changing Alarm Setpoints

To change alarm setpoints, use the base station or IR Link and refer to the following under Sensor Configuration:

- Low Alarm
- High Alarm
- TWA Alarm
- STEL Alarm

Stopping a Gas Alarm

The low and high alarms stop when the ambient gas concentration returns to the acceptable range.

Note

If alarms are set to latch, press ○ to reset the alarms.

The detector calculates the TWA value based on OSHA standards and the STEL value based on a user-defined 5 to 15 minute period. Refer to STEL Interval.

To stop a TWA or STEL alarm, perform one of the following:

1. Deactivate and reactivate the detector.
2. Reset the TWA/STEL/peak exposure readings. Refer to Viewing Gas Exposures).

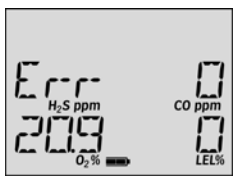
⚠ Warning

Follow all safety procedures as defined by your employer. Confirm with your supervisor before clearing TWA and STEL alarms.

Sensor Alarm

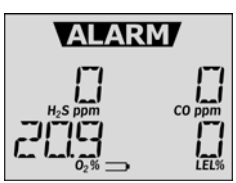
The detector tests for missing or defective sensors during the startup self-test and continuously thereafter.

- During start-up if a sensor fails, **Error** and the sensor name displays.
- If a sensor fails the self-test, **Err** displays above the gas type of the failed sensor. The detector will enter alarm. Press ◯ to acknowledge the sensor alarm and stoop the alarm. Refer to Troubleshooting.



Low Battery Alarm

- Battery power is continually displayed during normal operation. If battery power is low, ALARM and ▭ flashes. The detector performs a sequence of 10 rapid sirens and alternating flashes with 7 seconds of silence in between (continues for 15 minutes).



- If battery power becomes critically low, ALARM and **LOW BAT** display. The detector performs a sequence of 10 rapid sirens with 1 second of silence in between (sequence reactivates seven times). The detector then displays **OFF** and the detector deactivates.

Charge the battery immediately. Refer to Charging the Battery.

Note

Confidence Beep automatically disables during a low battery alarm.

Automatic Deactivation Alarm

An automatic deactivation alarm will occur if

- the battery voltage is too low to operate the detector,
- calibration is due but not performed (when the **Force Calibration** option is enabled),
- bump test is due but not performed (when the **Force Bump** options is enabled) and
- all sensors fail during the startup self-test.

The detector performs a sequence of 10 rapid sirens with alternating flashes with 1 second of silence in between (sequence reactivates seven times). **OFF** then displays and the detector deactivates.

Bump Test

Gas Cylinder Guidelines (Bump Test)

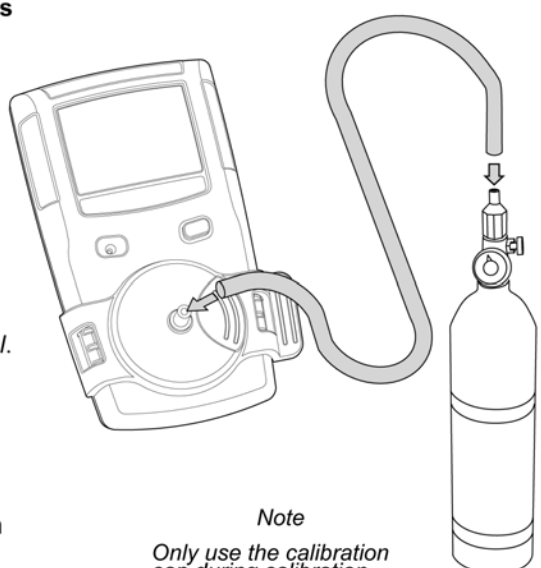
- **To ensure an accurate bump check, use a premium-grade gas. Use gases approved by the National Institute of Standards and Technology.**
- **Do not use a gas cylinder that is past its expiration date.**

Gas Cylinder Connection

1. Connect the calibration hose to the 0.5 l/min regulator on the gas cylinder. For use with the MicroDock II, use a demand flow regulator.

   NOTE: Cylinders that are used with a demand flow regulator must meet the following maximum inlet pressure specifications:
   - Disposable cylinders 0-1000 psig/70 bar
   - Refillable cylinders 0-3000 psig/207 bar

   To perform an automated bump check, refer to the *MicroDock II User Manual*.
2. Connect the calibration hose to the calibration cap.
3. Attach the calibration cap to the detector.
4. Apply gas. Verify the visual and audible alarms activate.
5. Close the regulator and remove the calibration cap from the detector. NOTE: The detector will temporarily remain in alarm until the gas clears from the sensors.
6. Disconnect the hose from the calibration cap and the regulator.



Note

Only use the calibration cap during calibration and bump check.

Calibration

Guidelines

When calibrating the detector, adhere to the following guidelines:

- Recommended gas mixture:
  CO: 100 ppm balance N_2
  H_2S: 25 ppm balance N_2
  LEL: 50% LEL or 2.5% for NA (2.2% for EU) by vol. methane balance air
  O_2: 18% by volume, balance N_2.
- To ensure accurate calibration, use a premium-grade calibration gas. Gases approved by the National Institute of Standards and Technology (NIST) improve the accuracy of the calibration.
- Do not use a gas cylinder past its expiration date.
- Calibrate a new sensor before use. Install the sensor, activate the detector, and allow the sensor to stabilize before starting calibration (used sensor: 60 seconds / new sensor: 5 minutes, for X3 O_2 stabilization takes 60 minutes.
- Calibrate the sensors at least once every 180 days, depending on use and sensor exposure to poisons and contaminants.
- Calibrate the detector if the gas readings varies during startup.
- Calibrate the sensor before defining the alarm setpoints.***8***
- Calibrate only in a safe area that is free of hazardous gas in an atmosphere of 20.9% oxygen.
- Do not calibrate the detector during or immediately after charging is complete.
- The oxygen sensor can be automatically calibrated each time upon activation (if this feature is enabled). Activate the detector in a normal (20.9%/20.8% oxygen) atmosphere.
- Allow the detector to stabilize for 1 minute after activation before performing a calibration or bump test.
- If a certified calibration is required, contact BW Technologies by Honeywell.

Diagnostics Test

The detector tests the air (auto zero) and the span gas that is applied (auto span) to ensure it meets expected values. Auto zero sets the zero-gas level of the sensor.

Auto Zero: If target gas is present, the zero level will be incorrect and the sensor will fail. If a sensor fails, an error message displays.

Auto Span: If the target gas does not meet expected values, an error message displays.

A sensors that fails to span retains the previous span value, and does not continue with the calibration process.

Connecting the Gas Cylinder to the Detector

Refer to the following Figure 7., Table 11., and procedures to connect the gas cylinder to the detector for calibration.

Note

Wind currents may cause false readings and poor calibrations.

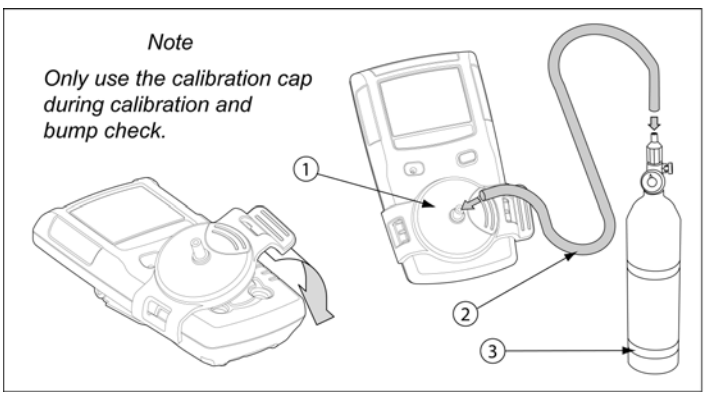


Figure 7. Connecting the Gas Cylinder to the Detector

Table 11. Connecting the Gas Cylinder to the Detector

Item	Description
1	Calibration cap
2	Calibration hose
3	Gas cylinder with 0.5 ml/min regulator

Read the following steps (1-7) before beginning calibration.

