



Pennsylvania Department of Environmental Protection

Appendix A – Site-Specific Health and Safety Plan

GTAC 8– Bishop Tube HSCA Site
S Malin Road
East Whiteland Township
Chester County, PA

November 12, 2025



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S Malin Road, East Whiteland Township
Chester County, Pennsylvania

Prepared for:
Mr. Dustin Armstrong
Pennsylvania Department of Environmental Protection
Southeast Regional Office
2 East Main Street
Norristown, PA 19401

Prepared by:
Groundwater & Environmental Services, Inc.
410 Eagleview Boulevard, Suite 110
Exton, Pennsylvania 19341

TEL: 800-220-3068
www.gesonline.com

GES Project:
0070462

Date:
November 12, 2025



Alison M. Gibbons
Staff Environmental Scientist



Timothy Uhler
Principal Project Manager

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GROUNDWATER & ENVIRONMENTAL SERVICES, INC.

SITE-SPECIFIC HEALTH AND SAFETY PLAN

FOR

Bishop Tube HSCA Site

S Malin Road

East Whiteland Township, Chester County, PA

EMERGENCY PHONE NUMBERS:

Local Police _____ 911

Local Fire _____ 911

Local _____ 911

Local Hospital Name, Phone Number & Address (Map and directions are attached as **Figure 1** and **Figure 2**):

Hospital Name	Paoli Hospital
Street Address	255 West Lancaster Avenue (Route 30)
City, State, Zip	Paoli, Pennsylvania 19301
Phone Number	(484) 565-1000

National Response Center (NRC): 1-800-424-8802

The NRC should be contacted in the event of a significant chemical release. Once notified, the NRC will activate a federal response to the spill. *Please confirm with the client and project manager to determine if the spill should be reported.*

Poison Control Center: 1-800-222-1222

The Poison Control Center should be contacted in the event of accidental poisoning. They will provide information on immediate treatment for the poisoning.

Project Contact Information:

Role	Name	Phone Number	Cell Phone Number
Site Supervisor	GES Personnel	(800) 426-9871	N/A
Project Manager	Timothy F. Uhler	(800) 426-9871, ext. 3071	(484) 883-0095
Vice President of Corporate Health and Safety	Thomas Baylis	(800) 426-9871, ext. 3021	(610) 587-1124
Client Representative	Dustin Armstrong	(484) 250-5723	N/A
Client Representative	Christine McCarthy	(484) 250-5725	N/A
Client Representative	Wayne Harms	(484) 250-5730	N/A

DO NOT TRANSPORT SERIOUSLY INJURED PERSONNEL TO THE HOSPITAL

CALL 911

1 Introduction

1.1 Approvals

	Name	Title	Date	Signature
Prepared By	Maggie Gibbons	Staff Environmental Scientist	October 8, 2025	<i>Alison M. Gibbons</i>
Reviewed By	Timothy F. Uhler	Project Manager	October 10, 2025	<i>T. Uhler</i>
Approved By	Kyle Slabik	Regional Health & Safety Officer	October 8, 2025	<i>Kyle Slabik</i>

1.2 Site Background

Project Name	Bishop Tube HSCA Site
Site Address	S Malin Road, East Whiteland Township, Chester County, PA
Nearest Intersection	S Malin Road and Lincoln Highway (Route 30)
Township/Municipality	East Whiteland Township
County	Chester County
Additional Information	The Bishop Tube HSCA Site is a former manufacturing facility that operated until 1999. The Site is currently owned by Constitution Drive Partners, L.P. (CDP), who purchased it from the Central and Western Chester County Industrial Development Authority in 2005. The Site has been vacant from 1999 to present. The Site was historically zoned industrial; however, the Site was rezoned by East Whiteland Township for residential use in 2014.

1.3 Scope of Work

Task 1	Site Preparation to Clear Vegetation
Task 2	Background Soil Investigation for Select Inorganics
Task 3	Soil Investigation
Task 4	Install a Cluster Monitoring Well
Task 5	Downhole Geophysical Investigation
Task 6	Packer Testing
Task 7	Groundwater Monitoring

Project Organization and Responsibilities

Responsibility	Name	Task Description
Project Manager	Timothy F. Uhler	Oversee and coordinate all budget and technical aspects for the project
Regional Health & Safety Manager/Officer	Kyle Slabik	Coordinate all health and safety operations for the project site
Site Supervisor	GES Personnel	Oversee and coordinate all health and safety aspects from the project site

1.4 Accident / Incident Medical Surveillance

As a follow-up to a work-related injury, all employees are entitled and encouraged to seek medical attention. All accidents and potential exposures must be reported **immediately** to the office leadership and / or Regional Health, Safety, Security, Environment (RHSE), who will coordinate with Corporate HSSE (CHSSE) to arrange for appropriate medical attention. Depending on the type of incident, it may be critical to perform tests within 24 to 48 hours. *Failure to report an injury or incident immediately will result in disciplinary action.*

Events surrounding Near Loss incidents will be recorded in the daily log and documented in accordance with the GES Incident Reporting Procedures.

2 Hazard Assessment

Job Safety Analysis (JSAs) are required for most site activities. Each JSA identifies and quantifies the health and safety hazards associated with each task and site operation to evaluate risks to workers. Using this information, appropriate control methods are selected to mitigate or (preferably) eliminate the identified risks.

2.1 Site Security

- Do not permit anyone who is not properly trained and outfitted with the appropriate PPE to enter the Exclusion or Contamination Reduction Zones (this includes GES personnel, clients, etc.)
- Use caution tape or barricade fencing where warranted to keep unauthorized personnel from entering the work area.
- On sites where it is believed that security is an issue, two employees will be used for all field work. The “buddy-system” will be in place and the two employees will be in constant communication and within each other’s line of sight. There will be a cellular phone available to call 911 if a violent condition presents itself.
- When acts of violence occur or when an employee(s) feels that they are being placed in a threatening position they must immediately leave the site.
- All potential acts of violence or threats by non-GES personnel must be immediately reported to the Office leadership and / or Project Manager and Regional HSSE. The situation will be discussed to determine future action on the site in question.
- If any GES employee notices suspicious persons or activities in a GES office or in the vicinity of a work area, he or she should immediately report the observation to his or her supervisor or Regional Operations Manager.

2.2 Fire/Explosion

If a fire is observed in the incipient phase (i.e., when it begins) and if the site personnel witnessing the fire feel secure in attempting to control the fire, the individual can attempt to extinguish the fire by using the onsite fire extinguisher. The fire extinguisher should be a 10 or 20 pound (lb.) dry chemical, Class A, B, and C extinguisher that is adequate for paper and wood based products (A), flammable and combustible liquids (B), and electrical (C) type fires.

If there is no fire extinguisher available or if site personnel do not feel secure in attempting to extinguish the fire, site personnel shall perform the following:

- Secure the site, if possible.
- Evacuate the area using the nearest safe pathway from the area.
- Proceed to the nearest phone and call 911 and provide the emergency operator all required information. This will activate the emergency response system.

If more than one individual is on the site team, the individual activating the evacuation plan shall verbally communicate to the other site personnel that there is an emergency condition and that they should evacuate from the work area. If contact cannot be made verbally with the other site personnel, any of the following systems can be used as long as the system is audible above background noise. The system can be the site vehicle horn, a whistle, an air horn, or other acceptable device. The system used for initiating an evacuation from the site shall be discussed during the tailgate meeting with the other site personnel prior to beginning the workday. The system that is decided upon shall be documented in the site logbook.

If an explosion or other unsafe condition occurs that the site supervisor had determined will place the other site personnel at risk, then the evacuation system described above should be activated immediately.

2.3 GES Work Permits

Work permits will be required for Confined Space Entry, Hot Work, and Lockout/Tag out as well as any Federal and client permitted activity. These permits must be obtained from the Project Manager or RHSSE prior to site work.

2.4 General Site Rules

The following general site rules apply to all personnel while on the site:

- Before daily site operations begin, the daily site safety checklist will be completed, the subcontractor's training documentation will be reviewed (as required by section 3 of this plan), and a pre-entry briefing will be held to review the site's health and safety plan concerns and emergency procedures. This meeting will be registered in this Health and Safety Plan. Attendance will be documented.
- One site worker will be assigned to keep the daily log for all health and safety-specific site activities, unless otherwise specified.
- All personnel will wear steel-toe safety boots. Hard hats will be worn when working near heavy equipment (drill rigs, excavating equipment, etc.), when individuals are working with overhead hazards present, when required in the Job Safety Analysis (JSA), or when required by the client.
- Eye protection and high visibility clothing/reflective safety vests will be donned at all times while on site.
- Possession of alcohol or illegal substances on the job site or consumption during hours of site operations is strictly prohibited.
- Food and/or beverages are not permitted in the site's Exclusion or Contamination Reduction Zones. Food and/or beverages will be permitted in the Support Zone, if proper decontamination procedures are being followed.

- Smoking, including the use of e-cigarettes, is not permitted on any site. Chewing tobacco, snuff, application of cosmetics and/or lip balm is not permitted in the site's Exclusion or Contamination Reduction Zones.
- A change in level of protection will be based on air monitoring equipment readings taken in the breathing zone.
- Field personnel will use air monitoring equipment and not their nose to determine site contamination (i.e., sniffing sampled soils or water in jars, confined spaces, open bore holes or trenches, etc.). Odors detected during the course of standard operating procedures, however, should be noted in the daily log.
- Field personnel should not stand with their head directly over a well when it is being opened.
- First Aid Kit(s) and Fire Extinguisher(s) will be available in all company vehicles and/or within 50 feet of the working area.

Note: Hot work activities require that a person onsite shall act as a fire watch with a Class A, B, C dry chemical extinguisher within 10 feet of the activity, and all necessary work requirements are satisfied.

Any revisions to the final Site-Specific Health and Safety Plan must be reviewed by the Project/Case Manager and approved by RHSSE or a Principal Geologist, at a minimum.

3 Exposure Monitoring Program

3.1 Real-Time Monitoring

Photo-ionization Detector (PID): Real-time monitoring for volatile organic compounds (VOCs) will be conducted using a photo-ionization detector (PID). The PID will be used to monitor employee breathing zones during all invasive activities. **Table 1** lists PID action levels and response requirements.

Combustible Gas Indicator/Oxygen Level Meter: Real-time monitoring for combustible gases and oxygen levels will be conducted using a Combustible Gas Indicator (CGI)/Oxygen Level Meter. The CGI will test for the presence of combustible gases by continuously monitoring the lower explosive limit (LEL) of organic vapors. The CGI will be used to monitor the LEL prior to, and during, Confined Space (CS) entries and during work near an excavation in contaminated soil. The Oxygen Level Meter will detect an oxygen-deficient or oxygen-enriched atmosphere, and will be used prior to, and during, all CS entry activities. If ionizing radiation is suspected at a site, a Geiger counter will be used to measure exposure under guidance of a Health Physicist. **Table 2** lists CGI, Oxygen Level Meter, and ionizing radiation action levels and response requirements.

Depending on the Contaminants of Concern, other forms of real-time monitoring equipment may be required to quantify chemical hazards and protect workers from exposure. These may include, but are not limited to bio-aerosol monitors, detector tubes, dust monitors, FROG meters, etc.

- Calibration of Real-Time Monitoring Equipment: Monitoring and calibration protocols will be performed in accordance with the manufacturer's guidelines. Calibration will be performed, at a minimum, prior to each day's use.
- Calibration logs will be maintained by the field personnel performing the calibrations.

3.2 Action Levels

Tables 1 and **2** list the action levels and response requirements for a PID and CGI/Oxygen Level Meter. Changing levels of protection, upgrading respiratory protection, or changing work practices is based on maintaining the upper limit of the action level for approximately **10 minutes** sustained in the breathing zone (i.e., a non-transient reading) or at the discretion of the Site Supervisor. If changes in protection levels are required, the Site Supervisor will stop the job and notify the Project Manager, who will contact Regional Engineering and CHSSE to determine if administrative or engineering controls can be implemented to mitigate or eliminate the hazard.

Table 3 provides action levels that must be complied with when petroleum products such as gasoline are the known site contaminants.

Tables 4 and **5** provide space to document site-specific action levels, should the site contain other potential site contaminants. Action levels must be determined by consultation

with/approval by CHSSE, based on established chemical exposure limits and monitoring instrument response factors.

TABLE 1

PID ACTION LEVELS

Meter Response (Breathing Zone)	Action Required
PID response <1 units above background	No respiratory protection required (i.e., Level D)
PID response >1 units above background (Bkgd.) and <10 units above Bkgd.	Stop work. Investigate the cause of elevated VOC measurements. Contact the Project Manager and determine if administrative or engineering controls can be implemented to mitigate or eliminate the elevated readings. If not medically qualified to wear respiratory protection, leave work zone. If the elevated readings cannot be reduced below 5 units above background or eliminated, and if medically qualified, fit tested, and trained to wear respiratory protection, then upgrade to Modified Level C, half-face respiratory protection.
PID response >10 units and <250 units above Bkgd.	Stop work. Investigate the cause of elevated VOC measurements. Contact the Project Manager and determine if administrative or engineering controls can be implemented to mitigate or eliminate the elevated readings. If not medically qualified to wear respiratory protection, leave work zone. If the elevated readings cannot be reduced below 5 units above background or eliminated, and if medically qualified, fit tested, and trained to wear respiratory protection, then upgrade to Modified Level C, full-face respiratory protection.
PID response >250 above Bkgd.	Retreat from work area ^{1,2}

1. If a retreat becomes necessary, CHSSE or Regional Engineering will be consulted in regard to adding mechanical ventilation or possible changes in work practices. Work will not resume until appropriate corrective measures are implemented.
2. Because direct reading instruments cannot indicate or are not compound specific, concentrations shown on the instruments shall be related to units above background and not parts per million (ppm).

TABLE 2
CGI/O2/RADIATION ACTION LEVELS

Meter Response	Action
CGI response <10 % LEL	Continue normal operations.
CGI response >10 % and <20 % LEL	Eliminate all sources of ignition from the work area; implement continuous monitoring. However if work is being done in a confined space, retreat from work area. ¹
CGI response >20 % LEL	Discontinue operations; allow to vent; retreat from work area. ¹
Oxygen level <19.5%	Retreat from work area. ¹
Oxygen level >23.5%	Retreat from work area. ¹
3X background to <2 mR/hr.	Radiation above background levels (normally 0.01-0.02 mR/hr.) signifies possible source(s) radiation present. Continue investigation with caution. Perform thorough monitoring. Consult with a health physicist.
>2mR/hr.	Potential radiation hazard. Evacuate site. Continue investigation only upon the advice of a health physicist.

1. If a retreat becomes necessary, CHSSE or Regional Engineering will be consulted in regard to adding mechanical ventilation or possible changes in work practices. Work will not resume until appropriate corrective measures are implemented.

TABLE 3
Retail Petroleum Materials of Concern

Contaminant	OSHA TWA (ppm)	ACGIH TLV (ppm)	Hazards	Entry Routes	IP
Benzene	N/A	N/A	N/A	N/A	N/A
Xylene	N/A	N/A	N/A	N/A	N/A
Ethylbenzene	N/A	N/A	N/A	N/A	N/A
Toluene	N/A	N/A	N/A	N/A	N/A

TWA = Time Weighted Average in parts per million (ppm)

C = Ceiling

IP = Ionization Potential

N/A = Not Applicable

1 = irritant to skin

6 = may cause nausea and vomiting

2 = irritant to eyes

7 = may cause liver and kidney damage

3 = irritant to respiratory system

8 = irritant to GI tract

4 = may cause headache

9 = carcinogen/possible carcinogen

5 = may cause dizziness, lightheadedness

10 = may cause damage to CNS

TABLE 4
Inorganic Gases and Vapors of Concern

Contaminant	OSHA TWA (ppm)	ACGIH TLV (ppm)	Hazards	Entry Routes	IP
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A

TWA = Time Weighted Average in parts per million (ppm)

C = Ceiling

IP = Ionization Potential

N/A = Not Applicable

1 = irritant to skin

6 = may cause nausea and vomiting

2 = irritant to eyes

7 = may cause liver and kidney damage

3 = irritant to respiratory system

8 = irritant to GI tract

4 = may cause headache

9 = carcinogen/possible carcinogen

5 = may cause dizziness, lightheadedness

10 = may cause damage to CNS

Note: Consult standard reference manuals for air concentration/toxicity data. Action level depends on PEL/REL/TLV. These Action Levels, if not defined by regulation, are some percent (usually 50%) of the applicable PEL/REL/TLV. That number must also be adjusted to account for instrument response factors.

TABLE 5
***Site Specific Hazards (Chemicals) of Concern**

Contaminant	OSHA TWA (ppm)	ACGIH TLV (ppm)	Hazards	Entry Routes	IP
Inorganics (Metals):					
Antimony	0.5 mg/m ³	0.5 mg/m ³	1,3,6,7	Inh, Skin, Ingest, Eyes	N/A
Arsenic	0.01 mg/m ³	0.01 mg/m ³	1,2,3,6,9, 10	Inh, Skin, Ingest, Eyes	N/A
Cadmium	0.005 mg/m ³	0.01 mg/m ³	3,4,5,6,7, 10	Inh, Skin, Ingest, Eyes	N/A
Chromium	1 mg/m ³	0.5 mg/m ³	1,2	Inh, Skin, Ingest, Eyes	N/A
Cobalt	0.1 mg/m ³	0.02 mg/m ³	1,2,3	Inh, Skin, Ingest, Eyes	N/A
Lead	50 µg/m ³	0.05 mg/m ³	1,2,4,6,8	Inh, Skin, Ingest, Eyes	N/A
Manganese	5 mg/m ³ (ceiling)	0.02 mg/m ³ (respirable particulate matter), 0.1 mg/m ³ ; (inhalable particulate matter)	1,2,3,4,9, 10	Inh, Skin, Ingest, Eyes	N/A
Mercury	0.1 mg/m ³ (ceiling)	0.025 mg/m ³ (8 hour TWA)	1,2,3,4,5,6, 8,10	Inh, Skin, Ingest, Eyes	N/A
Nickel	1 mg/m ³	1.5 mg/m ³	1,9	Inh, Skin, Ingest, Eyes	N/A
Selenium	0.2 mg/m ³	0.2 mg/m ³	3	Inh, Skin, Ingest, Eyes	N/A
Thallium	0.1 mg/m ³	0.2 mg/m ³	1,2,3,4,5,6, 7,8,10	Inh, Skin, Ingest, Eyes	N/A

TABLE 5

***Site Specific Hazards (Chemicals) of Concern**

Contaminant	OSHA TWA (ppm)	ACGIH TLV (ppm)	Hazards	Entry Routes	IP
Vanadium	0.1 mg/m ³ (fume); 0.5 mg/m ³ (respirable dust) (ceiling)	0.05 mg/m ³ (inhalable particulate matter)	1,2,3,4,5,6, 7,8	Inh, Skin, Ingest, Eyes	N/A
Zinc	5 mg/m ³	2 mg/m ³ (respirable particulate matter)	2,3,6	Inh, Skin, Ingest, Eyes	N/A
Other Inorganics:					
Fluoride	2.5 mg/m ³	2.5 mg/m ³	1,6,8	Inh, Skin, Ingest, Eyes	N/A
VOCs:					
Tetrachloroethene (PCE)	100	25	1,2,3,4,5,6, 7,9	Inh, Skin, Ingest, Eyes	9.32 eV
Trichloroethene (TCE)	100	10	1,2,4,5,6,7, 9	Inh, Skin, Ingest, Eyes	9.45 eV
1,1-Dichloroethene (1,1-DCE)	1	5	1,2,3,4,5,6, 7,9	Inh, Skin, Ingest, Eyes	10.00 eV
cis-1,2-Dichloroethene (cis-1,2-DCE)	200	200	2,3,10	Inh, Skin, Ingest, Eyes	9.65 eV
trans-1,2-Dichloroethene (trans-1,2-DCE)	200	200	2,3,10	Inh, Skin, Ingest, Eyes	9.65 eV
1,1,1-Trichloroethane (1,1,1-TCA)	350	350	1,2,5,6,7, 10	Inh, Skin, Ingest, Eyes	11.0 eV
1,1,2-Trichloroethane (1,1,2-TCA)	10	10	1,2,3,4,5,7	Inh, Skin, Ingest, Eyes	11.0 eV
Vinyl Chloride	1	1	7,8,9	Inh, Skin, Ingest, Eyes	9.99 eV
Per- and Polyfluoroalkyl Substances (PFAS)⁽¹⁾:					

TABLE 5
***Site Specific Hazards (Chemicals) of Concern**

Contaminant	OSHA TWA (ppm)	ACGIH TLV (ppm)	Hazards	Entry Routes	IP
Perfluoroisobutylene (PFIB)	NA	0.01 (C)	1,2,3,7,9	Inh, Skin, Ingest, Eyes	N/A
Perfluorobutyl ethylene	NA	100	1,2,3,4,6,7,9	Inh, Skin, Ingest, Eyes	N/A
Ammonium perfluorooctanoate	NA	0.01 mg/m3	1,2,3,7,9	Inh, Skin, Ingest, Eyes	N/A

TWA = Time Weighted Average in parts per million (ppm)

C = Ceiling

IP = Ionization Potential

NA = Non Applicable

1 = irritant to skin

6 = may cause nausea and vomiting

2 = irritant to eyes

7 = may cause liver and kidney damage

3 = irritant to respiratory system

8 = irritant to GI tract

4 = may cause headache

9 = carcinogen/possible carcinogen

5 = may cause dizziness, lightheadedness

10 = may cause damage to CNS

Note: Consult standard reference manuals for air concentration/toxicity data. Action level depends on PEL/REL/TLV. These Action Levels, if not defined by regulation, are some percent (usually 50%) of the applicable PEL/REL/TLV. That number must also be adjusted to account for instrument response factors.

(1) OSHA does not have any time weighted average (TWA) standards for PFAS. The American Conference for Governmental Industrial Hygienists (ACGIH) has established recommended Threshold Limit Values for three PFAS contaminants in air including perfluoroisobutylene (PFIB), perfluorobutyl ethylene, and ammonium perfluorooctanoate (APFO), listed in the above table.

Figures

Figure 1 – Site Location Map

GTAC 8

Bishop Tube HSCA Site Location Map

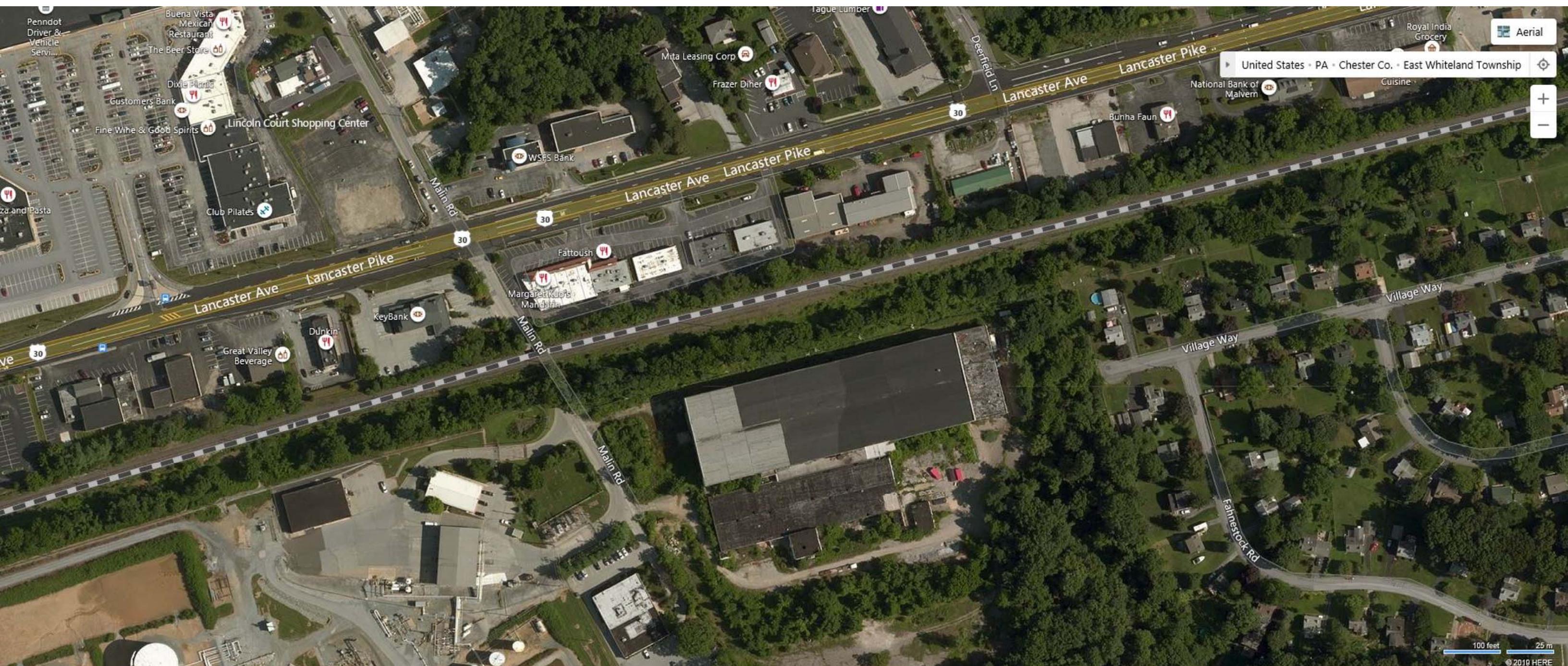


Figure 2 – Hospital Site Map



A 1 Malin Rd, East Whiteland Township, PA 19355
B Paoli Hospital, 255 W Lancaster Ave, Paoli, PA 19301

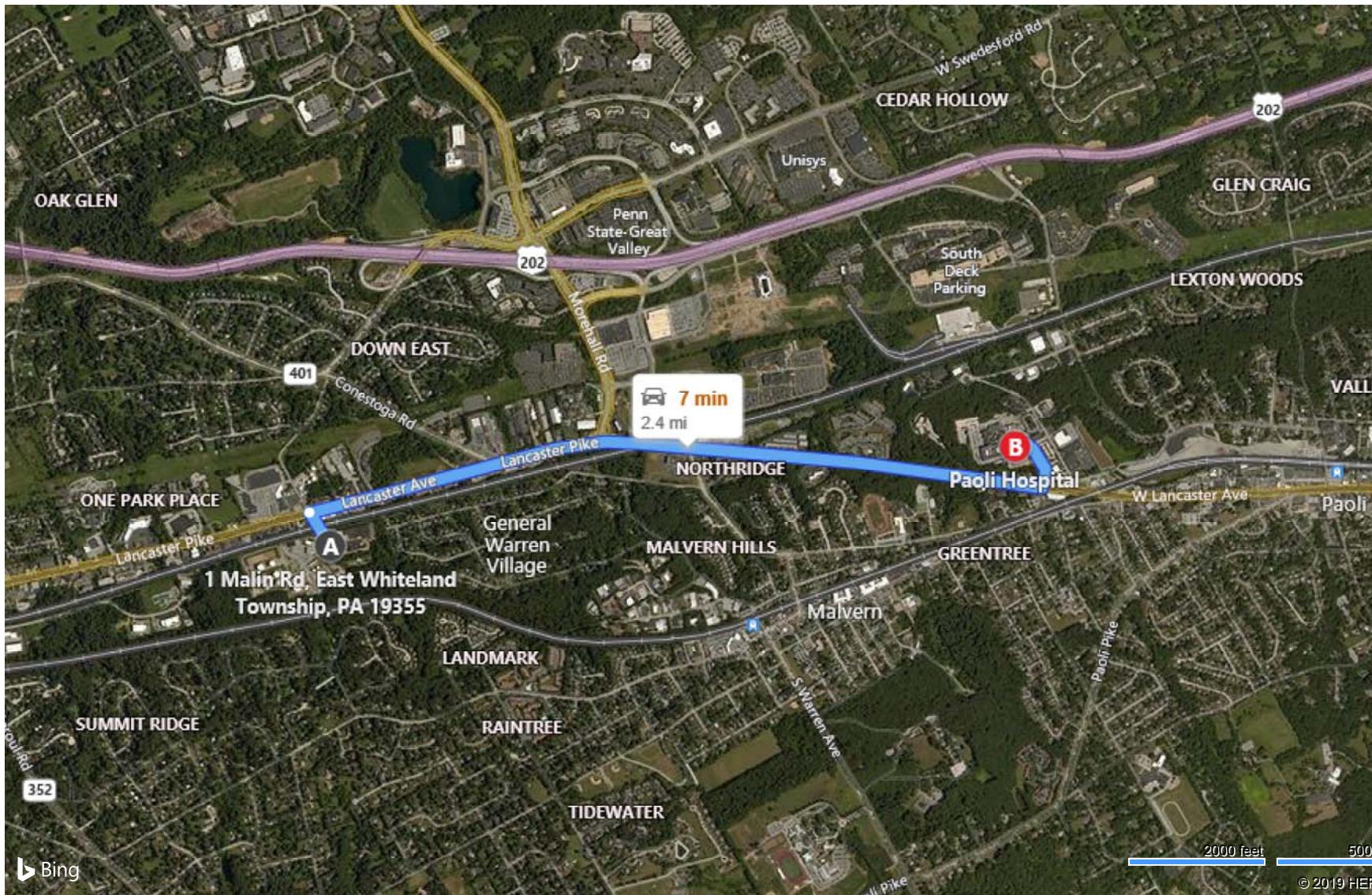
7 min, 2.4 mi
Moderate traffic
Via US-30
· Local roads

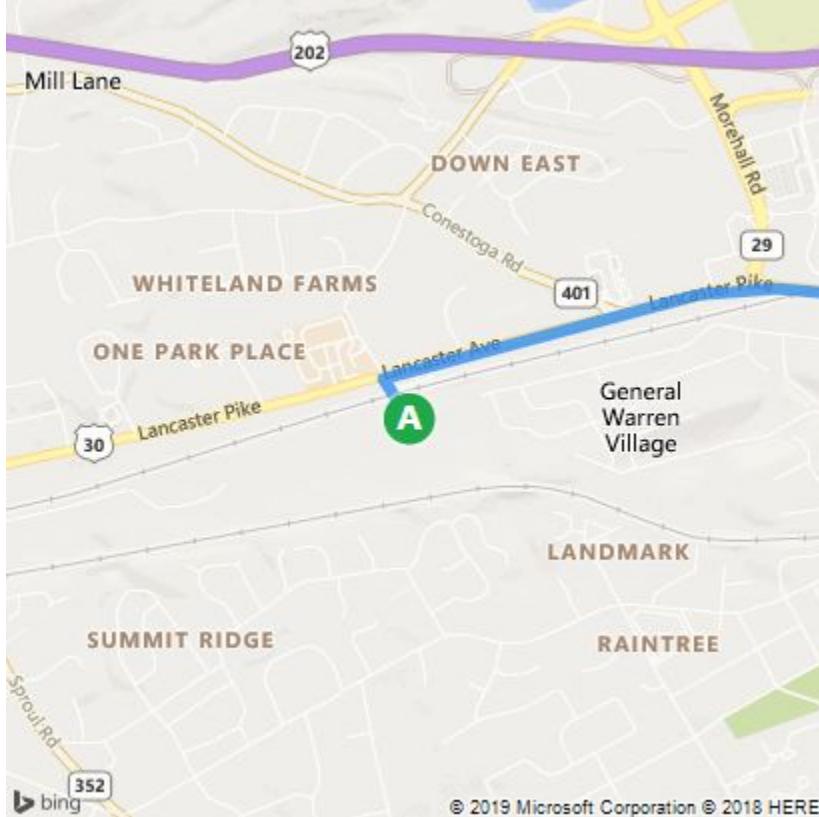
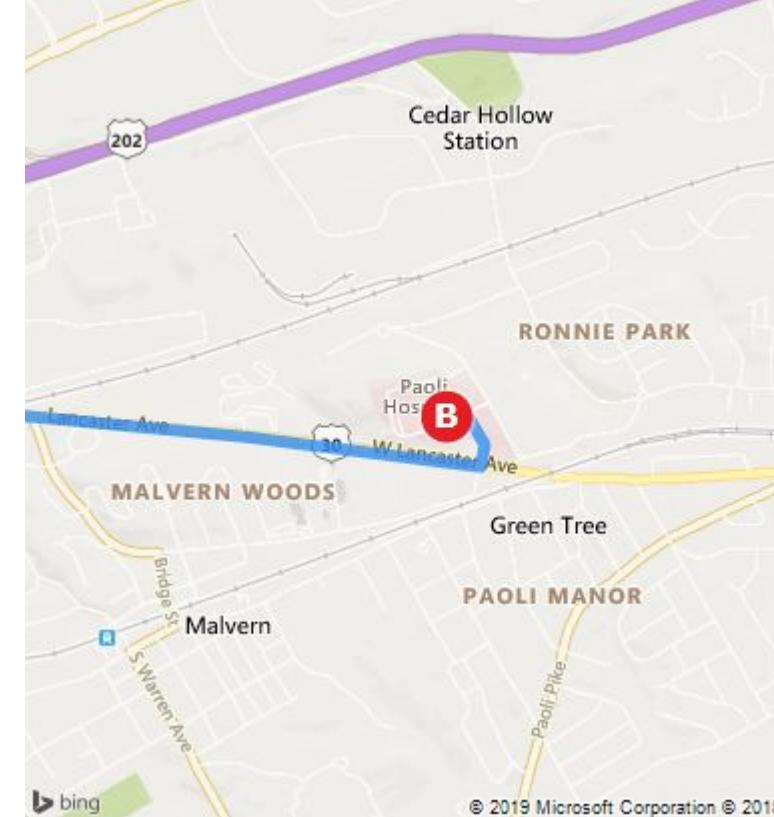
Directions from Bishop Tube HSCA Site to Paoli Hospital.

A 1 Malin Rd, East Whiteland Township, PA 19355

↑	1. Depart Malin Rd toward US-30 / Lancaster Ave / Lancaster Pike	0.1 mi
↗	2. Turn right onto US-30 / Lancaster Ave / Lancaster Pike	2.1 mi
;left	3. Turn left onto Green Hollow Rd	0.1 mi
↑	4. Keep straight onto road	328 ft
	5. Arrive on the right	

B Paoli Hospital



A 1 Malin Rd, East Whiteland Township, PA...**B Paoli Hospital, 255 W Lancaster Ave, Paoli...**

These directions are subject to the Microsoft® Service Agreement and are for informational purposes only. No guarantee is made regarding their completeness or accuracy. Construction projects, traffic, or other events may cause actual conditions to differ from these results. Map and traffic data © 2019 HERE™.

Attachment A – Site Safety Data Sheets (SDS)

- 1,1-Dichloroethene (1,1-DCE)
- 1,1,1-Trichloroethane (1,1,1-TCA)
- 1,1,2-Trichloroethane (1,1,2-TCA)
- Alconox
- Antimony
- Arsenic
- Cadmium
- Chromium
- cis-1,2-Dichloroethene (cis-1,2-DCE)
- Cobalt
- Fluoride
- Lead
- Liquinox
- Manganese
- Mercury
- Nickel
- Selenium
- Tetrachloroethene (PCE)
- Thallium
- trans-1,2-Dichloroethene (trans-1,2-DCE)
- Trichloroethene (TCE)
- Vanadium
- Vinyl Chloride
- Zinc

SAFETY DATA SHEET

Creation Date 11-Jan-2010

Revision Date 10-Feb-2015

Revision Number 1

1. Identification

Product Name 1,1,1-Trichloroethane, stabilized

Cat No. : AC294930000; AC294930250; AC294932500

Synonyms Methylchloroform

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

Entity / Business Name
Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01
/ **Europe** call: +32 14 57 52 11
Emergency Number **US**:001-201-796-7100 /
Europe: +32 14 57 52 99
CHEMTREC Tel. No.**US**:001-800-424-9300 /
Europe: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)

Acute Inhalation Toxicity - Vapors	Category 4
Carcinogenicity	Category 1B
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, Cardiovascular system.	

Label Elements

Signal Word

Danger

Hazard Statements

Harmful if inhaled

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
 Use only outdoors or in a well-ventilated area
 Do not breathe dust/fume/gas/mist/vapors/spray

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

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)

Harms public health and the environment by destroying ozone in the upper atmosphere

May form explosive peroxides

Repeated exposure may cause skin dryness or cracking

3. Composition / information on ingredients

Component	CAS-No	Weight %
1,1,1-Trichloroethane	71-55-6	>90
1,4-Dioxane	123-91-1	5-6

4. First-aid measures**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. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with a respiratory medical device. Obtain medical attention.

Ingestion

Do not induce vomiting. Call a physician or Poison Control Center immediately.

Most important symptoms/effects

No information available.

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

458 °C / 856.4 °F

Explosion Limits**Upper**

15.5 vol %

Lower

8.0 vol %

Sensitivity to Mechanical Impact

No information available

Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical

Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products

Carbon monoxide (CO) Carbon dioxide (CO₂) Hydrogen chloride gas

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. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health
2

Flammability
1

Instability
0

Physical hazards
N/A

6. Accidental release measures

Personal Precautions Use personal protective equipment. Ensure adequate ventilation.

Environmental Precautions Should not be released into the environment. See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Use only under a chemical fume hood. Wear personal protective equipment. Do not breathe vapors or spray mist. Do not ingest. Avoid contact with skin, eyes and clothing.