1. Verify the calibration gas being used matches the span concentration value(s) that are set for the detector. Refer to **Calibration Gas** in Fleet Manager II.
2. Attach a 0.5 ml/min regulator to the gas cylinder. To perform an automated calibration, use a demand flow regulator and refer to the *MicroDock II User Manual*.
3. Connect the calibration hose to the calibration cap.
4. Connect the other end of the calibration hose to the regulator on the gas cylinder.
5. Refer to Calibration Setup to apply gas.
6. When calibration is complete turn off gas and disconnect the hose from the calibration cap and regulator.
7. Ensure the gas cylinder is stored according to the manufacturer's specifications.

Calibration Setup

The following calibration procedures are written as calibration performance is intended. If an error or failure occurs, refer to Calibration Troubleshooting.

⚠ Caution

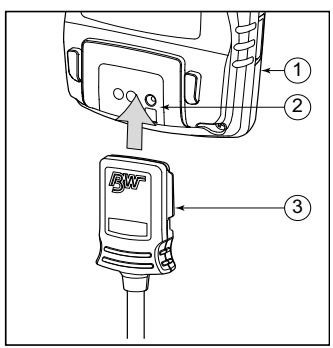
Only calibrate in a fresh air environment and in a safe area. Do not calibrate the detector during or immediately after charging.

Note

Calibration can be aborted at any time. To abort calibration, press ◯. The following screen displays.

Setting Span Gas Concentration Values

1. Activate the detector and allow startup to complete.
2. Connect the IR Link to the computer
3. Insert the IR Link into the IR interface on the back of the detector.
4. On the PC, open Fleet Manager II.
5. Login to the Administration functions. From the Devices toolbar, click **Configure Device via IR Link** and select **GasAlertMicroClip.**
6. Click Retrieve From Device. The fields populate with the detector's current settings.
7. Refer to Calibration Gas Concentration for span gas values.
8. Ensure the sensors to be calibrated are enabled in Fleet Manager II.
9. Using , select the concentration value(s) in the **Calibration Gas** field for each sensor. The values entered in Fleet Manager II must match the gas concentration values on the gas cylinder.
10. Click Save To Device to save the settings to the detector.



Connecting to the IR Link

Table 12: Connecting to the IR Link

Item	Description
1	Detector
2	IR and charger interface
3	IR Link

Calibrating with the IR Link

⚠ Caution

Only calibrate in a fresh air environment and in a safe area. Do not calibrate the detector during or immediately after charging.

To calibrate the detector with the IR Link, complete the following procedure:

1. Complete steps #1-10 under Setting Span Gas Concentration Values.
2. Click on the Device Operations tab.
3. Click **Calibrate**. The detector begins calibration. Refer to Auto Zero and Oxygen Sensor Calibration.

Calibration Procedure

⚠ Caution

Only calibrate in a fresh air environment and in a safe area. Do not calibrate the detector during or immediately after charging.

1. Press and hold ◯. The detector performs the **OFF** countdown. Continue holding ◯ as the detector briefly deactivates.

2. The detector then reactivates and performs the **CAL** countdown. Continue holding ◯ until the **CAL** countdown is complete.

Note

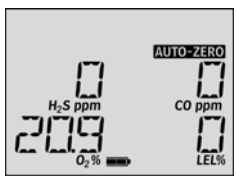
If ◯ is not held for the entire countdown, the detector will deactivate.

Auto Zero and Oxygen Sensor Calibration

Note

Do not apply calibration gas until **APPLY GAS** *displays, otherwise the auto zero function will fail.*

3. AUTO-ZERO flashes while the detector zeroes the combustible and toxic sensors, and calibrates the oxygen sensor.



When auto zero is complete, the detector beeps twice.

Auto Zero Successful: If the sensors successfully zero, the detector proceeds to the Auto Span function.

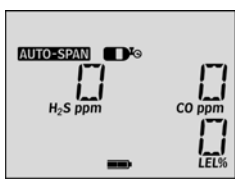
Auto Zero Unsuccessful: If the sensors fail auto zero, an error message displays showing which sensor failed. Refer to Calibration Troubleshooting.

Auto Span

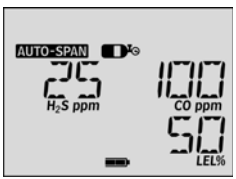
4. When auto zero is complete, **APPLY GAS** displays.

5. Attach the calibration cap to the detector. Refer to Figure 7. Open the valve on the regulator and apply gas at a flow rate of 250-500 ml/min.

   flashes and AUTO-SPAN displays



When a sufficient amount of gas has been detected (approximately 30 seconds after the gas has been applied), the detector beeps once, AUTO-SPAN flashes, and remains lit while the detector completes the span (approximately 2 minutes).



Successful Span

If the sensors have spanned successfully, the detector beeps and the calibration procedure continues.

Unsuccessful Span

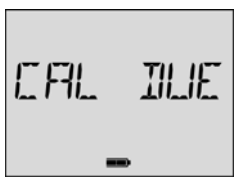
If any sensors fail the span, the following screen displays. Refer to Calibration Troubleshooting.

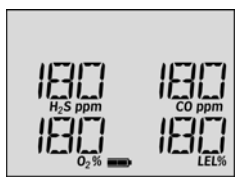
Calibration Due Date

Note

If a sensor fails calibration, the next due date for that sensor will not reset. Refer to Calibration Troubleshooting.

6. After calibration is complete, **CAL DUE** displays and all successfully calibrated sensors automatically reset the calibration due dates according to the calibration intervals in Fleet Manager II.





7. The number of days that displays is when the next sensor calibration should be performed.

Failed Sensor Past Calibration Due Date: If a sensor fails the span and it is past the calibration due date, the following three screens display.

1. Press ◯ to acknowledge the warning. The detector returns to normal operation.

Note

A negative number indicates that sensor is overdue for a calibration.

Verification

1. After calibration is complete and the detector returns to normal operation, verify the calibration using a gas cylinder other than the one used for calibration.
2. The gas concentration should not exceed the sensor's detection range. Confirm the LCD shows the expected concentration.
3. To ensure the readings are accurate, apply the verification gas for the same amount of time as was applied to the sensor when it was calibrated.

   Example: H_2S span time 2 minutes therefore, apply verification gas for 2 minutes.

Datalogs

The detector records various information that can be compiled to create a report. The detector is capable of storing 16 hours of information (when recording a datalog every 15 seconds). When the memory is full, the detector replaces the oldest datalogs with the most recent datalogs

Event Logs

The detector records the 10 most recent gas alarm events. The following information is recorded:

- Serial number of the detector
- Start time of alarm
- Type, level and duration of alarm
- Peak exposure level (ppm or %)
- Status of the sensor

Downloading Datalogs and Event Logs

The datalog and event log files can only be downloaded to a PC using an IR Link or the MicroDock II base station. Refer to the *Fleet Manager II Operator's Manual* or *MicroDock II User Manual*.

Software Requirements

To create spreadsheet reports of event logs, datalogs, and bump and calibration results, the following software applications are required:

- Fleet Manager II, and
- Microsoft Excel.

Maintenance

To maintain the detector in good operating condition, perform the following basic maintenance as required.

- Calibrate, bump check, and inspect the detector at regular intervals.
- Maintain an operations log of all maintenance, bump checks, calibrations, and alarm events.
- Clean the exterior with a soft damp cloth. Do not use solvents, soaps, or polishes.
- Do not immerse the detector in liquids.

Battery Cautions

⚠ Warning

To avoid personal injury and/or property damage, adhere to the following:

- **The detector must be deactivated to charge the battery.**
- **Charge the battery immediately when the detector emits a low battery alarm. Refer to Charging the Battery.**
- **Charge the battery in a safe area that is free of hazardous gas in temperatures of 32°F to 113°F (0°C to 45°C).**
- **Charge the battery using the BW Multi-Unit Cradle Charger or charger adapter only. Do not use any other charging adapters. Failure to adhere to this caution can lead to fire and/or explosion.**
- **The charging adapter is voltage specific to your region. Use of the charging adapter outside your region will damage the charger and the detector.**
- **Do not calibrate the detector during or immediately after charging the battery.**
- **The battery can only be replaced by the manufacturer. Failure to adhere to this caution can lead to fire and/or explosion.**
- ***Warning:* The GasAlertMicroClip uses a lithium battery that may present a risk of fire or chemical burn hazard if misused. Do not disassemble, heat above 212° (100°C), or incinerate.**
- ***Warning:* Lithium polymer cells exposed to heat at 266°F (130°C) for 10 minutes can cause fire and/or explosion.**

Charging the Battery

To charge the battery, refer to Figure 8., Table 13., and the following procedures (1-8).

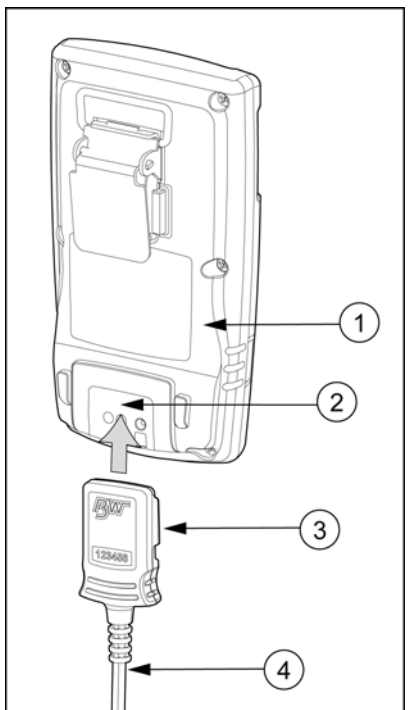


Figure 8. Connecting the Charging Adapter

Table 13. Connecting the Charging Adapter

Item	Description
1	Detector
2	IR and charger interface
3	Charging adapter
4	Charging cable

⚠ Warning

The detector must be charged in a safe area that is free of hazardous gas in temperatures of 32°F to 113°F (0°C to 45°C).

1. Deactivate the detector.
2. Plug the charging adapter into an AC outlet.

⚠ Caution

The charging adapter is voltage specific to your region. Use of the charging adapter outside your region will damage the charger and the detector.

3. Attach the charging adapter to the charger interface. Refer to Figure 8.
4. Allow the battery to charge per battery specifications. The charging indicator flashes on the LCD while the detector is being charged.

5. When charging is complete, the charging indicator stops flashing and displays ▬ to indicate a full charge. Remove the charging adapter and activate the detector.

   If the battery indicator does not display, refer to Troubleshooting.

6. Charge the battery after each workday.

Note

To reach full battery capacity, allow the battery to fully charge and fully discharge three times.

Charging the detector in temperatures above 113°F (45°C) will greatly reduce the number of charges the detector can accept.

The detector may be warm immediately following charging. This is normal.

Replacing a Sensor or Sensor Filter

⚠ Warning

To avoid personal injury, only use sensors that are specifically designed for the detector. Refer to Replacement Parts and Accessories.

Use proper ESD handling practices.

- Each sensor has a high degree of resistance to common vapors and gases. To clear a sensor, move the detector to a non-hazardous environment and wait 10 to 30 minutes.
- Do not expose a sensor to vapors of inorganic solvents such as fumes from paint thinners, or organic solvents such as benzoic acids and acrylic acids.
- Ensure hands are clean or wear gloves before handling components.

To replace a sensor or sensor filter, refer to

- Table 14,
- Figure 11,
- Figure 12
- Figure 13, and
- the following procedures.

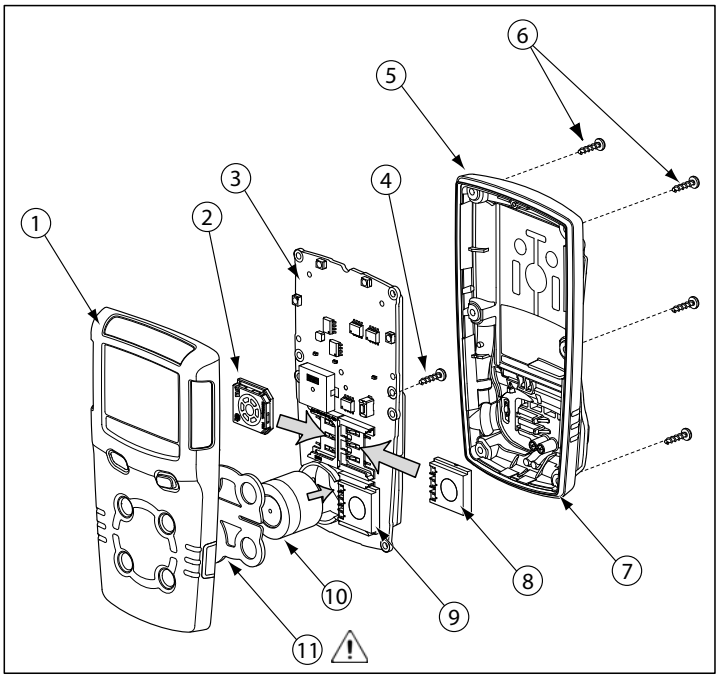


Figure 9. Replacing a Sensor or Sensor Filter

Table 14. Replacing a Sensor or Sensor Filter

Item	Description
1	Front shell
2	Combustible (LEL) sensor
3	PCB
4	PCB screws (2)
5	Rear shell
6	Machine screws (6)
7	Sealing rib
8	Carbon monoxide (CO) sensor
9	Hydrogen sulfide (H_2S) sensor
10	Oxygen (O_2) sensor
11	Sensor filter

Removing the back shell

1. Deactivate the detector. On a clean surface, place the detector face down.
2. Remove the six machine screws on the rear shell.
3. Remove the back cover by lifting the top and the bottom upwards simultaneously to prevent damaging the charger pins.

Replacing the Sensor Filter

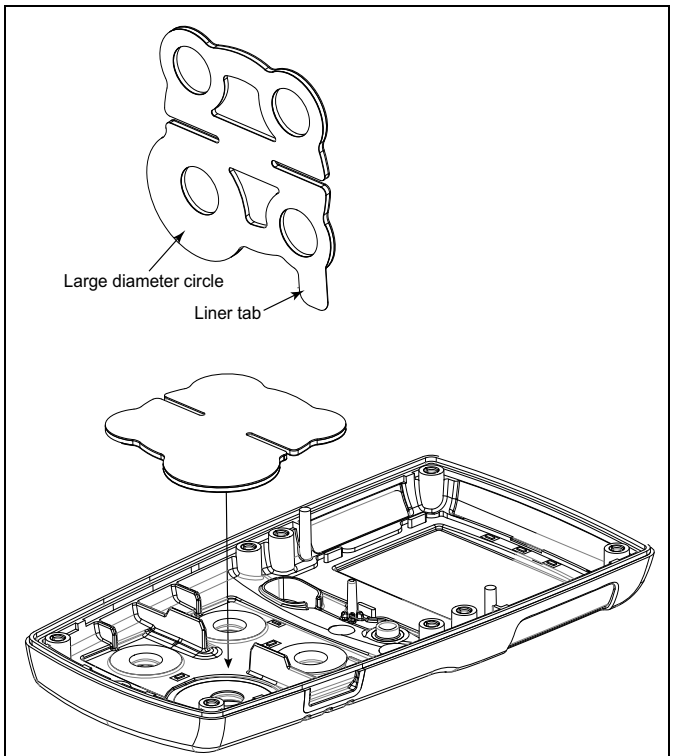
1. Note the placement of the PCB to ensure it is replaced correctly. Remove the two screws on the PCB. Remove the PCB carefully.

⚠ Caution

Ensure no damage occurs to the battery.

2. Remove the old sensor filter. It may be stuck to the sensors.
3. Pull the liner tab,if present, to remove the liner from the sensor filter. Do not fold the sensor filter.
4. Verify that the black gasket is facing the front shell and the large diameter circle on the gasket is aligned with the large circle on the front shell.
5. Place the gasket as shown, and then use your fingers to apply even pressure to the entire gasket.
6. To reassemble the detector, refer to Reassembling the detector.

Figure 10. Liner Tab



Replacing the H_2S, CO, and LEL sensor

1. Note the placement of the PCB to ensure it is replaced correctly. Remove the two screws on the PCB. Remove the PCB carefully.