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
1,1,1-Trichloroethane	TWA: 350 ppm STEL: 450 ppm	(Vacated) TWA: 350 ppm (Vacated) TWA: 1900 mg/m ³ (Vacated) STEL: 450 ppm (Vacated) STEL: 2450 mg/m ³ TWA: 350 ppm TWA: 1900 mg/m ³	IDLH: 700 ppm Ceiling: 350 ppm Ceiling: 1900 mg/m ³
1,4-Dioxane	TWA: 20 ppm Skin	(Vacated) TWA: 25 ppm (Vacated) TWA: 90 mg/m ³ Skin TWA: 100 ppm TWA: 360 mg/m ³	IDLH: 500 ppm Ceiling: 1 ppm Ceiling: 3.6 mg/m ³

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
1,1,1-Trichloroethane	TWA: 350 ppm TWA: 1910 mg/m ³ STEL: 450 ppm STEL: 2460 mg/m ³	TWA: 350 ppm TWA: 1900 mg/m ³ STEL: 450 ppm STEL: 2460 mg/m ³	TWA: 350 ppm STEL: 450 ppm
1,4-Dioxane	TWA: 20 ppm TWA: 72 mg/m ³ Skin	TWA: 25 ppm TWA: 90 mg/m ³ STEL: 100 ppm STEL: 360 mg/m ³	TWA: 20 ppm Skin

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	-33 °C / -27.4 °F
Boiling Point/Range	74 - 76 °C / 165.2 - 168.8 °F
Flash Point	No information available
Evaporation Rate	1.0 (Carbon Tetrachloride = 1.0)
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	15.5 vol %
Lower	8.0 vol %
Vapor Pressure	100 mmHg @ 20°C
Vapor Density	4.55 (Air = 1.0)
Relative Density	1.33
Solubility	Insoluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	458 °C / 856.4 °F
Decomposition Temperature	95 °C
Viscosity	0.86 mPa.s @ 20 °C
Molecular Formula	C ₂ H ₃ Cl ₃
Molecular Weight	133.4

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
Hazardous Decomposition Products	Carbon monoxide (CO), Carbon dioxide (CO ₂), Hydrogen chloride gas
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

11. Toxicological information

Acute Toxicity**Component Information**

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
1,1,1-Trichloroethane	2000 mg/kg (Rat)	15800 mg/kg (Rabbit)	18000 ppm (Rat) 4 h
1,4-Dioxane	5170 mg/kg (Rat) 4200 mg/kg (Rat)	7600 µL/kg (Rabbit)	48.5 mg/L (Rat) 4 h

Toxicologically Synergistic Products**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
1,1,1-Trichloroethane	71-55-6	Group 3	Not listed	Not listed	Not listed	Not listed
1,4-Dioxane	123-91-1	Group 2B	Reasonably Anticipated	A3	X	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)**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)**Mutagenic Effects** No information available**Reproductive Effects** Experiments have shown reproductive toxicity effects on laboratory animals.**Developmental Effects** Developmental effects have occurred in experimental animals.**Teratogenicity** Teratogenic effects have occurred in experimental animals.**STOT - single exposure** Central nervous system (CNS)**STOT - repeated exposure** Kidney Liver Cardiovascular system**Aspiration hazard** No information available**Symptoms / effects,both acute and delayed** No information available**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**

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
1,1,1-Trichloroethane	EC50 >669 mg/L/96h	46 - 59 mg/L LC50 96 h 91 - 126 mg/L LC50 96 h 69.7 mg/L LC50 96 h 52.9 mg/L LC50 96 h 56 mg/L LC50 96	EC50 = 105 mg/L 5 min	EC50 >530 mg/L 48h EC50: 2384 mg/L 48h

		h 57 - 90 mg/L LC50 96 h 35.2 - 50.7 mg/L LC50 96 h		
1,4-Dioxane	Not listed	9850 mg/L LC50 96 h 10306 - 14742 mg/L LC50 96 h 10000 mg/L LC50 96 h	EC50 = 610 mg/L 5 min EC50 = 668 mg/L 15 min EC50 = 733 mg/L 30 min	EC50 = 163 mg/L 48h

Persistence and Degradability No information available
Bioaccumulation/ Accumulation No information available.

Mobility

Component	log Pow
1,1,1-Trichloroethane	2.46
1,4-Dioxane	-0.42

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
1,1,1-Trichloroethane - 71-55-6	U226	-
1,4-Dioxane - 123-91-1	U108	-

14. Transport information

DOT

UN-No	UN2831
Proper Shipping Name	1,1,1-Trichloroethane
Hazard Class	6.1
Packing Group	III

TDG

UN-No	UN2831
Proper Shipping Name	1,1,1-TRICHLOROETHANE
Hazard Class	6.1
Packing Group	III

IATA

UN-No	UN2831
Proper Shipping Name	1,1,1-Trichloroethane (Mixture)
Hazard Class	6.1
Packing Group	III

IMDG/IMO

UN-No	UN2831
Proper Shipping Name	1,1,1-Trichloroethane (Mixture)
Hazard Class	6.1
Packing Group	III

15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
1,1,1-Trichloroethane	X	X	-	200-756-3	-		X	X	X	X	X
1,4-Dioxane	X	X	-	204-661-8	-		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

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
1,1,1-Trichloroethane	71-55-6	>90	1.0
1,4-Dioxane	123-91-1	5-6	0.1

SARA 311/312 Hazardous Categorization

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
1,1,1-Trichloroethane	-	-	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
1,1,1-Trichloroethane	X	X	-
1,4-Dioxane	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
1,1,1-Trichloroethane	1000 lb	-
1,4-Dioxane	100 lb	-

California Proposition 65 This product contains the following Proposition 65 chemicals:

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
1,4-Dioxane	123-91-1	Carcinogen	30 µg/day	Carcinogen

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
1,1,1-Trichloroethane	X	X	X	X	X
1,4-Dioxane	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 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 11-Jan-2010
Revision Date 10-Feb-2015
Print Date 10-Feb-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

Creation Date 01-May-2012

Revision Date 24-Dec-2021

Revision Number 5

1. Identification

Product Name	1,1,2-Trichloroethane
Cat No. :	AC139430000; AC139430010; AC139430025; AC139432500
CAS No	79-00-5
Synonyms	beta-Trichloroethane; Ethane trichloride; Vinyl trichloride
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 Company
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number

For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US**:001-201-796-7100 / **Europe**: +32 14 57 52 99
CHEMTREC Tel. No.**US**:001-800-424-9300 / **Europe**: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)

Acute oral toxicity	Category 4
Acute dermal toxicity	Category 4
Acute Inhalation Toxicity - Vapors	Category 3
Carcinogenicity	Category 2

Label Elements

Signal Word
Danger

Hazard Statements
Toxic if inhaled
Suspected of causing cancer

Harmful if swallowed or in contact with skin



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

Do not eat, drink or smoke when using this product

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

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

Skin

IF ON SKIN: Wash with plenty of soap and water

Call a POISON CENTER or doctor/physician if you feel unwell

Wash contaminated clothing before reuse

Ingestion

IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell

Rinse mouth

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)

Harmful to aquatic life with long lasting effects

Repeated exposure may cause skin dryness or cracking

WARNING. Cancer - <https://www.p65warnings.ca.gov/>.

3. Composition/Information on Ingredients

Component	CAS No	Weight %
1,1,2-Trichloroethane	79-00-5	<=100

4. First-aid measures

General Advice

Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.

Eye Contact

Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

Skin Contact

Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation	Remove to fresh air. If not breathing, give artificial respiration. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required.
Ingestion	Do NOT induce vomiting. Call a physician or poison control center immediately.
Most important symptoms and effects	None reasonably foreseeable.
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	459 °C / 858.2 °F
Explosion Limits	
Upper	15.5%
Lower	6.0%
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical

Vapors may form explosive mixtures with air. Non-combustible. 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 (CO₂). Chlorine. Phosgene. Hydrogen chloride gas.

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. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
3	1	0	N/A

6. Accidental release measures

Personal Precautions	Ensure adequate ventilation. Use personal protective equipment as required. Keep people away from and upwind of spill/leak. Evacuate personnel to safe areas.
Environmental Precautions	Should not be released into the environment. Do not flush into surface water or sanitary sewer system.

Methods for Containment and Clean Up	Keep in suitable, closed containers for disposal. Soak up with inert absorbent material.
---	--

7. Handling and storage

Handling	Wear personal protective equipment/face protection. Do not get in eyes, on skin, or on clothing. Use only under a chemical fume hood. Do not breathe mist/vapors/spray. Do not ingest. If swallowed then seek immediate medical assistance.
Storage.	Keep in a dry, cool and well-ventilated place. Keep container tightly closed. Keep away

from heat/sparks/open flames/hot surfaces. - No smoking. Incompatible Materials. Bases. Strong oxidizing agents. Strong bases. Metals.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
1,1,2-Trichloroethane	TWA: 10 ppm Skin	(Vacated) TWA: 10 ppm (Vacated) TWA: 45 mg/m ³ Skin TWA: 10 ppm TWA: 45 mg/m ³	IDLH: 100 ppm TWA: 10 ppm TWA: 45 mg/m ³	TWA: 10 ppm

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

OSHA - Occupational Safety and Health Administration

NIOSH IDLH: NIOSH - National Institute for Occupational Safety and Health

Engineering Measures

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	No information available
Melting Point/Range	-37 °C / -34.6 °F
Boiling Point/Range	110 - 115 °C / 230 - 239 °F @ 760 mmHg
Flash Point	No information available
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	15.5%
Lower	6.0%
Vapor Pressure	20 @ 25 mbar °C
Vapor Density	4.63 (Air = 1.0)
Specific Gravity	1.430
Solubility	4 g/L @ 20 °C
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	459 °C / 858.2 °F
Decomposition Temperature	No information available
Viscosity	1.69 cP at 25 °C
Molecular Formula	C ₂ H ₃ Cl ₃

Molecular Weight

133.4

10. Stability and reactivity

Reactive Hazard	None known, based on information available
Stability	Stable under normal conditions.
Conditions to Avoid	Excess heat. Incompatible products.
Incompatible Materials	Bases, Strong oxidizing agents, Strong bases, Metals
Hazardous Decomposition Products	Carbon monoxide (CO), Carbon dioxide (CO ₂), Chlorine, Phosgene, Hydrogen chloride gas
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
1,1,2-Trichloroethane	LD50 = 836 mg/kg (Rat)	LD50 = 5371 mg/kg (Rabbit)	LC50 = 2.78 mg/L (Rat) 8 h

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

Component	CAS No	IARC	NTP	ACGIH	OSHA	Mexico
1,1,2-Trichloroethane	79-00-5	Not listed	Not listed	A3	Not listed	A3

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 No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects, both acute and delayed No information available

Endocrine Disruptor Information No information available

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

12. Ecological information

Ecotoxicity

Do not empty into drains. Contains a substance which is: Harmful to aquatic organisms. The product contains following substances which are hazardous for the environment. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
1,1,2-Trichloroethane	EC50: = 167 mg/L, 96h static (Desmodesmus subspicatus)	LC50: = 81.6 mg/L, 96h flow-through (Pimephales promelas) LC50: 35 - 47 mg/L, 96h static (Lepomis macrochirus)	EC50 = 105 mg/L 5 min	EC50: 57 - 110 mg/L, 48h Static (Daphnia magna) EC50: = 18 mg/L, 48h (Daphnia magna)

Persistence and Degradability Persistence is unlikely

Bioaccumulation/ Accumulation No information available.

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

Component	log Pow
1,1,2-Trichloroethane	1.89

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
1,1,2-Trichloroethane - 79-00-5	U227	-

14. Transport information

DOT

UN-No UN2810
Proper Shipping Name TOXIC LIQUIDS, ORGANIC, N.O.S.
Technical Name (1,1,2-TRICHLOROETHANE)
Hazard Class 6.1
Packing Group III

TDG

UN-No UN2810
Proper Shipping Name TOXIC LIQUIDS, ORGANIC, N.O.S.
Hazard Class 6.1
Packing Group III

IATA

UN-No UN2810
Proper Shipping Name Toxic liquid, organic, n.o.s.
Hazard Class 6.1
Packing Group III

IMDG/IMO

UN-No UN2810
Proper Shipping Name Toxic liquid, organic, n.o.s.
Hazard Class 6.1
Packing Group III

15. Regulatory information

United States of America Inventory

Component	CAS No	TSCA	TSCA Inventory notification - Active-Inactive	TSCA - EPA Regulatory Flags
1,1,2-Trichloroethane	79-00-5	X	ACTIVE	-

Legend:

TSCA US EPA (TSCA) - Toxic Substances Control Act, (40 CFR Part 710)

X - Listed

'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

Component	CAS No	TSCA 12(b) - Notices of Export
1,1,2-Trichloroethane	79-00-5	Section 4

International Inventories

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

Component	CAS No	DSL	NDSL	EINECS	PICCS	ENCS	ISHL	AICS	IECSC	KECL
1,1,2-Trichloroethane	79-00-5	X	-	201-166-9	X	X	X	X	X	KE-34069

KECL - NIER number or KE number (<http://ncis.nier.go.kr/en/main.do>)

U.S. Federal Regulations

SARA 313

Component	CAS No	Weight %	SARA 313 - Threshold Values %
1,1,2-Trichloroethane	79-00-5	<=100	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
1,1,2-Trichloroethane	-	-	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
1,1,2-Trichloroethane	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
1,1,2-Trichloroethane	100 lb 1 lb	-

California Proposition 65 This product contains the following Proposition 65 chemicals.

Component	CAS No	California Prop. 65	Prop 65 NSRL	Category
1,1,2-Trichloroethane	79-00-5	Carcinogen	10 µg/day	Carcinogen

U.S. State Right-to-Know

Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
1,1,2-Trichloroethane	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 No information available

Authorisation/Restrictions according to EU REACH

Component	REACH (1907/2006) - Annex XIV - Substances Subject to Authorization	REACH (1907/2006) - Annex XVII - Restrictions on Certain Dangerous Substances	REACH Regulation (EC 1907/2006) article 59 - Candidate List of Substances of Very High Concern (SVHC)
1,1,2-Trichloroethane	-	Use restricted. See item 34 (see link for restriction details) Use restricted. See item 75. (see link for restriction details)	-

<https://echa.europa.eu/substances-restricted-under-reach>

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

Component	CAS No	OECD HPV	Persistent Organic Pollutant	Ozone Depletion Potential	Restriction of Hazardous Substances (RoHS)
1,1,2-Trichloroethane	79-00-5	Listed	Not applicable	Not applicable	Not applicable

Component	CAS No	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Major Accident Notification	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Safety Report Requirements	Rotterdam Convention (PIC)	Basel Convention (Hazardous Waste)
1,1,2-Trichloroethane	79-00-5	Not applicable	Not applicable	Not applicable	Annex I - Y45

16. Other information**Prepared By**

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

Creation Date

01-May-2012

Revision Date

24-Dec-2021

Print Date

24-Dec-2021

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 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 a 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

End of SDS

SAFETY DATA SHEET

SDS No.1021-21140

Revised Date May 7, 2014 1/5 page

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : 1,1-Dichloroethylene
NAME OF MANUFACTURER : GL Sciences Inc.
ADDRESS : 22-1 Nishishinjuku 6-chome Shinjuku-ku Tokyo 163-1130, Japan
CHARGE SECTION : International Sales Section
TELEPHONE No. : +81-3-5323-6620
FACSIMILE No. : +81-3-5323-6621
PRODUCT No. : 1021-21140
SDS No. : 1021-21140
Research use only.

2. HAZARDS IDENTIFICATION

GHS CLASSIFICATION : Flammable liquids : Category 1
Acute toxicity - oral : Category 4
Acute toxicity - inhalation : Category 3
Reproductive toxicity : Category 2
Specific target organ toxicity (single exposure) : Category 1 <liver, kidney, respiratory organ>
Specific target organ toxicity (single exposure) : Category 3 <anesthesia>
Specific target organ toxicity (repeated exposure) : Category 1 <liver>
Specific target organ toxicity (repeated exposure) : Category 2 <kidney>
Aspiration hazard : Category 2
Hazardous to the aquatic environment –acute hazard : Category 3

HAZARDS SYMBOL



SIGNAL WORD : Danger

HAZARD STATEMENT

H224 : Extremely flammable liquid and vapour
H302 : Harmful if swallowed
H331 : Toxic if inhaled
H361 : Suspected of damaging fertility or the unborn child.
H370 : Cause damage to organs <liver, kidney, respiratory tract>
H336 : May cause drowsiness or dizziness.
H372 : Cause damage to organs <liver> through prolonged or repeated exposure.
H373 : May cause damage to organs <kidney> through prolonged or repeated exposure.
H305 : May be harmful if swallowed and enters airway.
H402 : Harmful to aquatic life

PRECAUTIONARY STATEMENTS

P202 : Do not handle until all safety precautions have been read and understood.
P210 : Keep away from heat, hot surface, sparks, open flames and other ignition sources. No smoking.
P233 : Keep container tightly closed.
P240 : Ground and bond container and receiving equipment.
P241 : Use explosion-proof equipments.
P242 : Use non-sparking tools.

P243	Take action to prevent static discharges.
P280	Wear protective gloves/eye protection.
P264	Wash hands thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P260	Do not breathing gas/mist/vapours.
P271	Use only outdoors or in a well-ventilated area.
P314	Get medical attention if you feel unwell.
P273	Avoid release to the environment.
P303+P361+P353	IF ON SKIN: Take off immediately all contaminated clothing. Rinse skin with water.
P370+P378	In case of fire: Use appropriate medias to extinguish.
P301+P312	IF SWALLOWED: Call a POISON CENTER if you feel unwell.
P330	Rinse mouth.
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P311	Call POISON CENTER.
P308+P313	IF exposed or concerned: Get medical attention.
P301+P310	IF SWALLOWED: Immediately call a POISON CENTER.
P331	Do NOT induce vomiting.
P403+P235	Store in a well-ventilated place. Keep cool.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/container in accordance with all applicable regulations.

3. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL IDENTITY	: 1,1-Dichloroethylene
SYNOMYS	: Vinylidene chloride; 1,1-dichloroethene
CHEMICAL FOMULA	: CCl ₂ =CH ₂
CONTENT	: > 99 %
MOLECULAR WEIGHT	: 96.94
CAS No.	: 75-35-4
TSCA INVENTRY	: Listed
EINECS No.	: 200-864-0
EC INDEX No.	: 602-025-00-8

4. FIRST AID MEASURES

GENERAL ADVICE	: Wash off immediately with soap and plenty of water. In the case of respirable dust and/or fumes, use self-contained breathing apparatus and dust impervious protective suit. Use personal protective equipment.
INHALATION	: Move victim to fresh air. If breathing is difficult, give oxygen. If irritation persists, consult a physician.
SKIN CONTACT	: Remove contaminated clothes and shoes, rinse skin with plenty of water or shower. Use soap to help assure removal. If irritation persists, consult a physician.
EYE CONTACT	: Remove any contact lenses at once. Flush eyes well with flooding large amounts of running water for at least 15 minutes. Assure adequate flushing by separating the eyelids with sterile fingers. If irritation persists, consult a physician.
INGESTION	: Rinse mouth. Never give anything by mouth to an unconscious person. Do not induce vomiting. Consult a physician immediately.

5. FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA	: Carbon dioxide, dry chemical powder, foam, water spray
FIRE & EXPLOSION HAZARDS	: Flammable liquid. Hazardous toxic, irritating, dust or smoke may be emitted.
SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTERS	: Fireman should wear normal protective equipment(full bunker gear) and positive-pressure self-contained breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS	: Remove ignition sources and ventilate the area. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid raising dust and avoid contact with skin and eyes.
ENVIRONMENTAL PRECATIONS	: Prevent spills from entering sewers, watercourses or low areas.

METHODS FOR CLEAN UP	: Do not touch spilled material without suitable protection. After material is completely picked up, wash the spill site with soap and water and ventilate the area. Pull all wastes in a plastic bag for disposal and seal it tightly. Remove, clean, or dispose contaminated clothing.
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7. HANDLING AND STORAGE

HANDLING	: Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure. Handle material with suitable protection. After this product, dispose of contents/container in accordance with all applicable regulations and appropriate ways.
STORAGE	: Store away from sunlight in well-ventilated dry place at room temperature. Keep container tightly closed.
INCOMPATIBLE PRODUCTS	: Strong oxidizers and acids

8. EXPOSURE CONTROL/PERSONAL PROTECTION

ENGINEERING MEASURES	: Use exhaust ventilation to keep airborne concentrations below exposure limits. Use only with adequate ventilation.
VENTILATION	: Local Exhaust ; Necessary, Mechanical(General) ; Recommended
PERSONAL PROTECTION	
RESPIRATORY PROTECTION	: Use respirators approved under appropriate government standards and follow all regulations.
HAND PROTECTION	: Chemical resistant gloves
EYE PROTECTION	: Safety glasses(goggles)
SKIN PROTECTION	: Protective clothing
CONTROL PARAMETERS	
OSHA	: (Final limit) TWA=1ppm, 4mg/m ³
NIOSH REL	: Not established
ACGIH	: TWA=5ppm, 20mg/ m ³ STEL=20ppm, 79mg/ m ³

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE	: White
SHAPE	: Liquid
ODOR	: Characteristic odor
pH	: Not available
BOILING POINT	: 32°C
MELTING POINT	: -122°C
FLASH POINT	: -25°C
FLAMMABILITY	: lower: 5.6% , upper: 16%
AUTOIGNITION TEMPERATURE	: 570 °C
VAPOR PRESSURE	: 66.5 kPa (20°C)
VAPOR DENSITY	: Not available
DENSITY	: 3.3
SPECIFIC GRAVITY	: 1.2
SOLUBILITY IN	
WATER	: 0.25g/100mL (25°C)
Organic solvent	: soluble
DECOMPOSITION TEMPERATURE	: Not available

10. STABILITY AND REACTIVITY

REACTIVITY	: The substance can readily form explosive peroxides. The substance will polymerize readily due to heating or under the influence of oxygen, sunlight, copper or aluminium, with fire or explosion hazard. May explode on heating or on contact with flames. The substance decomposes on burning producing toxic phosgene.
CHEMICAL STABILITY	: React violently with oxidants. React violently with chlorosulfonic acid, nitric acid, fuming sulfuric acid.
CONDITION TO AVOID	: Sunlight, air, heat, ignition sources, inhaled to ozone, contact with incompatible materials.
INCOMPATIBLE MATERIALS	: Strong oxidizers and acids, metals-Fe, Cu, copper alloy, Al, aluminium alloy), peroxides, chlorsulfonic acid.

HAZARDOUS DECOMPOSITION PRODUCTS

: CO, CO₂, explosive vapour mixture, hydrogen chloride, phosgene, formaldehyde.

11. TOXICOLOGICAL INFORMATION

ACUTE TOXICITY (oral) : rat LD50= 1,500 mg/kg (calculated value)(CICAD 51,2003)

ACUTE TOXICITY (inhalation) : rat LC50= 2,300 ppm(4hr, calculated value)(CICAD 51(2003), etc...)

SKIN CORROSION/IRRITATION : lack of data

EYE DAMAGE/EYE IRRITATION : lack of data

GERM CELL MUTAGENICITY : Administration changes mutagenesis examination, somatic cell in vivo mutagenesis examination –Negative (CICAD 51(2003), EHC 100(1990), NTP DB(2006))

CARCINOGENICITY : Classified at EPA: C(2002), ACGIH: Group A4(2001), IARC: 3(1999)

REPRODUCTIVE TOXICITY : In an amount of medicine for usage that the general toxicity is seen in a mother animal, influence is seen in the next generation. (CERI·NITE hazard data sheet No.48(2005), CICAD 51(2003))

SPECIFIC TARGET ORGAN TOXICITY-single exposure : Human; The central nervous system depression or the excitement symptom is shown. When it is serious, it gets an unconsciousness. It becomes an irritation by the exposure for a few minutes. (CERI,NITE Hazard Data Sheet No.48,2005)
Animal; Damage in biliary canaliculus, Damage in proximal tubule, Centrilobular sphacelation of hepatic cell, Obstructive edema in lungs.(CERI,NITE Hazard Data SheetNo.48,2005)

SPECIFIC TARGET ORGAN TOXICITY-repeated exposure : Human: liver problems
Animal: hepatocyte swelling with the fatty degeneration of slight small leaf intermediateness, slight kidney regressiveness denaturation, abscess, nephritis, fatty degeneration of the liver and a nest-shaped necrosis. (CERI·NITE hazard data sheet No.48,2005)

ASPIRATION TOXICITY : Swallowing the liquid may cause aspiration into the lungs with the risk of causing the pneumonitis, Exposure at high levels could cause lowering of consciousness. (ICSC,2000)

ADDITIONAL INFORMATION

NTP : Not listed

IARC : Not classifiable as to Carcinogenicity to Human (Group 3)

OSHA : Not listed

ACGIH : Not Classifiable as a Human Carcinogen (A4)

12. ECOLOGICAL INFORMATION

ECOTOXICITY : Crustacean (daphnids): EC50=11.6mg/L/48hr (CERI·NITE hazard data sheet, 2005)

BIODEGRADABILITY : Easy to strip from environmental water. (CICAD,2003)

BIOACCUMULATION POTENTIAL : BCF=6.4 (Existing chemical substances safety inspection data)

MOBILITY IN SOIL : Not available

OTHER ADVERSE EFFECTS : Not listed in Montreal Protocol list.

13. DISPOSAL INFORMATION

Dispose in a hazardous-waste site in accordance with all applicable regulations. Any disposal practice must be in compliance with country, local, state, and federal laws and regulations (contact country, local or state environment agency for specific rules).

14. TRANSPORT INFORMATION

IATA

UN NUMBER : UN 1303
UN PROPER SHIPPING NAME : Vinylidene chloride, stabilized
CLASS or DIVISION : Flammable liquid (Class 3)
PACKING GROUP : PG I

DOT

IDENTIFICATION NUMBER : UN 1303
PROPER SHIPPING NAME : Vinylidene chloride, stabilized
HAZARD CLASS : Flammable liquid (Class 3)
MARINE POLLUTANT : Yes

15. REGULATORY INFORMATION

US REGULATIONS :

EPA : EPCRA TPQ = Not listed
CERCLA RQ = 100lb
EPCRA SECTION 313 de minimis concentration is 1.0%
C (Possible human carcinogen)

OSHA : TQ = Not listed

EU REGURATIONS : Labeling according to EC Directives; See section 2

16. OTHER INFORMATION

NOTICE:

The information contained in the SDS description is applicable exclusively to the chemical substance identified herein and for its intended use as an analytical reference standard or reagent and to the unit quantity intended for that purpose. The information does not relate to, and may not be appropriate for, any application or larger quantity of the substance described. Our products are intended for the use by individuals possessing sufficient technical skill and qualification on use the material potential hazardous chemical. Accordingly, no representation or warranty, express or implied, with respect to merchantability and fitness for a particular purpose is made with respect to the information contained herein.

Attention:

This product in terms of chemical identity and the unit amount provide is intended for use in chemical analysis and not for human consumption, nor any other purpose.

Effective date: 11 May 2020
Trade Name: Alconox®

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I Identification of the substance/mixture and of the supplier

1.1 GHS Product identifier

Trade Name: Alconox®

Product number: 1101, 1103, 1104, 1104-1, 1112, 1112-1, 1125, 1150

1.2 Application of the substance / the mixture: Cleaning material/Detergent

1.2.1 Recommended dilution ratio: 1 – 2% in water

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer:

Alconox Inc.
30 Glenn St
White Plains, NY 10603
(914) 948-4040

Supplier:

Emergency telephone number:
ChemTel Inc

North America: 1-888-255-3924
International: +1 813-248-0573

2 Hazards identification

2.1 Classification of the substance or mixture:

In compliance with EC regulation No. 1272, 29CFR1910/1200 and GHS requirements.

Hazard-determining components of labeling:

Tetrasodium Pyrophosphate
Sodium tripolyphosphate
Sodium Alkylbenzene Sulfonate

2.2 Label elements:

Eye damage, category 1.

Skin irritation, category 2.

Product at recommended dilution:

Eye irritation, category 2B

Hazard pictograms:



Signal word: Danger

Hazard statements:

H315 Causes skin irritation.

H318 Causes serious eye damage.

Precautionary statements:

P264 Wash skin thoroughly after handling.

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P280 Wear protective gloves/protective clothing/eye protection/face protection.
 P302+P352 If on skin: Wash with soap and water.
 P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
 P321 Specific treatment (see supplemental first aid instructions on this label).
 P332+P313 If skin irritation occurs: Get medical advice/attention.
 P362 Take off contaminated clothing and wash before reuse.
 P501 Dispose of contents and container as instructed in Section 13.

Hazardous Elements at Use Dilution:

Hazard Pictograms:



Signal Word: Warning

Hazard Statements:

H320 Causes eye irritation

Precautionary statements:

P302+P352 If on skin: Wash with soap and water.

P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.

P501 Dispose of contents and container as instructed in Section 13

Additional information: None.

Hazard description

Hazards Not Otherwise Classified (HNOC): May cause surfaces to become slippery if wet. Use caution in areas of foot traffic if on floors.

Information concerning particular hazards for humans and environment:

The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

Classification system:

The classification is according to EC regulation No. 1272, 29CFR1910/1200 and GHS Requirements, and extended by company and literature data. The classification is in accordance with the latest editions of international substances lists and is supplemented by information from technical literature and by information provided by the company.

3 Composition/information on ingredients

3.1 Chemical characterization: Not determined or not available.

3.2 Description: None

3.3 Hazardous components (percentages by weight)

Identification	Chemical Name	Classification	Wt. %
CAS number: 7758-29-4	Sodium tripolyphosphate	Skin Irrit. 2; H315 Eye Irrit. 2; H319	12-28
CAS number: 68081-81-2 or 68411-30-3	Sodium Alkylbenzene Sulfonate	Acute Tox. 4; H303 Skin Irrit. 2; H315 Eye Dam. 1; H318	8-22
CAS number: 7722-88-5	Tetrasodium Pyrophosphate	Skin Irrit. 2; H315 Eye Irrit. 2; H319	2-16

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Hazardous components at use dilution (percentages by weight):

Identification	Chemical Name	Classification	Wt. %
CAS number: 7758-29-4	Sodium tripolyphosphate	Eye Irrit. 2; H319	0.12 - 0.28
CAS number: 68081-81-2 or 68411-30-3	Sodium Alkylbenzene Sulfonate	Eye Irrit. 2; H319	0.08 – 0.22
CAS number: 7722-88-5	Tetrasodium Pyrophosphate	Eye Irrit. 2; H319	0.02 – 0.16

3.4 Additional Information: None.

4 First aid measures

4.1 Description of first aid measures

General information: None.

After inhalation:

Maintain an unobstructed airway.
 Loosen clothing as necessary and position individual in a comfortable position.

After skin contact:

Wash affected area with soap and water.
 Seek medical attention if symptoms develop or persist.

After eye contact:

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.
 Seek medical attention if irritation, discomfort, or vomiting persists.

4.2 Most important symptoms and effects, both acute and delayed

None

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

No additional information.

First aid measure at recommended dilution:

General information: None.

After inhalation:

Maintain an unobstructed airway.
 Loosen clothing as necessary and position individual in a comfortable position.

After skin contact:

Wash affected area with soap and water.

After eye contact:

Rinse/flush exposed eye(s) gently using water for 15-20 minutes.
 Remove contact lens(es) if able to do so during rinsing.

After swallowing:

Rinse mouth thoroughly. Seek medical attention if irritation, discomfort, or vomiting develops.

5 Firefighting measures

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5.1 Extinguishing media

Suitable extinguishing agents:

Use appropriate fire suppression agents for adjacent combustible materials or sources of ignition.

For safety reasons unsuitable extinguishing agents: None

5.2 Special hazards arising from the substance or mixture:

Thermal decomposition can lead to release of irritating gases and vapors.

5.3 Advice for firefighters

Protective equipment:

Wear protective eye wear, gloves and clothing.

Refer to Section 8.

5.4 Additional information:

Avoid inhaling gases, fumes, dust, mist, vapor and aerosols.

Avoid contact with skin, eyes and clothing.

6 Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures:

Ensure adequate ventilation.

Ensure air handling systems are operational.

6.2 Environmental precautions:

Should not be released into the environment.

Prevent from reaching drains, sewer or waterway.

6.3 Methods and material for containment and cleaning up:

Wear protective eye wear, gloves and clothing.

6.4 Reference to other sections: None

7 Handling and storage

7.1 Precautions for safe handling:

No expected hazards under normal use condition.

Avoid breathing mist or vapor if aerosolized.

Do not eat, drink, smoke or use personal products when handling chemical substances.

7.2 Conditions for safe storage, including any incompatibilities:

Store in a cool, well-ventilated area.

7.3 Specific end use(s):

No additional information.

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8 Exposure controls/personal protection



8.1 Control parameters:

- a) 7722-88-5, Tetrasodium Pyrophosphate, ACGIH TWA 10 mg/m³
- b) 7758-29-4, Sodium Tripolyphosphate, ACGIH TWA 10 mg/m³
- c) Dusts, non-specific OEL, Irish Code of Practice
 - (i) Total inhalable 10 mg/m³ (8hr)
 - (ii) Respirable 4 mg/m³ (8hr)
 - (iii) Tetrasodium Pyrophosphate, OSHA TWA 5 mg/m³, (8hr)

8.2 Exposure controls

Appropriate engineering controls:

Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling.

Respiratory protection:

Not needed under normal use conditions.

Protection of skin:

Select glove material impermeable and resistant to the substance.

Eye protection:

Safety goggles or glasses, or appropriate eye protection. Recommended to comply with ANSI Z87.1 and/or EN 166.

General hygienic measures:

Wash hands before breaks and at the end of work.

Avoid contact with skin, eyes and clothing.

Exposure Control and Personal Protective Equipment at recommended dilution:

Under normal use and operational conditions, no special personal protective equipment or engineering controls will be necessary. Handle with care.

9 Physical and chemical properties

Appearance (physical state, color):	White and cream colored flakes - powder	Explosion limit lower: Explosion limit upper:	Not determined or notavailable. Not determined or notavailable.
Odor:	Not determined or not available.	Vapor pressure at 20°C:	Not determined or notavailable.
Odor threshold:	Not determined or not available.	Vapor density:	Not determined or notavailable.
pH-value:	9.5 (1% aqueous solution)	Relative density:	Not determined or notavailable.

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Melting/Freezing point:	Not determined or not available.	Solubilities:	Not determined or not available.
Boiling point/Boiling range:	Not determined or not available.	Partition coefficient (n-octanol/water):	Not determined or not available.
Flash point (closed cup):	Not determined or not available.	Auto/Self-ignition temperature:	Not determined or not available.
Evaporation rate:	Not determined or not available.	Decomposition temperature:	Not determined or not available.
Flammability (solid, gaseous):	Not determined or not available.	Viscosity:	a. Kinematic: Not determined or not available. b. Dynamic: Not determined or not available.
Density at 20°C:	Not determined or not available.		

10 Stability and reactivity

- 10.1 Reactivity:** Not determined or not available.
- 10.2 Chemical stability:** Not determined or not available.
- 10.3 Possibility hazardous reactions:** Not determined or not available.
- 10.4 Conditions to avoid:** Not determined or not available.
- 10.5 Incompatible materials:** Not determined or not available.
- 10.6 Hazardous decomposition products:** Not determined or not available.

11 Toxicological information

11.1 Information on toxicological effects:

Acute Toxicity:

Oral:

: LD50 > 5000 mg/kg oral rat - Product.

Chronic Toxicity:

No additional information.

Skin corrosion/irritation:

Sodium Alkylbenzene Sulfonate: Causes skin irritation.

Serious eye damage/irritation:

Sodium Alkylbenzene Sulfonate: Causes serious eye damage.

Tetrasodium Pyrophosphate: Risk of serious damage to eyes.

Product information at recommended dilution:

Eye irritation may occur upon direct contact with eyes. No specific hazards for skin contact, inhalation, or chronic exposure are expected within normal use parameters.

Respiratory or skin sensitization:

Carcinogenicity:

IARC (International Agency for Research on Cancer):

NTP (National Toxicology Program):

Germ cell mutagenicity:

Reproductive toxicity:

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STOT-single and repeated exposure: No additional information.

Additional toxicological information: No additional information.

12 Ecological information

12.1 Toxicity:

Sodium Alkylbenzene Sulfonate: Fish, LC50 1.67 mg/l, 96 hours.
Sodium Alkylbenzene Sulfonate: Aquatic invertebrates, EC50 Daphnia 2.9 mg/l, 48 hours.
Sodium Alkylbenzene Sulfonate: Aquatic Plants, EC50 Algae 29 mg/l, 96 hours.
Tetrasodium Pyrophosphate: Fish, LC50 - other fish - 1,380 mg/l - 96 h.
Tetrasodium Pyrophosphate: Aquatic invertebrates, EC50 - Daphnia magna (Water flea) - 391 mg/l - 48 h.

12.2 Persistence and degradability:

No additional information.

12.3 Bioaccumulative potential:

No additional information.

12.4 Mobility in soil:

No additional information.

General notes: No additional information.

12.5 Results of PBT and vPvB assessment:

PBT: No additional information.

vPvB: No additional information.

12.6 Other adverse effects:

No additional information.

13 Disposal considerations

13.1 Waste treatment methods (consult local, regional and national authorities for proper disposal)

Relevant Information:

It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities. (US 40CFR262.11).

14 Transport information

14.1 UN Number: ADR, ADN, DOT, IMDG, IATA	None
14.2 UN Proper shipping name: ADR, ADN, DOT, IMDG, IATA	None
14.3 Transport hazard classes: ADR, ADN, DOT, IMDG, IATA	Class: None Label: None LTD.QTY: None

US DOT

Limited Quantity Exception:

None

Bulk:

RQ (if applicable): None

Proper shipping Name: None

Hazard Class: None

Packing Group: None

Marine Pollutant (if applicable): No additional information.

Non Bulk:

RQ (if applicable): None

Proper shipping Name: None

Hazard Class: None

Packing Group: None

Marine Pollutant (if applicable): No additional information.

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Comments: None	Comments: None
14.4 Packing group: ADR, ADN, DOT, IMDG, IATA	None
14.5 Environmental hazards:	None
14.6 Special precautions for user: Danger code (Kemler): EMS number: Segregation groups:	None None None None
14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code:	Not applicable.
14.8 Transport/Additional information: Transport category: Tunnel restriction code: UN "Model Regulation":	None None None

15 Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture.

North American

SARA

Section 313 (specific toxic chemical listings): None of the ingredients are listed.