⚠ Caution

Ensure no damage occurs to the battery.

If the sensor filter is stuck to the sensors, remove and replace the sensor filter into the front shell.

2. Slide the sensors out.

Note

Detectors that are configured for 1, 2, or 3 gases may contain a dummy sensor in one of the four sensor locations.

3. Insert the new sensor(s). For sensor positioning, refer to Figure 11.

Note: The Oxygen sensor is located in the bottom left corner of the detector.

4. To complete the detector, refer to Reassembling the detector.

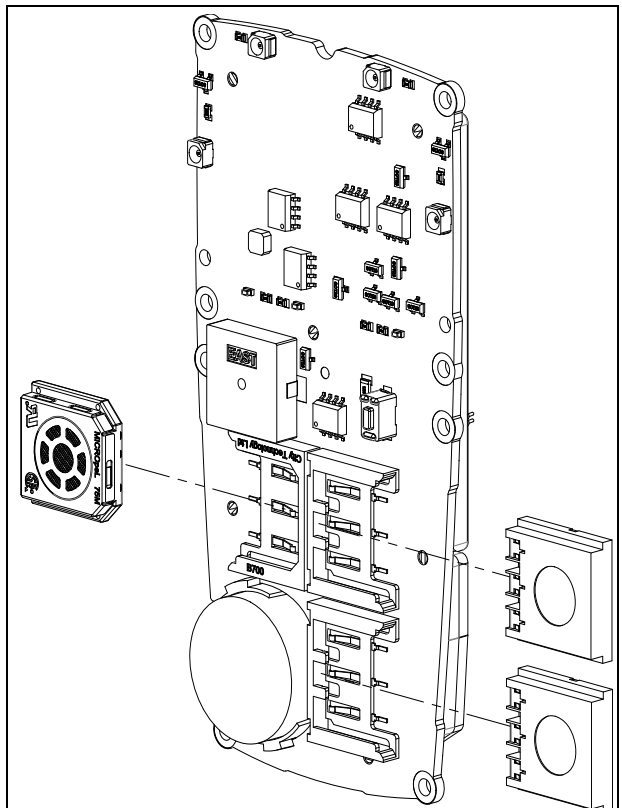
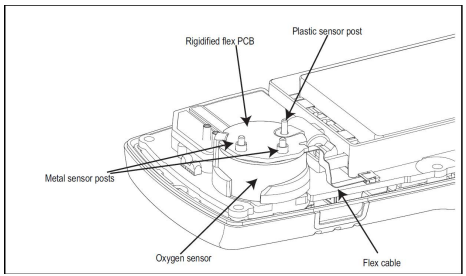


Figure 11. Sensor Positioning

Replacing the Oxygen Sensor XT and XL



Note: Detectors that are configured for 1, 2, or 3 gases may contain a dummy sensor in one of the four sensor locations.

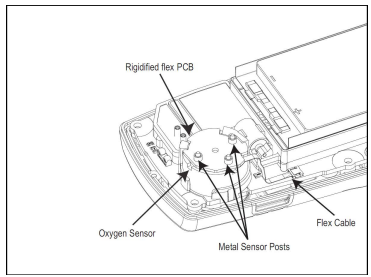
1. Gently remove the circular rigidified flex PCB atop the sensor from the metal sensor posts. Take care not to tear the flex cable.
2. Note the placement of the PCB to ensure it is replaced correctly. Remove the two screws on the PCB.

⚠ Caution

Ensure no damage occurs to the battery.

3. Lift the PCB straight up. The oxygen sensor will stay in the front shell. Remove the sensor.
4. On roughly the same spot on the front shell, place the new sensor. Lower the PCB over the oxygen sensor.
5. Carefully replace the circular rigidified flex PCB atop the metal sensor posts. Ensure the plastic sensor post is inserted into the clear plastic hole. Take care not to tear the flex cable.
6. Press down to secure the circular rigidified flex PCB atop the metal sensor posts.Take care not to press down too hard and accidentally activate the detector.
7. To complete the detector, refer to Reassembling the detector.

Replacing the Oxygen Sensor X3



Note: Detectors that are configured for 1, 2, or 3 gases may contain a dummy sensor in one of the four sensor locations.

1. Gently remove the circular rigidified flex PCB atop the sensor from the metal sensor posts. Take care not to tear the flex cable.
2. Note the placement of the PCB to ensure it is replaced correctly. Remove the two screws on the PCB.

⚠ Caution

Ensure no damage occurs to the battery.

3. Lift the PCB straight up. The oxygen sensor will stay in the front shell. Remove the sensor.
4. On roughly the same spot on the front shell, place the new sensor. Lower the PCB over the oxygen sensor.
5. Carefully replace the circular rigidified flex PCB atop the metal sensor posts. Take care not to tear the flex cable.
6. Press down to secure the circular rigidified flex PCB atop the metal sensor posts.Take care not to press down too hard and accidentally activate the detector.
7. To complete the detector, refer to Reassembling the detector.

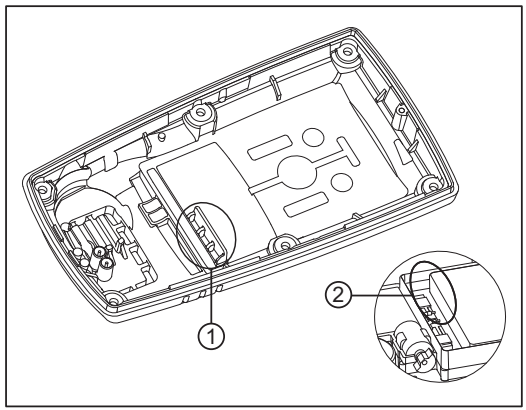
Reassembling the detector

1. To re-assemble the detector, perform the following:
   - Verify the PCB is seated correctly and inserted exactly as it was removed (sensors facing the front shell).
   - Replace the two PCB screws.
   - Visually inspect the battery to ensure no damage has occurred.
   - When replacing the rear shell, ensure the charging pins (bottom of inside rear shell) are aligned with the corresponding holes on the PCB. If the contact pins are bent, the battery will not charge correctly.

Note

Ensure the rib on the interior rear shell ① inserts between the battery and the PCB ②.

XT Model



XL-X3 Models

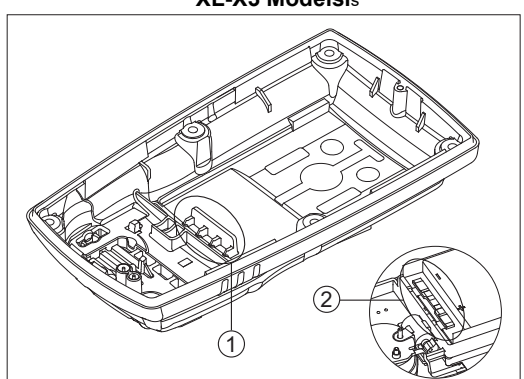


Figure 14. Replacing the Rear Shell

- Press the front and rear shells together firmly to ensure a proper seal. Ensure the front and rear shell have a uniform, tight 1/16 in (1 mm) seal on all sides of the detector.
- When replacing the screws, they must be seated properly to prevent cross threading. Turn the screw counter-clockwise until a click is heard and then begin tightening the screw clockwise.

2. New sensors must be calibrated. Activate the detector and calibrate the sensor(s). Refer to Calibration.

Troubleshooting

If a problem occurs, refer to the solutions in the Troubleshooting section.
If the problem persists, contact BW Technologies by Honeywell

Table 15. Troubleshooting

Problem	Possible Cause	Solution
Startup		
The detector does not activate.	Depleted battery	Charge battery. Refer to Charging the Battery.
	Damaged or defective detector	Contact BW Technologies by Honeywell.
The detector enters alarm immediately when activated.	Sensor needs to stabilize	Used sensor: wait 60 seconds New sensor: wait 5 minutes (The oxygen sensor in the X3 needs 60 minutes to stabilize)
	Low battery alarm	Charge battery. Refer to Charging the Battery.
	Detector requires calibration	Calibrate the detector. Refer to Calibration.
	Hazardous environment	Leave the area immediately. Deactivate and reactivate in a safe area that is free of hazardous gas, in an atmosphere of 20.9% oxygen.
The activation self-test fails.	General fault	Contact BW Technologies by Honeywell.
	Sensor failure	Replace the sensor. Refer to Replacing a Sensor or Sensor Filter.
Detector automatically deactivates during startup.	Battery power too low to operate	Charge battery. Refer to Charging the Battery.
	Force Calibration When Overdue option is enabled and calibration is not attempted	Calibrate the sensor(s) immediately. Refer to Calibration.
	Force Bump When Overdue option is enabled and a bump test is not attempted	Bump test the sensor(s) immediately. Refer to Bump Test.