Section 302 (extremely hazardous substances): None of the ingredients are listed.

CERCLA (Comprehensive Environmental Response, Clean up and Liability Act) Reportable

Spill Quantity: None of the ingredients are listed.

TSCA (Toxic Substances Control Act):

Inventory: All ingredients are listed as active.

Rules and Orders: Not applicable.

Proposition 65 (California):

Chemicals known to cause cancer: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for females: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for males: None of the ingredients are listed.

Chemicals known to cause developmental toxicity: None of the ingredients are listed.

Canadian

Canadian Domestic Substances List (DSL):

All ingredients are listed.

EU

REACH Article 57 (SVHC):

None of the ingredients are listed.

Effective date: 11 May 2020
Trade Name: Alconox®

Revision: 11 May 2020

Germany MAK: Not classified.
EC 648/2004 – This is an industrial detergent. Contains >30% phosphate, 15-30% anionic surfactant, <5% EDTA salts
EC 551/2009 – This is not a laundry or dishwasher detergent
EC 907/2006 – Contains no enzymes, optical brighteners, perfumes, allergenic fragrances, or preservative agents

Asia Pacific

Australia

Australian Inventory of Chemical Substances (AICS): All ingredients are listed.

China

Inventory of Existing Chemical Substances in China (IECSC): All ingredients are listed.

Japan

Inventory of Existing and New Chemical Substances (ENCS): All ingredients are listed.

Korea

Existing Chemicals List (ECL): All ingredients are listed.

New Zealand

New Zealand Inventory of Chemicals (NZOIC): All ingredients are listed.

Philippines

Philippine Inventory of Chemicals and Chemical Substances (PICCS): All ingredients are listed.

Taiwan

Taiwan Chemical Substance Inventory (TSCI): All ingredients are listed.

16 Other information

Abbreviations and Acronyms: None

Summary of Phrases

Hazard statements:

H315 Causes skin irritation.
H318 Causes serious eye damage.

NFPA: 1-0-0

HMIS: 1-0-0

At recommended dilution:

NFPA: 1-0-0

HMIS: 1-0-0

Precautionary statements:

P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P321 Specific treatment (see supplemental first aid instructions on this label).
P332+P313 If skin irritation occurs: Get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P501 Dispose of contents and container as instructed in Section 13.

Manufacturer Statement:

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.

Antimony



SAFETY DATA SHEET

1 PRODUCT AND SUPPLIER IDENTIFICATION

Product Name: Antimony - shot, pieces, rod, target

Formula: Sb

Supplier: ESPI Metals

1050 Benson Way

Ashland, OR 97520

Telephone: 800-638-2581

Fax: 541-488-8313

Email: sales@espimetals.com

Emergency: Infotrac 800-535-5053 (US) or 352-323-3500 (24 hour)

Recommended Uses: Scientific Research

2 HAZARDS IDENTIFICATION

GHS Classification (29 CFR 1910.1200): Not classified as hazardous

GHS Label Elements:

Signal Word: N/A

Hazard Statements: N/A

Precautionary Statements: N/A

3 COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient: Antimony

CAS#: 7440-36-0

%: 100

EC#: 231-146-5

4 FIRST AID MEASURES

General Measures: No special requirements.

INHALATION: Remove to fresh air, keep warm and quiet, give oxygen if breathing is difficult. Seek medical attention.

INGESTION: Rinse mouth with water. Do not induce vomiting. Seek medical attention. Never induce vomiting or give anything by mouth to an unconscious person.

SKIN: Remove contaminated clothing, brush material off skin, wash affected area with soap and water. Seek medical attention if symptoms persist.

EYES: Flush eyes with lukewarm water, including under upper and lower eyelids, for at least 15 minutes. Seek medical attention if symptoms persist.

Most Important Symptoms/Effects, Acute and Delayed: May cause irritation and metal fume fever with flu-like symptoms. See section 11 for more information.

Indication of Immediate Medical Attention and Special Treatment: No other information available.

5 FIREFIGHTING MEASURES

Extinguishing Media: Use suitable extinguishing agent for surrounding materials and type of fire.

Unsuitable Extinguishing Media: No information available.

Specific Hazards Arising from the Material: This product does not present fire or explosion hazards as shipped. Small chips, fine turnings and dust from processing may be ignitable at high temperature. May release toxic fumes of antimony oxide or stibine gas under fire conditions.

Special Protective Equipment and Precautions for Firefighters: Full face, self-contained breathing apparatus and full protective clothing when necessary.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures: Wear appropriate respiratory and protective equipment specified in section 8. Isolate spill area and provide ventilation. Avoid breathing dust or fume. Avoid contact with skin and eyes. Eliminate all sources of ignition.

Methods and Materials for Containment and Cleaning Up: For larger pieces - pick up mechanically. For chips or dust - vacuum using a HEPA filter. Place in properly labeled closed containers. Avoid creating dusts.

Environmental Precautions: Do not allow to enter drains or to be released to the environment.

7 HANDLING AND STORAGE

Precautions for Safe Handling: Avoid creating dust. Avoid breathing dust or fumes. Provide adequate ventilation if dusts are created. Avoid exposure to high temperature. Avoid contact with skin and eyes. Wash thoroughly before eating or smoking. See section 8 for information on personal protection equipment.

Conditions for Safe Storage, Including Any Incompatibilities: Store in a sealed container. Store in a cool, dry area. Do not store together with oxidizers, acids or halogens. See section 10 for more information on incompatible materials.

8 EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits: Antimony

OSHA/PEL: 0.5 mg/m³

ACGIH/TLV: 0.5 mg/m³

Appropriate Engineering Controls: Ensure adequate ventilation to maintain exposures below occupational limits. Whenever possible the use of local exhaust ventilation or other engineering controls is the preferred method of controlling exposure to airborne dust and fume to meet established occupational exposure limits. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Do not blow dust off clothing or skin with compressed air.

Individual Protection Measures, Such as Personal Protective Equipment:

Respiratory Protection: If permissible levels are exceeded, use NIOSH approved dust respirator.

Eye Protection: Safety glasses

Skin Protection: Impermeable gloves

9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance:

Form: Solid in various forms

Color: Silver gray, metallic

Odor: Odorless

Odor Threshold: Not determined

pH: N/A

Melting Point: 630.5 °C

Boiling Point: 1750 °C

Flash Point: N/A

Evaporation Rate: N/A

Flammability: N/A

Upper Flammable Limit: N/A

Lower Flammable Limit: N/A

Vapor Pressure:	1 mm Hg @ 886
Vapor Density:	N/A
Relative Density (Specific Gravity):	6.684 g/cc @ 25
Solubility in H₂O:	Insoluble
Partition Coefficient (n-octanol/water):	Not determined
Autoignition Temperature:	No data
Decomposition Temperature:	No data
Viscosity:	N/A

10 STABILITY AND REACTIVITY

Reactivity: No data

Chemical Stability: Stable under recommended storage conditions.

Possibility of Hazardous Reactions: Antimony is spontaneously flammable with fluorine, chlorine, or bromine. Antimony will react with nascent (freshly formed) hydrogen to form stibine (SbH₃) which is extremely toxic.

Conditions to Avoid: Avoid creating or accumulating fines or dusts.

Incompatible Materials: Acids, strong oxidizing agents, halogens, halogenated acids, halogenated compounds, ammonium salts.

Hazardous Decomposition Products: Antimony oxide fume, stibine (SbH₃).

11 TOXICOLOGICAL INFORMATION

Likely Routes of Exposure: Inhalation, skin, eyes.

Symptoms of Exposure: May cause irritation and possibly systemic effects including a metallic taste in the mouth, vomiting, colic, loss of appetite and weight, and diarrhea.

Acute and Chronic Effects: Acute systemic exposure to antimony compounds may cause loss of hair, dry scaly skin, and weight loss. Damage to the heart, liver, and kidneys can occur, and death from myocardial failure may follow. Fatalities from antimony poisoning are rare. The toxicity of elemental antimony has not been well studied, however, due to insolubility most elements in their metallic state are not considered to be serious health hazards.

Acute Toxicity: LD50 oral - rat - 7500mg/kg

Carcinogenicity: NTP: Not identified as carcinogenic **IARC:** Not identified as carcinogenic

To the best of our knowledge the chemical, physical and toxicological characteristics of the substance are not fully known.

12 ECOLOGICAL INFORMATION

Ecotoxicity: No data

Persistence and Degradability: No data

Bioaccumulative Potential: No data

Mobility in Soil: No data

Other Adverse Effects: Do not allow material to be released to the environment. No further relevant information available.

13 DISPOSAL CONSIDERATIONS

Waste Disposal Method:

Product: Dispose of in accordance with Federal, State and Local regulations.

Packaging: Dispose of in accordance with Federal, State and Local regulations.

14 TRANSPORT INFORMATION

Shipping Regulations: Not regulated

UN Number: N/A

UN Proper Shipping Name: N/A

Transport Hazard Class: N/A

Packing Group: N/A

Marine Pollutant: No

Special Precautions: N/A

15 REGULATORY INFORMATION

TSCA Listed: All components are listed.

Regulation (EC) No 1272/2008 (CLP): N/A

Canada WHMIS Classification (CPR, SOR/88-66): Not controlled

HMIS Ratings: **Health:** 1 **Flammability:** 0 **Physical:** 0

NFPA Ratings: **Health:** 1 **Flammability:** 0 **Instability:** 0

Chemical Safety Assessment: A chemical safety assessment has not been carried out.

16 OTHER INFORMATION

The information contained in this document is based on the state of our knowledge at the time of publication and is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI Metals makes

no representation, warranty, or guarantee of any kind with respect to the information contained in this document or any use of the product based on this information. ESPI Metals shall not be held liable for any damages resulting from handling or from contact with the above product. Users should satisfy themselves that they have all current data relevant to their particular use.

Prepared by: ESPI Metals

Revised/Reviewed: August 2015

Arsenic



SAFETY DATA SHEET

1 PRODUCT AND SUPPLIER IDENTIFICATION

Product Name: Arsenic - lump or powder

Formula: As

Supplier: ESPI Metals

1050 Benson Way

Ashland, OR 97520

Telephone: 800-638-2581

Fax: 541-488-8313

Email: sales@espimetals.com

Emergency: Infotrac 800-535-5053 (US) or 352-323-3500 (24 hour)

Recommended Uses: Scientific Research

2 HAZARDS IDENTIFICATION

GHS Classification (29 CFR 1910.1200): Acute toxicity - oral, category 4, Acute toxicity - inhalation, category 4.

GHS Label Elements:



Signal Word: Warning

Hazard Statements: H302 Harmful if swallowed, H332 Harmful if inhaled.

Precautionary Statements: P261 Avoid breathing dust or fume, P264 Wash hands thoroughly after handling, P270 Do not eat, drink or smoke when using this product, P271 Use only outdoors or in a well-ventilated area, P281 Use personal protective equipment as required, P301+P304+P312 IF SWALLOWED OR INHALED: Call a POISON CENTER or doctor/physician if you feel unwell, P330 Rinse mouth, P501 Dispose of contents/container in accordance with local, state or federal regulations.

3 COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient: Arsenic

CAS#: 7440-38-2

%: 100

EC#: 231-148-6

4 FIRST AID MEASURES

General Measures: Remove patient from area of exposure.

INHALATION: Remove to fresh air, keep warm and quiet, give oxygen if breathing is difficult. Seek immediate medical attention.

INGESTION: Rinse mouth with water. Do not induce vomiting. Seek immediate medical attention. Never induce vomiting or give anything by mouth to an unconscious person.

SKIN: Remove contaminated clothing, brush material off skin, wash affected area with soap and water. Seek medical attention.

EYES: Flush eyes with lukewarm water, including under upper and lower eyelids, for at least 15 minutes. Seek medical attention.

Most Important Symptoms/Effects, Acute and Delayed: May cause vomiting, abdominal pain, diarrhea. See section 11 for more information.

Indication of Immediate Medical Attention and Special Treatment: No other information available.

5 FIREFIGHTING MEASURES

Extinguishing Media: Use suitable extinguishing agent for surrounding materials and type of fire. Smother small fires involving arsenic powder or dust with Class D or other metal extinguishing agent.

Unsuitable Extinguishing Media: No information available.

Specific Hazards Arising from the Material: Emits toxic fumes under fire conditions.

Special Protective Equipment and Precautions for Firefighters: Full face, self-contained breathing apparatus and full protective clothing when necessary.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures: Wear appropriate respiratory and protective equipment specified in section 8. Isolate spill area and provide ventilation. Avoid breathing dust or fume. Avoid contact with skin and eyes. Eliminate all sources of ignition.

Methods and Materials for Containment and Cleaning Up: Avoid creating dust. Wet sweep or vacuum up spill so as not to create more dust. Place in properly labeled closed containers.

Environmental Precautions: Do not allow to enter drains or to be released to the environment.

7 HANDLING AND STORAGE

Precautions for Safe Handling: Handle in an enclosed, controlled process. Transfer material in closed systems or within a completely hooded containment with local exhaust ventilation. Prevent spillage. Avoid creating dusts. Avoid exposure to high temperature. Avoid breathing dust or fumes. Avoid contact with skin and eyes. Wash thoroughly before eating or smoking. See section 8 for information on personal protection equipment.

Conditions for Safe Storage, Including Any Incompatibilities: Store in a cool, dry area. Store material tightly sealed in properly labeled containers. Do not store together with oxidizers, acids or halogens. See section 10 for more information on incompatible materials.

8 EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits: Arsenic

OSHA/PEL: 0.01 mg/m³

ACGIH/TLV: 0.01 mg/m³

Appropriate Engineering Controls: Handle in a controlled, enclosed environment. Ensure adequate ventilation to maintain exposures below occupational limits. Whenever possible the use of local exhaust ventilation or other engineering controls is the preferred method of controlling exposure to airborne dust and fume to meet established occupational exposure limits. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Do not blow dust off clothing or skin with compressed air. Clothing worn in areas of exposure to arsenic dust or fume should be restricted to the workplace and laundered regularly.

Individual Protection Measures, Such as Personal Protective Equipment:

Respiratory Protection: Where airborne exposures may exceed OSHA/ACGIH permissible air concentrations, the minimum respiratory protection recommended is negative pressure air purifying respirator with cartridges that are NIOSH/MSHA approved against dusts, fumes and mists having a TWA less than 0.05 mg/m³.

Eye Protection: Safety glasses or goggles.

Skin Protection: Wear impermeable gloves, protective work clothing. Protective overgarments or work clothing must be worn by persons who may become contaminated with particulate during work activities.

9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance:

Form: Lump or powder

Color: Gray

Odor: Odorless

Odor Threshold: Not determined

pH: N/A

Melting Point: 817 °C (28 atm.)

Boiling Point: 613 °C (sublimes)

Flash Point: N/A

Evaporation Rate: N/A

Flammability: N/A

Upper Flammable Limit: N/A

Lower Flammable Limit: N/A

Vapor Pressure: 1 mm Hg @ 372 °C (solid)

Vapor Density: N/A

Relative Density (Specific Gravity): 5.727 g/cc @ 14 °C

Solubility in H₂O: Insoluble

Partition Coefficient (n-octanol/water): Not determined

Autoignition Temperature: No data

Decomposition Temperature: No data

Viscosity: N/A

10 STABILITY AND REACTIVITY

Reactivity: No data

Chemical Stability: Stable under recommended storage conditions.

Possibility of Hazardous Reactions: Hydrogen gas can react with inorganic arsenic to form the highly toxic gas arsine.

Conditions to Avoid: Avoid creating dusts. Avoid high temperatures.

Incompatible Materials: Moist air, strong oxidizing agents, oxidizing acids, halogen and halogen compounds, sulfur, platinum, palladium, zinc, lithium, hydrogen gas.

Hazardous Decomposition Products: Arsenic oxide fume, arsine.

11 TOXICOLOGICAL INFORMATION

Likely Routes of Exposure: Inhalation, skin and eyes

Symptoms of Exposure: May cause irritation and systemic poisoning with symptoms including abdominal pain, nausea, vomiting, diarrhea, and encephalopathy and peripheral neuropathy.

Acute and Chronic Effects: Acute effects of inorganic arsenic compounds include vomiting, abdominal pain and diarrhea, followed by numbness and tingling of the extremities, muscle cramping, and death, in extreme cases. The first signs of long-term exposure to high levels of inorganic arsenic are usually observed in the skin, and include pigmentation changes, skin lesions, and hard patches on the palms and soles of the feet (hyperkeratosis). Other adverse health effects that may be associated with long-term ingestion of inorganic arsenic include developmental effects, neurotoxicity, diabetes and cardiovascular disease.

Acute Toxicity: LD50 oral - rat - 763mg/kg

Carcinogenicity: **NTP:** Known to be human carcinogen **IARC:** Group 1 - Carcinogenic to humans

To the best of our knowledge the chemical, physical and toxicological characteristics of the substance are not fully known.

12 ECOLOGICAL INFORMATION

Ecotoxicity: No data

Persistence and Degradability: No data

Bioaccumulative Potential: No data

Mobility in Soil: No data

Other Adverse Effects: Danger to drinking water and to aquatic organisms. Do not allow material to be released to the environment. No further relevant information available.

13 DISPOSAL CONSIDERATIONS

Waste Disposal Method:

Product: Dispose of in accordance with Federal, State and Local regulations.

Packaging: Dispose of in accordance with Federal, State and Local regulations.

14 TRANSPORT INFORMATION

UN Number: UN1558

UN Proper Shipping Name: Arsenic

Transport Hazard Class: 6.1

Packing Group: II

Marine Pollutant: No

Special Precautions: Warning: Toxic substances

15 REGULATORY INFORMATION

TSCA Listed: All components are listed.

Regulation (EC) No 1272/2008 (CLP): Acute toxicity - oral, category 4, Acute toxicity - inhalation, category 4, Hazardous to the aquatic environment - acute hazard, category 1, Hazardous to the aquatic environment - chronic hazard, category 1.

Canada WHMIS Classification (CPR, SOR/88-66): Acute toxicity.

HMIS Ratings: Health: 2 Flammability: 1 Physical: 0

NFPA Ratings: Health: 2 Flammability: 1 Instability: 0

Chemical Safety Assessment: A chemical safety assessment has not been carried out.

16 OTHER INFORMATION

The information contained in this document is based on the state of our knowledge at the time of publication and is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI Metals makes no representation, warranty, or guarantee of any kind with respect to the information contained in this document or any use of the product based on this information. ESPI Metals shall not be held liable for any damages resulting from handling or from contact with the above product. Users should satisfy themselves that they have all current data relevant to their particular use.

Prepared by: ESPI Metals

Revised/Reviewed: July 2015

Cadmium



SAFETY DATA SHEET

1 PRODUCT AND SUPPLIER IDENTIFICATION

Product Name: Cadmium - pieces, shot, sheet, foil, rod, wire, target

Formula: Cd

Supplier: ESPI Metals
1050 Benson Way
Ashland, OR 97520

Telephone: 800-638-2581

Fax: 541-488-8313

Email: sales@espimetals.com

Emergency: Infotrac 800-535-5053 (US) or 352-323-3500 (24 hour)

Recommended Uses: Scientific Research

2 HAZARDS IDENTIFICATION

GHS Classification (29 CFR 1910.1200): Acute toxicity - oral, category 3, Acute toxicity - inhalation, category 1, Carcinogenicity, category 1B, Specific target organ toxicity - repeated exposure, category 2.

GHS Label Elements:



Signal Word: Danger

Hazard Statements: H301 Toxic if swallowed, H330 Fatal if inhaled, H350 May cause cancer, H373 May cause damage to kidneys through prolonged or repeated exposure.

Precautionary Statements: P201 Obtain special instructions before use, P202 Do not handle until all safety precautions have been read and understood, P260 Do not breath dust or fume, 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, P281 Use personal protective equipment as required, P284 Wear respiratory protection, P301+P310 IF

SWALLOWED: Immediately call a POISON CENTER or doctor/physician, P330 Rinse mouth, P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing, P310 Immediately call a POISON CENTER or doctor/physician, P308+P313 IF exposed or concerned: Get medical advice/attention, P314 Get medical advice/attention if you feel unwell, P405 Store locked up, P501 Dispose of contents/container in accordance with local, state or federal regulations.

NOTE: In the solid form in which it is provided, and under typical handling and use, this material does not pose a health hazard. Subsequent operations performed by the end user, such as exposure to high temperatures, melting or grinding, may produce highly toxic cadmium oxide dust or fume. ESPI Metals does not warranty this material for any specific application and all precautions must be taken by the end user to prevent and protect against exposure to inhalable particulate. See section 8 for information on exposure controls and personal protection.

3 COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient: Cadmium

CAS#: 7440-43-9

%: 100

EC#: 231-152-8

4 FIRST AID MEASURES

General Measures: Under normal handling and use, exposure to solid forms of this material present few health hazards, however subsequent operations such as grinding, melting or welding may produce hazardous dust or fumes. Emergency responders should take care to avoid secondary exposure to cadmium particulate. Wear appropriate protective equipment.

INHALATION: Remove to fresh air, keep warm and quiet, give oxygen if breathing is difficult. Seek immediate medical attention. Treat pulmonary edema as a priority, even if no symptoms (i.e. wheezing, coughing, shortness of breath, etc.) are apparent. Symptoms of pulmonary edema can be delayed up to 48 hours after exposure. Quickly transport victim to an emergency care facility.

INGESTION: Rinse mouth with water. Do not induce vomiting. Seek immediate medical attention. Never induce vomiting or give anything by mouth to an unconscious person. Ingested cadmium may lead to spontaneous vomiting. If vomiting occurs naturally, have victim rinse mouth with water again.

SKIN: Remove contaminated clothing, wash affected area with soap and water. Seek medical attention. Wash contaminated clothing before reusing.

EYES: Flush eyes with lukewarm water, including under upper and lower eyelids, for at least 15 minutes. Seek medical attention.

Most Important Symptoms/Effects, Acute and Delayed: May cause respiratory irritation, coughing, headache. See section 11 for more information.

Indication of Immediate Medical Attention and Special Treatment: No other information available.

5 FIREFIGHTING MEASURES

Extinguishing Media: Use Class D dry powder extinguishing agent.

Unsuitable Extinguishing Media: Do not use water or foam.

Specific Hazards Arising from the Material: This product does not present fire or explosion hazards as shipped. Fine dust from processing may ignite if allowed to accumulate and subjected to an ignition source. When heated, cadmium emits highly toxic fumes of cadmium oxide.

Special Protective Equipment and Precautions for Firefighters: Full face, self-contained breathing apparatus and full protective clothing.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures: Wear appropriate respiratory and protective equipment specified in section 8. Isolate spill area and provide ventilation. Avoid breathing dust or fume. Avoid contact with skin and eyes. Eliminate all sources of ignition.

Methods and Materials for Containment and Cleaning Up: Avoid creating dusts. For larger pieces - pick up mechanically. For chips or dust - vacuum spill using a system equipped with a HEPA filtration system and place in properly labeled closed containers. Special precautions must be taken when changing filters on HEPA vacuum cleaners used to clean up hazardous materials. Caution should be taken to minimize airborne generation of particulate and avoid contamination of air and water.

Environmental Precautions: Do not allow to enter drains or to be released to the environment.

7 HANDLING AND STORAGE

Precautions for Safe Handling: Handle in a well-ventilated area. Avoid exposure to high temperature. Avoid creating dust. Avoid breathing dust or fumes. Provide local exhaust ventilation if dusts are created. Avoid contact with skin and eyes. Wash thoroughly before eating or smoking. See section 8 for information on personal protection equipment.

Conditions for Safe Storage, Including Any Incompatibilities: Store in a sealed container. Store in a cool, dry area. Do not store together with oxidizers, acids or halogens. See section 10 for more information on incompatible materials.

8 EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits: Cadmium

OSHA/PEL: 0.005 mg/m³

ACGIH/TLV: 0.01 mg/m³

Appropriate Engineering Controls: Whenever possible the use of local exhaust ventilation or other engineering controls is the preferred method of controlling exposure to airborne dust and fume to meet established occupational exposure limits. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Do not blow dust off clothing or skin with compressed air. Clothing worn in areas of exposure to cadmium dust or fume should be restricted to the workplace and laundered regularly.

Individual Protection Measures, Such as Personal Protective Equipment:

Respiratory Protection: When potential exposures are above the occupational limits, approved respirators must be used.

Eye Protection: Safety glasses

Skin Protection: Wear impermeable gloves, protective work clothing as necessary.

9 PHYSICAL AND CHEMICAL PROPERTIES**Appearance:**

Form: Solid in various forms

Color: Silvery metallic

Odor: Odorless

Odor Threshold: Not determined

pH: N/A

Melting Point: 320.9 °C

Boiling Point: 765 °C

Flash Point: N/A

Evaporation Rate: N/A

Flammability: No data

Upper Flammable Limit: No data

Lower Flammable Limit: No data

Vapor Pressure: 1 mm Hg @ 394 °C

Vapor Density: N/A

Relative Density (Specific Gravity): 8.642 g/cc

Solubility in H₂O: Insoluble

Partition Coefficient (n-octanol/water): Not determined

Autoignition Temperature: No data

Decomposition Temperature: No data

Viscosity: N/A

10 STABILITY AND REACTIVITY

Reactivity: No data

Chemical Stability: Stable under recommended storage conditions.

Possibility of Hazardous Reactions: High temperatures will generate toxic cadmium oxide fumes.

Conditions to Avoid: Avoid creating or accumulating fines or dusts. Avoid high temperatures.

Incompatible Materials: Peroxides, chlorates, nitrates, halogens, interhalogens, strong acids, strong bases, sulphur, potassium, zinc, selenium and tellurium.

Hazardous Decomposition Products: Cadmium oxide fume.

11 TOXICOLOGICAL INFORMATION

Likely Routes of Exposure: Inhalation, skin, eyes.

Symptoms of Exposure: Inhalation of fumes may cause upper respiratory tract irritation and systemic poisoning with early symptoms including headache, coughing, and a metallic taste.

Acute and Chronic Effects: After a delay of several hours (up to 10) after inhalation of dust or fumes, a person may develop constriction of the chest, persistent cough, and progressive shortness of breath. There may be headache, chills, diarrhea, muscle aches, nausea, vomiting, irritability, and restlessness. Prolonged exposure to cadmium dust and/or fume may cause loss of sense of smell, occasional ulcerations of the nasal passages, rhinolaryngitis, cough, shortness of breath, mild anemia, sleeplessness, irritability, loss of appetite, and cadmium-yellow fringe on teeth. The primary target organ for chronic cadmium effects is the kidney with increased excretion of a specific low molecular weight protein (beta-2-microglobulin). Exposures to high levels of cadmium dust or fume may be immediately dangerous to life or health and can cause delayed pneumonitis with fever and chest pain, and pulmonary edema resulting in death.

Acute Toxicity: LD50 oral - rat - 225mg/kg, LC50 inhalation - rat - 25mg/kg/30 min

Carcinogenicity: NTP: K - Known to be carcinogenic **IARC:** 1 - Carcinogenic to humans

To the best of our knowledge the chemical, physical and toxicological characteristics of the substance are not fully known.

12 ECOLOGICAL INFORMATION

Ecotoxicity: No data

Persistence and Degradability: No data

Bioaccumulative Potential: No data

Mobility in Soil: No data

Other Adverse Effects: May be toxic to aquatic organisms. Do not allow material to be released to the environment. No further relevant information available.

13 DISPOSAL CONSIDERATIONS

Waste Disposal Method:

Product: Dispose of in accordance with Federal, State and Local regulations.

Packaging: Dispose of in accordance with Federal, State and Local regulations.

14 TRANSPORT INFORMATION

Shipping Regulations: Not regulated

UN Number: N/A

UN Proper Shipping Name: N/A

Transport Hazard Class: N/A

Packing Group: N/A

Marine Pollutant: No

15 REGULATORY INFORMATION

TSCA Listed: All components are listed.

Regulation (EC) No 1272/2008 (CLP): Acute toxicity - oral, category 3, Acute toxicity - inhalation, category 1, Carcinogenicity, category 1B, Specific target organ toxicity - repeated exposure, category 2, Hazardous to the aquatic environment - acute hazard, category 1, Hazardous to the aquatic environment - chronic hazard, category 1.

Canada WHMIS Classification (CPR, SOR/88-66): Acute toxicity, Carcinogenicity, Specific target organ toxicity - repeated exposure.

HMIS Ratings: **Health:** 1 **Flammability:** 0 **Physical:** 0

NFPA Ratings: **Health:** 3 **Flammability:** 0 **Instability:** 0

Chemical Safety Assessment: A chemical safety assessment has not been carried out.

16 OTHER INFORMATION

The information contained in this document is based on the state of our knowledge at the time of publication and is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI Metals makes no representation, warranty, or guarantee of any kind with respect to the information contained in this document or any use of the product based on this information. ESPI Metals shall not be held liable for any damages resulting from handling or from contact with the above product. Users should satisfy themselves that they have all current data relevant to their particular use.

Prepared by: ESPI Metals

Revised/Reviewed: July 2015

Chromium



SAFETY DATA SHEET

1 PRODUCT AND SUPPLIER IDENTIFICATION

Product Name: Chromium - flake, granules, pellets, pieces, rod, target

Formula: Cr

Supplier: ESPI Metals

1050 Benson Way

Ashland, OR 97520

Telephone: 800-638-2581

Fax: 541-488-8313

Email: sales@espimetals.com

Emergency: Infotrac 800-535-5053 (US) or 352-323-3500 (24 hour)

Recommended Uses: Scientific Research

2 HAZARDS IDENTIFICATION

GHS Classification (29 CFR 1910.1200): Not classified as hazardous

GHS Label Elements:

Signal Word: N/A

Hazard Statements: N/A

Precautionary Statements: N/A

3 COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient: Chromium

CAS#: 7440-47-3

%: 100

EC#: 231-157-5

4 FIRST AID MEASURES

General Measures: No special requirements.

INHALATION: Remove to fresh air, keep warm and quiet, give oxygen if breathing is difficult. Seek medical attention.

INGESTION: Rinse mouth with water. Do not induce vomiting. Seek medical attention. Never induce vomiting or give anything by mouth to an unconscious person.

SKIN: Remove contaminated clothing, brush material off skin, wash affected area with soap and water. Seek medical attention if symptoms develop or persist.

EYES: Flush eyes with lukewarm water, including under upper and lower eyelids, for at least 15 minutes. Seek medical attention if symptoms develop or persist.

Most Important Symptoms/Effects, Acute and Delayed: May cause irritation. See section 11 for more information.

Indication of Immediate Medical Attention and Special Treatment: No other relevant information available.

5 FIREFIGHTING MEASURES

Extinguishing Media: Use extinguishing agent suitable for surrounding material and type of fire.

Unsuitable Extinguishing Media: No information available.

Specific Hazards Arising from the Material: This product does not present fire or explosion hazards as shipped. Fine dust from processing is a weak to moderate fire hazard if allowed to accumulate and subjected to an ignition source. May emit toxic metal oxide fumes under fire conditions.

Special Protective Equipment and Precautions for Firefighters: Full face, self-contained breathing apparatus and full protective clothing when necessary.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures: Wear appropriate respiratory and protective equipment specified in section 8. Isolate spill area and provide ventilation. Avoid breathing dust or fume. Avoid contact with skin and eyes. Eliminate all sources of ignition.

Methods and Materials for Containment and Cleaning Up: Avoid dust formation. Sweep or scoop up. Place in properly labeled closed container for further handling and disposal.

Environmental Precautions: Do not allow to be released to the environment.

7 HANDLING AND STORAGE

Precautions for Safe Handling: Avoid creating dust. Keep finely divided chromium away from any source of ignition and cleaned up immediately. Do not breathe dust or fumes. Provide adequate ventilation if dusts are created. Avoid contact with skin and eyes. Wash thoroughly before eating or smoking. See section 8 for information on personal protection equipment.

Conditions for Safe Storage: Store in a cool, dry area. See section 10 for more information on incompatible materials.

8 EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits: Chromium

OSHA/PEL: 1 mg/m³

ACGIH/TLV: 0.5 mg/m³

Engineering Controls: Ensure adequate ventilation to maintain exposures below occupational limits. Whenever possible the use of local exhaust ventilation or other engineering controls is the preferred method of controlling exposure to airborne dust and fume to meet established occupational exposure limits. Use good housekeeping and sanitation practices. Do not allow dusts to accumulate as they may present a fire hazard. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Do not blow dust off clothing or skin with compressed air.

Respiratory Protection: If permissible levels are exceeded, use NIOSH approved dust respirator.

Eye Protection: Safety glasses

Skin Protection: Wear impermeable gloves, protective work clothing as necessary.

9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance:

Form: Solid in various forms

Color: Silver gray metallic

Odor: Odorless

Odor Threshold: Not determined

pH: N/A

Melting Point: 1857±20 °C

Boiling Point: 2672 °C

Flash Point: N/A

Evaporation Rate: N/A

Flammability: No data

Upper Flammable Limit: No data

Lower Flammable Limit: No data

Vapor Pressure: 1 mm Hg @ 1616 °C

Vapor Density: N/A

Relative Density (Specific Gravity): 7.20 g/cc @ 28 °C

Solubility in H₂O: Insoluble

Partition Coefficient (n-octanol/water): Not determined

Autoignition Temperature: No data

Decomposition Temperature: No data

Viscosity: N/A

10 STABILITY AND REACTIVITY

Reactivity: No data

Chemical Stability: Stable under recommended storage conditions.

Possibility of Hazardous Reactions: No data

Conditions to Avoid: Avoid creating or accumulating fines or dusts.

Incompatible Materials: Acids, strong oxidizing agents, ammonium nitrite, bromine pentafluoride and carbon dioxide.

Hazardous Decomposition Products: Chromium oxide fume.

11 TOXICOLOGICAL INFORMATION

Likely Routes of Exposure: Inhalation, skin, eyes.

Symptoms of Exposure: May cause irritation if dusts or fumes are inhaled or swallowed. Fines/dusts may irritate skin and eyes.

Acute and Chronic Effects: Although much is known about the health effects of chromium compounds, the health effects of chromium metal, Cr(0), is not well studied. Due to insolubility most elements in their metallic state are not considered to be serious health hazards.

Acute Toxicity: No data

Carcinogenicity: NTP: Not identified as carcinogenic **IARC:** 3 - Not classifiable as to carcinogenicity in humans

To the best of our knowledge the chemical, physical and toxicological characteristics of the substance are not fully known.

12 ECOLOGICAL INFORMATION

Ecotoxicity: No data

Persistence and Degradability: No data

Bioaccumulative Potential: No data

Mobility in Soil: No data

Other Adverse Effects: Do not allow material to be released to the environment without proper governmental permits. No further relevant information available.

13 DISPOSAL CONSIDERATIONS

Waste Disposal Method:

Product: Dispose of in accordance with Federal, State and Local regulations.

Packaging: Dispose of in accordance with Federal, State and Local regulations.

14 TRANSPORT INFORMATION

Shipping Regulations: Not regulated

UN Number: N/A

UN Proper Shipping Name: N/A

Transport Hazard Class: N/A

Packing Group: N/A

Marine Pollutant: No

15 REGULATORY INFORMATION

TSCA Listed: All components are listed.

Regulation (EC) No 1272/2008 (CLP): N/A

Canada WHMIS Classification (CPR, SOR/88-66): N/A

HMIS Ratings: **Health:** 0 **Flammability:** 0 **Physical:** 0

NFPA Ratings: **Health:** 0 **Flammability:** 0 **Instability:** 0

Chemical Safety Assessment: A chemical safety assessment has not been carried out.

16 OTHER INFORMATION

The information contained in this document is based on the state of our knowledge at the time of publication and is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI Metals makes no representation, warranty, or guarantee of any kind with respect to the information contained in this document or any use of the product based on this information. ESPI Metals shall not be held liable for any damages resulting from handling or from contact with the above product. Users should satisfy themselves that they have all current data relevant to their particular use.

Prepared by: ESPI Metals

Revised/Reviewed: July 2015



Safety Data Sheet

Material Name: CIS-1,2-DICHLOROETHYLENE

SDS ID: MAT05125

Section 1 - PRODUCT AND COMPANY IDENTIFICATION

Material Name

CIS-1,2-DICHLOROETHYLENE

Synonyms

CIS-ACETYLENE DICHLORIDE; 1,2-DICHLOROETHYLENE; C2H2Cl2

Chemical Family

halogenated, aliphatic

Product Use

Industrial and Specialty Gas Applications.

Restrictions on Use

None known.

Details of the supplier of the safety data sheet

MATHESON TRI-GAS, INC.

150 Allen Road, Suite 302

Basking Ridge, NJ 07920

General Information: 1-800-416-2505

Emergency #: 1-800-424-9300 (CHEMTREC)

Outside the US: 703-527-3887 (Call collect)

Section 2 - HAZARDS IDENTIFICATION

Classification in accordance with paragraph (d) of 29 CFR 1910.1200.

Flammable Liquids - Category 2

Acute Toxicity - Oral - Category 4

Acute Toxicity - Inhalation - Vapor - Category 4

Skin Corrosion/Irritation - Category 2

Serious Eye Damage/Eye Irritation - Category 2A

Germ Cell Mutagenicity - Category 2

Specific target organ toxicity - Single exposure - Category 3

Specific target organ toxicity - Repeated exposure - Category 2

Hazardous to the Aquatic Environment - Chronic - Category 3

GHS Label Elements**Symbol(s)**



Safety Data Sheet

Material Name: CIS-1,2-DICHLOROETHYLENE

SDS ID: MAT05125



Signal Word

Danger

Hazard Statement(s)

Highly flammable liquid and vapour.

Harmful if swallowed.

Causes skin irritation.

Causes serious eye irritation.

Suspected of causing genetic defects.

May cause respiratory irritation.

May cause drowsiness or dizziness.

May cause damage to organs through prolonged or repeated exposure. (circulatory system, central nervous system, Hematopoietic System, liver)

Precautionary Statement(s)

Prevention

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 and eye/face protection.

Use only outdoors or in a well-ventilated area.

Wash thoroughly after handling.

Do not eat, drink or smoke when using this product.

Obtain special instructions before use.

Do not handle until all safety precautions have been read and understood.

Use Personal Protective equipment as required.

Do not breathe vapor or mist.

Response

In case of fire.

Use appropriate media for extinction.

IF exposed or concerned: Get medical advice/attention.

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.

IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with



Safety Data Sheet

Material Name: CIS-1,2-DICHLOROETHYLENE**SDS ID: MAT05125**

water/shower.

If skin irritation occurs: Get medical advice/attention.

Wash contaminated clothing 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 SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell.

Rinse mouth.

Storage

Store in a well-ventilated place.

Keep cool.

Keep container tightly closed.

Store locked up.

Disposal

Dispose in accordance with all applicable regulations.

Statement of Unknown Toxicity

100% of the mixture consists of ingredient(s) of unknown acute toxicity.

Other Hazards

No information available.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

CAS	Component Name	Percent
156-59-2	CIS-1,2-DICHLOROETHYLENE	100

Section 4 - FIRST AID MEASURES

Inhalation

If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

Skin

Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

Eyes

Flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Then get immediate medical attention.



Safety Data Sheet

Material Name: CIS-1,2-DICHLOROETHYLENE

SDS ID: MAT05125

Ingestion

If swallowed, get medical attention. Rinse mouth.

Most Important Symptoms/Effects

Acute

respiratory tract irritation, skin irritation, eye irritation, central nervous system depression

Delayed

circulatory system damage, hematopoietic system, central nervous system damage, liver damage, mutagenic effects

Note to Physicians

For inhalation, consider oxygen.

Section 5 - FIRE FIGHTING MEASURES

Extinguishing Media

Suitable Extinguishing Media

regular dry chemical, carbon dioxide, water spray, regular foam, Large fires: Use water spray, fog or regular foam.

Unsuitable Extinguishing Media

Do not scatter spilled material with high-pressure water streams.

Special Hazards Arising from the Chemical

Severe fire hazard. Moderate explosion hazard. Vapor/air mixtures are explosive above flash point. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back.

Hazardous Combustion Products

Phosgene, hydrogen chloride gas, Oxides of carbon

Fire Fighting Measures

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 unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Do not scatter spilled material with high-pressure water streams. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Water may be ineffective.

Special Protective Equipment and Precautions for Firefighters

Wear full protective fire fighting gear including self contained breathing apparatus (SCBA) for protection against possible exposure.



Safety Data Sheet

Material Name: CIS-1,2-DICHLOROETHYLENE

SDS ID: MAT05125

Section 6 - ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures

Wear personal protective clothing and equipment, see Section 8.

Methods and Materials for Containment and Cleaning Up

Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Reduce vapors with water spray. Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Dike for later disposal. Remove sources of ignition. Keep unnecessary people away, isolate hazard area and deny entry.

Environmental Precautions

Avoid release to the environment.

Section 7 - HANDLING AND STORAGE

Precautions for Safe Handling

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 discharges. Wear protective gloves/eye protection/face protection. Use only outdoors or in a well-ventilated area. Wash hands thoroughly after handling. Do not eat, drink or smoke when using this product. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use Personal Protective equipment as required. Do not breathe vapor or mist.

Conditions for Safe Storage, Including any Incompatibilities

Store in a well-ventilated place.

Keep cool.

Keep container tightly closed.

Store locked up.

Store and handle in accordance with all current regulations and standards. Store in a well-ventilated area. Keep cool. Keep container tightly closed. Keep locked up. Grounding and bonding required. Subject to storage regulations: U.S. OSHA 29 CFR 1910.106. Keep separated from incompatible substances.

Incompatible Materials

bases, metals, combustible materials, oxidizing materials, Acids

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Component Exposure Limits

CIS-1,2-DICHLOROETHYLENE	156-59-2
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Safety Data Sheet

Material Name: CIS-1,2-DICHLOROETHYLENE**SDS ID: MAT05125**

ACGIH:	200 ppm TWA
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EU - Occupational Exposure (98/24/EC) - Binding Biological Limit Values and Health Surveillance Measures

There are no biological limit values for any of this product's components.

ACGIH - Threshold Limit Values - Biological Exposure Indices (BEI)

There are no biological limit values for any of this product's components.

Engineering Controls

Provide local exhaust or process enclosure ventilation system. Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Ensure compliance with applicable exposure limits.

Individual Protection Measures, such as Personal Protective Equipment

Eye/face protection

Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

Skin Protection

Wear appropriate chemical resistant clothing.

Respiratory Protection

The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA. 2000 ppm. Any supplied-air respirator operated in a continuous-flow mode. Any powered, air-purifying respirator with organic vapor cartridge(s). Any air-purifying respirator with a full facepiece and an organic vapor canister. Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister. Any self-contained breathing apparatus with a full facepiece. Any supplied-air respirator with a full facepiece. Emergency or planned entry into unknown concentrations orIDLH conditions -. Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode. Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode. Escape -. Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister. Any appropriate escape-type, self-contained breathing apparatus. 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. Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Glove Recommendations

Wear appropriate chemical resistant gloves.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Colorless liquid	Physical State	liquid
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Safety Data Sheet

Material Name: CIS-1,2-DICHLOROETHYLENE**SDS ID: MAT05125**

Odor	pleasant odor	Color	colorless
Odor Threshold	Not available	pH	Not available
Melting Point	-81 °C (-114 °F)	Boiling Point	60 °C (140 °F)
Freezing point	Not available	Evaporation Rate	Not available
Boiling Point Range	Not available	Flammability (solid, gas)	Not available
Autoignition	460 °C (860 °F)	Flash Point	4 °C Closed Cup (39 °F)
Lower Explosive Limit	9.7 %	Decomposition	Not available
Upper Explosive Limit	12.8 %	Vapor Pressure	400 mmHg at 41 °C
Vapor Density (air=1)	3.34	Specific Gravity (water=1)	1.2837
Water Solubility	(Insoluble)	Partition coefficient: n-octanol/water	Not available
Viscosity	Not available	Solubility (Other)	Not available
Density	Not available	Henry's Law Constant	4.13406 hPa at 24.8 °C
KOC	240 (Estimate)	Log KOW	1.9
Physical Form	liquid	Molecular Formula	C ₂ -H ₂ -Cl ₂
Molecular Weight	96.94	OSHA Flammability Class	IB

Solvent Solubility**Soluble**

acetone, Benzene, ether, alcohol

Section 10 - STABILITY AND REACTIVITY

Chemical Stability

May decompose on contact with air, light, moisture, heat or storage and use above room temperature. Releases toxic and/or corrosive gases.

Possibility of Hazardous Reactions

May polymerize. Avoid contact with incompatible materials.



Safety Data Sheet

Material Name: CIS-1,2-DICHLOROETHYLENE

SDS ID: MAT05125

Conditions to Avoid

Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat. Keep out of water supplies and sewers.

Incompatible Materials

bases, metals, combustible materials, oxidizing materials, Acids

Hazardous decomposition products

Phosgene, hydrogen chloride gas, Oxides of carbon

Section 11 - TOXICOLOGICAL INFORMATION

Information on Likely Routes of Exposure

Inhalation

irritation, nausea, vomiting, drowsiness, headache, dizziness, loss of coordination

Skin Contact

irritation

Eye Contact

irritation

Ingestion

headache, drowsiness, dizziness, loss of coordination

Acute and Chronic Toxicity

Component Analysis - LD50/LC50

The components of this material have been reviewed in various sources and the following selected endpoints are published:

CIS-1,2-DICHLOROETHYLENE (156-59-2)

Oral LD50 Mouse 2200 mg/kg

Immediate Effects

respiratory tract irritation, skin irritation, eye irritation, central nervous system depression

Delayed Effects

circulatory system damage, hematopoietic system, central nervous system damage, liver damage, mutagenic effects

Irritation/Corrosivity Data

respiratory tract irritation, skin irritation, eye irritation

Respiratory Sensitization

No data available.

Dermal Sensitization

No data available.

Component Carcinogenicity

None of this product's components are listed by ACGIH, IARC, NTP, DFG or OSHA



Safety Data Sheet

Material Name: CIS-1,2-DICHLOROETHYLENE

SDS ID: MAT05125

Germ Cell Mutagenicity

Available data characterizes this substance as mutagenic.

Tumorigenic Data

No data available

Reproductive Toxicity

No data available.

Specific Target Organ Toxicity - Single Exposure

respiratory tract, central nervous system

Specific Target Organ Toxicity - Repeated Exposure

circulatory system, central nervous system, Hematopoietic System, liver

Aspiration hazard

No data available.

Medical Conditions Aggravated by Exposure

respiratory disorders

Section 12 - ECOLOGICAL INFORMATION

Component Analysis - Aquatic Toxicity

No LOLI ecotoxicity data are available for this product's components

Persistence and Degradability

This material may biodegrade in soil and water.

Bioaccumulative Potential

Biconcentration potential in aquatic organisms is low based on a BCF value of 5.

Mobility

Expected to have moderate mobility in soil.

Section 13 - DISPOSAL CONSIDERATIONS

Disposal Methods

Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): D001.

Component Waste Numbers

The U.S. EPA has not published waste numbers for this product's components

Section 14 - TRANSPORT INFORMATION



Safety Data Sheet

Material Name: CIS-1,2-DICHLOROETHYLENE**SDS ID: MAT05125**

US DOT Information:

Shipping Name: 1,2-Dichloroethylene

Hazard Class: 3

UN/NA #: UN1150

Packing Group: II

Required Label(s): 3

IMDG Information:

Shipping Name: 1,2-Dichloroethylene

Hazard Class: 3

UN#: UN1150

Packing Group: II

Required Label(s): 3

Section 15 - REGULATORY INFORMATION

U.S. Federal Regulations

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), CERCLA (40 CFR 302.4), TSCA 12(b), and/or require an OSHA process safety plan.

CIS-1,2-DICHLOROETHYLENE	156-59-2
CERCLA:	1000 lb final RQ; 454 kg final RQ

SARA Section 311/312 (40 CFR 370 Subparts B and C)

Acute Health: Yes Chronic Health: Yes Fire: Yes Pressure: No Reactivity: Yes

U.S. State Regulations

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA
CIS-1,2-DICHLOROETHYLENE	156-59-2	No	Yes	No	No	Yes

Not listed under California Proposition 65**Canadian WHMIS Ingredient Disclosure List (IDL)**

The components of this product are either not listed on the IDL or are present below the threshold limit listed on the IDL.

WHMIS Classification

BD2

Component Analysis - Inventory

CIS-1,2-DICHLOROETHYLENE (156-59-2)



Safety Data Sheet

Material Name: CIS-1,2-DICHLOROETHYLENE**SDS ID: MAT05125**

US	CA	EU	AU	PH	JP - ENCS	JP - ISHL	KR - KECI/KECL	KR - TCCA	CN	NZ	MX	TW
Yes	NSL	EIN	Yes	No	Yes	No	Yes	No	Yes	Yes	No	Yes

Section 16 - OTHER INFORMATION

NFPA Ratings

Health: 2 Fire: 3 Reactivity: 1

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

Summary of Changes

Updated: 05/01/2015

Key / Legend

ACGIH - American Conference of Governmental Industrial Hygienists; ADR - European Road Transport; AU - Australia; BOD - Biochemical Oxygen Demand; C - Celsius; CA - Canada; CAS - Chemical Abstracts Service; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CLP - Classification, Labelling, and Packaging; CN - China; CPR - Controlled Products Regulations; DFG - Deutsche Forschungsgemeinschaft; DOT - Department of Transportation; DSD - Dangerous Substance Directive; DSL - Domestic Substances List; EEC - European Economic Community; EINECS - European Inventory of Existing Commercial Chemical Substances; EPA - Environmental Protection Agency; EU - European Union; F - Fahrenheit; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; ICAO - International Civil Aviation Organization; IDL - Ingredient Disclosure List; IDLH - Immediately Dangerous to Life and Health; IMDG - International Maritime Dangerous Goods; JP - Japan; Kow - Octanol/water partition coefficient; KR - Korea; LEL - Lower Explosive Limit; LLV - Level Limit Value; LOLI - List Of Lists™ - ChemADVISOR's Regulatory Database; MAK - Maximum Concentration Value in the Workplace; MEL - Maximum Exposure Limits; NFPA - National Fire Protection Agency; NIOSH - National Institute for Occupational Safety and Health; NJTSR - New Jersey Trade Secret Registry; NTP - National Toxicology Program; NZ - New Zealand; OSHA - Occupational Safety and Health Administration; PH - Philippines; RCRA - Resource Conservation and Recovery Act; REACH- Registration, Evaluation, Authorisation, and restriction of Chemicals; RID - European Rail Transport; SARA - Superfund Amendments and Reauthorization Act; STEL - Short-term Exposure Limit; TDG - Transportation of Dangerous Goods; TSCA - Toxic Substances Control Act; TWA - Time Weighted Average; UEL - Upper Explosive Limit; US - United States.

Other Information**Disclaimer:**

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Safety Data Sheet

Material Name: CIS-1,2-DICHLOROETHYLENE

SDS ID: MAT05125

Cobalt



SAFETY DATA SHEET

1 PRODUCT AND SUPPLIER IDENTIFICATION

Product Name: Cobalt - pieces, pellets, shot, sheet, foil, rod, wire, target

Formula: Co

Supplier: ESPI Metals

1050 Benson Way

Ashland, OR 97520

Telephone: 800-638-2581

Fax: 541-488-8313

Email: sales@espimetals.com

Emergency: Infotrac 800-535-5053 (US) or 352-323-3500 (24 hour)

Recommended Uses: Scientific Research

2 HAZARDS IDENTIFICATION

GHS Classification (29 CFR 1910.1200): Not classified as hazardous

GHS Label Elements:

Signal Word: N/A

Hazard Statements: N/A

Precautionary Statements: N/A

3 COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient: Cobalt

CAS#: 7440-48-4

%: 100

EC#: 231-158-0

4 FIRST AID MEASURES

General Measures: No special requirements.

INHALATION: Remove to fresh air, keep warm and quiet, give oxygen if breathing is difficult. Seek medical attention.

INGESTION: Rinse mouth with water. Do not induce vomiting. Seek medical attention. Never induce vomiting or give anything by mouth to an unconscious person.

SKIN: Remove contaminated clothing, brush material off skin, wash affected area with soap and water. Seek medical attention if symptoms persist.

EYES: Flush eyes with lukewarm water, including under upper and lower eyelids, for at least 15 minutes. Seek medical attention if symptoms persist.

Most Important Symptoms/Effects, Acute and Delayed: May cause irritation. See section 11 for more information.

Indication of Immediate Medical Attention and Special Treatment: No other relevant information available.

5 FIREFIGHTING MEASURES

Extinguishing Media: Use suitable extinguishing media for surrounding material and type of fire.

Unsuitable Extinguishing Media: No information available.

Specific Hazards Arising from the Material: May emit metal oxide fumes under fire conditions.

Special Protective Equipment and Precautions for Firefighters: Full face, self-contained breathing apparatus and full protective clothing when necessary.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures: Wear appropriate respiratory and protective equipment specified in section 8. Isolate spill area and provide ventilation. Avoid breathing dust or fume. Avoid contact with skin and eyes. Eliminate all sources of ignition.

Methods and Materials for Containment and Cleaning Up: Avoid raising dust. Sweep or scoop up. Place in a closed container for further handling and disposal.

Environmental Precautions: Do not allow to enter drains or to be released to the environment.

7 HANDLING AND STORAGE

Precautions for Safe Handling: Avoid creating dust. Avoid breathing dust or fumes. Provide adequate ventilation if dusts are created. Avoid contact with skin and eyes. Wash thoroughly before eating or smoking. See section 8 for information on personal protection equipment.

Conditions for Safe Storage: Store in a sealed container. Store in a cool, dry area. Protect from acids. See section 10 for more information on incompatible materials.

8 EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits: Cobalt

OSHA/PEL: 0.1 mg/m³

ACGIH/TLV: 0.02 mg/m³

Engineering Controls: Ensure adequate ventilation to maintain exposures below occupational limits. Whenever possible the use of local exhaust ventilation or other engineering controls is the preferred method of controlling exposure to airborne dust and fume to meet established occupational exposure limits. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Do not blow dust off clothing or skin with compressed air.

Respiratory Protection: If permissible levels are exceeded, use NIOSH approved dust respirator.

Eye Protection: Safety glasses

Skin Protection: Wear impermeable gloves, protective work clothing as necessary.

9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance:

Form: Solid in various forms

Color: Silver-gray metallic

Odor: Odorless

Odor Threshold: Not determined

pH: N/A

Melting Point: 1495 °C

Boiling Point: 2870 °C

Flash Point: N/A

Evaporation Rate: N/A

Flammability: N/A

Upper Flammable Limit: N/A

Lower Flammable Limit: N/A

Vapor Pressure: No data

Vapor Density: N/A

Relative Density (Specific Gravity): 8.92 g/cc

Solubility in H₂O: Insoluble

Partition Coefficient (n-octanol/water): Not determined

Autoignition Temperature: No data

Decomposition Temperature: No data

Viscosity: N/A

10 STABILITY AND REACTIVITY

Reactivity: No data

Chemical Stability: Stable under recommended storage conditions.

Possibility of Hazardous Reactions: No data

Conditions to Avoid: Avoid creating or accumulating fines or dusts.

Incompatible Materials: Acids

Hazardous Decomposition Products: Cobalt oxide fume.

11 TOXICOLOGICAL INFORMATION

Likely Routes of Exposure: Inhalation, skin and eyes.

Symptoms of Exposure: May cause irritation.

Acute and Chronic Effects: Acute exposure to cobalt metal dusts or fumes is characterized by irritation to the eyes, and to a lesser extent, irritation to the skin. Chronic exposure to cobalt metal dust or fumes may cause respiratory and dermatologic signs and symptoms. Chronic exposure to cobalt by inhalation in humans results in effects on the respiratory system, such as respiratory irritation, wheezing, asthma, decreased lung function, pneumonia, and fibrosis.

Acute Toxicity: LD50 Oral - rat - 6,171mg/kg

Carcinogenicity: **NTP:** Not identified as carcinogenic **IARC:** 2B - Possibly carcinogenic to humans

To the best of our knowledge the chemical, physical and toxicological characteristics of the substance are not fully known.

12 ECOLOGICAL INFORMATION

Ecotoxicity: No data

Persistence and Degradability: No data

Bioaccumulative Potential: No data

Mobility in Soil: No data

Other Adverse Effects: No further relevant information available.

13 DISPOSAL CONSIDERATIONS

Waste Disposal Method:

Product: Dispose of in accordance with Federal, State and Local regulations.

Packaging: Dispose of in accordance with Federal, State and Local regulations.

14 TRANSPORT INFORMATION

Shipping Regulations: Not regulated

UN Number: N/A

UN Proper Shipping Name: N/A

Transport Hazard Class: N/A

Packing Group: N/A

Marine Pollutant: No

15 REGULATORY INFORMATION

TSCA Listed: All components are listed.

Regulation (EC) No 1272/2008 (CLP): N/A

Canada WHMIS Classification (CPR, SOR/88-66): N/A

HMIS Ratings: **Health:** 1 **Flammability:** 0 **Physical:** 0

NFPA Ratings: **Health:** 1 **Flammability:** 0 **Instability:** 0

Chemical Safety Assessment: A chemical safety assessment has not been carried out.

16 OTHER INFORMATION

The information contained in this document is based on the state of our knowledge at the time of publication and is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI Metals makes no representation, warranty, or guarantee of any kind with respect to the information contained in this document or any use of the product based on this information. ESPI Metals shall not be held liable for any damages resulting from handling or from contact with the above product. Users should satisfy themselves that they have all current data relevant to their particular use.

Prepared by: ESPI Metals

Revised/Reviewed: July 2015

AUSTRALIAN CHEMICAL REAGENTS
SAFETY DATA SHEET

Date Prepared: February 2022
Version No: 6

1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name: Fluoride Std (0 - 1000 mg/L)
Product Code: 0782
Other Names: Nil
Uses: Analytical Reagent

Supplier: Australian Chemical Reagents
38-50 Bedford Street Gillman SA 5013

Contacts: Telephone: 61 08 84402000
Fax: 61 08 84402001
Emergency Phone: 61 08 84402000 Mon-Fri 8:30am - 5:00pm

2. HAZARDS INFORMATION

Hazard classification: Classified as non-Hazardous according to the Globally Harmonised System of classification and labelling of Chemicals (GHS) including Work, Health and Safety regulations, Australia.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Ingredients :

Chemical Entity	CAS No	Proportion
Sodium Fluoride	[7681-49-4]	0 to 0.22%
Water	[7732-18-5]	to 100%

4. FIRST AID MEASURES

Safety showers and eye wash facilities should be provided.

Swallowed :

If conscious wash out mouth with water. Seek medical advice. Show this SDS to medical practitioner.

Eye :

Immediately hold eyelids open and flood with water for at least 15 minutes. Obtain medical aid. Show this SDS to medical practitioner.

Skin :

Remove contaminated clothing. Immediately wash skin thoroughly with water and mild soap. Seek medical advice if irritation persists. Show this SDS to medical practitioner. Launder clothing before reuse.

Inhaled :

Remove from contaminated air. Maintain breathing with artificial respiration if necessary. Seek medical assistance. Show this SDS to a doctor.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media:

Water spray. Carbon dioxide, dry chemical powder, or appropriate foam.

Hazards From Combustion Products:

The solution will not burn or support combustion.

Precautions For Fire Fighters and Special Protective Equipment:

Fire fighters and others who may be exposed to combustion products during fire should wear full protective clothing including positive pressure self-contained breathing apparatus (SCBA). Wear SCBA with full face-piece, operated in positive pressure mode when fighting fires.

6. ACCIDENTAL RELEASE MEASURES

Emergency procedures:

Prevent from entering waterways. Restrict access to area. Ventilate area. Remove chemicals that can react with the spilled material.

Methods and materials for containment and clean up:

Use inert material such as sand or earth to contain spill or leak. Absorb spills with chemical absorber or vermiculite and dispose of in accordance with local regulations.

7. HANDLING AND STORAGE

Precautions for Safe Handling:

Do not get in eyes, on skin, on clothing. Avoid prolonged or repeated exposure.

Conditions for Safe Storage:

Store sealed in original container in a cool well ventilated situation away from foods and other chemicals. Do not store in direct sunlight. Observe good hygiene and housekeeping practices.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

National Exposure Standards:

SWA – Fluorides (as F) 2.5 mg/m³ TWA

Biological Limit Values: No data available.

Engineering Controls:

Not required with normal use. If mists are likely to be generated maintain atmospheric concentrations well below exposure standards with extraction ventilation.

Personal Protective Equipment (PPE):

The use of nitrile or neoprene gloves complying with AS 2161 and the use of faceshield, chemical goggles or safety glasses with side shield protection complying with AS/NZS 1337 is recommended.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance :	Clear liquid
Odour:	Nil
pH:	7
Boiling Point (°C) :	100
Freezing/melting Point:	0
Vapour Pressure (mm of Hg @ 25°C) :	Not applicable
Vapour Density:	Not applicable
Specific Gravity :	1
Flash Point (°C) :	Not flammable
Flammability Limits (%) :	Not flammable
Solubility in Water (g/L) :	Soluble

10. STABILITY AND REACTIVITY

Chemical stability:

Stable.

Conditions to avoid:

Excessive heat.

Incompatible materials:

Calcium salts.

Hazardous decomposition products:

Refer to section 5 (Fire Fighting Measures).

Hazardous reactions:

Hazardous polymerization will not occur.

11. TOXICOLOGICAL INFORMATION

Health Effects:

Swallowed : Not considered a hazard. Ingestion of large amounts of higher concentrations may be harmful. For Sodium fluoride oral human LD₅₀ 71mg/kg.

Eye : Not considered a hazard. Higher concentration solutions may be irritating to eye tissue. For sodium fluoride 20 mg applied to rabbit eyes for 24 hours produced moderate irritation.

Skin : Not considered a hazard.

Inhaled : Not considered a hazard.

Chronic Effects: Symptoms of fluoride overexposure may include salivation, nausea, vomiting, abdominal pain, fever, laboured breathing. Fluoride ion can reduce serum calcium levels possibly causing fatal hypocalcemia.

12. ECOLOGICAL INFORMATION

Ecotoxicity:

No data available.

Persistence and degradability:

No data available.

Mobility:

No data available.

13. DISPOSAL CONSIDERATIONS

Contact a licensed professional waste disposal service to dispose of this material. Observe all federal, state and local environmental regulations.

14. TRANSPORT INFORMATION

UN Number: Not applicable

UN Proper Shipping Name: Not applicable

Class and subsidiary risk(s): Not applicable

Packing Group: Not applicable

Hazchem Code: Not applicable

Special precautions for user : Nil

15. REGULATORY INFORMATION

Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP):

Nil

16. OTHER INFORMATION

Disclaimer:

All information given by the Company is offered in good faith and is believed to the best of our knowledge to be accurate. However this information is offered without warranty representation inducement or licence and the Company does not assume legal responsibility for reliance upon the same.

Every person dealing with the materials referred to herein does so at his or her own risk absolutely and must make independent determinations of suitability and completeness of information from all sources to ensure their proper use.

Lead



SAFETY DATA SHEET

1 PRODUCT AND SUPPLIER IDENTIFICATION

Product Name: Lead - pellets, shot, sheet, foil, rod, wire, target

Formula: Pb

Supplier: ESPI Metals

1050 Benson Way

Ashland, OR 97520

Telephone: 800-638-2581

Fax: 541-488-8313

Email: sales@espimetals.com

Emergency: Infotrac 800-535-5053 (US) or 352-323-3500 (24 hour)

Recommended Uses: Scientific Research

2 HAZARDS IDENTIFICATION

GHS Classification (29 CFR 1910.1200): Carcinogenicity, category 2, Reproductive toxicity, category 2, Specific target organ toxicity - repeated exposure, category 2.

GHS Label Elements:



Signal Word: Warning

Hazard Statements: H351 Suspected of causing cancer, H361 Suspected of damaging fertility or the unborn child, H373 May cause damage to organs through prolonged or repeated exposure.

Precautionary Statements: P201 Obtain special instructions before use, P202 Do not handle until all safety precautions have been read and understood, P260 Do not breath dust/fume/gas/mist/vapors/spray, P281 Use personal protective equipment as required, P308+P313 IF exposed or concerned: Get medical advice/attention, P314

Get medical advice/attention if you feel unwell, P405 Store locked up, P501 Dispose of contents/container in accordance with local, state or federal regulations.

3 COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient: Lead

CAS#: 7439-92-1

%: 100

EC#: 231-100-4

4 FIRST AID MEASURES

General Measures: Remove patient from area of exposure.

INHALATION: Remove to fresh air, keep warm and quiet, give oxygen if breathing is difficult. Seek immediate medical attention.

INGESTION: Rinse mouth with water. Do not induce vomiting. Seek immediate medical attention. Never induce vomiting or give anything by mouth to an unconscious person.

SKIN: Remove contaminated clothing, wash affected area with soap and water. Seek medical attention. Wash contaminated clothing before reusing.

EYES: Flush eyes with lukewarm water, including under upper and lower eyelids, for at least 15 minutes. Seek medical attention.

Most Important Symptoms/Effects, Acute and Delayed: May cause irritation. See section 11 for more information.

Indication of Immediate Medical Attention and Special Treatment: No other information available.

5 FIREFIGHTING MEASURES

Extinguishing Media: Use suitable extinguishing agent for surrounding materials and type of fire.

Unsuitable Extinguishing Media: No information available.

Specific Hazards Arising from the Material: This product does not present fire or explosion hazards as shipped. Fine dust from processing is a weak to moderate fire hazard if allowed to accumulate and subjected to an ignition source. Under fire conditions toxic fumes of lead oxide may be released.

Special Protective Equipment and Precautions for Firefighters: Full face, self-contained breathing apparatus and full protective clothing when necessary.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures: Wear appropriate respiratory and protective equipment specified in section 8. Isolate spill area and provide ventilation. Avoid breathing dust or fume. Avoid contact with skin and eyes.

Methods and Materials for Containment and Cleaning Up: For larger pieces - pick up mechanically. For chips or dust - vacuum using a HEPA filter. Place in properly labeled closed containers. Avoid creating dusts. Do not use compressed air.

Environmental Precautions: Do not allow to enter drains or to be released to the environment.

7 HANDLING AND STORAGE

Precautions for Safe Handling: Handle in a well-ventilated area. Avoid creating dust. Avoid exposure to high temperature. Provide adequate ventilation if dusts are created. Avoid breathing dust or fumes. Avoid contact with skin and eyes. Wash thoroughly before eating or smoking. See section 8 for information on personal protection equipment.

Conditions for Safe Storage, Including Any Incompatibilities: Store in a sealed container. Store in a cool, dry area. Protect from moisture. Do not store together with strong oxidizers or acids. See section 10 for more information on incompatible materials.

8 EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits: Lead

OSHA/PEL: 50 µg/m³

ACGIH/TLV: 0.05 mg/m³

Appropriate Engineering Controls: Whenever possible the use of local exhaust ventilation or other engineering controls is the preferred method of controlling exposure to airborne dust and fume to meet established occupational exposure limits. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Do not blow dust off clothing or skin with compressed air. Clothing worn in areas of exposure to lead dust or fume should be restricted to the workplace and laundered regularly.

Individual Protection Measures, Such as Personal Protective Equipment:

Respiratory Protection: When potential exposures are above the occupational limits, approved respirators must be used.

Eye Protection: Safety glasses

Skin Protection: Wear impermeable gloves, protective work clothing as necessary.

9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance:

Form: Solid in various forms

Color: Silvery metallic

Odor: Odorless

Odor Threshold: Not determined

pH: N/A

Melting Point: 327.5 °C

Boiling Point: 1740 °C

Flash Point: N/A

Evaporation Rate: N/A

Flammability: No data

Upper Flammable Limit: No data

Lower Flammable Limit: No data

Vapor Pressure: 1 mm Hg @ 973 °C

Vapor Density: N/A

Relative Density (Specific Gravity): 11.34 g/cc

Solubility in H₂O: Insoluble

Partition Coefficient (n-octanol/water): Not determined

Autoignition Temperature: No data

Decomposition Temperature: No data

Viscosity: N/A

10 STABILITY AND REACTIVITY

Reactivity: No data

Chemical Stability: Stable under recommended storage conditions.

Possibility of Hazardous Reactions: High temperatures will generate toxic lead oxide fumes.

Conditions to Avoid: Avoid creating or accumulating fines or dusts. Avoid high temperatures.

Incompatible Materials: Strong acids, strong oxidizers, halogens and interhalogen compounds.

Hazardous Decomposition Products: Lead oxide fume.

Other: Freshly cut or cast lead surfaces tarnish rapidly due to the formation of an insoluble protective layer of basic lead carbonate.

11 TOXICOLOGICAL INFORMATION

Likely Routes of Exposure: Inhalation, skin, eyes. Product as shipped does not present an inhalation hazard; however subsequent operations may create dusts or fumes which could be inhaled.

Symptoms of Exposure: Skin or eye contact with dust or fume may cause local irritation. Inhalation of dust or fumes may cause headache, nausea, vomiting, abdominal spasms, fatigue, sleep disturbances, weight loss, anemia,

and pain in legs, arms, and joints. An acute short-term dose of lead could cause acute encephalopathy with seizures, coma, and death. However, short-term exposure of this magnitude is rare. Kidney damage, as well as anemia, can occur from acute exposure. Symptoms due to ingestion of lead dust or fume would be similar to those from inhalation. Other health effects such as metallic taste in the mouth and constipation or bloody diarrhea might also be expected to occur.

Acute and Chronic Effects: Lead accumulates in bone and body organs once it enters the body. Elimination from the body is slow. Initial and periodic medical examinations are advised for persons repeatedly exposed to levels above the exposure limits of lead dust or fumes. Once lead enters the body, it can affect a variety of organ systems, including the nervous system, kidneys, reproductive system, blood formation, and gastrointestinal system.

Acute Toxicity: No data

Carcinogenicity:

Lead and Lead Compounds, Inorganic: **NTP:** R - Reasonably anticipated to be a carcinogen **IARC:** 2B - Possibly carcinogenic to humans

To the best of our knowledge the chemical, physical and toxicological characteristics of the substance are not fully known.

12 ECOLOGICAL INFORMATION

Ecotoxicity: No data

Persistence and Degradability: No data

Bioaccumulative Potential: No data

Mobility in Soil: No data

Other Adverse Effects: Do not allow material to be released to the environment. No further relevant information available.

13 DISPOSAL CONSIDERATIONS

Waste Disposal Method:

Product: Dispose of in accordance with Federal, State and Local regulations.

Packaging: Dispose of in accordance with Federal, State and Local regulations.

14 TRANSPORT INFORMATION

Shipping Regulations: Not regulated

UN Number: N/A

UN Proper Shipping Name: N/A

Transport Hazard Class: N/A

Packing Group: N/A

Marine Pollutant: No

15 REGULATORY INFORMATION

TSCA Listed: All components are listed.

Regulation (EC) No 1272/2008 (CLP): Carcinogenicity, category 2, Reproductive toxicity, category 2, Specific target organ toxicity - repeated exposure, category 2, Hazardous to the aquatic environment - acute hazard, category 1, Hazardous to the aquatic environment - chronic hazard, category 1.

Canada WHMIS Classification (CPR, SOR/88-66): Carcinogenicity, Reproductive toxicity, Specific target organ toxicity - repeated exposure.

HMIS Ratings: **Health:** 1 **Flammability:** 0 **Physical:** 0

NFPA Ratings: **Health:** 1 **Flammability:** 0 **Instability:** 0

Chemical Safety Assessment: A chemical safety assessment has not been carried out.

16 OTHER INFORMATION

The information contained in this document is based on the state of our knowledge at the time of publication and is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI Metals makes no representation, warranty, or guarantee of any kind with respect to the information contained in this document or any use of the product based on this information. ESPI Metals shall not be held liable for any damages resulting from handling or from contact with the above product. Users should satisfy themselves that they have all current data relevant to their particular use.

Prepared by: ESPI Metals

Revised/Reviewed: July 2015

Safety Data Sheet
 according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and
 GHS

Effective date: 05/12/2015

Revision: 05/12/2015

LIQUINOX

1 Identification of the Substance/mixture and of the Company/Undertaking

1.1 Product identifier

Trade name: LIQUINOX

Application of the substance / the preparation: Hand detergent.

1.2 Relevant identified uses of the substance or mixture and uses advised against:

No additional information available.

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer/Supplier:

Alconox, Inc.
 30 Glenn St., Suite 309
 White Plains, NY 10603
 Phone: 914-948-4040



Further information obtainable from: Product Safety Department.

1.4 Emergency telephone number:

ChemTel Inc.: (800)255-3924, +1 (813)248-0585

2 Hazards Identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008:

Classification according to Directive 67/548/EEC or Directive 1999/45/EC:



GHS07

Skin Irrit. 2, H315: Causes skin irritation.

Information concerning particular hazards for human and environment:

The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

Classification system:

The classification is according to the latest editions of the EU-lists, and extended by company and literature data

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008:

The product is classified and labelled according to the CLP regulation.

Hazard pictograms:



GHS07

Signal word: Warning

Hazard-determining components of labelling:

Alkyl benzene sulfonic acid, sodium salt.

Safety Data Sheet
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GHS

Effective date: 05/12/2015

Revision: 05/12/2015

LIQUINOX

Hazard statements:

H315: Causes skin irritation.

Precautionary statements:

P332+P313: If skin irritation occurs: Get medical advice/attention.

P302+P352: IF ON SKIN: Wash with plenty of soap and water.

P501: Dispose of contents/container in accordance with local/regional/national/international regulations.

Other Hazard description:**WHMIS-classification and symbols:**

D2B - Toxic material causing other toxic effects

**NFPA ratings (scale 0 - 4)**

Health = 1
 Fire = 0
 Reactivity = 0

HMIS-ratings (scale 0 - 4)

HEALTH	1	Health = 1
FIRE	0	Fire = 0
REACTIVITY	0	Reactivity = 0

2.3 Other hazards**Results of PBT and vPvB assessment**

PBT: Not applicable.

vPvB: Not applicable.

3 Composition/Information on Ingredients**3.2 Chemical characterization: Mixture****Description:** Hazardous ingredients of mixture listed below.

Identifying Nos.	Description	Wt. %
CAS: 68081-81-2	Alkyl benzene sulfonic acid, sodium salt	10 - 25%
CAS: 1300-72-7 EINECS: 215-090-9	Sodium xylene sulphonate	2.5 - 10%
CAS: 84133-50-6	Alcohol Ethoxylate	2.5 - 10%
CAS: 68603-42-9 EINECS: 271-657-0	Coconut diethanolamide	2.5 - 10%
CAS: 17572-97-3 EINECS: 241-543-5	Ethylenediaminetetraacetic acid, tripotassium salt	2.5 - 10%

Additional information: For the wording of the listed risk phrases refer to section 16.

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and
GHS

Effective date: 05/12/2015

Revision: 05/12/2015

LIQUINOX

4 First Aid Measures

4.1 Description of first aid measures

General information:

Take affected persons out into the fresh air.

After inhalation:

Supply fresh air; consult doctor in case of complaints.

After skin contact:

Immediately wash with water and soap and rinse thoroughly for 30 minutes. If skin irritation continues, consult a doctor.

After eye contact:

Remove contact lenses if worn.

Rinse opened eye for at least 30 minutes under running water, lifting upper and lower lids occasionally. Immediately consult a doctor.

After swallowing:

Do not induce vomiting; call for medical help immediately. Rinse out mouth and then drink plenty of water.

A person vomiting while laying on their back should be turned onto their side.

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

Irritating, all routes of exposure.

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

No additional information available.

5 Firefighting Measures

5.1 Extinguishing media:

Suitable extinguishing agents:

CO2, powder or water spray. Fight larger fires with water spray or alcohol resistant foam.

5.2 Special hazards arising from the substance or mixture:

No additional information available.