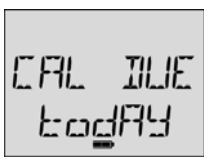
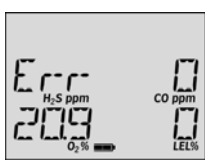
Table 15. Troubleshooting

Problem	Possible Cause	Solution
Detector Operation		
Detector does not display expected gas readings after activation self-test.	Sensor not stabilized	Used sensor: wait 60 seconds New sensor: wait 5 minutes (The oxygen sensor in the X3 needs 60 minutes to stabilize)
	Sensor(s) requires calibration	Calibrate the sensor(s). Refer to Calibration.
	Target gas is present	Detector is operating properly. Use caution in suspect areas.
Detector does not respond to pushbutton.	Battery is depleted	Charge battery. Refer to Charging the Battery.
	Detector is performing operations that do not require user input	Pushbutton operation restores automatically when the operation ends.
Detector does not accurately measure gas.	Sensor(s) requires calibration	Calibrate the sensors. Refer to Calibration.
	Detector is colder/hotter than ambient gas	Allow the detector to attain ambient temperature before use.
	Sensor filter is blocked	Replace the sensor filter. Refer to Replacing a Sensor or Sensor Filter.
Detector does not enter into alarm.	Alarm setpoint(s) defined incorrectly	Reset alarm setpoints. Refer to Factory Gas Alarm Setpoints and Sensor Configuration.
	Alarm setpoint(s) set to zero	Reset alarm setpoints. Refer to Factory Gas Alarm Setpoints and Sensor Configuration.
	Detector is in calibration mode	Complete the calibration procedure.

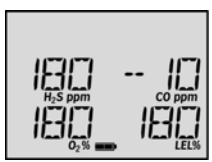
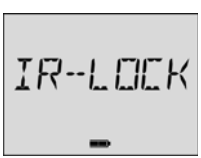
Table 15. Troubleshooting

Problem	Possible Cause	Solution
Detector intermittently enters alarm without reason.	Ambient gas levels are near alarm setpoint or the sensor is exposed to a puff of the target gas	Detector is operating normally. Use caution in suspect areas. Check the peak (maximum) gas exposure reading.
	Alarm setpoints defined incorrectly	Reset alarm setpoints. Refer to Factory Gas Alarm Setpoints and Sensor Configuration.
	Detector requires calibration	Calibrate the sensors. Refer to Calibration.
	Missing or faulty sensor(s)	Replace the sensor. Refer to Replacing a Sensor or Sensor Filter.
Features and options are not operating as expected.	Changes have been made in Fleet Manager II	Verify settings in Fleet Manager II are correct.
Charging		
Battery has been charging for 3+ hours (XT model) or 6+ hours (XL-X3 models). The charging indicator on the detector LCD shows the battery is still charging.	Battery is trickle charging	Battery is fully charged and ready for operation.
Battery indicator does not display when charging.	Detector is depleted below normal levels	Charge the battery for 8 hours. Detector LEDs may light during first 5 hours. This is normal. If the battery indicator does not light after charging for 8 hours, contact BW Technologies by Honeywell.
When detector is activated after charging, the battery indicator does not display.	Battery is defective	Contact BW Technologies by Honeywell.

Startup Troubleshooting

Error Screen	Problem	Solution	Error Screen	Problem	Solution
	Sensor Error The sensor failed during the self-test.	Calibrate the sensor(s). Refer to Calibration. Reactivate the detector. If error displays again, replace the sensor. Refer to Replacing a Sensor or Sensor Filter.		**IR Lock Enabled** If the **IR Lock** screen displays, an IR device is required to calibrate the sensors.	Perform calibration using the IR Link with Fleet Manager II software, or insert the detector into the MicroDock II station. Refer to **Cal Lock (Calibration IR Lock)** in User Options and Calibration.
	**Calibration Overdue** Displays when calibration is overdue. If the **Force Calibration When Overdue** option is enabled, the sensor(s) must be calibrated to enter normal operation.	Press ◯ to continue and calibrate the sensor(s) immediately. Refer to Calibration. If the **IR Lock enabled** screen displays, the MicroDock II station or the IR Link with Fleet Manager II must be used to calibrate.		**Bump Test Fail** A bump test has just been performed. The detector is prompting for another bump test because a sensor(s) has failed.	Perform another Bump Test. Ensure the cylinder is not empty and that the cylinder is not past the expiry date. Ensure the regulator is fully opened to apply gas. If **Bump Check Today** displays again, calibrate the sensors. Refer to Calibration. If the calibration is unsuccessful, refer to Replacing a Sensor or Sensor Filter.
	Forced Calibration If **Force Calibration When Overdue** is enabled, the sensors must be calibrated to enter normal operation.	Press and hold ◯ to calibrate the sensors, or press ◯ and release to deactivate the detector. Refer to Calibration. If the **IR Lock enabled** screen displays, an IR device must be used to calibrate.		**Sensor Fail** A sensor has failed during the startup self-test.	Perform a Bump Test and reactivate the detector. If the sensor fails again, perform Calibration. Reactivate the detector again. If the sensor still does not pass, refer to Replacing a Sensor or Sensor Filter.

Calibration Troubleshooting

Error Screen	Problem	Solution	Error Screen	Problem	Solution
	Auto-zero Unsuccessful H_2S, CO, or LEL sensor fails to auto-zero, or O_2 sensor fails to calibrate.	Attempt calibration again. Refer to Calibration. If **ERROR** displays again, replace the sensor. Refer to Replacing a Sensor or Sensor Filter.		**No Gas Detected** If the gas is not detected about 30 seconds after the APPLY GAS message is displayed, the detector fails the calibration.	Ensure the sensor is enabled. Verify gas cylinder is not empty or past the expiration date. Check/replace the regulator. Attempt calibration again. If the calibration fails again, refer to Replacing a Sensor or Sensor Filter.
	Auto Span Unsuccessful H_2S, CO, or LEL, or O_2 sensor fails to auto-span.	Ensure sensor is enabled. Verify gas cylinder is not empty or past the expiration date. Check/replace the regulator. Attempt calibration again. If the sensor fails the span again, refer to Replacing a Sensor or Sensor Filter.		**Calibration Due Date Overdue** A sensor displays a negative number for a next due date after calibration is performed.	Calibration for the sensor was unsuccessful. The due date will not reset. Attempt calibration of the sensor again. If still unsuccessful, refer to Replacing a Sensor or Sensor Filter. Calibrate the new sensor immediately.
	**IR Lock Enabled** **IR-Lock** displays when calibration is attempted.	Perform calibration using the IR Link with Fleet Manager II software, or insert the detector into the MicroDock II station. Refer to **Cal Lock (Calibration IR Lock)** in User Options and Calibration.			

Replacement Parts and Accessories

⚠ Warning

To avoid personal injury and/or damage to the detector, use only the specified replacement parts.

To order parts or accessories listed in the following table, contact BW Technologies by Honeywell.

Table 16. Replacement Parts and Accessories

Model No.	Description
Sensors	
SR-W-MP75C	MICROpeL combustible (LEL) sensor
SR-H-MC	MICROceL hydrogen sulfide (H_2S) sensor
SR-M-MC	MICROceL carbon monoxide (CO) sensor
SR-DUMM1	Replacement dummy O_2 sensor
SR-TOX-MC-DUMM	Replacement dummy CO or H_2S sensor
SR-W-MC-DUMM	Replacement dummy LEL sensor
SR-X3P	Replacement O_2 Sensor (Compatible with X3 only)
SR-X2V	Replacement O_2 sensor (Compatible with XT and XL only)
Sensor filters	
MC2-SS	Replacement quad sensor screens (Kit of 2).
MC2-SS-K1	Replacement quad sensor screens (Kit of 10)
MC-AF-1	Auxiliary adapter (filters not included)
MC-SS-AF-K1	Auxiliary kit (adapter with 10 filters)
Regulator	
Reg-0.5	Regulator (0.5 l/min)
Gas Cylinders	
CG-Q58-4	Quad gas cylinder: CH_4 (2.5%), O_2 (18.0%), H_2S (25 ppm), CO (100 ppm), bal. N_2 (58 l)
CG-Q34-4	Quad gas cylinder: CH_4 (2.5%), O_2 (18.0%), H_2S (25 ppm), CO (100 ppm), bal. N_2 (34 l)
CG-T34	Dual gas cylinder: 50% LEL (CH_4 2.5%) O_2 (20.9%), bal. N_2 (34 l)
CK-Q58-4	Quad calibration kit with regulator, quad gas cylinder (CG-Q58-4), hose, and carrying case
G0042-H25	Single gas cylinder: H_2S (25 ppm), bal. N_2 (58 l)

Model No.	Description
CG2-M-200-103	Single gas cylinder: CO (100 ppm), bal N_2 (103 l)
CG-BUMP1	Bump alarm gas aerosol: CH_4 (2.5%), O_2 (10%), H_2S (40 ppm), CO (200 ppm)
Charger and Accessories	
MC2-CO1-MC5*	Multi-unit (5) cradle charger
GA-PA-1-MC5*	Multi-unit wall outlet power adapter
GA-PA-3	12-24 VDC direct-wire power adapter
GA-PA-1*	Replacement wall outlet power adapter
GA-VPA-1	12-24 VDC Vehicle power adaptor
Confined space kit	
MC-CK-DL	Deluxe confined space kit for the GasAlertMicroClip products.
MC-CK-CC	Carry case and foam insert for the GasAlertMicroClip products
MicroDock II and Module	
DOCK2-2-1C1P-00-G*	MicroDock II Automatic Test and Calibration System, GasAlertMicroClip XT/XL module, and charging cable
DOCK2-2-1P-00-G*	MicroDock II Automatic Test and Calibration System and GasAlertMicroClip XT/XL module

Model No.	Description
DOCK2-0-1P-00-G	GasAlertMicroClip XT/XL docking module
Datalogging Accessories	
GA-USB1-IR	IR Connectivity Kit (with Fleet Manager II)
Sampling/Testing Equipment	
MC-TC-1	Replacement test cap
MC-AS01	Manual aspirator pump kit with probe (1 ft. / 0.3 m)
MC-TC-1	Calibration cap
Carrying Accessories	
GA-NS-1	Neck strap with safety release
GA-LY-1	Short strap 6 in. (15.2 cm)
GA-ES-1	Extension strap 4 ft. (1.2 m)
GA-CH-2	Chest harness
MC2-LC-1	Black leather PVC carrying holster for XT
Miscellaneous	
MCX3-FC1	Replacement front enclosure - Yellow (Compatible with X3 only)

Model No.	Description
MCX3-FC1B	Replacement front enclosure - Black (Compatible with X3 only)
MCX3-BC1	Replacement back enclosure - Yellow (Compatible with X3 only)
MCX3-BC1B	Replacement back enclosure - Black (Compatible with X3 only)
MCX3-FPCB1	Replacement flex PCB (Compatible with X3 only)
MCX3-MPCB1	Replacement main PCB and battery (Compatible with X3 only)
MCXL-FC1 MC2-FC1	Replacement front enclosure – Yellow (compatible with XL only))
MCXL-FC1B MC2-FCIB	Replacement front enclosure – Black (compatible with XL only)
MCXL-BC1 MC2BC1	Replacement back enclosure – Yellow (compatible with XL only)
MCXL-BC1B MC2-BCIB	Replacement back enclosure – Black (compatible with XL only)
MC2-FPCB1	Replacement flex PCB (for XT)

Model No.	Description
MCXL-MPCB1 MC2-MCPCB1	Replacement main PCB and battery (compatible with XL only)
MC-LCD-K1	Replacement LCD (for XT)
MC-SCREW-K1	Replacement screw kit (for XT)

**Add one of the following applicable suffixes to the end of the order number to ensure power adapter is correct for region.*

-UK for United Kingdom

-EU for Europe,

-AU for Australia/China,

-NA for North America,

-CN for China,

-BR for Brazil,

Specifications

Instrument dimensions:
XT: 11.25 x 6.00 x 2.89 cm (4.4 x 2.4 x 1.1 in.)
XL-X3: 11.25 x 6.00 x 3.22 cm (4.4 x 2.4 x 1.2 in.)

Weight:
XT: 170 g (6.0 oz.)
XL: 190 g (6.7 oz.)

X3: 179 g (6.3 oz.)

Operating temperature: -4°F to +122°F (-20°C to +50°C) ()
Storage temperature: -40°F to +122°F (-40°C to +50°C)

Operating humidity: 0% to 95% relative humidity (non-condensing)

Alarm setpoints: May vary by region and are user defined. All setpoints automatically display during the startup self-test

Detection range:

H_2S: 0 – 100 ppm (1 / 0.1 ppm increments)

CO: 0 – 500 ppm (1 ppm increments)

O_2: 0 – 30.0% vol. (0.1% vol. increments)

Combustible (LEL): 0% to 100% LEL (1% LEL increments) or 0.0% to 5.0% v/v methane

Alarm conditions: TWA alarm, STEL alarm, low alarm, high alarm, multi-gas alarm, over limit (OL) alarm, low battery alarm, confidence beep, automatic deactivation alarm

Audible alarm: 95 dB at 30 cm (1 ft.) (100 dB typical) variable pulsed beeper

Visual alarm: Red light-emitting diodes (LED)

Display: Alphanumeric liquid crystal display (LCD)

Backlight: Activates when the pushbutton is pressed and deactivates after 5 seconds; also activates during an alarm condition

Self-test: Initiated upon activation

Calibration: Automatic zero and automatic span

Oxygen sensor: Automatic span upon activation (enable/disable)

User field options: Startup message, Confidence Beep, latching alarms, enable/disable safe display mode, oxygen measurement, combustible sensor measurement, sensor disable, define calibration interval, force calibration, calibration lock, force bump, define bump interval, bump due lock, stealth mode, low alarm acknowledge, language selection, enable/disable automatic oxygen calibration, enable/disable auto zero at startup, define alarm setpoints, span concentration values, define STEL calculation period, IntelliFlash, and Confidence Beep and IntelliFlash Interval

Table 17: Battery Operating Time

	XL-X3	**XT**
Typical Battery Life*	18 hours Recharges in less than 6 hours	10 hours Recharges in less than 4 hours
Cold Weather Battery Life**	12 hours at -4°F / -20°C	

*Approximately 20% capacity loss is normal with lithium polymer batteries after 500 charge cycles. Refer to the Operator's Manual for additional information.

**Battery is guaranteed to have 12 hour runtime during warranty period under normal operating temperature of -4°F / -20°C to 122°F/50°C.

1ppm =1 µmol/mol

Manufacture: RAE Systems (Shanghai) Inc.