5.3 Advice for firefighters:

Protective equipment:

Wear self-contained respiratory protective device.

Wear fully protective suit.

6 Accidental Release Measures

6.1 Personal precautions, protective equipment and emergency procedures:

Ensure adequate ventilation.

Particular danger of slipping on leaked/spilled product.

6.2 Environmental precautions:

Dilute with plenty of water.

Do not allow to enter sewers/ surface or ground water.

6.3 Methods and material for containment and cleaning up:

Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).

Clean the affected area carefully; suitable cleaners are: Warm water

Dispose contaminated material as waste according to item 13. Ensure adequate ventilation.

6.4 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

7 Handling and Storage

7.1 Precautions for safe handling:

No special precautions are necessary if used correctly.

Information about fire - and explosion protection:

No special measures required.

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and
GHS

Effective date: 05/12/2015

Revision: 05/12/2015

LIQUINOX

7.2 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: No special requirements.

Further information about storage conditions: None

7.3 Specific end use(s): No additional information available.

8 Exposure Controls/Personal Protection

8.1 Control parameters

Ingredients with limit values that require monitoring at the workplace:

The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.

Additional information: The lists valid during the making were used as basis.

8.2 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 and skin.

Respiratory protection:

Not required under normal conditions of use.

Protection of hands:



Protective gloves

The glove material has to be impermeable and resistant to the product. Selection of the glove material should be based on the penetration time, rates of diffusion and the degradation of the glove material.

Material of gloves:

The selection of a suitable gloves does not only depend on the material, but also on the quality, and varies from manufacturer to manufacturer.

Penetration time of glove material:

The exact break through time has to be determined by the manufacturer of the protective gloves. DO NOT exceed the breakthrough time set by the Manufacturer.

For long term contact, gloves made of the following materials are considered suitable:

Butyl rubber, BR

Nitrile rubber, NBR

Natural rubber (NR)

Neoprene gloves

Eye protection:



Safety glasses

Goggles recommended during refilling.

Body protection: Protective work clothing

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and
GHS

Effective date: 05/12/2015

Revision: 05/12/2015

LIQUINOX

9 Physical and Chemical Properties

9.1 Information on basic physical and chemical properties:

General Information:

Appearance:

Form:	Liquid
Color:	Light Yellow
Odor:	Odorless
Odor threshold:	Not determined.
pH-value:	8.5

Change in condition:

Melting point/Melting range:	Not determined.
Boiling point/Boiling range:	100°C
Flash point:	Not applicable.
Flammability (solid, gaseous):	Not applicable.
Ignition temperature:	Not applicable.
Decomposition temperature:	Not determined.
Self-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:

23 hPa

Density:

1.08 g/cm³

Relative density:

Not determined.

Vapor density:

Not determined.

Evaporation rate:

Not determined.

Solubility in / Miscibility with water:

Fully miscible.

Segregation coefficient (n-octanol/water):

Not determined.

Viscosity:

Dynamic:	Not determined.
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Kinematic:	Not determined.
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Solvent content:

Organic solvents:	Not determined.
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Solids content:	Not determined.
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9.2 Other information:

No additional information available.

10 Stability and Reactivity

10.1 Reactivity:

10.2 Chemical stability:

Thermal decomposition / conditions to be avoided:

No decomposition if used according to specifications.

10.3 Possibility of hazardous reactions:

Reacts with strong oxidizing agents. Reacts with strong acids.

10.4 Conditions to avoid:

No additional information available.

10.5 Incompatible materials:

No additional information available.

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and
GHS

Effective date: 05/12/2015

Revision: 05/12/2015

LIQUINOX

10.6 Hazardous decomposition products:

Carbon monoxide and carbon dioxide
 Sulphur oxides (SO_x)
 Nitrogen oxides

11 Toxicological Information

11.1 Information on toxicological effects:

Toxicity data: Toxicity data is available for mixture:

Primary irritant effect:

On the skin: Irritating to skin and mucous membranes.
On the eye: 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 the calculation method of the General EU Classification Guidelines for Preparations as issued in the latest version: Irritant

12 Ecological Information

12.1 Toxicity:

Aquatic toxicity: No additional information available.

12.2 Persistence and degradability: Biodegradable.

12.3 Bioaccumulative potential: Does not accumulate in organisms.

12.4 Mobility in soil: No additional information available.

Additional ecological information:

General notes:

Water hazard class 1 (German Regulation) (Self-assessment): slightly hazardous for water.

Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.

Must not reach sewage water or drainage ditch undiluted or un-neutralized.

12.5 Results of PBT and vPvB assessment:

PBT: Not applicable.

vPvB: Not applicable.

12.6 Other adverse effects: No additional information available.

13 Disposal Considerations

13.1 Waste treatment methods:

Recommendation:

Smaller quantities can be disposed of with household waste.

Small amounts may be diluted with plenty of water and washed away. Dispose of bigger amounts in accordance with Local Authority requirements.

The surfactant used in this product complies with the biodegradability criteria as laid down in Regulation (EC) No. 648/2004 on detergents. Data to support this assertion are held at the disposal of the competent authorities of the Member States and will be made available to them, at their direct request or at the request of a detergent manufacturer.

Uncleaned packaging:

Recommendation: Disposal must be made according to official regulations.

Recommended cleansing agents: Water, together with cleansing agents, if necessary.

14 Transport Information

14.1 UN-Number:

DOT, ADR, ADN, IMDG, IATA: Not Regulated

14.2 UN proper shipping name:

DOT, ADR, IMDG, IATA: Not Regulated

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and
GHS

Effective date: 05/12/2015

Revision: 05/12/2015

LIQUINOX

14.3 Transport hazard class(es):

DOT, ADR, IMDG, IATA:

Class:

Not Regulated

Label:

-

14.4 Packing group:

DOT, ADR, IMDG, IATA:

Not Regulated

14.5 Environmental hazards:

Marine pollutant:

No

14.6 Special precautions for user:

Not applicable.

14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code: Not applicable.

UN "Model Regulation":

Not Regulated

15 Regulatory Information**15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:**

United States (USA):

SARA:

Section 355 (extremely hazardous substances): None of the ingredient is listed.

Section 313 (Specific toxic chemical listings): None of the ingredient is listed.

TSCA (Toxic Substances Control Act): All ingredients are listed.

Proposition 65 (California):

Chemicals known to cause cancer: None of the ingredient is listed.

Chemicals known to cause reproductive toxicity for females: None of the ingredient is listed.

Chemicals known to cause reproductive toxicity for males: None of the ingredient is listed.

Chemicals known to cause developmental toxicity: None of the ingredient is listed.

Carcinogenic Categories:

EPA (Environmental Protection Agency): None of the ingredient is listed.

TLV (Threshold Limit Value established by ACGIH): None of the ingredient is listed.

NIOSH-Ca (National Institute for Occupational Safety and Health): None of the ingredient is listed.

OSHA-Ca (Occupational Safety & Health Administration): None of the ingredient is listed.

Canadá:

Canadian Domestic Substances List (DSL): All ingredients are listed.

Canadian Ingredient Disclosure list (limit 0.1%): None of the ingredient is listed.

Canadian Ingredient Disclosure list (limit 1%): None of the ingredient is listed.

15.2 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.

Relevant phrases:

H315: Causes skin irritation.

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and
GHS

Effective date: 05/12/2015

Revision: 05/12/2015

LIQUINOX

Abbreviations and Acronyms:

ADR: 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.
GHS: Globally Harmonized System of Classification and Labelling of Chemicals.
ACGIH: American Conference of Governmental Industrial Hygienists.
NFPA: National Fire Protection Association (USA).
HMIS: Hazardous Materials Identification System (USA).
WHMIS: Workplace Hazardous Materials Information System (Canada).
VOC: Volatile Organic Compounds (USA, EU).
LC50: Lethal concentration, 50 percent.
LD50: Lethal dose, 50 percent.

SDS Created by:

Global Safety Management, Inc.
10006 Cross Creek Blvd
Tampa, FL, 33647
Tel: 1-844-GSM-INFO (1-844-476-4636)
Website: www.GSMSDS.com

Manganese



SAFETY DATA SHEET

1 PRODUCT AND SUPPLIER IDENTIFICATION

Product Name: Manganese - flake, pieces, rod, target

Formula: Mn

Supplier: ESPI Metals

1050 Benson Way

Ashland, OR 97520

Telephone: 800-638-2581

Fax: 541-488-8313

Email: sales@espimetals.com

Emergency: Infotrac 800-535-5053 (US) or 352-323-3500 (24 hour)

Recommended Uses: Scientific Research

2 HAZARDS IDENTIFICATION

GHS Classification (29 CFR 1910.1200): Not classified as hazardous

GHS Label Elements:

Signal Word: N/A

Hazard Statements: N/A

Precautionary Statements: N/A

3 COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient: Manganese

CAS#: 7439-96-5

%: 100

EC#: 231-105-1

4 FIRST AID MEASURES

General Measures: No special requirements.

INHALATION: Remove to fresh air, keep warm and quiet, give oxygen if breathing is difficult. Seek medical attention.

INGESTION: Rinse mouth with water. Do not induce vomiting. Seek medical attention. Never induce vomiting or give anything by mouth to an unconscious person.

SKIN: Remove contaminated clothing, brush material off skin, wash affected area with soap and water. Seek medical attention if symptoms develop or persist.

EYES: Flush eyes with lukewarm water, including under upper and lower eyelids, for at least 15 minutes. Seek medical attention if symptoms develop or persist.

Most Important Symptoms/Effects, Acute and Delayed: May cause irritation. See section 11 for more information.

Indication of Immediate Medical Attention and Special Treatment: No other relevant information available.

5 FIREFIGHTING MEASURES

Extinguishing Media: Use Class D dry powder extinguishing agent.

Unsuitable Extinguishing Media: Do not use water, foam, halogenated gas or carbon dioxide.

Specific Hazards Arising from the Material: This product does not present fire or explosion hazards as shipped. Dust from processing may be flammable when exposed to heat, sparks or flame. May emit toxic metal oxide fumes under fire conditions.

Special Protective Equipment and Precautions for Firefighters: Full face, self-contained breathing apparatus and full protective clothing when necessary.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures: Wear appropriate respiratory and protective equipment specified in section 8. Isolate spill area and provide ventilation. Avoid breathing dust or fume. Avoid contact with skin and eyes. Eliminate all sources of ignition.

Methods and Materials for Containment and Cleaning Up: Avoid dust formation. Sweep or scoop up and place in a closed container for further handling and disposal.

Environmental Precautions: Do not allow to be released to the environment.

7 HANDLING AND STORAGE

Precautions for Safe Handling: Avoid creating dust. Avoid breathing dust or fumes. Provide adequate ventilation if dusts are created. Avoid contact with skin and eyes. Wash thoroughly before eating or smoking. See section 8 for information on personal protection equipment.

Conditions for Safe Storage: Store in a cool, dry area. Store in a closed container. Protect from moisture. Do not store together with oxidizers, acids or halogens. See section 10 for more information on incompatible materials.

8 EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits: Manganese

OSHA/PEL: 5 mg/m³

ACGIH/TLV: 0.2 mg/m³

Engineering Controls: Ensure adequate ventilation to maintain exposures below occupational limits. Whenever possible the use of local exhaust ventilation or other engineering controls is the preferred method of controlling exposure to airborne dust and fume to meet established occupational exposure limits. Use good housekeeping and sanitation practices. Do not allow dusts to accumulate as they may present a fire hazard. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Do not blow dust off clothing or skin with compressed air.

Respiratory Protection: If permissible levels are exceeded, use NIOSH approved dust respirator.

Eye Protection: Safety glasses

Skin Protection: Wear impermeable gloves, protective work clothing as necessary.

9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance:

Form: Solid in various forms

Color: Gray metallic

Odor: Odorless

Odor Threshold: Not determined

pH: N/A

Melting Point: 1244±3 °C

Boiling Point: 1962 °C

Flash Point: N/A

Evaporation Rate: N/A

Flammability: No data

Upper Flammable Limit: No data

Lower Flammable Limit: N/A

Vapor Pressure: 1 mm Hg @ 1292 °C

Vapor Density: N/A

Relative Density (Specific Gravity): 7.20 g/cc

Solubility in H₂O: Decomposes

Partition Coefficient (n-octanol/water): Not determined

Autoignition Temperature: No data

Decomposition Temperature: No data

Viscosity: N/A

10 STABILITY AND REACTIVITY

Reactivity: No data

Chemical Stability: Stable under recommended storage conditions.

Possibility of Hazardous Reactions: Manganese dusts dispersed in air in sufficient concentrations, and in the presence of an ignition source, may be flammable in open spaces or explosive in confined spaces.

Conditions to Avoid: Avoid creating or accumulating fines or dusts.

Incompatible Materials: Acids, water or steam, halogens, hydrogen peroxide, nitrous oxide, phosphorous vapor, sulfur dioxide, all alkalis.

Hazardous Decomposition Products: Manganese oxide fume, hydrogen gas.

11 TOXICOLOGICAL INFORMATION

Likely Routes of Exposure: Inhalation, skin, eyes.

Symptoms of Exposure: May cause irritation if dusts or fumes are inhaled or swallowed. Fines/dusts may irritate skin and eyes.

Acute and Chronic Effects: Chronic inhalation exposure of humans to high levels of manganese may result in a syndrome called manganism which typically begins with feelings of weakness and lethargy and progresses to other symptoms such as gait disturbances, clumsiness, tremors, speech disturbances, a mask-like facial expression and psychological disturbances. Manganese is an essential micronutrient in humans.

Acute Toxicity: No data

Carcinogenicity: NTP: Not identified as carcinogenic **IARC:** Not identified as carcinogenic

To the best of our knowledge the chemical, physical and toxicological characteristics of the substance are not fully known.

12 ECOLOGICAL INFORMATION

Ecotoxicity: No data

Persistence and Degradability: No data

Bioaccumulative Potential: No data

Mobility in Soil: No data

Other Adverse Effects: Possibly harmful to aquatic life. Do not allow material to be released to the environment without proper governmental permits. No further relevant information available.

13 DISPOSAL CONSIDERATIONS

Waste Disposal Method:

Product: Dispose of in accordance with Federal, State and Local regulations.

Packaging: Dispose of in accordance with Federal, State and Local regulations.

14 TRANSPORT INFORMATION

Shipping Regulations: Not regulated

UN Number: N/A

UN Proper Shipping Name: N/A

Transport Hazard Class: N/A

Packing Group: N/A

Marine Pollutant: No

15 REGULATORY INFORMATION

TSCA Listed: All components are listed.

Regulation (EC) No 1272/2008 (CLP): N/A

Canada WHMIS Classification (CPR, SOR/88-66): N/A

HMIS Ratings: **Health:** 0 **Flammability:** 0 **Physical:** 0

NFPA Ratings: **Health:** 0 **Flammability:** 0 **Instability:** 0

Chemical Safety Assessment: A chemical safety assessment has not been carried out.

16 OTHER INFORMATION

The information contained in this document is based on the state of our knowledge at the time of publication and is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI Metals makes no representation, warranty, or guarantee of any kind with respect to the information contained in this document or any use of the product based on this information. ESPI Metals shall not be held liable for any damages resulting from handling or from contact with the above product. Users should satisfy themselves that they have all current data relevant to their particular use.

Prepared by: ESPI Metals

Revised/Reviewed: July 2015

Mercury



SAFETY DATA SHEET

1 PRODUCT AND SUPPLIER IDENTIFICATION

Product Name: Mercury

Formula: Hg

Supplier: ESPI Metals

1050 Benson Way

Ashland, OR 97520

Telephone: 800-638-2581

Fax: 541-488-8313

Email: sales@espimetals.com

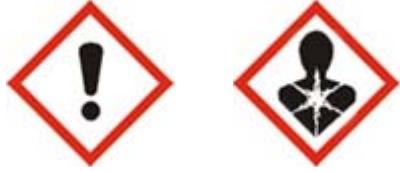
Emergency: Infotrac 800-535-5053 (US) or 352-323-3500 (24 hour)

Recommended Uses: Scientific Research

2 HAZARDS IDENTIFICATION

GHS Classification (29 CFR 1910.1200): Acute toxicity - inhalation, category 4, Specific target organ toxicity - repeated exposure, category 1.

GHS Label Elements:



Signal Word: Danger

Hazard Statements: H332 Harmful if inhaled, H372 Causes damage to the central nervous system through prolonged or repeated exposure - inhalation.

Precautionary Statements: P260 Do not breath dust/fume/gas/mist/vapors/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, P304+P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing,

P312 Call a POISON CENTER or doctor/physician if you feel unwell, P501 Dispose of contents/container in accordance with local, state or federal regulations.

3 COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient: Mercury

CAS#: 7439-97-6

%: 100

EC#: 231-106-7

4 FIRST AID MEASURES

General Measures: Emergency responders should take precautions to ensure their own safety before attempting rescue. Wear appropriate protective equipment. Remove victims from the source of exposure as quickly as possible. If ingested and transport is necessary, prepare the transport vehicle in case the patient/victim vomits. The vomit may contain elemental mercury that can contaminate the transport vehicle. Have a suction apparatus ready and prepare several towels and double-sealable plastic bags to quickly clean and isolate vomitus. Only a professional mercury clean-up kit with a self-contained vacuum system should be used to decontaminate the transport vehicle. Ordinary vacuum cleaners can vaporize elemental mercury and increase the concentration of airborne mercury.

INHALATION: Remove to fresh air, keep warm and quiet, give oxygen if breathing is difficult. Seek immediate medical attention. If mouth-to-mouth is necessary always use a barrier or bag-valve-mask device.

INGESTION: Rinse mouth with water. Do not induce vomiting. Seek immediate medical attention. Never induce vomiting or give anything by mouth to an unconscious person.

SKIN: Remove contaminated clothing, quickly and gently blot or brush away excess material, wash affected area with soap and water. Seek medical attention. Thoroughly clean or safely dispose of contaminated clothing before reusing.

EYES: Quickly and gently blot or brush material off the face. Flush eyes with lukewarm water, including under upper and lower eyelids, for at least 15 minutes. Seek medical attention.

Most Important Symptoms/Effects, Acute and Delayed: May cause irritation to skin and eyes, difficulty breathing or shortness of breath, chest pain and dry cough. See section 11 for more information.

Indication of Immediate Medical Attention and Special Treatment: No other information available.

5 FIREFIGHTING MEASURES

Extinguishing Media: Use extinguishing media suitable for surrounding materials and type of fire.

Unsuitable Extinguishing Media: Do not use a heavy water stream.

Specific Hazards Arising from the Material: Under fire conditions, highly toxic mercury vapor and mercuric oxide fumes will be released.

Special Protective Equipment and Precautions for Firefighters: Full face, self-contained breathing apparatus and full protective clothing when necessary.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures: Wear appropriate respiratory and protective equipment specified in section 8. Isolate spill area and provide ventilation. Keep unnecessary and unprotected personnel out of spill area.

Methods and Materials for Containment and Cleaning Up: Do not touch spilled material. Dike spilled product to prevent runoff. Stop or reduce leak if safe to do so. For small spills, take up with sand or other absorbent material and place in properly labeled closed containers for later disposal. Mercury spill kit may also be used for small spills in the workplace. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures.

After the spill has been contained and removed, decontaminate the area. All equipment used in response should be decontaminated thoroughly. If such equipment cannot be adequately decontaminated, it must be discarded with other spill residue. Place all spill residue in appropriate container, seal immediately, and label appropriately. The area should be properly inspected to ensure that all traces of mercury have been removed prior to re-occupation by non-emergency personnel.

Environmental Precautions: Do not allow to enter drains or to be released to the environment.

7 HANDLING AND STORAGE

Precautions for Safe Handling: Wear appropriate respiratory and protective equipment specified in section 8. Only trained personnel should work with this product. Handle in a well-ventilated area. Open containers slowly on a stable surface. When handling mercury use a glass, plastic or steel tray to contain any spills that might occur. **Caution:** mercury amalgamates with many common metals such as aluminum, so the container should be chosen carefully. Avoid exposure to high temperature. Avoid breathing fumes. Avoid contact with skin and eyes. Wash thoroughly before eating or smoking.

Conditions for Safe Storage, Including Any Incompatibilities: Store in closed unbreakable containers (polyethylene). Store in the original labeled shipping container when possible. Store in an area that is cool, dry and temperature-controlled, away from direct sunlight, heat and ignition sources. Do not store together with ammonia, halogens or oxidizers. See section 10 for more information on incompatible materials.

8 EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits: Mercury

OSHA/PEL: 0.1 mg/m³ (ceiling)

ACGIH/TLV: 0.025 mg/m³ (8 hour TWA)

Appropriate Engineering Controls: Whenever possible the use of local exhaust ventilation, process enclosure or other engineering controls is the preferred method of controlling exposure to meet established occupational exposure limits. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Clothing worn in areas of exposure to mercury vapor should be restricted to the workplace and stored in special lockers.

Individual Protection Measures, Such as Personal Protective Equipment:

Respiratory Protection: When potential exposures are above the occupational limits, approved respirators must be used. Self-contained breathing apparatus can be used up to 5 mg/m³ with a full face piece above 1mg/m³. Positive pressure type air supplied breathing equipment has been recommended above 5 mg/m³.

Eye Protection: Splash goggles or safety glasses. A face shield should be worn when possibility of splash exists.

Skin Protection: Wear impermeable gloves, protective work clothing as necessary.

9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance:

Form: Liquid

Color: Silvery metallic

Odor: Odorless

Odor Threshold: Not determined

pH: N/A

Melting Point: -38.87 °C

Boiling Point: 356.58 °C

Flash Point: N/A

Evaporation Rate: N/A

Flammability: N/A

Upper Flammable Limit: N/A

Lower Flammable Limit: N/A

Vapor Pressure: 1 mm Hg @ 126.2 °C

Vapor Density: N/A

Relative Density (Specific Gravity): 13.546 g/cc @ 20 °C

Solubility in H₂O: Insoluble

Partition Coefficient (n-octanol/water): Not determined

Autoignition Temperature: No data

Decomposition Temperature: No data

Viscosity: N/A

10 STABILITY AND REACTIVITY

Reactivity: No data

Chemical Stability: Stable under recommended storage conditions.

Possibility of Hazardous Reactions: High temperatures will generate toxic mercury vapor and mercuric oxide fumes.

Conditions to Avoid: Avoid high temperatures, contact with incompatibles.

Incompatible Materials: Acetylenic compounds, ammonia, boron, diiodophosphide, ethylene oxide, metals (aluminum, potassium, lithium, sodium, rubidium) methyl azide, methyl silane, oxygen, oxidants (bromine, peroxyformic acid, chlorine dioxide, nitric acid, tetracarbonylnickel, nitromethane, silver perchlorate).

Hazardous Decomposition Products: Mercury vapor and mercuric oxide fume.

11 TOXICOLOGICAL INFORMATION

Likely Routes of Exposure: Inhalation, skin and eyes.

Symptoms of Exposure: Inhalation of fumes may cause irritation to lungs, gastrointestinal irritation and a metallic taste in the mouth.

Acute and Chronic Effects: Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea, vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation. Chronic exposure to small amounts of mercury vapor may cause weakness, fatigue, anorexia, weight loss and gastrointestinal distress. Chronic exposure to larger amounts may cause mercurial fine tremor punctuated by coarse shaking, erythema, gingivitis, excessive salivation and immune dysfunction.

Acute Toxicity: LC₅₀ - inhalation - rabbit - 29mg/m³ (30 hours)

Carcinogenicity: NTP: Not identified as carcinogenic **IARC:** 3 - Not classifiable as to its carcinogenicity to humans

To the best of our knowledge the chemical, physical and toxicological characteristics of the substance are not fully known.

12 ECOLOGICAL INFORMATION

Ecotoxicity: LC₅₀ Catfish 0.35 mg/L/96

Persistence and Degradability: No data

Bioaccumulative Potential: No data

Mobility in Soil: No data

Other Adverse Effects: Do not allow material to be released to the environment. No further relevant information available.

13 DISPOSAL CONSIDERATIONS

Waste Disposal Method:

Product: Dispose of in accordance with Federal, State and Local regulations.

Packaging: Dispose of in accordance with Federal, State and Local regulations.

14 TRANSPORT INFORMATION

UN Number: UN2809

UN Proper Shipping Name: Mercury

Transport Hazard Class: 8 (6.1)

Packing Group: III

Marine Pollutant: No

15 REGULATORY INFORMATION

TSCA Listed: All components are listed.

Regulation (EC) No 1272/2008 (CLP): Acute toxicity - inhalation, category 4, Specific target organ toxicity - repeated exposure, category 1, Hazardous to the aquatic environment - acute hazard, category 1, Hazardous to the aquatic environment - chronic hazard, category 1.

Canada WHMIS Classification (CPR, SOR/88-66): Acute toxicity, Specific target organ toxicity - repeated exposure.

HMIS Ratings: **Health:** 3 **Flammability:** 0 **Physical:** 0

NFPA Ratings: **Health:** 3 **Flammability:** 0 **Instability:** 1

Chemical Safety Assessment: A chemical safety assessment has not been carried out.

16 OTHER INFORMATION

The information contained in this document is based on the state of our knowledge at the time of publication and is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI Metals makes no representation, warranty, or guarantee of any kind with respect to the information contained in this document or any use of the product based on this information. ESPI Metals shall not be held liable for any damages resulting from handling or from contact with the above product. Users should satisfy themselves that they have all current data relevant to their particular use.

Prepared by: ESPI Metals

Revised/Reviewed: July 2015

Nickel



SAFETY DATA SHEET

1 PRODUCT AND SUPPLIER IDENTIFICATION

Product Name: Nickel - pellets, pieces, shot, sheet, foil, rod, wire, target

Formula: Ni

Supplier: ESPI Metals

1050 Benson Way

Ashland, OR 97520

Telephone: 800-638-2581

Fax: 541-488-8313

Email: sales@espimetals.com

Emergency: Infotrac 800-535-5053 (US) or 352-323-3500 (24 hour)

Recommended Uses: Scientific Research

2 HAZARDS IDENTIFICATION

GHS Classification (29 CFR 1910.1200): Not classified as hazardous

GHS Label Elements:

Signal Word: N/A

Hazard Statements: N/A

Precautionary Statements: N/A

3 COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient: Nickel

CAS#: 7440-02-0

%: >99

EC#: 231-111-4

4 FIRST AID MEASURES

General Measures: No special requirements.

INHALATION: Remove to fresh air, keep warm and quiet, give oxygen if breathing is difficult. Seek medical attention.

INGESTION: Rinse mouth with water. Do not induce vomiting. Seek medical attention. Never induce vomiting or give anything by mouth to an unconscious person.

SKIN: Remove contaminated clothing, brush material off skin, wash affected area with soap and water. Seek medical attention if symptoms develop or persist.

EYES: Flush eyes with lukewarm water, including under upper and lower eyelids, for at least 15 minutes. Seek medical attention if symptoms develop or persist.

Most Important Symptoms/Effects, Acute and Delayed: May cause irritation. See section 11 for more information.

Indication of Immediate Medical Attention and Special Treatment: No other relevant information available.

5 FIREFIGHTING MEASURES

Extinguishing Media: Use extinguishing agent suitable for surrounding material and type of fire.

Unsuitable Extinguishing Media: No information available.

Specific Hazards Arising from the Material: May emit toxic metal oxide fumes under fire conditions.

Special Protective Equipment and Precautions for Firefighters: Full face, self-contained breathing apparatus and full protective clothing when necessary.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures: Wear appropriate respiratory and protective equipment specified in section 8. Isolate spill area and provide ventilation. Avoid breathing dust or fume. Avoid contact with skin and eyes.

Methods and Materials for Containment and Cleaning Up: Avoid dust formation. Sweep or scoop up. Place in properly labeled closed containers.

Environmental Precautions: Do not allow to be released to the environment.

7 HANDLING AND STORAGE

Precautions for Safe Handling: Avoid creating dust. Avoid breathing dust or fumes. Provide adequate ventilation if dusts are created. Avoid contact with skin and eyes. Wash thoroughly before eating or smoking. See section 8 for information on personal protection equipment.

Conditions for Safe Storage: Store in a cool, dry area. Store away from acids. See section 10 for more information on incompatible materials.

8 EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits: Nickel

OSHA/PEL: 1 mg/m³

ACGIH/TLV: 1.5 mg/m³

Engineering Controls: Ensure adequate ventilation to maintain exposures below occupational limits. Whenever possible the use of local exhaust ventilation or other engineering controls is the preferred method of controlling exposure to airborne dust and fume to meet established occupational exposure limits. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Do not blow dust off clothing or skin with compressed air.

Respiratory Protection: If permissible levels are exceeded, use NIOSH approved dust respirator.

Eye Protection: Safety glasses

Skin Protection: Wear impermeable gloves, protective work clothing as necessary.

9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance:

Form: Solid in various forms

Color: Silver gray metallic

Odor: Odorless

Odor Threshold: Not determined

pH: N/A

Melting Point: 1455 °C

Boiling Point: 2730 °C

Flash Point: N/A

Evaporation Rate: N/A

Flammability: N/A

Upper Flammable Limit: N/A

Lower Flammable Limit: N/A

Vapor Pressure: 1 mm Hg @ 1810 °C

Vapor Density: N/A

Relative Density (Specific Gravity): 8.9 g/cc

Solubility in H₂O: Insoluble

Partition Coefficient (n-octanol/water): Not determined

Autoignition Temperature: N/A

Decomposition Temperature: No data

Viscosity: N/A

10 STABILITY AND REACTIVITY

Reactivity: No data

Chemical Stability: Stable under recommended storage conditions.

Possibility of Hazardous Reactions: No data.

Conditions to Avoid: Avoid creating or accumulating fines or dusts.

Incompatible Materials: Acids.

Hazardous Decomposition Products: Nickel oxide fume.

11 TOXICOLOGICAL INFORMATION

Likely Routes of Exposure: Inhalation, skin, eyes.

Symptoms of Exposure: May cause irritation. May cause an allergic reaction in sensitized individuals.

Acute and Chronic Effects: The most common harmful health effect of metallic nickel in humans is an allergic skin reaction in those who are sensitive to nickel. Although nickel compounds are known human carcinogens, the evidence suggests that the relatively insoluble metallic nickel is less likely to present a carcinogenic hazard than are the nickel compounds that tend to release proportionately more nickel ion.

Acute Toxicity: No data

Carcinogenicity: NTP: R - reasonably anticipated to be a human carcinogen **IARC:** 2B - possibly carcinogenic to humans

To the best of our knowledge the chemical, physical and toxicological characteristics of the substance are not fully known.

12 ECOLOGICAL INFORMATION

Ecotoxicity: No data

Persistence and Degradability: No data

Bioaccumulative Potential: No data

Mobility in Soil: No data

Other Adverse Effects: Do not allow material to be released to the environment without proper governmental permits. No further relevant information available.

13 DISPOSAL CONSIDERATIONS

Waste Disposal Method:

Product: Dispose of in accordance with Federal, State and Local regulations.

Packaging: Dispose of in accordance with Federal, State and Local regulations.

14 TRANSPORT INFORMATION

Shipping Regulations: Not regulated

UN Number: N/A

UN Proper Shipping Name: N/A

Transport Hazard Class: N/A

Packing Group: N/A

Marine Pollutant: No

15 REGULATORY INFORMATION

TSCA Listed: All components are listed.

Regulation (EC) No 1272/2008 (CLP): N/A

Canada WHMIS Classification (CPR, SOR/88-66): N/A

HMIS Ratings: Health: 1 Flammability: 0 Physical: 0

NFPA Ratings: Health: 1 Flammability: 0 Instability: 0

Chemical Safety Assessment: A chemical safety assessment has not been carried out.

16 OTHER INFORMATION

The information contained in this document is based on the state of our knowledge at the time of publication and is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI Metals makes no representation, warranty, or guarantee of any kind with respect to the information contained in this document or any use of the product based on this information. ESPI Metals shall not be held liable for any damages resulting from handling or from contact with the above product. Users should satisfy themselves that they have all current data relevant to their particular use.

Prepared by: ESPI Metals

Revised/Reviewed: July 2015

Selenium



SAFETY DATA SHEET

1 PRODUCT AND SUPPLIER IDENTIFICATION

Product Name: Selenium - powder, shot

Formula: Se

Supplier: ESPI Metals

1050 Benson Way

Ashland, OR 97520

Telephone: 800-638-2581

Fax: 541-488-8313

Email: sales@espimetals.com

Emergency: Infotrac 800-535-5053 (US) or 352-323-3500 (24 hour)

Recommended Uses: Scientific Research

2 HAZARDS IDENTIFICATION

GHS Classification (29 CFR 1910.1200): Not classified as hazardous

GHS Label Elements:

Signal Word: N/A

Hazard Statements: N/A

Precautionary Statements: N/A

3 COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient: Selenium

CAS#: 7782-49-2

%: >99

EC#: 034-001-00-2

4 FIRST AID MEASURES

General Measures: Remove patient from area of exposure.

INHALATION: Remove to fresh air, keep warm and quiet, give oxygen if breathing is difficult. Seek medical attention.

INGESTION: Rinse mouth with water. Do not induce vomiting. Seek medical attention. Never induce vomiting or give anything by mouth to an unconscious person.

SKIN: Remove contaminated clothing, brush material off skin, wash affected area with soap and water. Seek medical attention.

EYES: Flush eyes with lukewarm water, including under upper and lower eyelids, for at least 15 minutes. Seek medical attention.

Most Important Symptoms/Effects, Acute and Delayed: May cause irritation. See section 11 for more information.

Indication of Immediate Medical Attention and Special Treatment: No other relevant information available.

5 FIREFIGHTING MEASURES

Extinguishing Media: Use suitable extinguishing agent for surrounding materials and type of fire.

Unsuitable Extinguishing Media: No information available.

Specific Hazards Arising from the Material: May emit toxic selenium oxide fumes under fire conditions.

Special Protective Equipment and Precautions for Firefighters: Full face, self-contained breathing apparatus and full protective clothing when necessary.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures: Wear appropriate respiratory and protective equipment specified in section 8. Isolate spill area and provide ventilation. Avoid breathing dust or fume. Avoid contact with skin and eyes. Eliminate all sources of ignition.

Methods and Materials for Containment and Cleaning Up: Avoid dust formation. Scoop up or vacuum using a vacuum system equipped with a HEPA filter. Place in properly labeled closed containers.

Environmental Precautions: Do not allow to enter drains or to be released to the environment.

7 HANDLING AND STORAGE

Precautions for Safe Handling: Handle in an enclosed, controlled process. Avoid creating dust. Provide adequate ventilation if dusts are created. Avoid breathing dust or fumes. Avoid contact with skin and eyes. Wash thoroughly before eating or smoking. See section 8 for information on personal protection equipment.

Conditions for Safe Storage: Store in a sealed container. Store in a cool, dry area. Protect from oxidizers and halogens. See section 10 for more information on incompatible materials.

8 EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits: Selenium (Selenium compounds, as Se)

OSHA/PEL: 0.2 mg/m³

ACGIH/TLV: 0.2 mg/m³

Engineering Controls: When working with finely divided powders, handle in a controlled, enclosed environment. Ensure adequate ventilation to maintain exposures below occupational limits. Whenever possible the use of local exhaust ventilation or other engineering controls is the preferred method of controlling exposure to airborne dust and fume to meet established occupational exposure limits. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Do not blow dust off clothing or skin with compressed air.

Respiratory Protection: When potential exposures are above the occupational limits, approved respirators must be used.

Eye Protection: Safety glasses

Skin Protection: Wear impermeable gloves, protective work clothing as necessary.

9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance:

Form: Shot or powder

Color: Gray to black

Odor: Odorless

Odor Threshold: Not determined

pH: N/A

Melting Point: 217 °C

Boiling Point: 684±1 °C

Flash Point: N/A

Evaporation Rate: N/A

Flammability: No data

Upper Flammable Limit: No data

Lower Flammable Limit: No data

Vapor Pressure: 1 mm Hg @ 356 °C

Vapor Density: N/A

Relative Density (Specific Gravity): 4.28 - 4.81 g/cc @ 20 °C

Solubility in H₂O: Insoluble

Partition Coefficient (n-octanol/water): Not determined

Autoignition Temperature: No data

Decomposition Temperature: No data

Viscosity: N/A

10 STABILITY AND REACTIVITY

Reactivity: No data

Chemical Stability: Stable under recommended storage conditions.

Possibility of Hazardous Reactions: Under reducing conditions (i.e., any strong acid or base plus an active metal) or in the presence of nascent (freshly formed) hydrogen, highly toxic hydrogen selenide gas may be formed. At temperatures above the melting point corrosive selenium oxides may be generated.

Conditions to Avoid: Dusting conditions, high temperatures.

Incompatible Materials: Strong acids, bases, and oxidizers, halogen gases, sodium, potassium, nascent hydrogen.

Hazardous Decomposition Products: Selenium oxides, hydrogen selenide gas.

11 TOXICOLOGICAL INFORMATION

Likely Routes of Exposure: Inhalation, skin and eyes.

Symptoms of Exposure: Inhalation of elemental selenium dusts may cause irritation and congestion.

Acute and Chronic Effects: Elemental selenium dusts may cause irritation of the respiratory tract. Other symptoms include metallic taste, pallor, irritability, fatigue and garlic odor of breath. Selenium is an essential trace element in humans and animals. Many selenium compounds, including selenium dioxide which is a decomposition product of elemental selenium, are toxic.

Acute Toxicity: LD50 oral - rat - 6700 mg/kg

Carcinogenicity: **NTP:** Not identified as carcinogenic **IARC:** Not identified as carcinogenic

To the best of our knowledge the chemical, physical and toxicological characteristics of the substance are not fully known.

12 ECOLOGICAL INFORMATION

Ecotoxicity: No data

Persistence and Degradability: No data

Bioaccumulative Potential: No data

Mobility in Soil: No data

Other Adverse Effects: No further relevant information available.