Address: 990 East Huiwang Road, Jiading District, Shanghai, China 201815

Tel: =86-21-69522616

Year of manufacture: The detector's year of manufacture is determined from the serial number. The second and third number after the letters determines the year of manufacture

E.g.: KA4**10**-000001 = 2010 year of manufacture

Approved battery:

Approved batteries for GasAlertMicroClip XT:
Narada NL 503759

Approved batteries for GasAlertMicroClip XL:
Narada NLP883759LT20

Approved batteries for GasAlertMicroClip X3:
Narada NLP883759LT20

Rechargeable battery		**Temperature code**
Lithium polymer	-20°C ≤ Ta ≤ +50°C	T4

Battery charger: GasAlertMicroClip charging adapter

⚠ Warning

Charge only in a safe area that is free of hazardous gas and within temperatures of 32°F to 113°F (0°C to 45°C) First-time charge:
XT: 2-3 hours
XL-X3: 5-6 hours

Normal charge:
XT: 2-3 hours
XL-X3: 5-6 hours

Warranty XT-XL: 2 years including sensors

Warranty X3: 3 years including sensors

Guarantee: Battery is guaranteed to have a 12 hour runtime during warranty period under the normal operating temperature of -4°F/-20°C to 122°F/50°C

Approvals:
Approved by CSA to both U.S. and Canadian Standards
CAN/CSA C22.2 No. 157 and C22.2 152
ANSI/UL – 913 and ANSI/ISA – 12.13.01 Part 1

CSA	Class I, Division 1, Group A, B, C, and D
ATEX	CE 0539 ⟨Ex⟩ II 1 G Ex da ia IIC T4 Ga Sira 13ATEX2330 EN 60079-0, EN 60079-11, EN 60079-26
IECEx	Ex da ia IIC T4 Ga IECEx CSA 05.0015 IEC 60079-0, IEC 60079-11, IEC 60079-26
KTL	GasAlertMicroClip XT:12-KB4BO-0053[1] GasAlertMicroClip XL:14-KB4BO-0659X[2] GasAlertMicroClip X3:15-KA4BO-0307X[3]

Indication Error LEL:± 5% FS: H2S: ± 5x 10-6:CO: ± 10%: O2:± 5% FS

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules and

1. http://www.honeywellanalytics.com/~/media/honeywell-analytics/products/gasalertmicroclip/documents/koreanexcertificate_juarez_gamicroclipxt_12kb4-bo0053.pdf?la=en
2. http://www.honeywellanalytics.com/~/media/honeywell-analytics/products/gasalertmicroclip/documents/korea-certification_gasalertmicroclip-xl-14kb4-bo0659x.pdf?la=en
3. http://www.honeywellanalytics.com/~/media/honeywell-analytics/Products/GasAlertMicroClip X3/Certification/GasAlertMicroClip X3 KTL Certificate

ICES-003 Canadian EMI requirements. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

General Datalogger Specifications

Storage: 16 hours at 15-second intervals

Memory type: Wraparound memory ensures most recent data is always saved

Datalog Interval: The default interval is one reading every 15 seconds. The user has the option to change the intervals to rates from 1 to 120 seconds.

Data recorded: All sensor readings, all alarm conditions, calibrations, event flags, battery status, sensor status, confidence beep activation, and detector status with the time and date for each reading and unit serial number

Operation: Requires no user intervention (automatic)

Compatible with: Desktop PC computer or laptop

Operating system: Windows 2000 or higher

Download via: IR device (IR Link adapter or MicroDock II base station)

Software required:

- Fleet Manager II application,
- Microsoft Excel (optional) to create custom reports.

Wear yellow. Work safe.

50120681-002 EN-F2

English
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APPENDIX K

PANDEMIC PREVENTION PLAN

PANDEMIC PREVENTION PLAN

March 2020

PREPARED BY: Trihydro Corporation

1252 Commerce Drive, Laramie, WY 82070

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1.0 PANDEMIC PREPAREDNESS PLAN

1.1 INTRODUCTION

This Pandemic Preparedness Plan was created to provide guidance and address concerns regarding a possible pandemic. This plan provides information on decision-making and details appropriate actions to be taken by Trihydro in the event of a pandemic. This document will be reviewed and/or tested annually and may be updated and amended at any time in the future.

1.2 BACKGROUND

A pandemic is a disease occurring over large areas and affecting large numbers of individuals. A pandemic is determined when:

- A novel (new) virus sub-type arises whereas humans have little or no immunity to the virus.
- The virus spreads easily from person to person, (e.g., through sneezing or coughing).
- A wide-spreading disease that spans a broad geographical area and affects large numbers of people.

Examples of diseases that could result in a pandemic include but are not limited to Influenza and Coronavirus (i.e., MERS, SARS, and COVID-19).

Pandemic viruses are likely to cause similar symptoms as seasonal flu, but the symptoms may be more severe. As with any novel disease, symptoms of a pandemic are ambiguous and will continue to be ambiguous until the disease has existed within the population for a given time period.

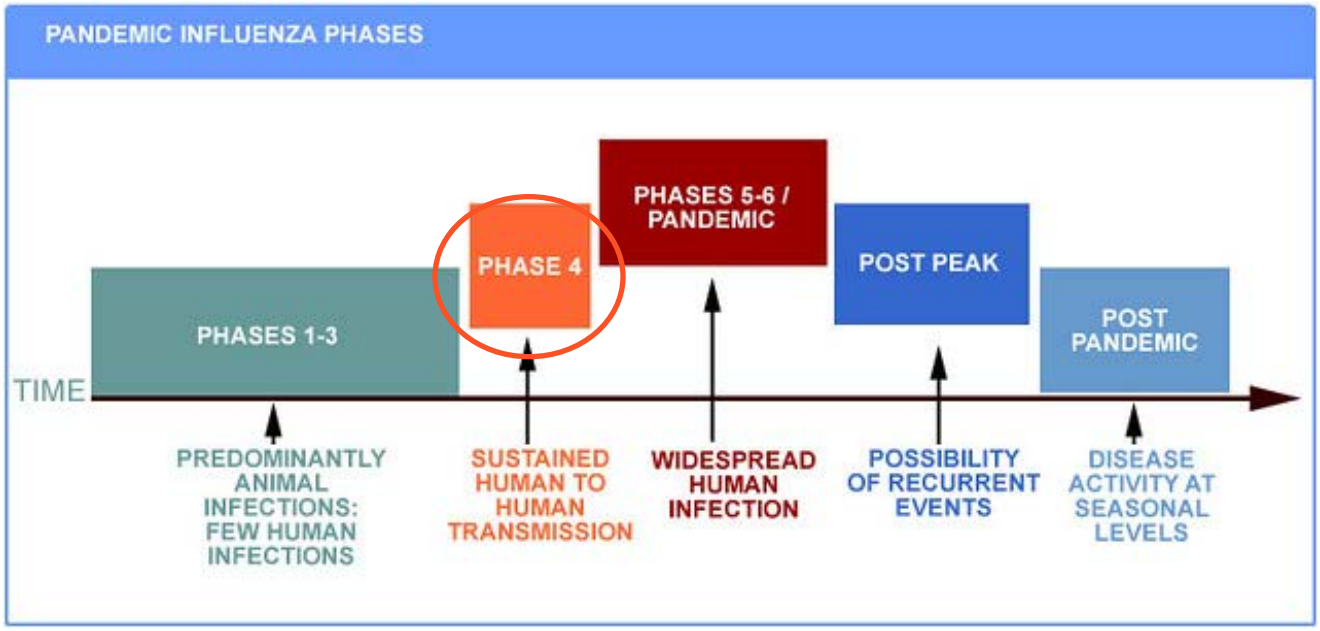
According to the Centers for Disease Control and Prevention (CDC), "on February 11, 2020, the World Health Organization (WHO) announced an official name for the disease that is causing the 2019 novel coronavirus outbreak, first identified in Wuhan China. The new name of this disease is coronavirus disease 2019, abbreviated as COVID-19. In COVID-19, 'CO' stands for 'corona,' 'VI' for 'virus,' and 'D' for disease. Formerly, this disease was referred to as "2019 novel coronavirus" or "2019-nCoV" (CDC 2020). COVID-19 is a new disease, caused by a novel (or new) coronavirus that has not previously been seen in humans.

1.3 PANDEMIC PHASES

WHO has defined phases of a pandemic to help assist with planning and response activities; Figure 1-1 illustrates these phases:

- Phase 1—No animal-to-human transmission reported
- Phase 2 – Some animal-to-human transmission
- Phase 3 – Limited human-to-human transmission
- Phase 4 – Increased human-to-human transmission
- Phase 5 – Significant human-to-human transmission
- Phase 6 –Sustained human-to-human transmission

Figure 1-1



As determined by the H1N1 Pandemic of 2009, this chart does not account for *virulence* of the novel strain. Therefore, these phases simply indicate the type of transmission; no information is implied relative to severity through use of these phases.