13 DISPOSAL CONSIDERATIONS

Waste Disposal Method:

Product: Dispose of in accordance with Federal, State and Local regulations.

Packaging: Dispose of in accordance with Federal, State and Local regulations.

14 TRANSPORT INFORMATION

Shipping Regulations: Not regulated

UN Number: N/A

UN Proper Shipping Name: N/A

Transport Hazard Class: N/A

Packing Group: N/A

Marine Pollutant: No

15 REGULATORY INFORMATION

TSCA Listed: All components are listed.

Regulation (EC) No 1272/2008 (CLP): N/A

Canada WHMIS Classification (CPR, SOR/88-66): N/A

HMIS Ratings: Health: 1 **Flammability:** 0 **Physical:** 0

NFPA Ratings: Health: 2 **Flammability:** 0 **Instability:** 0

Chemical Safety Assessment: A chemical safety assessment has not been carried out.

16 OTHER INFORMATION

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handling or from contact with the above product. Users should satisfy themselves that they have all current data relevant to their particular use.

Prepared by: ESPI Metals

Revised/Reviewed: July 2015

SAFETY DATA SHEET: TETRACHLOROETHYLENE

1. IDENTIFICATION

Product Name: TETRACHLOROETHYLENE
Synonyms: Perchloroethylene; Carbon dichloride
Formula and Formula Weight: Cl₂C:CCl₂ 165.85
Integra numbers beginning with: T226.50
Recommended Use: Commercial/industrial use
Restrictions on Use: No information available

INTEGRA Chemical Company 24 Hour Emergency Response: CHEMTREC 800-424-9300 (Outside USA 703-527-3887)
1216 6th Ave N
Kent WA 98032
Phone: 253-479-7000

2. HAZARDS IDENTIFICATION

OSHA Classification: Hazard Category: Hazard Statement:
Carcinogenicity 2 Suspected of causing cancer.
Signal Word: WARNING



Precautionary Statements

Prevention: Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Wear protective gloves, protective clothing, eye protection, face protection.
Response: If exposed or concerned: Get medical advice, attention.
Storage: Store locked up.
Disposal: Dispose of contents, container in accordance with all governmental regulations.

Hazards Not Otherwise Classified: No information available

3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	Synonyms	CAS #	% Weight
Tetrachloroethylene	Perchloroethylene; Carbon dichloride	00127-18-4	100

4. FIRST AID MEASURES

Inhalation: Remove person to fresh air and keep comfortable for breathing. If not breathing, give artificial respiration. If breathing is difficult administer oxygen. Seek medical attention.
Eye Contact: Flush eyes with water for at least 15 minutes. Seek immediate medical attention.
Skin Contact: Flush skin with plenty of water. Seek medical attention.
Ingestion: Rinse mouth and give victim large quantities of water. Never give anything by mouth to an unconscious person. Seek immediate medical attention.
Additional notes: Symptoms and effects include irritation of eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin redness; liver damage; drunkenness; unconsciousness, death.
Potential occupational carcinogen.

5. FIRE-FIGHTING MEASURES

Extinguishing Media: Material is not flammable. Use extinguishing media suitable to surrounding materials.
Special Equipment and Precautions: Use water to cool nearby containers and structures. Wear full protective equipment, including suitable respiratory protection.
Specific Hazards: Fire conditions may liberate toxic and noxious fumes. Vapors may accumulate. Inhalation of vapors may cause unconsciousness or death.
Hazardous combustion products: Hydrogen chloride and trace amounts of phosgene and chlorine

6. ACCIDENTAL RELEASE MEASURES

Spill Procedures: Remove all potential ignition sources. Prevent spread of spill. Wear full protective equipment including suitable respiratory protection. Absorb with sand or inert material. Place into suitable container for disposal.

7. HANDLING AND STORAGE

Incompatible Materials: Incompatible with strong acids and strong oxidizers. Strong Alkalies. Finely divided metals, zinc, barium, lithium
Storage and Handling: Store locked up in a cool, dry, well-ventilated area away from incompatible materials. Keep containers tightly closed and protect them from physical damage.

Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Wear protective gloves, protective clothing, eye protection, face protection.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

OSHA & ACGIH Exposure Limits:

Tetrachloroethylene	OSHA TWA: 100 ppm; 300 ppm peak ACGIH STEL: 100 ppm; 685 mg/m ³	OSHA Ceiling: 200 ppm ACGIH TWA: 25 ppm; 170 mg/m ³
Engineering Controls:	Use general or local exhaust ventilation to meet TLV and PEL requirements.	
Respiratory Protection:	Respiratory protection required if airborne concentrations exceed PEL or TLV. Use a NIOSH approved full facepiece chemical cartridge respirator with an organic vapor cartridge.	
Skin/Eye Protective Equipment:	Safety goggles, protective clothing and gloves appropriate for the risk of exposure. Facilities storing or utilizing this material should have readily accessible eyewash stations and safety showers. Select respirators and other safety equipment in accordance with regulations and based upon the particular conditions of use and risk of exposure. Always use safe chemical-handling and good industrial hygiene practices.	

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Clear, colorless liquid
Odor:	Ether-like odor
Odor Threshold:	6.17 ppm
pH:	Not available
Melting/Freezing Point:	-19 °C
Initial Boiling Point and Boiling Range:	121 °C
Flash Point:	Not available
Evaporation Rate:	2.8 Butyl Acetate=1
Flammability:	Not available
Flammable or Explosive	Upper: Not available
Limits (% by volume in air)	Lower: Not available
Vapor Pressure:	13 mm Hg@20°C
Vapor Density:	5.8
Relative Density:	1.62 Water=1
Solubility:	0.15g in 1L water @25°C
Partition Coefficient: n-octanol/water	2.9
Auto-Ignition Temperature:	Not available
Decomposition Temperature:	Not available
Viscosity:	Not available

10. STABILITY AND REACTIVITY

Reactivity:	No information available
Stability:	Stable
Possibility of Hazardous Reactions:	Hazardous polymerization will not occur
Conditions to Avoid:	Heat, sparks and open flame.
Incompatibles:	Incompatible with strong acids and strong oxidizers. Strong Alkalies. Finely divided metals, zinc, barium, lithium
Decomposition Products:	Hydrogen chloride and trace amounts of phosgene and chlorine

11. TOXICOLOGICAL INFORMATION

Effects of Over Exposure:

Inhalation:	May cause dizziness, nasal irritation, nausea, flush face and neck, headache, drowsiness, skin redness, incoordination, drunkenness, unconsciousness and death. In confined or poorly ventilated areas vapors can readily accumulate and can cause unconsciousness and death.
Skin Contact:	Contact may cause skin irritation.
Eye Contact:	Contact may be irritating to the eyes.
Ingestion:	Single dose oral toxicity is low. If aspirated, may be rapidly absorbed through the lungs and result in injury to other body systems.
Chronic Effects:	Excessive exposure may cause anesthetic or narcotic effects, central nervous system effects, liver effects, kidney effects. Alcohol consumed immediately before or after exposure may increase adverse effects.
Target Organs:	Eyes, skin, respiratory system, liver, kidneys, central nervous system.
Additional Effects:	No information available
Reproductive Effects:	No information available
Carcinogenicity:	Tetrachloroethylene is listed by the NTP as Anticipated Human Carcinogen and by the IARC as Group 2A, Probable Human Carcinogen.

Toxicity Data:

Tetrachloroethylene	LD50 (skin, rabbit)	> 10000 mg/kg
	LD50 (oral, rat)	2400 mg/kg

12. ECOLOGICAL INFORMATION

	<u>Aquatic Toxicity Data:</u>	<u>Terrestrial Toxicity Data:</u>
Tetrachloroethylene	LC50 Lepomis macrochirus: 11- 15 mg/L	- No information available
Persistence and degradability:	No information available	
Bioaccumulative potential:	Does not bioaccumulate	
Mobility in soil:	No information available	
Other adverse effects:	Toxic to aquatic life with longlasting effect	

13. DISPOSAL CONSIDERATIONS

Disposal Procedures: Dispose of material and containers in accordance with all local, state and federal regulations.

14. TRANSPORTATION INFORMATION

This product is a regulated material for domestic ground transporation, per CFR Title 49.

UN Number: UN1897
Proper Shipping Name: Tetrachloroethylene
Packing Group: III
Hazard Class: 6.1
Environmental hazards: Marine pollutant
Special precautions: No information available
Bulk transport: No information available

15. REGULATORY INFORMATION

Tetrachloroethylene is listed in the TSCA inventory and in SARA 313.

16. OTHER INFORMATION

OSHA SDS #: 26569 rev 101 3/27/2015

NE = Not established, NA = Not applicable or Not available

The information presented above is offered for informational purposes only. This SDS, and the associated product, is intended for use only by technically qualified persons, and at their own discretion and risk. Since conditions and manner of use are outside the control of Integra Chemical Company, we make no warranties, either expressed or implied, and assume no liability in connection with any use of this information.

***** END OF SDS *****



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Thallium



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Available Mon-Fri 8am to 5pm
Pacific Time



ONLINE

SAFETY DATA SHEET

1 PRODUCT AND SUPPLIER IDENTIFICATION

Product Name: Thallium Solid

Formula: Tl

Supplier: ESPI Metals

1050 Benson Way

Ashland, OR 97520

Telephone: 800-638-2581

Fax: 541-488-8313

Email: sales@espimetals.com

Emergency: Infotrac 800-535-5053 (US) or 352-323-3500 (24 hour)

Recommended Uses: Scientific Research

What's New?



[Check out our new Rare Earth Overview Video](#)

2 HAZARDS IDENTIFICATION

GHS Classification (29 CFR 1910.1200): Acute toxicity - oral, category 2.

GHS Label Elements:



Signal Word: Danger

Hazard Statements: H300 Fatal if swallowed.

Precautionary Statements: P264 Wash hands thoroughly after handling, P270 Do not eat, drink or smoke when using this product, P301+P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician, P330 Rinse mouth, P405 Store locked up, P501 Dispose of contents/container in accordance with local, state or federal regulations.

Contact

ESPI Metals

1050 Benson Way
Ashland, Oregon 97520

541.488.8311 telephone
800.638.2581 toll-free

541.488.8313 fax
800.488.0060 toll-free fax

sales@espimetals.com

3 COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient: Thallium

CAS#: 7440-28-0

%: 100

EC#: 231-138-1

Jan 26, 2016 at 11:33 New York			
	Price	Change	High
Gold	▲ 1117.60	+9.70	1120.10
Silver	▲ 14.46	+0.24	14.61
Platinum	▲ 872.00	+15.00	880.00
Palladium	▲ 495.00	+9.00	504.00

Conversion Tool

Try our [conversion tools](#) by clicking [here](#).

4 FIRST AID MEASURES

General Measures: Emergency responders should take care to avoid secondary exposure to thallium if it is present. Wear appropriate protective equipment.

INHALATION: Remove to fresh air, keep warm and quiet, give oxygen if breathing is difficult. Seek immediate medical attention. If mouth-to-mouth is necessary always use a barrier or bag-valve-mask device.

INGESTION: Rinse mouth with water. Do not induce vomiting. Seek immediate medical attention. Never induce vomiting or give anything by mouth to an unconscious person.

SKIN: Remove contaminated clothing, wash affected area with soap and water taking care not to break the skin and to cover all open wounds. Seek medical attention. Contaminated clothing should be safely contained and properly disposed of.

EYES: Flush eyes with lukewarm water, including under upper and lower eyelids, for at least 15 minutes. Seek medical attention immediately.

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Most Important Symptoms/Effects, Acute and Delayed: Symptoms are usually delayed and include gastrointestinal distress and neurological symptoms. See section 11 for more information.

Indication of Immediate Medical Attention and Special Treatment: No other information available.

5 FIREFIGHTING MEASURES

Extinguishing Media: Use extinguishing media suitable for surrounding materials and type of fire.

Unsuitable Extinguishing Media: No further information available.

Specific Hazards Arising from the Material: Under fire conditions, thallium may release highly toxic fumes or gases.

Special Protective Equipment and Precautions for Firefighters: Full face, self-contained breathing apparatus and full protective clothing.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures: Wear appropriate respiratory and protective equipment specified in section 8. Isolate spill area and provide ventilation. Avoid breathing dust or fume. Avoid contact with skin and eyes. Eliminate all sources of ignition.

Methods and Materials for Containment and Cleaning Up: Scoop up or vacuum with a system utilizing a HEPA filtration system and place in properly labeled sealed containers. Special precautions must be taken when changing filters on HEPA vacuum cleaners used to clean up hazardous materials. Avoid creating dusts. Avoid contamination of air and water.

Environmental Precautions: Do not allow to enter drains or to be released to the environment.

7 HANDLING AND STORAGE

Precautions for Safe Handling: Wear appropriate respiratory and protective equipment specified in section 8. Only trained personnel should work with this product. Handle in a well-ventilated area. Avoid exposure to high temperature. Avoid breathing fumes. Avoid contact with skin and eyes. Wash thoroughly before eating or smoking.

Conditions for Safe Storage, Including Any Incompatibilities: Store under dry, inert gas such as argon, or can also be stored under deaerated water. Store in sealed unbreakable containers; the original labeled shipping container when possible. Store in an area that is cool, dry and temperature-controlled, away from direct sunlight, heat and ignition sources or where freezing is possible. Do not store together with acids, halogens or oxidizers. See section 10 for more information on incompatible materials.

8 EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits: Thallium (Soluble compounds, as Tl)

OSHA/PEL: 0.1 mg/m³

ACGIH/TLV: 0.02 mg/m³(inhalable)

Appropriate Engineering Controls: Handle in an enclosed, controlled process under dry argon. Whenever possible the use of local exhaust ventilation, process enclosure or other engineering controls is the preferred method of controlling exposure to meet established occupational exposure limits. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Clothing worn in areas of exposure to thallium dust or vapor should be restricted to the workplace and stored in special lockers.

Individual Protection Measures, Such as Personal Protective Equipment:

Respiratory Protection: When potential exposures are above the occupational limits, approved respirators must be used.

Eye Protection: Splash goggles or safety glasses.

Skin Protection: Wear impermeable gloves, protective work clothing as necessary.

9 PHYSICAL AND CHEMICAL PROPERTIES**Appearance:**

Form: Rod

Color: Gray metallic

Odor: Odorless

Odor Threshold: Not determined

pH: N/A

Melting Point: 303.5 °C

Boiling Point: 1457±10 °C

Flash Point: N/A

Evaporation Rate: N/A

Flammability: No data

Upper Flammable Limit: No data

Lower Flammable Limit: No data

Vapor Pressure: 1 mm Hg @ 825 °C

Vapor Density: N/A

Relative Density (Specific Gravity): 11.85 g/cc

Solubility in H₂O: Insoluble

Partition Coefficient (n-octanol/water): Not determined

Autoignition Temperature: No data

Decomposition Temperature: No data

Viscosity: N/A

10 STABILITY AND REACTIVITY

Reactivity: No data

Chemical Stability: Stable under recommended storage conditions.

Possibility of Hazardous Reactions: High temperatures will generate toxic thallium oxide fumes.

Conditions to Avoid: Avoid high temperatures, reacts slowly with moist air.

Incompatible Materials: Oxidizing agents, strong acids, halogens, air and moisture.

Hazardous Decomposition Products: Thallium oxide fume.

11 TOXICOLOGICAL INFORMATION

Likely Routes of Exposure: Inhalation, skin and eyes.

Symptoms of Exposure: Abdominal pain and vomiting, extreme pain in the extremities, lethargy, hair loss.

Acute and Chronic Effects: Almost all of the available information refers to ingestion of thallium compounds, largely due to accidental ingestion, intentional poisoning and suicide attempts. Adverse reactions are dose dependent and occur in 3 stages. Massive doses may cause gastrointestinal distress (nausea, vomiting and abdominal pain) within 30 minutes but symptoms are usually delayed for 8 hours or longer. Gastrointestinal symptoms from smaller doses may be delayed 24-48 hours. This is followed by neurological effects 2-5 days or even longer after ingestion, although it may occur as early as 12 hours after massive exposure. Other effects include hair loss, severe pain in the extremities, lethargy, ataxia, back pain, abnormal reflexes, neuropathy, muscle weakness, mental abnormalities, tremors, abnormal vision, headache, coma, convulsion, and death. There was no information available for exposure to thallium metal specifically rather than thallium compounds, and little conclusive information regarding exposure via inhalation.

Acute Toxicity: No data

Carcinogenicity: **NTP:** Not identified as carcinogenic **IARC:** Not identified as carcinogenic

To the best of our knowledge the chemical, physical and toxicological characteristics of the substance are not fully known.

12 ECOLOGICAL INFORMATION

Ecotoxicity: LC50 - Cyprinodon variegatus (sheepshead minnow) - 21.0 mg/l - 96.0 h

Persistence and Degradability: No data

Bioaccumulative Potential: No data

Mobility in Soil: No data

Other Adverse Effects: Do not allow material to be released to the environment. No further relevant information available.

13 DISPOSAL CONSIDERATIONS**Waste Disposal Method:**

Product: Dispose of in accordance with Federal, State and Local regulations.

Packaging: Dispose of in accordance with Federal, State and Local regulations.

14 TRANSPORT INFORMATION

UN Number: UN3288

UN Proper Shipping Name: Toxic solid, inorganic, n.o.s. (Thallium)

Transport Hazard Class: 6.1

Packing Group: II

Marine Pollutant: Yes

15 REGULATORY INFORMATION

TSCA Listed: All components are listed.

Regulation (EC) No 1272/2008 (CLP): Acute toxicity - oral, category 2, Hazardous to the aquatic environment - acute hazard, category 3, Hazardous to the aquatic environment - chronic hazard, category 3.

Canada WHMIS Classification (CPR, SOR/88-66): Acute toxicity.

HMIS Ratings: Health: 3 Flammability: 0 Physical: 0

NFPA Ratings: Health: 3 Flammability: 0 Instability: 0

Chemical Safety Assessment: A chemical safety assessment has not been carried out.

16 OTHER INFORMATION

The information contained in this document is based on the state of our knowledge at the time of publication and is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI Metals makes no representation, warranty, or guarantee of any kind with respect to the information contained in this document or any use of the product based on this information. ESPI Metals shall not be held liable for any damages resulting from handling or from contact with the above product. Users should satisfy themselves that they have all current data relevant to their particular use.

Prepared by: ESPI Metals

Revised/Reviewed: July 2015

1. PRODUCT AND COMPANY IDENTIFICATION**1.1 Product identifiers**

Product name : *trans*-1,2-Dichloroethylene

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
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

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
Acute aquatic toxicity (Category 3), H402
Chronic aquatic toxicity (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.
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/ protective clothing/ eye protection/ face protection.
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 victim to fresh air and keep at rest in a position comfortable for breathing.
P312	Call a POISON CENTER or doctor/ physician if you feel unwell.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
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

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms	:	<i>trans</i> -1,2-Dichloroethene <i>trans</i> -Acetylene dichloride
Formula	:	C ₂ H ₂ Cl ₂
Molecular weight	:	96.94 g/mol
CAS-No.	:	156-60-5
EC-No.	:	205-860-2
Index-No.	:	602-026-00-3

Hazardous components

Component	Classification	Concentration
trans -Dichloroethylene	Flam. Liq. 2; Acute Tox. 4; Aquatic Acute 3; Aquatic Chronic 3; H225, H332, H412	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

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

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

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

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

Use water spray to cool unopened containers.

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.

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 an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

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.

Recommended storage temperature 2 - 8 °C

Light sensitive. Air and moisture sensitive. Refrigerate before opening.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

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	200.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Central Nervous System impairment Eye irritation		

		TWA	200.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)	
		Central Nervous System impairment Eye irritation			
		TWA	200 ppm	USA. ACGIH Threshold Limit Values (TLV)	
		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).

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.

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 Upper explosion limit: 12.8 %(V)
Lower explosion limit: 9.7 %(V)

	explosive limits	
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 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

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. Extremes of temperature and direct sunlight.

10.5 Incompatible materials

Oxidizing agents, Bases

10.6 Hazardous decomposition products

Other decomposition products - No data available

In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 1,235 mg/kg

LD50 Oral - Mouse - 2,122 mg/kg

Remarks: Behavioral:Altered sleep time (including change in righting reflex). Behavioral:Somnolence (general depressed activity). Behavioral:Ataxia.

LC50 Inhalation - Rat - 24100 ppm

Remarks: Behavioral:Somnolence (general depressed activity).

LD50 Dermal - Rabbit - > 5,000 mg/kg

Remarks: Prolonged skin contact may cause skin irritation and/or dermatitis. Nutritional and Gross Metabolic:Weight loss or decreased weight gain.

No data available

Skin corrosion/irritation

Skin - Rabbit

Result: Skin irritation - 24 h

Serious eye damage/eye irritation

Eyes - Rabbit

Result: Eye irritation

Respiratory or skin sensitisation

No data available

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 identified as a carcinogen or potential carcinogen by OSHA.

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: KV9400000

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 -

12. ECOLOGICAL INFORMATION**12.1 Toxicity**

Toxicity to daphnia and EC50 - Daphnia magna (Water flea) - 220.00 mg/l - 48 h
other aquatic
invertebrates

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.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. 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.

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

IATA

UN number: 1150 Class: 3 Packing group: II

Proper shipping name: 1,2-Dichloroethylene

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

	CAS-No.	Revision Date
trans-Dichloroethylene	156-60-5	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
trans-Dichloroethylene	156-60-5	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
trans-Dichloroethylene	156-60-5	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.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox. Acute toxicity

Aquatic Acute Acute aquatic toxicity

Aquatic Chronic	Chronic aquatic toxicity
Flam. Liq.	Flammable liquids
H225	Highly flammable liquid and vapour.
H332	Harmful if inhaled.
H402	Harmful to aquatic life.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	3
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.7

Revision Date: 12/10/2015

Print Date: 02/16/2016

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SECTION 1. IDENTIFICATION

Product identifier used on the label

: Trichloroethylene

Product Code(s) : Not available.

Recommended use of the chemical and restrictions on use

: Reagent; Chemical intermediate.
Use pattern: Professional Use Only
Restriction on use: None known

Chemical family : Pure substance

**Name, address, and telephone number
of the supplier:**

Comet Chemical Company Ltd.

3463 Thomas Street

Innisfil, ON, Canada
L9S 3W4

Supplier's Telephone # : 705-436-5580

24 Hr. Emergency Tel # : TERRRAPURE ENVIRONMENTAL : 800-567-7455

**Name, address, and telephone number of
the manufacturer:**

Refer to supplier

SECTION 2. HAZARDS IDENTIFICATION

Classification of the chemical

Clear colourless liquid. Ether like odour.

This material is classified as hazardous under U.S. OSHA regulations (29CFR 1910.1200) (Hazcom 2012) and Canadian WHMIS regulations (Hazardous Products Regulations) (WHMIS 2015).

Hazard classification

Skin Irritation - Category 2

Eye Damage/Irritation - Category 2B

Carcinogenicity - Category 1

Germ Cell Mutagenicity - Category 2

Specific Target Organ Toxicity, Single Exposure -Category 3 (respiratory)

Specific Target Organ Toxicity, Single Exposure - Category 3 narcotic effects

Label elements

Hazard pictogram(s)



Signal Word

DANGER!

Hazard statement(s)

Causes skin irritation.

Causes serious eye irritation.

May cause cancer.

Suspected of causing genetic defects.

May cause respiratory irritation.

May cause drowsiness or dizziness.

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Precautionary statement(s)

Obtain special instructions before use.
 Do not handle until all safety precautions have been read and understood.
 Wash thoroughly after handling.
 Avoid breathing mist or vapours.
 Use only outdoors or in a well-ventilated area.
 Wear protective gloves/clothing and eye/face protection.

If exposed or concerned: Get medical advice/attention.
 If on skin: Wash with plenty of soap and water.
 If skin irritation occurs: Get medical advice/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 inhaled: Remove person to fresh air and keep comfortable for breathing.
 Call a POISON CENTER or doctor/physician if you feel unwell.

Store locked up.
 Store in a well-ventilated place. Keep container tightly closed.

Dispose of contents/container in accordance with local/regional/national/international regulations.

Other hazards

Other hazards which do not result in classification: Burning produces obnoxious and toxic fumes. May be harmful if swallowed. Ingestion can cause gastrointestinal irritation, nausea, and diarrhea. May be an aspiration hazard. Aspiration into the lungs during swallowing or subsequent vomiting may cause chemical pneumonitis, which can be fatal.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Pure substance

<u>Chemical name</u>	<u>Common name and synonyms</u>	<u>CAS #</u>	<u>Concentration</u>
Trichloroethene	1,1,2-Trichlorethylene; Ethylene trichloride	79-01-6	100.00

SECTION 4. FIRST-AID MEASURES

Description of first aid measures

Ingestion : Seek immediate medical attention/advice. Do not induce vomiting. Have victim rinse mouth with water, then give one to two glasses of water to drink. Never give anything by mouth to an unconscious person. If vomiting occurs spontaneously, keep victim's head lowered (forward) to reduce the risk of aspiration.

Inhalation : Immediately remove person to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen by qualified medical personnel only. Seek immediate medical attention/advice.

Skin contact : Remove/Take off immediately all contaminated clothing. Flush affected skin with gently flowing lukewarm water for at least 20 minutes. Seek immediate medical attention/advice. Wash contaminated clothing before re-use. Leather and shoes that have been contaminated with the solution may need to be destroyed.

Eye contact : Immediately flush eyes thoroughly with running water for at least 20 to 30 minutes. Seek immediate medical attention/advice.

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Most important symptoms and effects, both acute and delayed

- : Causes skin irritation. Symptoms may include redness, itching and swelling. Causes serious eye irritation. Symptoms may include redness, pain, tearing and conjunctivitis. May cause respiratory irritation. Symptoms may include upper respiratory irritation, coughing and breathing difficulties. May cause central nervous system effects. Inhalation could result in pulmonary edema (fluid accumulation). Symptoms may include pain, headache, nausea, vomiting, dizziness, drowsiness and other central nervous system effects. May be harmful if swallowed. May be an aspiration hazard. Aspiration into the lungs during swallowing or subsequent vomiting may cause chemical pneumonitis, which can be fatal. May cause cancer. Suspected of causing genetic defects.

Indication of any immediate medical attention and special treatment needed

- : Treat symptomatically.

SECTION 5. FIRE-FIGHTING MEASURES

Extinguishing media

Suitable extinguishing media

- : Use water fog or fine spray, foams, carbon dioxide or dry chemical.

Unsuitable extinguishing media

- : Do not use a solid water stream as it may scatter and spread fire.

Special hazards arising from the substance or mixture / Conditions of flammability

- : Burning produces obnoxious and toxic fumes. Combustible liquid. Vapors are heavier than air and may spread along floors. Vapors may travel considerable distance to a source of ignition and flash back.

Flammability classification (OSHA 29 CFR 1910.106)

- : Not flammable.

Hazardous combustion products

- : Carbon oxides;Hydrogen chloride. ; Phosgene .

Special protective equipment and precautions for firefighters

Protective equipment for fire-fighters

- : Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

Special fire-fighting procedures

- : Firefighters should wear proper protective equipment and self-contained breathing apparatus with full face piece operated in positive pressure mode. Move containers from fire area if safe to do so. Water spray may be useful in cooling equipment exposed to heat and flame.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

- : All persons dealing with clean-up should wear the appropriate protective equipment including self-contained breathing apparatus. Refer to protective measures listed in sections 7 and 8. Keep all other personnel upwind and away from the spill/release. Restrict access to area until completion of clean-up.

Environmental precautions

- : Do not allow material to contaminate ground water system. For large spills, dike the area to prevent spreading.

Methods and material for containment and cleaning up

- : Ventilate the contaminated area. Stop the flow of material, if this is without risk. Dike for water control. Use only non-sparking tools and equipment in the clean-up process. Contain and absorb spilled liquid with non-combustible, inert absorbent material (e.g. sand), then place absorbent material into a container for later disposal (see Section 13).

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Special spill response procedures

- : If a spill/release in excess of the EPA reportable quantity is made into the environment, immediately notify the national response center in the United States (phone: 1-800-424-8802).
- EPA/CERCLA Reportable quantity (RQ): Trichloroethylene (100 lbs / 45.4 kg)

SECTION 7. HANDLING AND STORAGE

Precautions for safe handling

- : Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use only outdoors or in a well-ventilated area. Wear protective gloves/clothing and eye/face protection. Avoid breathing vapour or mist. Avoid contact with skin, eyes and clothing. Keep away from heat and sources of ignition. Keep away from metals and incompatibles. Label containers appropriately. Keep containers tightly closed when not in use. Wash thoroughly after handling.

Conditions for safe storage

- : Store in a cool, dry, well-ventilated area. Store away from incompatibles and out of direct sunlight. Storage area should be clearly identified, clear of obstruction and accessible only to trained and authorized personnel. Inspect periodically for damage or leaks. No smoking in the area.

Incompatible materials

- : Strong oxidizers (e.g. Chlorine, Peroxides, etc.). Reducing agents ;Reactive metals ;Alkalies ;Epoxides Copper alloys.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Limits:

<u>Chemical Name</u>	<u>ACGIH TLV</u>		<u>OSHA PEL</u>	
	<u>TWA</u>	<u>STEL</u>	<u>PEL</u>	<u>STEL</u>
Trichloroethene	10 ppm	25 ppm	100 ppm	N/Av

Exposure controls

Ventilation and engineering measures

- : Provide exhaust ventilation or other engineering controls to keep the airborne concentration of vapours below their respective threshold limit value.

Respiratory protection

- : Respiratory protection is required if the concentrations exceed the TLV. A NIOSH/MSHA approved air-purifying respirator with the appropriate chemical cartridges or a positive-pressure, air-supplied respirator may be used to reduce exposure. Advice should be sought from respiratory protection specialists.

Skin protection

- : Impervious gloves must be worn when using this product. Advice should be sought from glove suppliers.

Eye / face protection

- : Chemical splash goggles are recommended. A full face shield may also be necessary.

Other protective equipment

- : Wear resistant clothing and boots. An eyewash station and safety shower should be made available in the immediate working area. Other equipment may be required depending on workplace standards.

General hygiene considerations

- : Avoid breathing mist or vapours. Avoid contact with skin, eyes and clothing. Do not eat, drink, smoke or use cosmetics while working with this product. Upon completion of work, wash hands before eating, drinking, smoking or use of toilet facilities. Remove soiled clothing and wash it thoroughly before reuse.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	: Clear colourless liquid.
Odour	: Sweet ethereal odour.
Odour threshold	: 80-100 ppm
pH	: Not applicable.
Melting/Freezing point	: -73°C (-99°F)

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Initial boiling point and boiling range

: 82.2°C (188.96°F)

Flash point : Does not Flash

Flashpoint (Method) : Not applicable.

Evaporation rate (BuAe = 1) : 4.5-4.9

Flammability (solid, gas) : Not applicable.

Lower flammable limit (% by vol.)

: 8%

Upper flammable limit (% by vol.)

: 50%

Oxidizing properties : None known.

Explosive properties : Not explosive

Vapour pressure : 60 mm Hg @ 20°C

Vapour density : 4.5

Relative density / Specific gravity

: 1.46

Solubility in water : Soluble (1.1 g/L)

Other solubility(ies) : Soluble in most organic solvents.

Partition coefficient: n-octanol/water or Coefficient of water/oil distribution

: 2.42-2.53

Auto-ignition temperature : 420°C (788°F)

Decomposition temperature : Not available.

Viscosity : 0.57 centipoise @ 20°C

Volatiles (% by weight) : Not available.

Volatile organic Compounds (VOC's)

: N/A

Absolute pressure of container

: N/A

Flame projection length : N/A

Other physical/chemical comments

: Molecular Weight: 131

SECTION 10. STABILITY AND REACTIVITY

Reactivity : Not normally reactive.

Chemical stability : Stable under normal conditions.

Possibility of hazardous reactions

: No dangerous reaction known under conditions of normal use.

Conditions to avoid : Avoid heat and open flame. Ensure adequate ventilation, especially in confined areas.
Avoid contact with incompatible materials.

Incompatible materials : Strong oxidizers (e.g. Chlorine, Peroxides, etc.). Reducing agents ;Reactive metals
;Alkalies ;Epoxides Copper alloys.

Hazardous decomposition products

: None known, refer to hazardous combustion products in Section 5.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure:

Routes of entry inhalation : YES

Routes of entry skin & eye : YES

Routes of entry Ingestion : YES

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Routes of exposure skin absorption

: NO

Potential Health Effects:

Signs and symptoms of short-term (acute) exposure

Sign and symptoms Inhalation

- : May cause severe irritation to the nose, throat and respiratory tract. Symptoms may include upper respiratory irritation, coughing and breathing difficulties. Inhalation of extremely high concentrations could cause pulmonary edema (fluid accumulation). Symptoms of pulmonary edema (chest pain, shortness of breath) may be delayed. May cause central nervous system effects. Symptoms may include pain, headache, nausea, vomiting, dizziness, drowsiness and other central nervous system effects.

Sign and symptoms ingestion

- : May be harmful if swallowed. Ingestion can cause gastrointestinal irritation, nausea, and diarrhea. May be an aspiration hazard. Aspiration into the lungs may cause chemical pneumonitis.

Sign and symptoms skin

- : Causes skin irritation. Symptoms may include redness, itching and swelling.

Sign and symptoms eyes

- : Causes serious eye irritation. Symptoms may include stinging sensation, tearing, conjunctivitis and possibly corneal damage.

Potential Chronic Health Effects

- : Frequent or prolonged contact may defat and dry the skin, leading to discomfort and dermatitis. Prolonged exposure can cause central nervous system effects.

Mutagenicity

- : This material is classified as hazardous under U.S. OSHA regulations (29CFR 1910.1200) (Hazcom 2012) and Canadian WHMIS regulations (Hazardous Products Regulations) (WHMIS 2015). Classification : Germ Cell Mutagenicity - Category 2 Suspected of causing genetic defects.

Carcinogenicity

- : This material is classified as hazardous under U.S. OSHA regulations (29CFR 1910.1200) (Hazcom 2012) and Canadian WHMIS regulations (Hazardous Products Regulations) (WHMIS 2015). Classification Carcinogenic Category 1 May cause cancer.

Reproductive effects & Teratogenicity

- : Not expected to have other reproductive effects.

Sensitization to material

- : Not expected to be a skin or respiratory sensitizer.

Specific target organ effects

- : Eyes, skin, respiratory system and digestive system.

This material is classified as hazardous under U.S. OSHA regulations (29CFR 1910.1200) (Hazcom 2012) and Canadian WHMIS regulations (Hazardous Products Regulations) (WHMIS 2015). Classification: Specific Target Organ Toxicity, Single Exposure -Category 3 (respiratory) May cause respiratory irritation. Specific Target Organ Toxicity, Single Exposure - Category 3 narcotic effects May cause drowsiness or dizziness.

Not classified as a specific target organ toxicity-repeated exposure.

Medical conditions aggravated by overexposure

- : Pre-existing skin, eye and respiratory disorders.

Synergistic materials

- : Not available.

Toxicological data

- : See below for toxicological data on the substance.

<u>Chemical name</u>	<u>LC₅₀(4hr)</u>	<u>LD₅₀</u>	
	<u>inh, rat</u>	<u>(Oral, rat)</u>	<u>(Rabbit, dermal)</u>
Trichloroethylene	38.96 mg/L	5602 mg/kg	>29000mg/kg

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Other important toxicological hazards

: None known or reported by the manufacturer.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity : The product should not be allowed to enter drains or water courses, or be deposited where it can affect ground or surface waters. See the following tables for individual ingredient ecotoxicity data.

Ecotoxicity data:

<u>Ingredients</u>	CAS No	Toxicity to Fish		
		LC50 / 96h	NOEC / 21 day	M Factor
Trichloroethene	79-01-6	21.9 mg/L (Fathead minnow)	n/av	none

<u>Ingredients</u>	CAS No	Toxicity to Daphnia		
		EC50 / 48h	NOEC / 21 day	M Factor
Trichloroethene	79-01-6	18 mg/L (Daphnia magna)	n/av	none

<u>Ingredients</u>	CAS No	Toxicity to Algae		
		EC50 / 96h or 72h	NOEC / 96h or 72h	M Factor
Trichloroethene	79-01-6	450 mg/L (Green algae)	n/av	none

Persistence and degradability

: Not readily biodegradable.

Bioaccumulation potential

: No data is available on the product itself.

<u>Components</u>	<u>Partition coefficient n-octanol/water (log Kow)</u>	<u>Bioconcentration factor (BCF)</u>
Trichloroethene (CAS 79-01-6)	2.29	4-39

Mobility in soil

: No data is available on the product itself.

Other Adverse Environmental effects

: No data is available on the product itself.

SECTION 13. DISPOSAL CONSIDERATIONS

Handling for Disposal

: Handle waste according to recommendations in Section 7. Empty containers retain residue (liquid and/or vapour) and can be dangerous.

Methods of Disposal

: Dispose of in accordance with federal, provincial and local hazardous waste laws.

RCRA

:

The Waste code should be assigned in discussion between the user, the producer and the waste disposal company.

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SECTION 14. TRANSPORTATION INFORMATION

Regulatory Information	UN Number	UN proper shipping name	Transport hazard class(es)	Packing Group	Label
TDG	UN1710	TRICHLOROETHYLENE	6.1	III	
TDG Additional information		May be shipped as Limited Quantity when transported in containers no larger than 5.0 Litres; in packages not exceeding 30 kg gross mass.			
49CFR/DOT	UN1710	TRICHLOROETHYLENE	6.1	III	
49CFR/DOT Additional information		US CERCLA Reportable quantity (RQ): (100 lbs / 45.4 kg). May be shipped as Limited Quantity when shipped in containers no greater than 1.0 Litre; per Section 173.154 of 49 CFR.			
ICAO/IATA	UN1710	Trichloroethylene	6.1	III	
ICAO/IATA Additional information		Refer to ICAO/IATA Packing Instruction			
IMDG	UN1710	TRICHLOROETHYLENE	6.1	III	
IMDG Additional information		May be shipped as limited quantity. Check the IMDG regulations for details.			

Special precautions for user : None known or reported by the manufacturer.

Environmental hazards : See ECOLOGICAL INFORMATION, Section 12.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

: Not available.

SECTION 15 - REGULATORY INFORMATION

US Federal Information:

Components listed below are present on the following U.S. Federal chemical lists:

Ingredients	CAS #	TSCA Inventory	CERCLA Reportable Quantity(RQ) (40 CFR 117.302):	SARA TITLE III: Sec. 302, Extremely Hazardous Substance, 40 CFR 355:	SARA TITLE III: Sec. 313, 40 CFR 372, Specific Toxic Chemical	Toxic Chemical	de minimus Concentration
Trichloroethene	79-01-6	Yes	100 lb/ 45.4 kg	N/Av	Yes		Yes

SARA TITLE III: Sec. 311 and 312, SDS Requirements, 40 CFR 370 Hazard Classes: Acute Health Hazard ; Chronic Health Hazard. Under SARA Sections 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are 500 pounds for the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.



Comet Chemical Company Ltd.
3463 Thomas Street
Innisfil, ON, Canada, L9S 3W4
Telephone: (705) 436 5580

Trichloroethylene

SDS Preparation Date (mm/dd/yyyy): 09/23/2015

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US State Right to Know Laws:

The following chemicals are specifically listed by individual States:

<u>Ingredients</u>	<u>CAS #</u>	<u>California Proposition 65</u>		<u>State "Right to Know" Lists</u>					
		<u>Listed</u>	<u>Type of Toxicity</u>	<u>CA</u>	<u>MA</u>	<u>MN</u>	<u>NJ</u>	<u>PA</u>	<u>RI</u>
Trichloroethene	79-01-6	Yes	Carcinogen	Yes	Yes	Yes	Yes	Yes	Yes

Canadian Information:

Canadian Environmental Protection Act (CEPA) information: All ingredients listed appear on the Domestic Substances List (DSL).

Canadian WHMIS Classification: Refer to Section 2 for a WHMIS Classification for this product.

International Information:

Components listed below are present on the following International Inventory list:

<u>Ingredients</u>	<u>CAS #</u>	<u>European EINECS</u>	<u>Australia AICS</u>	<u>Philippines PICCS</u>	<u>Japan ENCS</u>	<u>Korea KECL/KECL</u>	<u>China IECSC</u>	<u>New Zealand IOC</u>
Trichloroethene	79-01-6	201-167-4	Present	Present	(2)-105	KE-13680	Present	HSR001555

SECTION 16. OTHER INFORMATION

Legend

- : ACGIH: American Conference of Governmental Industrial Hygienists
- CAS: Chemical Abstract Services
- ERAP: Emergency Response Assistance Plan
- HSDB: Hazardous Substances Data Bank
- IARC: International Agency for Research on Cancer
- Inh: Inhalation
- LC: Lethal Concentration
- LD: Lethal Dose
- MSHA: Mine Safety and Health Administration
- N/Ap: Not Applicable
- N/Av: Not Available
- NIOSH: National Institute of Occupational Safety and Health
- NTP: National Toxicology Program
- OSHA: Occupational Safety and Health Administration
- PEL: Permissible exposure limit
- RTECS: Registry of Toxic Effects of Chemical Substances
- STEL: Short Term Exposure Limit
- TDG: Canadian Transportation of Dangerous Goods Act & Regulations
- TLV: Threshold Limit Values
- TWA: Time Weighted Average
- WHMIS: Workplace Hazardous Materials Identification System

References

- : Canadian Centre for Occupational Health and Safety, CCInfoWeb Databases, 2015 (Chempendium, RTECS, HSDB, INCHEM).
- European Chemicals Agency, Classification Legislation, 2015
- 6. OECD- The Global Portal to Information on Chemical Substances - eChemPortal, 2015
- Material Safety Data Sheet from manufacturer

Preparation Date (mm/dd/yyyy)

: 09/23/2015



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Trichloroethylene

SDS Preparation Date (mm/dd/yyyy): 09/23/2015

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Other special considerations for handling

: Provide adequate information, instruction and training for operators.

<p>Prepared for:</p> <p>Comet Chemical Company Ltd. 3463 Thomas Street Innisfil, ON L9S 3W4 Information (M-F 8:00-5:00): 705-436-5580 www.cometchemical.com</p>	
<p>Prepared by:</p> <p>ICC The Compliance Center Inc. Telephone: (888) 442-9628 (U.S.); (888) 977-4834 (Canada) http://www.thecompliancecenter.com</p>	

DISCLAIMER

This Safety Data Sheet was prepared by ICC The Compliance Center Inc. using information provided by Comet Chemical Company Ltd. and CCOHS' Web Information Service. The information in the Safety Data Sheet is offered for your consideration and guidance when exposed to this product. ICC The Compliance Center Inc and Comet Chemical Company Ltd. expressly disclaim all expressed or implied warranties and assume no responsibilities for the accuracy or completeness of the data contained herein. The data in this SDS does not apply to use with any other product or in any other process.

This Safety Data Sheet may not be changed, or altered in any way without the expressed knowledge and permission of ICC The Compliance Center Inc. and Comet Chemical Company Ltd.

END OF DOCUMENT



SAFETY DATA SHEET

Creation Date 24-Aug-1997

Revision Date 10-Feb-2015

Revision Number 1

1. Identification

Product Name	VANADIUM	
Cat No. :	AC206420000; AC206420010; AC206420050; AC206422500	
Synonyms	Vanadium pentoxide	
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	Entity / Business Name Acros Organics One Reagent Lane Fair Lawn, NJ 07410	Emergency Telephone Number For information US call: 001-800-ACROS-01 / Europe call: +32 14 57 52 11 Emergency Number US :001-201-796-7100 / Europe : +32 14 57 52 99 CHEMTREC Tel. No. US :001-800-424-9300 / Europe :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)

Acute oral toxicity	Category 4
Acute Inhalation Toxicity - Dusts and Mists	Category 4
Serious Eye Damage/Eye Irritation	Category 1
Germ Cell Mutagenicity	Category 2
Carcinogenicity	Category 2
Reproductive Toxicity	Category 2
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	
Specific target organ toxicity - (repeated exposure)	Category 1

Label Elements

Signal Word

Danger

Hazard Statements

Harmful if swallowed
Causes serious eye damage
Harmful if inhaled
May cause respiratory irritation
Suspected of causing genetic defects
Suspected of causing cancer
Suspected of damaging the unborn child

Causes 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
 Do not eat, drink or smoke when using this product
 Use only outdoors or in a well-ventilated area
 Do not breathe dust/fume/gas/mist/vapors/spray

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

Eyes

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 or doctor/physician

Ingestion

IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell

Rinse mouth

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)

Toxic to aquatic life with long lasting effects

3. Composition / information on ingredients

Component	CAS-No	Weight %
Vanadium pentoxide	1314-62-1	>95

4. First-aid measures

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 soap and plenty of water while removing all contaminated clothes and shoes. Obtain medical attention.
Inhalation	Remove from exposure, lie down. Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Immediate medical attention is required.
Ingestion	Call a physician immediately. Clean mouth with water.
Most important symptoms/effects	Causes eye burns.
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	No information available
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical

Non-combustible.

Hazardous Combustion Products

Thermal decomposition can lead to release of irritating gases and vapors

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
	3	0	0	N/A

6. Accidental release measures

Personal Precautions

Ensure adequate ventilation. Use personal protective equipment.

Environmental Precautions

See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.

Methods for Containment and Clean Up Sweep up or vacuum up spillage and collect in suitable container for disposal.

7. Handling and storage

Handling

Do not breathe dust. Do not breathe vapors or spray mist. Do not get in eyes, on skin, or on clothing. Use only in area provided with appropriate exhaust ventilation.

Storage

Keep in a dry, cool and well-ventilated place. Keep container tightly closed. Keep locked-up.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Vanadium pentoxide	TWA: 0.05 mg/m ³		IDLH: 35 mg/m ³ Ceiling: 0.05 mg/m ³

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Vanadium pentoxide	TWA: 0.05 mg/m ³	TWA: 0.5 mg/m ³	TWA: 0.05 mg/m ³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

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.

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	Powder Solid
Appearance	Amber
Odor	Odorless
Odor Threshold	No information available
pH	4 (5 % Solution)
Melting Point/Range	690 °C / 1274 °F
Boiling Point/Range	1750 °C / 3182 °F
Flash Point	No information available
Evaporation Rate	No information available
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	0.0443 hPa @ 700 °C
Vapor Density	No information available
Relative Density	3.350
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	1750 °C
Viscosity	No information available
Molecular Formula	O5 V2
Molecular Weight	181.88

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Combustible material.

Incompatible Materials Strong acids, Reducing agents

Hazardous Decomposition Products Thermal decomposition can lead to release of irritating gases and vapors

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity**Component Information**

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Vanadium pentoxide	474 mg/kg (Rat, male) 467 mg/kg (Rat, female) 314 mg/kg (Rat, male) 221 mg/kg (Rat, female)	50 mg/kg (Rabbit)	4.29 mg/L (Rat) 4 h

Toxicologically Synergistic Products**Delayed and immediate effects as well as chronic effects from short and long-term exposure**

Irritation No information available

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
Vanadium pentoxide	1314-62-1	Group 2B	Not listed	A3	X	Not listed

Mutagenic Effects Substances which cause concern for man owing to possible mutagenic effects but for which the available information is not adequate for making a satisfactory assessment

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 No information available

Endocrine Disruptor Information No information available

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

12. Ecological information**Ecotoxicity**

Do not empty into drains.

Persistence and Degradability No information available

Bioaccumulation/ Accumulation No information available.

Mobility No information available.

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

Hazard Class

UN2862

6.1

Packing Group	III
TDG	
UN-No	UN2862
Hazard Class	6.1
Packing Group	III
IATA	
UN-No	2862
Proper Shipping Name	VANADIUM PENTOXIDE
Hazard Class	6.1
Packing Group	III
IMDG/IMO	
UN-No	2862
Proper Shipping Name	VANADIUM PENTOXIDE
Hazard Class	6.1
Packing Group	III

15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Vanadium pentoxide	X	X	-	215-239-8	-		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
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SARA 313	Not applicable
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Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Vanadium pentoxide	1314-62-1	>95	1.0

SARA 311/312 Hazardous Categorization

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Vanadium pentoxide	X	1000 lb	-	-

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
Vanadium pentoxide	1000 lb	1000 lb

California Proposition 65 This product contains the following Proposition 65 chemicals:

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Vanadium pentoxide	1314-62-1	Carcinogen	-	Carcinogen

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Vanadium pentoxide	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): N
 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
 E Corrosive material
 D2A Very toxic materials



16. Other information

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

Creation Date 24-Aug-1997
Revision Date 10-Feb-2015
Print Date 10-Feb-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

Airgas®

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.
----------------	--

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.

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.

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).

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
vinyl chloride	<p>ACGIH TLV (United States, 3/2012). TWA: 1 ppm 8 hours.</p> <p>OSHA PEL (United States, 6/2010). STEL: 5 ppm 15 minutes. TWA: 1 ppm 8 hours.</p> <p>OSHA PEL 1989 (United States, 3/1989). STEL: 5 ppm 15 minutes. TWA: 1 ppm 8 hours.</p>

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.

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 (ft³/lb)	: 1.0989
Gas Density (lb/ft³)	: 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.

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.

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

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	<p>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.</p> <p>Limited quantity Yes.</p> <p>Packaging instruction Passenger aircraft Quantity limitation: Forbidden.</p> <p>Cargo aircraft Quantity limitation: 150</p>	<p>Explosive Limit and Limited Quantity Index 0.125</p> <p>ERAP Index 3000</p> <p>Passenger Carrying Road or Rail Index Forbidden</p>	-	-	<p>Passenger and Cargo Aircraft Quantity limitation: 0 Cargo Aircraft Only Quantity limitation: 150 kg</p>

Section 14. Transport information

kg	<u>Special provisions</u> 21, B44, T50				
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"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 : Listed

(b) Hazardous Air Pollutants (HAPs)

Clean Air Act Section 602 : Not listed
Class I Substances

Clean Air Act Section 602 : Not listed
Class II Substances

DEA List I Chemicals (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

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.

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.)



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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	:	10/13/2014.
Version	:	0.03
Key to abbreviations	:	<p>ATE = Acute Toxicity Estimate BCF = Bioconcentration Factor GHS = Globally Harmonized System of Classification and Labelling of Chemicals IATA = International Air Transport Association IBC = Intermediate Bulk Container IMDG = International Maritime Dangerous Goods LogPow = logarithm of the octanol/water partition coefficient MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution) UN = United Nations ACGIH – American Conference of Governmental Industrial Hygienists AIHA – American Industrial Hygiene Association CAS – Chemical Abstract Services CEPA – Canadian Environmental Protection Act</p>

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.

ZINC METAL SAFETY DATA SHEET

SECTION 1. IDENTIFICATION

Product Identity: Zinc Metal

Trade Names and Synonyms: High Grade Zinc; Special High Grade Zinc; Zinc, Zn, CGG Alloy <1% Aluminum.

Manufacturer:

Teck Metals Ltd.
Trail Operations
Trail, British Columbia
V1R 4L8
Emergency Telephone: 250-364-4214

Supplier:

In U.S.:
Teck American Metal Sales
Incorporated
501 North Riverpoint Blvd, Suite 300
Spokane, WA
USA, 99202

Preparer:

Teck Metals Ltd.
Suite 3300 – 550 Burrard Street
Vancouver, British Columbia
V6C 0B3

Other than U.S.:

Teck Metals Ltd.
#1700 – 11 King Street West
Toronto, Ontario
M5H 4C7

Date of Last Review: July 15, 2015.

Date of Last Edit: July 15, 2015.

Product Use: Zinc metal is used to coat steel for corrosion protection (galvanizing, electroplating, electrogalvanizing), as an alloying element in bronze, brass, aluminum and other metal alloys, for zinc die casting alloys, for zinc dry cell and zinc/air batteries, for the production of zinc sheet for architectural and coinage applications, as a reducing agent in organic chemistry and for other chemical applications.

SECTION 2. HAZARDS IDENTIFICATION

CLASSIFICATION:

*NOTE: In the form in which it is sold this product is not regulated as a Hazardous Product in the U.S. or Canada.
This Safety Data Sheet is provided for information purposes only.*

Health	Physical	Environmental
Acute Toxicity (Oral, Inhalation)	– Does not meet criteria	Does not meet criteria for any Physical Hazard
Skin Corrosion/Irritation	– Does not meet criteria	Aquatic Toxicity – (Short Term/Long Term) Does not meet any criteria
Eye Damage/Eye Irritation	– Does not meet criteria	
Respiratory or Skin Sensitization	– Does not meet criteria	
Mutagenicity	– Does not meet criteria	
Carcinogenicity	– Does not meet criteria	
Reproductive Toxicity	– Does not meet criteria	
Specific Target Organ Toxicity:		
Acute Exposure	– Does not meet criteria	
Chronic Exposure	– Does not meet criteria	

LABEL:

Symbols: None required	Signal Word: None required
Hazard Statements None required	Precautionary Statements: None required

Emergency Overview: A lustrous bluish-silver metal that does not burn in bulk but may form explosive mixtures if dispersed in air as a fine powder. Zinc oxide fume is formed when zinc metal is heated to or near the boiling point, or is burned. Contact with acids or alkalis generates flammable hydrogen gas which can accumulate in poorly ventilated areas. Do NOT use water or foam on burning zinc metal. Apply dry chemical, sand or special powder extinguishing media. Zinc is relatively non-toxic and poses little immediate hazard to the health of emergency response personnel or to the environment in an emergency situation.

Potential Health Effects: Zinc is essentially non-toxic to humans. However, zinc oxide fumes may cause mild local irritation to eyes, nose, throat and upper airways. Acute over-exposure to zinc oxide fume may cause metal fume fever, characterized by flu-like symptoms such as chills, fever, nausea, and vomiting which may be delayed 3 – 10 hours in onset. In most cases, dermal exposure to zinc or zinc compounds does not result in any noticeable toxic effects. Zinc is not listed as a carcinogen by OSHA, NTP, IARC, ACGIH or the EU (see Toxicological Information, Section 11).

Potential Environmental Effects: Zinc metal has relatively low bioavailability and poses no immediate ecological risks. Depending on physico-chemical characteristics (e.g., pH, water hardness), compounds of zinc metal can be toxic, particularly in the aquatic environment. Zinc also has the potential to bioaccumulate in plants and animals in both aquatic and terrestrial environments (see Ecological Information, Section 12).

SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

COMPONENTS	CAS Registry No.	CONCENTRATION (% wgt/wgt)
Zinc	7440-66-6	99+%

Note: See Section 8 for Occupational Exposure Guidelines.

SECTION 4. FIRST AID MEASURES

Eye Contact: *Symptoms:* Mild eye irritation, redness. Do not rub eye(s). Let the eye(s) water naturally for a few minutes. Look right and left, then up and down. If particle/dust does not come out, cautiously rinse eye(s) with lukewarm, gently flowing water for 5 minutes or until particle/dust is removed, while holding eyelid(s) open. If eye irritation persists, get medical advice/attention. DO NOT attempt to manually remove anything from the eye.

Skin Contact: *Symptoms:* Soiling of skin. No health effects expected. If irritation does occur, rinse with lukewarm, gently flowing water for 5 minutes or until the product is removed. If skin irritation occurs or you feel unwell, get medical advice/attention.

Molten Metal: Flush contact area to solidify and cool but do not attempt to remove encrusted material or clothing. Cover burns and seek medical attention immediately.

Inhalation: *Symptoms:* Coughing and irritation in heavy dust clouds. If symptoms are experienced remove source of contamination or move victim from exposure area to fresh air immediately and obtain medical advice. NOTE: Metal fume fever may develop 3-10 hours after exposure to zinc oxide fumes. If symptoms of metal fume fever (flu-like symptoms) develop, obtain medical attention.

Ingestion: *Symptoms:* Stomach upset, nausea, diarrhea. If swallowed, no specific intervention is indicated as this material is not likely to be hazardous by ingestion. However, if you are concerned or you feel unwell, obtain medical advice.

SECTION 5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Massive metal is difficult to ignite and is not considered a serious fire hazard. However, finely-divided metallic dust may form flammable or explosive dust clouds when dispersed in the air at high concentrations and exposed to heat, flame, or other ignition sources. Bulk dust in a damp state may heat spontaneously and ignite on exposure to air. Contact with acids and alkali hydroxides results in evolution of hydrogen gas which is potentially explosive. Mixtures with potassium chlorate or fused ammonium nitrate may explode on impact.

Extinguishing Media: Apply dry chemical, dry sand, or special powder extinguishing (Class D) media. Do NOT use water, carbon dioxide or foam on molten metals. Water may be ineffective for extinguishing a fire but should be used to keep fire-exposed billets, ingots and castings cool.

Fire Fighting: If possible, move material not yet involved in the fire from the fire area. If this is not possible, cool fire-exposed zinc by applying hose streams or fogs. Apply only dry chemical, sand, or special powder extinguishing media to any molten or burning zinc metal. Take extreme caution to prevent contact of water with molten or burning zinc. Zinc foil in particular may ignite in the presence of water. Zinc oxide fumes may evolve in fires. Fire fighters should be fully trained and wear full protective clothing including an approved, self-contained breathing apparatus which supplies a positive air pressure within a full face-piece mask.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures for Cleanup: Control source of release if possible to do so safely. Clean up spilled material immediately observing precautions in Section 8, Personal Protection. Molten metal should be allowed to cool and harden before cleanup. Once solidified wear gloves, pick up and return to process. Powder or dust should be cleaned up by sweeping/shoveling, etc. Solid metal is recyclable. Return uncontaminated spilled material to the process if possible. Place contaminated material in clean, dry,

suitably labelled containers for later recovery or disposal. Treat or dispose of waste material in accordance with all local, state/provincial, and national requirements.

Personal Precautions: Protective clothing, gloves, and a respirator are recommended for persons responding to an accidental release (see also Section 8). Close-fitting safety goggles may be necessary in some circumstances to prevent eye contact with zinc dust and fume. Where molten metal is involved, wear heat-resistant gloves and suitable clothing for protection from hot-metal splash.

Environmental Precautions: Zinc metal has relatively low bioavailability and poses no immediate ecological risks. Depending on physico-chemical characteristics (e.g., pH, water hardness), compounds of zinc metal can be toxic, particularly in the aquatic environment. Zinc also has the potential to bioaccumulate in plants and animals in both aquatic and terrestrial environments. Releases of the product to water and soil should be prevented.

SECTION 7. HANDLING AND STORAGE

Store zinc in a DRY covered area, separate from incompatible materials. Zinc ingots suspected of containing moisture should be THOROUGHLY DRIED before being added to a molten bath. Ingots may contain cavities that collect moisture. Entrained moisture will expand explosively when immersed in a molten bath.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Guidelines: (Time-Weighted Average (TWA) concentration over 8 hr unless otherwise indicated)

Component	ACGIH TLV	OSHA PEL	NIOSH REL
Zinc	None established†	None established†	None established†

NOTE: OEGs for individual jurisdictions may differ from those given above. Check with local authorities for the applicable OEGs in your jurisdiction.

ACGIH - American Conference of Governmental Industrial Hygienists; OSHA - Occupational Safety and Health Administration; NIOSH - National Institute for Occupational Safety and Health. TLV – Threshold Limit Value, PEL – Permissible Exposure Limit, REL – Recommended Exposure Limit.

† NOTE: While there is no established OEL for zinc as such, there are OELs for zinc oxide which may be formed during burning, welding or other fuming processes.

The OSHA PEL final rule limits for zinc oxide dust are 10 mg/m³ (total) and 5 mg/m³ (respirable); the OSHA PEL final rule limit for zinc oxide fume is 5 mg/m³. Note that the OSHA PEL final rule limits are currently non-enforceable due to a court decision. The OSHA PEL transitional limits therefore remain in force at present. They are 15 mg/m³ (total) and 5 mg/m³ (respirable) while the transitional PEL for zinc oxide fume is 5 mg/m³. The ACGIH TLV for zinc oxide is 2 mg/m³ (respirable fraction) with a Short Term Exposure Limit (STEL) of 10 mg/m³ (respirable fraction). The NIOSH REL for zinc oxide (dust or fume) is 5 mg/m³ 10 hr TWA with a 15 mg/m³ ceiling limit (15 minute sample) for zinc oxide dust and a 10 mg/m³ STEL for zinc oxide fume (15 minute sample).

NOTE: The selection of the necessary level of engineering controls and personal protective equipment will vary depending upon the conditions of use and the potential for exposure. The following are therefore only general guidelines that may not fit all circumstances. Control measures to consider include:

Ventilation: Use adequate local or general ventilation to maintain the concentration of zinc oxide fumes in the working environment well below recommended occupational exposure limits. Supply sufficient replacement air to make up for air removed by the exhaust system. Where metallic particles of zinc are being collected and transported by a ventilation system, use a non-sparking, grounded ventilation system separate from other exhaust ventilation systems. Locate dust collectors and fans outdoors if possible and provide dust collectors with explosion vents or blow out panels. Refer to appropriate NFPA Standards 484, 654, and/or 68 for specific guidance.

Protective Clothing: Gloves and coveralls, shop coat or other work clothing are recommended to prevent prolonged or repeated direct skin contact when zinc is processed. Eye protection should be worn where fume or dust is generated. Respiratory protection may be required where zinc oxide fume is generated. Where hot or molten metal is handled, heat-resistant gloves, face shield, and clothing to protect from hot metal splash should be worn. Safety type boots are recommended.

Respirators: Where zinc oxide dust or fumes are generated and cannot be controlled to within acceptable levels, use appropriate NIOSH-approved respiratory protection equipment (a 42CFR84 Class N, R or P-95 particulate filter cartridge).

General Hygiene Considerations: Always practice good personal hygiene. Refrain from eating, drinking, or smoking in work areas. Thoroughly wash hands before eating, drinking, or smoking in appropriate designated areas. No special packaging materials are required.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Bluish-silver lustrous metal	Odour: None	Odour Threshold: None	pH: Not Applicable
Vapour Pressure: 1 mm at 487°C Negligible at 20°C	Vapour Density: Not Applicable	Melting Point/Range: 420°C	Boiling Point/Range: 908°C
Relative Density (Water = 1): 7.1	Evaporation Rate: Not Applicable	Coefficient of Water/Oil Distribution: Log P (oct) = -0.47 (estimated)	Solubility: Insoluble in Water (0.2 mg/l @ pH 7)
Flash Point: Not Applicable.	Flammable Limits (LEL/UEL): LEL (Zinc Dust): 500 g/m ³ ; UEL Not Determined.	Auto-ignition Temperature: Approx 680°C (dust cloud in air), Approx 460°C (dust layer).	Decomposition Temperature: Oxidation starts approx 450°C

SECTION 10. STABILITY AND REACTIVITY

Stability & Reactivity: Massive metal is stable and not considered reactive under normal temperatures and pressures. Hazardous polymerization or runaway reactions will not occur. Zinc metal slowly becomes covered with a white coating of a hydrated basic zinc carbonate on exposure to moist air. Fine, condensed zinc dust or powder may heat spontaneously and ignite on exposure to air when damp. Zinc metal will react with acids and strong alkalis to generate hydrogen gas. A violent, explosive reaction may occur when powdered zinc is heated with sulphur. Powdered zinc will become incandescent or ignite in the presence of fluorine, chlorine, bromine or interhalogens (e.g., chlorine trifluoride). Powdered zinc can also react explosively with halogenated hydrocarbons if heated. Mixtures with potassium chlorate or fused ammonium nitrate may explode on impact.

Incompatibilities: Contact with acids and alkalis will generate highly flammable hydrogen gas. Contact with acidic solutions of arsenic and antimony compounds may evolve highly toxic ARSINE or STIBINE gas. Incompatible with strong oxidizing agents such as chlorine, fluorine, bromine, sodium, potassium or barium peroxide, sodium or potassium chlorate, chromium trioxide and fused ammonium nitrate. Also incompatible with elemental sulphur dust, halogenated hydrocarbons or chlorinated solvents, chlorinated rubber, and ammonium sulphide or calcium disulphide.

Hazardous Decomposition Products: High temperature operations such as oxy-acetylene cutting, electric arc welding or overheating a molten bath will generate zinc oxide fume which, on inhalation in sufficient quantity, can produce metal fume fever, a transient influenza-like illness.

SECTION 11. TOXICOLOGICAL INFORMATION

General: Zinc, especially in the metal form, is relatively non-toxic. However, it can react with other materials, such as oxygen or acids, to form compounds that can be potentially toxic. The primary route of exposure would be through the generation and inhalation of zinc oxide fume.

Acute:

Skin/Eye: In most cases, dermal exposure to zinc or zinc compounds does not result in any noticeable toxic effects. Zinc metal is not chemically irritating to the eyes.

Inhalation: If excessive quantities of zinc oxide fume are inhaled, it can result in the condition called metal fume fever. The symptoms of metal fume fever will occur within 3 to 10 hours, and include immediate dryness and irritation of the throat, tightness of the chest and coughing, which may later be followed by flu-like symptoms of fever, malaise, perspiration, frontal headache, muscle cramps, low back pain, occasionally blurred vision, nausea, and vomiting. The symptoms are temporary and generally disappear, without medical intervention, within 24 to 48 hours of onset. There are no recognized complications, after affects, or chronic affects that result from this condition.

Ingestion: Zinc is not expected to be harmful if ingested. When ingested in excessive quantities, zinc can irritate the stomach resulting in nausea, vomiting, abdominal pain and diarrhea. Ingestion is not a typical route of occupational exposure.

Chronic:

There is no chronic form of metal fume fever but in rare instances an acute incident may be followed by complaints such as bronchitis or pneumonia. Some workers may develop a short-term immunity (resistance) so that repeated exposure to zinc oxide fumes does not cause metal fume fever. This immunity (resistance) however is quickly lost after short absences from work (weekends or vacations). Workers exposed to finely-divided metallic zinc for up to 35 years revealed no acute or chronic illnesses

attributable to zinc. Prolonged or repeated skin contact with zinc dust or powder may cause dryness, irritation and cracking (dermatitis) since zinc is astringent and may tend to draw moisture from the skin. Zinc is not listed as a human carcinogen by the Occupational Safety and Health Administration (OSHA), the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), the American Conference of Governmental Industrial Hygienists (ACGIH) or the European Union (EU).

Animal Toxicity:

<u>Ingredient:</u>	<u>Acute Oral Toxicity:</u>	<u>Acute Dermal Toxicity:</u>	<u>Acute Inhalation Toxicity:</u>
Zinc	>5,000 mg/kg [†]	No data	No data

[†] LD₅₀, Mouse, Oral,

SECTION 12. ECOLOGICAL INFORMATION

Zinc metal is relatively insoluble; however, processing of the product or extended exposure in aquatic and terrestrial environments may lead to the release of zinc compounds in bioavailable forms. Zinc is highly mobile, and can be toxic in the aquatic environment with water hardness, pH and dissolved organic carbon content being major regulating factors. Zinc also has the potential to bioaccumulate in plants and animals in both aquatic and terrestrial environments. In soils, zinc is moderately mobile in accordance with soil properties (e.g., cation exchange capacity, pH, redox potential, chemical species); these properties also influence its bioavailability to terrestrial plants.

SECTION 13. DISPOSAL CONSIDERATIONS

If material cannot be returned to process or salvage, dispose of in accordance with applicable regulations.

SECTION 14. TRANSPORT INFORMATION

PROPER SHIPPING NAME Not applicable – not regulated.
U.S. DOT AND TRANSPORT CANADA HAZARD CLASSIFICATION Not applicable
U.S. DOT AND TRANSPORT CANADA PID Not applicable
MARINE POLLUTANT..... No
IMO CLASSIFICATION Not regulated

SECTION 15. REGULATORY INFORMATION

U.S.
INGREDIENTS LISTED ON TSCA INVENTORY..... Yes
HAZARDOUS UNDER HAZARD COMMUNICATION STANDARD..... No
CERCLA SECTION 103 HAZARDOUS SUBSTANCES Zinc..... Yes RQ: 1,000 lb. (454 kg.)*
* reporting not required when diameter of the pieces of solid metal released is equal to or exceeds 100 micrometers (0.004 inches).
EPCRA SECTION 302 EXTREMELY HAZARDOUS SUBSTANCE No
EPCRA SECTION 311/312 HAZARD CATEGORIES No Hazard Categories Apply
EPCRA SECTION 313 TOXIC RELEASE INVENTORY:..... This product does not contain any toxic chemicals subject to the Toxic Release reporting requirements. However, potential by-products from working with this product - "Zinc (Fume or Dust)" CAS 7440-66-6 are reportable.

SECTION 16. OTHER INFORMATION

Date of Original Issue: July 23, 1997 **Version:** 01 (*First edition*)
Date of Latest Revision: July 15, 2015 **Version:** 14

The information in this Safety Data Sheet is based on the following references:

- American Conference of Governmental Industrial Hygienists, 2004, Documentation of the Threshold Limit Values and Biological Exposure Indices, 7th Edition plus updates.

- American Conference of Governmental Industrial Hygienists, 2015, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.
- American Conference of Governmental Industrial Hygienists, 2015, Guide to Occupational Exposure Values.
- Bretherick's Handbook of Reactive Chemical Hazards, 20th Anniversary Edition (P. G. Urben, Ed), 1995.
- Canadian Centre for Occupational Health and Safety (CCOHS) Hamilton, ON, CHEMINFO Record No. 239 – Zinc Metal.
- European Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures, amending and repealing directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (REACH).
- Health Canada, SOR/2015-17, Hazardous Products Regulations, 30 January 2015.
- International Agency for Research on Cancer (IARC), Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, 1972 – present, (multi-volume work), World Health Organization, Geneva.
- Merck & Co., Inc., 2001, The Merck Index, An Encyclopedia of Chemicals, Drugs, and Biologicals, 13th Edition.
- National Library of Medicine, National Toxicology Information Program, Hazardous Substance Data Bank (on-line version).
- Oak Ridge National Laboratory, Oak Ridge, Tennessee – Toxicity Summary for Zinc and Zinc Compounds, April 1992.
- Patty's Toxicology, 5th Edition, 2001 E. Bingham, B. Cohrssen & CH Powell (Eds.).
- U.S. Dept. of Health and Human Services, National Institute of Environmental Health Sciences, National Toxicology Program (NTP), 13th Report on Carcinogens, October 2014.
- U.S. Dept. of Health and Human Services, National Institute for Occupational Safety and Health, NIOSH Pocket Guide to Chemical Hazards (on-line edition).
- U.S. Dept. of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Toxicological Profile for Zinc - August 2005.
- U.S. Dept. of Health and Human Services, National Institute for Occupational Safety and Health, Registry of Toxic Effects of Chemical Substances (RTECS), CCOHS on-line version.
- U.S. Occupational Safety and Health Administration, 1989, Code of Federal Regulations, Title 29, Part 1910.

Notice to Reader

Although reasonable precautions have been taken in the preparation of the data contained herein, it is offered solely for your information, consideration and investigation. Teck American Metal Sales Incorporated and Teck Metals Ltd. extend no warranty and assume no responsibility for the accuracy of the content and expressly disclaim all liability for reliance thereon. This safety data sheet provides guidelines for the safe handling and processing of this product; it does not and cannot advise on all possible situations. Therefore, your specific use of this product should be evaluated to determine if additional precautions are required. Individuals exposed to this product should read and understand this information and be provided pertinent training prior to working with this product.

Attachment B – Job Safety Analyses and Daily Site Safety Checklists

Job Loss Analysis (JLA)

Page 1 of 2

JLA Title: Brush Hog Use

Date Developed: 7/20/2018	Revised Date: 1/4/2023	Revision #: 010
Initial Development Team: Scott Andresini		
Latest Revision by: Tom Baylis, CIH; VP HSSE		
Quality Review by: Tom Baylis, CIH; VP HSSE		

REQUIRED PPE: Air Purifying Respirator; Ear Muffs; Ear Plugs; Face Shield; Fire Retardant Clothing; Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); Goggles; Hard Hat; Safety Glasses; Safety-toed Boots; Shirt (Highly-Visible Short/Long Sleeve); Tychem Suit; Tyvek Suit; Vest (Highly Visible Reflective Striped); **Other:** Enter other required PPE.

TASK-SPECIFIC TOOLS AND EQUIPMENT:

Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures
1. Prior to mowing property	<p>1a. Heat or cold stress symptoms from adverse weather conditions (extreme heat / cold, snow, rain, wind, icy, tornado, earthquake, hurricane, flood...)</p> <p>1b. Skin irritation / allergic reaction that could result from contact with poisonous plants.</p>	<p>1a. Ensure weather forecast is monitored in field and in office.</p> <ul style="list-style-type: none"> ➢ During "suspected" weather concerns weather should be monitored at pre-determined time interval ➢ Review GES policy on severe weather (type, actions to take (shelter and first aid) and communications) ➢ Have a severe weather plan in place (located in HASP or JSA) and discuss throughout day as weather changes ➢ Staff, knowing seasonally weather conditions, should have required PPE and clothing (coats, hats, rain gear, extra dry clothing, sun screen...) <p>1b. Eliminate poison plants (i.e. poison ivy) by spraying area</p> <ul style="list-style-type: none"> ➢ Identify poisonous plants, such as poison ivy and poison oak. ➢ Wash hands and arms immediately with soap and water if skin contacts with poisonous plants occur. ➢ Do not approach or cut areas where poisonous plants have been identified. ➢ Apply an over-the-counter barrier cream such as Ivy Block® to prevent poisonous plant oils contacting the skin. ➢ Don long pants with socks pulled over legs to prevent skin contact with plants. ➢ Don long sleeve shirt or Tyvek suit to minimize skin expose to plants. <p>NOTE: Review, inspect, and locate safety equipment incl. Fire extinguisher, & first aid kit</p>
2. Unload Mower from trailer	<p>2a. Cuts to hand or fingers as a result of being caught in moving parts of trailer or lawnmower</p> <p>2b. Hand and arm fractures or contusions as a result of tripping and falling when unloading mower, working on uneven surfaces etc..</p>	<p>2a. Do not place hands/fingers near moving/rotating parts of trailer and / or brush hog.</p> <ul style="list-style-type: none"> ➢ All equipment must be inspected prior to use to ensure all safety shut down switches are working. ➢ Have all bystanders keep a minimum of 10 feet away from moving/rotating parts ➢ Inspect trailer prior to loading equipment to ensure ramps are in good condition and ramp support cables are not frayed, ➢ Ensure brakes (if applicable) on mower are secured and mower is secured to trailer. ➢ Ensure work area is established prior to unloading equipment. ➢ Ensure clearance of cables when unloading equipment to prevent hitting cables and causing failure. ➢ Lower trailer door/ramp slowly, and stay to the center door/ramp to avoid whiplash of cable in the event of cable failure ➢ Don PPE (Safety glasses, safety shoes, hi-visible long sleeve shirts / outerwear, leather gloves, hard hat). <p>2b. Inspect the work area and look for uneven areas that may create a tripping hazard.</p> <ul style="list-style-type: none"> ➢ Plan walking path through work area to avoid the uneven areas ➢ If the path of travel is obstructed (lighting, over growth, clutter...) utilize a walking stick and probe ahead, walk slowly and use caution. ➢ Don safety boots with skid / puncture resistant soles that comply with GES requirements.