1.4 PLANNING FOR A PANDEMIC

The Health and Safety Manager, Todd Forry and Human Resources Director, Karissia Kersey, are Trihydro's designated pandemic coordinators.

The Pandemic Response Team (PRT) includes:

- Jack Bedessem –President
- Bradley Mallberg, Esq. – Vice President of Risk Management
- Brian Pelan – Director of Operational Service and Excellence Programs
- Jana Brinkman – Health and Safety Coordinator
- Tony Kupilik – Health and Safety Coordinator

The primary functions of the pandemic response team include:

- Maintaining the team's awareness of global developments.
- Developing awareness and preparedness materials for Trihydro personnel.
- Maintaining links with external stakeholders for pandemic planning.
- Planning for effects of the flu pandemic on the company.

Each Trihydro office has an Office Health & Safety Coordinator (OHSC), which is designated as a pandemic response team member. The OHSC primary contact information is provided in each office Emergency Action Plan (EAP).

1.5 PANDEMIC RESPONSE

1.5.1 INFECTION CONTROL

Trihydro will seek to reduce the overall and specific risks to staff members by taking reasonable appropriate infection-control actions.

Upon notification that a pandemic is occurring, the PRT and its coordinators will attempt to complete the following:

- Post prominent notices at facility entry points advising staff and visitors not to enter for at least 24 hours after their fever has broken.
- Educate employees through e-mail or hardcopy on recommended measures to stop the virus from spreading.

- Check supplies and re-stock if necessary.

At the discretion of the company, it may purchase and maintain a stock of health protection supplies to be distributed to and used by Trihydro employees in the event of an influenza pandemic. The company is under no obligation to provide such supplies during an influenza pandemic.

The items that may be purchased for pandemic preparedness include, but are not limited to:

- Liquid-hand sanitizers
- Tissues
- Nitrile gloves
- Other appropriate protective gear

Basic health protection advice will be issued to staff, including but not limited to, the information in Sections 1.5.4 and 1.5.5 of this document.

1.5.2 WORK PRACTICES

Employees are encouraged to stay home from work when feeling ill, or while members of their household have flu-like symptoms. Trihydro reserves the right to send anyone home who appears ill or contagious. If an employee becomes ill, or observes another person exhibiting flu-like symptoms at work, notify Human Resources or their supervisor as soon as possible. Employee(s) are encouraged to seek medical care and report diagnosed influenza or COVID-19. The employee will be required to provide a fit-for-duty at the discretion of the company. Individuals who have symptoms of acute respiratory illness should not return to the workplace until they are fever free for 24-hours without the use of fever-reducing or other symptom-altering medications and/or the approval of a qualified health care provider. Some project sites may have alternative procedures for coverage if/when applicable.

Pursuant to the Trihydro Sick Leave Policy employees should notify their direct supervisor and stay home if they are sick. In the event of a severe pandemic (20% absenteeism), employees may be allowed to work from home using the Internet, e-mail, telephone, and fax. Consult with your business unit leader for prior approval to work from home.

1.5.3 TRAINING

Training is covered in the Trihydro Hazard Communication Program. Additional steps will be taken as new information is available from the CDC and local and state agencies.

Lessons learned will be shared along with additional guidance from Trihydro, clients, local, and federal agencies on Trihydro's internal teams page for review by Trihydro employees and subcontractors.

1.5.4 SOCIAL DISTANCING

During a pandemic, employees are encouraged to practice social distancing, which includes but is not limited to:

- Avoiding hand shaking
- Avoiding face-to-face meetings
- Maintaining a safe distance of at least 6 feet during face-to-face meetings
- Avoiding crowded places or heavily populated gatherings
- Avoiding congregating
- Avoiding unnecessary trips outside of the office
- Bringing lunch and washing your own silverware or containers
- Avoiding sharing telephones

1.5.5 PREVENTION MEASURES

Employees are encouraged to practice respiratory etiquette and hand hygiene, including (CDC 2020):

- Clean your hands often with an alcohol-based hand sanitizer that contains at least 60-95% alcohol
- Regularly wash hands with soap and water for at least 20 seconds
- Avoid touching your eyes, nose, and mouth with unwashed hands
- Cover your mouth and nose with a tissue when you cough or sneeze
- Put your used tissue in a waste basket
- If you don't have a tissue, cough or sneeze into your upper sleeve, not your hands
- Clean and disinfect frequently touched objects and surfaces using a regular household cleaning spray or wipe
- Maintain healthy habits that support your immune system (e.g., get enough rest and sleep, eat a healthy diet, exercise)
- Recommended that you get appropriate immunizations, if not already done so

1.6 COMPENSATION

In the event an employee is unable to work, time shall be recorded in accordance with the company's paid sick leave policy on a case by case basis.

1.7 TRAVEL

Travel restrictions may be enforced by the federal government and Trihydro. Whereby, only essential business travel would be permitted during a pandemic, and procedures for approving travel would require authorization from senior management. Additionally, employees who visit pandemic-affected areas on business will be provided with the appropriate health precautions and personal protective equipment (PPE). Employees visiting affected areas for non-business purposes during a pandemic are to notify HR and may be required to work from home for a specified period of quarantine and may not return to work without a "fit-for-duty" release.

Specific to the 2020 COVID-19 outbreak, employees, contractors, or subcontractors who have travelled to the following locations or who have experienced the following (subject to change per CDC notices) in the past 14 days, regardless of symptoms, should not enter the workplace until further notice (CDC 2020):

- Travel to or through Mainland China, South Korea, Italy, Japan, Iran, Singapore, Hong Kong, Taiwan or any other country for which the CDC has issued a Travel Notice (See CDC COVID-19 Travel Notices)
- Close contact with persons who have traveled to or through Mainland China, South Korea, Italy, Japan, Iran or any other country for which the CDC has issued a Travel Notice (See CDC COVID-19 Travel Notices)
- Close contact with persons who may have been exposed to the virus or have been diagnosed with COVID-19

Employees meeting any of these criteria should avoid entering the workplace and contact their direct supervisor and Human Resources to coordinate alternative work arrangements (e.g., home or other isolated location) if possible. Instructions will be provided regarding return to work procedures based on each circumstance and in accordance with local public health direction. Guidance should be given to contractors or subcontractors that any of their employees experiencing any of the above should remain off-site and seek direction from their direct supervisor and client representative.

If you believe the situation merits trained medical personnel, please contact WorkCare™ at (888) 449-7787 or 911 immediately and inform the WorkCare™ attending physician or 911 operator of the individual's symptoms, location, and any other pertinent information.

- Consider avoiding or deferring unnecessary and nonessential travel for business and work; particularly when
  - Travelling via commercial airlines and mass transit systems (e.g. subway, train, bus, etc.)
  - Travelling to a heavily populated area and/or meeting or conference where lot of people will be congregating and interacting
- If you are unsure about travelling or whether your travel is necessary/essential, you should contact your direct supervisor and/or use your stop work authority
- Check with clients and/or conference leaders for special site restrictions and changes to scheduled events
- Stay abreast of current travel guidance from reputable health organizations (e.g., CDC, State Health Departments)
- Employees who need to travel are encouraged to check themselves for symptoms of acute respiratory illness before starting and upon returning from travel
- If you become sick while traveling for work, you should notify your supervisor and promptly contact WorkCare™ or a qualified health care provider for advice
- Personal travel:
  - CDC guidelines restricting travel to certain areas should always be followed. There is increased risk that any travel, particularly to international locations, could be disrupted without prior notice. We encourage employees and their families to consider the potential that personal travel plans could be disrupted while in transit, that exit or entrance to airports, cruise ships, or across borders could be denied, or that you or family members could be placed into quarantine while on travel or upon return. Travel of any kind during pandemics should be limited to essential situations only.

1.8 PANDEMIC RECOVERY

Trihydro will take reasonable steps to keep appropriate lines of communication open with staff during the recovery stage. Regular updates on recovery interventions and preparedness for subsequent pandemic waves will be communicated via email and Teams website as they become available to the company.

1.9 REFERENCES

Centers for Disease Control and Prevention (CDC). 2020. Coronavirus (COVID-19) How to Prepare. Available from: https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/testing.html.