3. Brush Hog use	<p>3a. Lacerations to skin/eyes that could result from contact with flying debris during brush hogging operations</p> <p>3b. Fractures /contusions due to contact with moving vehicles while mowing on road side</p> <p>3c. Fractures/ Contusions to torso as a result of being caught in moving/rotating parts of lawn mower</p> <p>3d. Hearing loss caused by excessive noise during operation of lawn mower</p> <p>3e. Eye injuries from wind blowing dust/debris into eyes</p>	<p>3a. Ensure individual is trained and complies with safe operations of equipment.</p> <ul style="list-style-type: none"> ➢ Ensure all equipment is inspected and all safeguards are working and in place (E-Stop, guards...). ➢ Ensure all non-essential personnel are 15 feet from operation of equipment. ➢ Traverse area prior to cutting, ensure there is no debris that could damage mower, or become a potential projectile. ➢ Wear a face shield in addition to safety glasses when flying particles are possible. ➢ Don required PPE (safety glasses, hi-visible clothing, safety shoes, leather gloves; may have to upgrade to face shield, hearing protection, cut resistant gloves, hard hat...) ➢ Do not allow anyone to stand near the path of the cutting chute exit <p>3b. Utilize cones/barricades/safety fence to establish the work zone – zone – Comply with GES Traffic Control program.</p> <ul style="list-style-type: none"> ➢ Perform mowing operations so operator is facing on-coming traffic. ➢ Use "spotter" to warn personnel of approaching vehicles in high traffic areas. ➢ Don high visible sleeved shirt or outerwear, such as high visible traffic vests or clothing. ➢ Don high visible outwear with reflective stripping. <p>3c. Do not position the body such that it could be caught in rotating parts of lawn mower.</p> <ul style="list-style-type: none"> ➢ All equipment must be inspected prior to use to ensure all safety shut down switches are working. ➢ Have all bystanders keep a minimum of 15 feet away from moving/rotating parts ➢ Drive slowly, maintain 3-pts of contact while entering/exiting mower. ➢ Never operate a mower on terrain (slopes) that may cause mower to tip over. ➢ Inspect the mower for safety devices (blade guard) and placards. ➢ Ensure E-Stop is operational by intentionally activating it, and, if available, catcher unit is functional ➢ If catcher unit is clogged, turn off mower, all components are stopped. ➢ Ensure blade is disengaged and stopped, parking brake is set, mower shutdown prior to dismounting, or other personnel entering work area. ➢ Do not wear jewelry, loose clothing, remove any strings from clothing such as hoodies, tuck pant legs into boots or use duct tape to secure pant legs around boots <p>3d. Create an exclusion zone around the work area so that third parties are not exposed to hazardous noise levels.</p> <ul style="list-style-type: none"> ➢ Don ear plugs and/or ear muffs. ➢ Double hearing protection (ear plugs and ear muffs) may be necessary if levels are found to be above 100 db. <p>3e. Identify wind direction and work upwind if possible.</p> <ul style="list-style-type: none"> ➢ Upgrade eye protection to spoggles or goggles. ➢ Upgrade to HEPA Filter mask if conditions (dry and heavy airborne dust) warrant.
4. Fueling the mower	4a. Burns due to fire that can result from the ignition of flammable liquid during fueling and re-fueling	<p>4a. Fuel before starting, when equipment is cold.</p> <ul style="list-style-type: none"> ➢ Allow equipment to cool completely before re-fueling. ➢ Fuel in area clear of debris and well ventilated. ➢ If fuel container has no spout, use a funnel. Wipe tool clean of excess fuel before starting. ➢ No smoking within 50' of fueling area.
5. Demobilize to next location or complete scope of work. See section 2 for mower / trailer loading	5a. Hand and arm fractures or contusions as a result of tripping and falling when exiting mower or walking to inspect next location	<p>5a. Use 3-points of contact while entering/exiting vehicle/mower.</p> <ul style="list-style-type: none"> ➢ Inspect the work area and look for uneven areas that may create a tripping hazard. ➢ Plan walking path through work area to avoid the uneven areas ➢ If the path of travel is obstructed (lighting, over growth, clutter...) utilize a walking stick and probe ahead, walk slowly and use caution. ➢ Don safety boots with skid / puncture resistant soles that comply with GES requirements.
On-site edits:		

Job Loss Analysis (JLA)

Page 1 of 2

JLA Title: Chain Saw Use

Date Developed: 2/23/2005	Revised Date: 1/4/2023	Revision #: 012
Initial Development Team: Chip Markovich, Staff Geologist / J. Pachy, RHSSE		This JLA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JLA.
Latest Revision by: Basith Mohammed, Regional HSSE Manager		
Quality Review by: Tom Baylis, CIH; VP HSSE		
REQUIRED PPE: <input type="checkbox"/> Air Purifying Respirator; <input checked="" type="checkbox"/> Ear Muffs; <input checked="" type="checkbox"/> Ear Plugs; <input checked="" type="checkbox"/> Face Shield; <input type="checkbox"/> Fire Retardant Clothing; <input checked="" type="checkbox"/> Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); <input type="checkbox"/> Goggles; <input checked="" type="checkbox"/> Hard Hat; <input checked="" type="checkbox"/> Safety Glasses; <input checked="" type="checkbox"/> Safety-toed Boots; <input checked="" type="checkbox"/> Shirt (Highly-Visible Short/Long Sleeve); <input type="checkbox"/> Tychem Suit; <input type="checkbox"/> Tyvek Suit; <input type="checkbox"/> Vest (Highly Visible Reflective Striped); Other: Enter other required PPE.		
TASK-SPECIFIC TOOLS AND EQUIPMENT: Chain saw		
Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures
A. Power Equipment 1. Preparing to use chain saw	<p>1a. Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of chain saw</p> <p>1b. Hearing loss caused by excessive noise during operation of chain saw</p> <p>1c. cuts to hand or fingers as a result of being caught in moving/rotating parts of chain saw</p> <p>1d. Lacerations to skin/ eyes that could result from contact with flying debris from chain saw</p>	<p>1a. Read manufacturers manual on safe operating requirements</p> <ul style="list-style-type: none"> ➢ Make sure blades are sharp and all guards are in place before starting a cut. ➢ Inspect the cutting equipment prior to start of cut. ➢ Cut away from your body and keep hands out of the path of cutting tools. ➢ Have bystanders maintain a 3 foot distance from the cutting operation at all times. ➢ Don PPE (e.g., eye protection, long pants, nitrile sampling gloves (inner), Kevlar cut resistant gloves (outer), and hard hat with face shield, hearing protection, long sleeve shirts, and steel-toed boots). ➢ Don a pair of chain saw Kevlar chaps to protect legs during operation of chainsaw; will give some kickback protection. <p>1b. Create an exclusion zone around the work area so that third parties are not exposed to hazardous noise levels.</p> <ul style="list-style-type: none"> ➢ Hearing protection should be worn if noise levels exceed 85 dBA as per this policy or if noise level is unknown (e.g., measurement device is not available or has not been pre-determined) ➢ Don ear plugs and/or ear muffs. ➢ Double hearing protection (ear plugs and ear muffs) may be necessary if levels are found to be above 100 db. <p>1c. Do not place hands/fingers near moving/rotating parts of saw blade</p> <ul style="list-style-type: none"> ➢ All equipment must be inspected prior to use to ensure all safety shut down switches are working. ➢ Have all bystanders keep a minimum of 3 feet away from moving/rotating parts. ➢ Don leather gloves or cut resistant gloves ➢ Position your body so no body parts can be contacted by the chain saw blade. <p><i>Note: Extreme caution must be taken while handling and using chain saw.</i></p> <p>1d. Ensure individual is trained and complies with safe operations of equipment.</p> <ul style="list-style-type: none"> ➢ Ensure all equipment has been inspected and all safeguards are working and in place (E-Stop, guards...). ➢ Ensure all non-essential personnel are 10 feet from operation of equipment. ➢ Don required PPE (safety glasses, hi-visible clothing, safety shoes, leather gloves; upgrade to face shield, hearing protection, cut resistant gloves, hard hat) <p><i>Note: Only trained personnel are permitted to operate chain saw.</i></p> <p><i>Note: Read and follow operating instructions and all safety precautions from manufacturer</i></p>
2. Transporting the saw	2a. Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of saw blade during transportation of chain saw	<p>2a. Put the chain guard on the saw when not in use.</p> <ul style="list-style-type: none"> ➢ Always carry the saw at your side with the cutting bar and chain to the rear and to the outside. ➢ Never carry a chain saw in the passenger area of a vehicle. ➢ Don Kevlar Level II Cut Resistant Gloves. ➢ Don Cutting Chaps for legs when carrying chain saw.
3. Fueling a chain saw	3a. Burns to hands, arms, body due to fire that can result from	<p>3a. Use the fuel mix recommended by the manufacturer.</p> <ul style="list-style-type: none"> ➢ Fuel before starting, when equipment is cold.

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

	the ignition of flammable liquid during fueling and re-fueling	<ul style="list-style-type: none"> ➤ Allow equipment to cool completely for at least 10 minutes before re-fueling. ➤ Fuel in area clear of debris and well ventilated. ➤ If fuel container has no spout, use a funnel. Wipe tool clean of excess fuel before starting. ➤ No smoking within 50' of fueling area.
4. Starting the chain saw	4a. Back/body sprain/strain from pulling starting cord and holding saw	<p>4a. Ensure operator has an open, level, debris-free area to start chain saw.</p> <ul style="list-style-type: none"> ➤ Hold the saw firmly on the ground by holding it down with one hand on the top handle. ➤ Pull the starter cord with the other hand. (inspect prior to pulling) ➤ The chain should not be moving while the saw is idling. ➤ Never start the saw while holding it off the ground, or by "drop starting" it. ➤ Keep fingers, hands and arms way from idling chain and any hot components of saw (engine, muffler)
5. Cutting activities	<p>5a. Hearing loss caused by excessive noise during operation of chain saw</p> <p>5b. cuts to hand or fingers as a result of being caught in moving/rotating parts of chain saw</p> <p>5c. Lacerations to skin/ eyes that could result from contact with flying debris from chain saw</p> <p>5b. Skin irritation / allergic reaction that could result from contact with poisonous plants.</p> <p>5c. Back/body sprain/strain due to kickback of chain saw</p>	<p>5a. Create an exclusion zone around the work area so that third parties are not exposed to hazardous noise levels.</p> <ul style="list-style-type: none"> ➤ Hearing protection should be worn if noise levels exceed 85 dBA as per this policy or if noise level is unknown (e.g., measurement device is not available or has not been pre-determined) ➤ Don ear plugs and/or ear muffs. ➤ Double hearing protection (ear plugs and ear muffs) may be necessary if levels are found to be above 100 db. <p>5b. Do not place hands/fingers near moving/rotating parts of saw blade</p> <ul style="list-style-type: none"> ➤ All equipment must be inspected prior to use to ensure all safety shut down switches are working. ➤ Have all bystanders keep a minimum of 3 feet away from moving/rotating parts. ➤ Don leather gloves ➤ Position your body so no body parts can be contacted by the chain saw blade. <p><i>Note: Extreme caution must be taken while handling and using chain saw.</i></p> <p>5c. Ensure individual is trained and complies with safe operations of equipment.</p> <ul style="list-style-type: none"> ➤ Ensure all equipment has inspected and all safeguards are working and in place (E-Stop, guards...). ➤ Ensure all non-essential personnel are 10 feet from operation of equipment. ➤ Don required PPE (safety glasses, hi-visible clothing, safety shoes, leather gloves; may have to upgrade to face shield, hearing protection, cut resistant gloves, hard hat...) <p>5b. Inspect site for hazards.</p> <ul style="list-style-type: none"> ➤ Eliminate poison plants (i.e. poison ivy) by spraying area ➤ Identify poisonous plants, such as poison ivy and poison oak. ➤ Wash hands and arms immediately with soap and water if skin contacts with poisonous plants occur. ➤ Do not approach or traverse areas where poisonous plants have been identified. ➤ Apply an over-the-counter barrier cream such as Ivy Block® to prevent poisonous plant oils contacting the skin. ➤ Don long pants with socks pulled over legs to prevent skin contact with plants. ➤ Don long sleeve shirt or Tyvek suit to minimize skin expose to plants. <p>5c. Use a saw equipped with a chain brake or kickback guard.</p> <ul style="list-style-type: none"> ➤ Hold the saw firmly with both hands; grip the top handle by putting the thumb around it. ➤ Watch for twigs that can snag the chain. ➤ Don't pinch the chain while cutting. ➤ Saw with the lower part of the bar close to the bumper, not on the top near the nose. ➤ Maintain high saw speed when entering or leaving a cut. ➤ Keep the chain sharp and tightened during operation. ➤ Refer to the owner's manual for specific requirements. <p>➤ WARNING: Do not reach above your shoulder to cut; the chain will be too close to your face in this position.</p>
On-site edits:		

Job Loss Analysis (JLA)

Page 1 of 1

JLA Title: Cutting Liners (Poly, Geo, Landfill Type Liners)

Date Developed: 2/23/2005	Revised Date: 1/2/2023	Revision #: 014 This JLA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JLA.									
REQUIRED PPE: <input type="checkbox"/> Air Purifying Respirator; <input type="checkbox"/> Ear Muffs; <input type="checkbox"/> Ear Plugs; <input type="checkbox"/> Face Shield; <input type="checkbox"/> Fire Retardant Clothing; <input checked="" type="checkbox"/> Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); <input type="checkbox"/> Goggles; <input type="checkbox"/> Hard Hat; <input checked="" type="checkbox"/> Safety Glasses; <input checked="" type="checkbox"/> Safety-toed Boots; <input checked="" type="checkbox"/> Shirt (Highly-Visible Short/Long Sleeve); <input type="checkbox"/> Tychem Suit; <input type="checkbox"/> Tyvek Suit; <input type="checkbox"/> Vest (Highly Visible Reflective Striped); Other: Enter other required PPE.											
TASK-SPECIFIC TOOLS AND EQUIPMENT: Approved cutting tool (self-retracting and / or covered blade), Extra blades (if applicable)											
<table border="1"> <thead> <tr> <th>Activity/Sequence of Job Tasks</th><th>Potential Hazards</th><th>Risk Control Measures</th></tr> </thead> <tbody> <tr> <td>A. Cutting of the Liner 1. Use of hand tools (e.g., safety knives, poly line cutter, etc.)</td><td> <p>1a. Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of cutting tool / material</p> <p>1b. Repetitive muscle strain to shoulders, elbow or back from prolonged use of cutting tool</p> <p>1c. Hand and arm fractures or contusions as a result of tripping and falling when walking or working on /around liner surfaces</p> </td><td> <p>1a. Use approved geo-probe liner cutting tool instead of retractable blade knife whenever cutting geo-probe liners.</p> <ul style="list-style-type: none"> ➢ Ensure the cutting instrument(s) used are the approved tool for the job, you are trained on the safe usage and are equipped with "self-retracting" blades that CANNOT be overridden by the user (i.e. held out or locked open) or blades that are guarded and do not allow the blade to come in contact with the user. ➢ Make sure blades are sharp (new, no damage) and all guards are in place before starting a cut. When cutting geo-probe liners secure the liner in holder and pull geo-probe liner from one end to the other with both hands keeping all body parts out of the cutting path (line of fire of the cutting tool). ➢ Inspect the cutting equipment prior to start of cut, including the self-retracting mechanism. ➢ Cut away from your body and keep hands out of the path of cutting tools. ➢ Ensure cutting path is free of obstructions to eliminate contact to fingers, hand, and arm. ➢ Have bystanders maintain a 3 foot distance from the cutting operation at all times. ➢ Never walk with the blade in the "out" position and ensure blade is covered / secured when not in use. ➢ If handling materials or equipment that has sharp edges, avoid contact with the material. ➢ The liner being cut must not interfere with the operator's vision. ➢ Prior to cutting liners and such ensure individual has a stable stance, feet are planted securely on level ground. ➢ Individual has clear visibility to cutting surface and is not attempting to cut while body is in awkward position. ➢ Don PPE (e.g., eye protection, long pants, nitrile sampling gloves (inner), Kevlar or other (Level II) cut resistant gloves (outer), long sleeve shirt, steel-toed boots). If there is a chance of liquid exposure switch order of gloves; Kevlar inner, nitrile outer). <p>Note: The use of utility and / or personal knives (i.e., Stanley knives, box cutters, pocket knives) is STRICTLY PROHIBITED.</p> <p>1b. Maintain a steady and balanced stance with legs shoulder width apart</p> <ul style="list-style-type: none"> ➢ Take breaks between cutting process, never over exert shoulder, elbow and back. ➢ Ensure area where cutting is taking place provides enough space to back, shoulders, elbow to be aligned and straight. <p>1c. Inspect the work area and look for uneven areas that may create a tripping hazard.</p> <ul style="list-style-type: none"> ➢ Plan walking path through work area to avoid the uneven areas ➢ Inspect the liner to see if it is wet and slippery – be aware of weather conditions (rain, snow). ➢ Remove any standing water/snow/ice before traversing. ➢ Inspect the liner for wrinkles, bulges, or depressions that could create a tripping hazard or hide a hole. ➢ Don safety boots with skid / puncture resistant soles that comply with GES requirements </td></tr> <tr> <td>On-site edits:</td><td></td><td></td></tr> </tbody> </table>			Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures	A. Cutting of the Liner 1. Use of hand tools (e.g., safety knives, poly line cutter, etc.)	<p>1a. Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of cutting tool / material</p> <p>1b. Repetitive muscle strain to shoulders, elbow or back from prolonged use of cutting tool</p> <p>1c. Hand and arm fractures or contusions as a result of tripping and falling when walking or working on /around liner surfaces</p>	<p>1a. Use approved geo-probe liner cutting tool instead of retractable blade knife whenever cutting geo-probe liners.</p> <ul style="list-style-type: none"> ➢ Ensure the cutting instrument(s) used are the approved tool for the job, you are trained on the safe usage and are equipped with "self-retracting" blades that CANNOT be overridden by the user (i.e. held out or locked open) or blades that are guarded and do not allow the blade to come in contact with the user. ➢ Make sure blades are sharp (new, no damage) and all guards are in place before starting a cut. When cutting geo-probe liners secure the liner in holder and pull geo-probe liner from one end to the other with both hands keeping all body parts out of the cutting path (line of fire of the cutting tool). ➢ Inspect the cutting equipment prior to start of cut, including the self-retracting mechanism. ➢ Cut away from your body and keep hands out of the path of cutting tools. ➢ Ensure cutting path is free of obstructions to eliminate contact to fingers, hand, and arm. ➢ Have bystanders maintain a 3 foot distance from the cutting operation at all times. ➢ Never walk with the blade in the "out" position and ensure blade is covered / secured when not in use. ➢ If handling materials or equipment that has sharp edges, avoid contact with the material. ➢ The liner being cut must not interfere with the operator's vision. ➢ Prior to cutting liners and such ensure individual has a stable stance, feet are planted securely on level ground. ➢ Individual has clear visibility to cutting surface and is not attempting to cut while body is in awkward position. ➢ Don PPE (e.g., eye protection, long pants, nitrile sampling gloves (inner), Kevlar or other (Level II) cut resistant gloves (outer), long sleeve shirt, steel-toed boots). If there is a chance of liquid exposure switch order of gloves; Kevlar inner, nitrile outer). <p>Note: The use of utility and / or personal knives (i.e., Stanley knives, box cutters, pocket knives) is STRICTLY PROHIBITED.</p> <p>1b. Maintain a steady and balanced stance with legs shoulder width apart</p> <ul style="list-style-type: none"> ➢ Take breaks between cutting process, never over exert shoulder, elbow and back. ➢ Ensure area where cutting is taking place provides enough space to back, shoulders, elbow to be aligned and straight. <p>1c. Inspect the work area and look for uneven areas that may create a tripping hazard.</p> <ul style="list-style-type: none"> ➢ Plan walking path through work area to avoid the uneven areas ➢ Inspect the liner to see if it is wet and slippery – be aware of weather conditions (rain, snow). ➢ Remove any standing water/snow/ice before traversing. ➢ Inspect the liner for wrinkles, bulges, or depressions that could create a tripping hazard or hide a hole. ➢ Don safety boots with skid / puncture resistant soles that comply with GES requirements 	On-site edits:		
Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures									
A. Cutting of the Liner 1. Use of hand tools (e.g., safety knives, poly line cutter, etc.)	<p>1a. Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of cutting tool / material</p> <p>1b. Repetitive muscle strain to shoulders, elbow or back from prolonged use of cutting tool</p> <p>1c. Hand and arm fractures or contusions as a result of tripping and falling when walking or working on /around liner surfaces</p>	<p>1a. Use approved geo-probe liner cutting tool instead of retractable blade knife whenever cutting geo-probe liners.</p> <ul style="list-style-type: none"> ➢ Ensure the cutting instrument(s) used are the approved tool for the job, you are trained on the safe usage and are equipped with "self-retracting" blades that CANNOT be overridden by the user (i.e. held out or locked open) or blades that are guarded and do not allow the blade to come in contact with the user. ➢ Make sure blades are sharp (new, no damage) and all guards are in place before starting a cut. When cutting geo-probe liners secure the liner in holder and pull geo-probe liner from one end to the other with both hands keeping all body parts out of the cutting path (line of fire of the cutting tool). ➢ Inspect the cutting equipment prior to start of cut, including the self-retracting mechanism. ➢ Cut away from your body and keep hands out of the path of cutting tools. ➢ Ensure cutting path is free of obstructions to eliminate contact to fingers, hand, and arm. ➢ Have bystanders maintain a 3 foot distance from the cutting operation at all times. ➢ Never walk with the blade in the "out" position and ensure blade is covered / secured when not in use. ➢ If handling materials or equipment that has sharp edges, avoid contact with the material. ➢ The liner being cut must not interfere with the operator's vision. ➢ Prior to cutting liners and such ensure individual has a stable stance, feet are planted securely on level ground. ➢ Individual has clear visibility to cutting surface and is not attempting to cut while body is in awkward position. ➢ Don PPE (e.g., eye protection, long pants, nitrile sampling gloves (inner), Kevlar or other (Level II) cut resistant gloves (outer), long sleeve shirt, steel-toed boots). If there is a chance of liquid exposure switch order of gloves; Kevlar inner, nitrile outer). <p>Note: The use of utility and / or personal knives (i.e., Stanley knives, box cutters, pocket knives) is STRICTLY PROHIBITED.</p> <p>1b. Maintain a steady and balanced stance with legs shoulder width apart</p> <ul style="list-style-type: none"> ➢ Take breaks between cutting process, never over exert shoulder, elbow and back. ➢ Ensure area where cutting is taking place provides enough space to back, shoulders, elbow to be aligned and straight. <p>1c. Inspect the work area and look for uneven areas that may create a tripping hazard.</p> <ul style="list-style-type: none"> ➢ Plan walking path through work area to avoid the uneven areas ➢ Inspect the liner to see if it is wet and slippery – be aware of weather conditions (rain, snow). ➢ Remove any standing water/snow/ice before traversing. ➢ Inspect the liner for wrinkles, bulges, or depressions that could create a tripping hazard or hide a hole. ➢ Don safety boots with skid / puncture resistant soles that comply with GES requirements 									
On-site edits:											

Job Loss Analysis (JLA)

Page 1 of 2

JLA Title: Cutting vegetation with Weed-Whacker

Date Developed: 2/9/2005	Revised Date: 1/27/2022	Revision #: 010
Initial Development Team: Dylan Shaw, Tech; Chip Markovich, Staff Geologist / J. Pachy, Regional HSSE Manager		This JLA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JLA.
Latest Revision by: Mark Lancaster, Regional HSSE Manager		
Quality Review by: J. Pachy, Regional HSSE Manager		
<p>REQUIRED PPE: <input type="checkbox"/>Air Purifying Respirator; <input checked="" type="checkbox"/>Ear Muffs; <input checked="" type="checkbox"/>Ear Plugs; <input checked="" type="checkbox"/>Face Shield; <input type="checkbox"/>Fire Retardant Clothing; <input checked="" type="checkbox"/>Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); <input type="checkbox"/>Goggles; <input checked="" type="checkbox"/>Hard Hat; <input checked="" type="checkbox"/>Safety Glasses; <input checked="" type="checkbox"/>Safety-toed Boots; <input checked="" type="checkbox"/>Shirt (Highly-Visible Short/Long Sleeve); <input type="checkbox"/>Tychem Suit; <input type="checkbox"/>Tyvek Suit; <input type="checkbox"/>Vest (Highly Visible Reflective Striped); Other: Enter other required PPE.</p>		
<p>TASK-SPECIFIC TOOLS AND EQUIPMENT: Click here to enter tools and equipment.</p>		
Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures
A. Preparation for Using Weed Whacker	<p>1a. Burns to hands / arms or body due to fire that can result from the ignition of flammable liquid during fueling and re-fueling</p>	<p>1a. Fuel before starting, when equipment is cold.</p> <ul style="list-style-type: none"> ➢ Allow equipment to cool completely before re-fueling. ➢ Fuel in area clear of debris and well ventilated. ➢ If fuel container has no spout, use a funnel. Wipe tool clean of excess fuel before starting. ➢ No smoking within 50' of fueling area. ➢ Don PPE (steel-toe boots, hard hat, safety glasses, hi-visible long-sleeve shirt and nitrile gloves)
B Weed whacker start up	<p>1a. Back/body sprain/strain from starting weed whacker</p> <p>1b. Lacerations to skin/eyes that could result from contact with flying debris from line hitting soil or material causing it to become airborne</p>	<p>1a. Place the Weed Whacker in a clear, debris-free area on level ground.</p> <ul style="list-style-type: none"> ➢ Hold the Whacker firmly on the ground by putting your foot through the rear handle (if possible) and by holding it down with one hand on the top handle, ensure you have a balanced stance ➢ Pull the starter cord with the other hand. ➢ Never start the whacker while holding it off the ground, or by "drop starting" it. <p>1b. Ensure individual is trained and complies with safe operations of equipment.</p> <ul style="list-style-type: none"> ➢ Ensure all equipment is inspected and all safeguards are working and in place (E-Stop, guards...). ➢ Ensure all non-essential personnel are at least 40 feet from operation of equipment (from the line of fire of flying debris). ➢ Inspect cutting area for foreign objects (thick vegetation, trash, or miscellaneous debris) that may create flying hazard. ➢ Place the Weed Whacker in a clear, debris-free area on level ground. ➢ Don required PPE (safety glasses, hi-visible clothing, safety shoes, leather gloves; may have to upgrade to face shield, hearing protection, cut resistant gloves, hard hat...)
C. Use of Weed Whacker.	<p>1a. Lacerations to skin/eyes that could result from contact with flying debris from flying debris while cutting vegetation.</p> <p>1b. Lacerations to skin/eyes that could result from contact with cutting line</p> <p>1c. Hearing loss caused by excessive noise during operation of weed whacker</p>	<p>1a. Remove any foreign objects that may hinder weed whacking operations (tools, equipment, trash, any type of debris) that could become airborne.</p> <ul style="list-style-type: none"> ➢ Remove debris that could cause you to slip or lose your balance. ➢ Keep both hands firmly on the weed whacker when cutting. ➢ Don required PPE (safety glasses, hi-visible clothing, safety shoes, leather gloves; may have to upgrade to face shield, hearing protection, cut resistant gloves, hard hat...) <p>1b. Cut away from your body and keep hands at least one foot from the cutting line.</p> <ul style="list-style-type: none"> ➢ Never attempt to inspect or fix weed whacker while it is running. ➢ Never place body parts near rotating cutting line or blade on weed whacker. ➢ Ensure all guards are in place around cutting line ➢ Don required PPE (safety glasses, hi-visible clothing, safety shoes, leather gloves; may have to upgrade to face shield, hearing protection, cut resistant gloves, hard hat...) <p>1c. Create an exclusion zone around the work area so that third parties are not exposed to hazardous noise levels.</p> <ul style="list-style-type: none"> ➢ Hearing protection should be worn if noise levels exceed 85 dBA as per this policy or if noise level is unknown (e.g., measurement device is not available or has not been pre-determined) ➢ Don ear plugs and/or ear muffs. ➢ Double hearing protection (ear plugs and ear muffs) may be necessary if levels are found to be above 100 db.

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

	1d. Hand and arm fractures or contusions as a result of tripping and falling when walking or working on uneven surfaces	1d. Inspect the work area and look for uneven areas that may create a tripping hazard. <ul style="list-style-type: none">➢ Plan walking path through work area to avoid the uneven areas➢ If the path of travel is obstructed (lighting, over growth, clutter...) utilize a walking stick and probe ahead, walk slowly and use caution.➢ Don safety boots with skid / puncture resistant soles that comply with GES requirements.
On-site edits:		

Job Loss Analysis (JLA)

Page 1 of 2

JLA Title: Decontamination of Drilling Equipment

Date Developed: 8/23/2013	Revised Date: 1/4/2023	Revision #: 009
Initial Development Team: Carl Farley, driller; Alana Kopicz – Staff Scientist		This JLA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JLA.
Latest Revision by: Mark Lancaster, Regional HSSE Manager		
Quality Review by: Mark Lancaster, Regional HSSE Manager		

REQUIRED PPE: Air Purifying Respirator; Ear Muffs; Ear Plugs; Face Shield; Fire Retardant Clothing; Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); Goggles; Hard Hat; Safety Glasses; Safety-toed Boots; Shirt (Highly-Visible Short/Long Sleeve); Tychem Suit; Tyvek Suit; Vest (Highly Visible Reflective Striped); **Other:** Enter other required PPE.

TASK-SPECIFIC TOOLS AND EQUIPMENT: Pressure washer

Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures
1. Set Up Exclusion Zone	<p>1a. Fractures/contusions to body due to contact with Drill rig.</p> <p>1b. Fractures / contusions to body due to contact with moving vehicles.</p> <p>1c. Back/body sprain/strain from lifting, moving or carrying equipment /materials</p> <p>1d. Hand and arm fractures or contusions as a result of tripping and falling when walking or working on uneven surfaces</p>	<p>1a. All equipment should be inspected prior to use by the operator to ensure all safety devices are working as designed (i.e. back up alarms, kill switches, etc.)</p> <ul style="list-style-type: none"> ➢ Never stand in equipment path (i.e., within swing radius of counter weight of excavators, backhoe or bucket arm, moving truck, etc.). ➢ Never assume operator can see you. Make eye contact with operator and have "show of hands" to ensure hands are off of the operating switches prior to approaching. Use hand signals that were determined during the tailgate meeting ➢ Ensure wheel chocks are in placed behind rear wheels ➢ Don high visible sleeved shirt or outerwear, such as high visible traffic vests or clothing. <p>1b. Utilize cones/barricades/safety fence to establish the work zone – Comply with GES Traffic Control program.</p> <ul style="list-style-type: none"> ➢ Do not permit access to work zone by non-essential personnel. ➢ Inform facility personnel of work (restricted) area. ➢ All staff not involved in the activity must remain 25 feet outside of work area ➢ Use "spotter" to warn personnel of approaching vehicles in high traffic areas. ➢ Don high visible sleeved shirt or outerwear, such as high visible traffic vests or clothing. ➢ If working alongside an active roadway, where vehicular traffic is heavy, dawn/dusk hours, or if weather if overcast or rainy, high visible outwear with reflective stripping must be worn. <p>1c. Determine whether the item must be lifted - can it be left in place or pushed/pulled into place?</p> <ul style="list-style-type: none"> ➢ Ensure path is level and clear of debris/obstacles. ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area. ➢ Once equipment / material is at staging / work location inspect to ensure proper working order. <p>1d. Inspect the work area and look for uneven areas that may create a tripping hazard.</p> <ul style="list-style-type: none"> ➢ Plan walking path through work area to avoid the uneven areas ➢ If the path of travel is obstructed (lighting, over growth, clutter...) utilize a walking stick and probe ahead, walk slowly and use caution. ➢ Don safety boots with skid / puncture resistant soles that comply with GES requirements.
2. Load/ Unload equipment to be decontaminated	<p>2a. Back/body sprain/strain from lifting, removing or carrying equipment /materials from vehicle / rig</p> <p>2b. Fractures/contusions to body due to contact with vehicle / drill rig.</p>	<p>2a. Determine whether the item must be lifted - can it be left in place or pushed/pulled into place?</p> <ul style="list-style-type: none"> ➢ Utilize 3-points of contact when getting into and out of vehicles / rig when removing equipment. ➢ Ensure path is level and clear of debris/obstacles. ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area. <p>2b. Ensure wheel chocks are used (front & back of each rear tire) and truck has parking break engaged.</p> <ul style="list-style-type: none"> ➢ Don high visible sleeved shirt or outerwear, such as high visible traffic vests or clothing.

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

3. Decontamination	<p>3a. Irritation or burns to the eyes or even blindness due to contact with decontamination material</p> <p>3b. Cuts, contusions or burns to the hands, arms or other body parts due to contact with high pressure water stream</p> <p>3c. Hearing loss caused by excessive noise during operation of pressure washer</p>	<p>3a. Avoid splashing when handling materials.</p> <ul style="list-style-type: none"> ➢ If handling chemicals, review SDS and understand signs/symptoms of exposure and first aid measures. ➢ Be conscious of changing wind direction and stand up-wind. Do not allow overspray to be directed out of the contamination area. ➢ Don safety glasses and be prepared to upgrade PPE to poly face shield or goggles, chemical resistance suit (Tyvek/Tychem) if there is a potential for splashing of the chemical to occur. <p>3b. Do not direct pressure washer stream towards hands or feet.</p> <ul style="list-style-type: none"> ➢ All staff not involved in the activity must remain 25 feet outside of work area ➢ Ensure all hoses / connection are secured and rated for pressure ➢ Wear leather or mechanic gloves and a face shield with safety glasses underneath. <p>3c. Create a 20 foot exclusion zone around the work area so that third parties are not exposed to hazardous noise levels.</p> <ul style="list-style-type: none"> ➢ Hearing protection should be worn if noise levels exceed 85 dBA or if noise level is unknown (e.g., measurement device is not available or has not been pre-determined) ➢ Don ear plugs and/or ear muffs. ➢ Double hearing protection (ear plugs and ear muffs) may be necessary if levels are found to be above 100 db.
4. Loading of Clean Equipment on to Support Vehicle	<p>4a. Back/body sprain/strain from lifting, carrying equipment /materials back on to rig / truck</p>	<p>4a. Ensure path is level and clear of debris/obstacles.</p> <ul style="list-style-type: none"> ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Augers shall be loaded onto a truck using a powered lift-gate. Mechanical means shall be the preferred method of loading equipment onto other vehicles. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area.
Site Specific Edits:		

Job Loss Analysis (JLA)

Page 1 of 3

JLA Title: Drilling/Deep Bedrock Drilling/Core Analysis

Date Developed: 3/17/2005	Revised Date: 1/4/2023	Revision #: 016 This JLA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JLA.									
REQUIRED PPE: <input type="checkbox"/> Air Purifying Respirator; <input type="checkbox"/> Ear Muffs; <input checked="" type="checkbox"/> Ear Plugs; <input type="checkbox"/> Face Shield; <input type="checkbox"/> Fire Retardant Clothing; <input checked="" type="checkbox"/> Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); <input type="checkbox"/> Goggles; <input checked="" type="checkbox"/> Hard Hat; <input checked="" type="checkbox"/> Safety Glasses; <input checked="" type="checkbox"/> Safety-toed Boots; <input checked="" type="checkbox"/> Shirt (Highly-Visible Short/Long Sleeve); <input type="checkbox"/> Tychem Suit; <input type="checkbox"/> Tyvek Suit; <input checked="" type="checkbox"/> Vest (Highly Visible Reflective Striped); Other: Enter other required PPE.											
TASK-SPECIFIC TOOLS AND EQUIPMENT: PID/ CGI, extra traffic control supplies											
<table border="1"> <thead> <tr> <th>Activity/Sequence of Job Tasks</th><th>Potential Hazards</th><th>Risk Control Measures</th></tr> </thead> <tbody> <tr> <td>A. Bedrock Drilling 1. Mobilizing to location, beginning drilling</td><td> <u>1a.</u> Cuts to hand or fingers as a result of being caught in moving/rotating parts of drill rig <u>1b.</u> Back/body sprain/strain from lifting, moving or carrying equipment /materials <u>1c.</u> Respiratory irritation/inflammation, headache, nausea, dizziness, caused by exposure to hazardous atmosphere. <u>1d.</u> Lacerations to skin/eyes that could result from contact with flying debris from drill rig <u>1e.</u> Hearing loss caused by excessive noise during operation of drill rig </td><td> <u>1a.</u> Do not place hands/fingers near moving/rotating parts of augers <ul style="list-style-type: none"> ➢ All equipment must be inspected prior to use to ensure all safety shut down switches are working. ➢ Have all bystanders keep a minimum of 3 feet away from moving/rotating parts ➢ Do not wear excessively loose, baggy clothing, or jewelry. Ensure long hair is tied back. ➢ Don leather gloves <u>1b.</u> Determine whether the item must be lifted - can it be left in place or pushed/pulled into place? <ul style="list-style-type: none"> ➢ Ensure path is level and clear of debris/obstacles. ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area. <u>1c.</u> Eliminate hazardous atmosphere by venting or degassing the area. <ul style="list-style-type: none"> ➢ Monitor work area with PID and comply with action levels document in HASP table 1. ➢ If hazardous atmosphere can't be eliminated with engineering controls, respirator upgrade may be necessary. ➢ Only those enrolled in a Medical Monitoring Program and with a current fit test (w/in past 12 months) may don a respirator. ➢ If respirator upgrade is required, contact office LHSO, Site Operations/Project Management before proceeding. <u>1d.</u> Be aware of high pressure air and/or water near the drill head. <ul style="list-style-type: none"> ➢ Ensure all equipment is inspected and all safeguards are working and in place (E-Stop, guards...). ➢ Ensure all non-essential personnel are 15 feet from operation of equipment. ➢ Be alert for rock dust near the coring unit. ➢ Don safety glasses, may have to upgrade to face shield. <u>1e.</u> Hearing protection should be worn if noise levels exceed 85 dBA or if noise level is unknown (e.g., measurement device is not available or has not been pre-determined) <ul style="list-style-type: none"> ➢ Create an exclusion zone around the work area so that third parties are not exposed to hazardous noise levels. ➢ Don ear plugs and/or ear muffs. ➢ Double hearing protection (ear plugs and ear muffs) may be necessary if levels are found to be above 100 db. </td></tr> <tr> <td>2. Collecting bedrock cores (if necessary)</td><td> <u>2a.</u> Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges on core <u>2b.</u> Cuts to hand or fingers as a result of being caught in moving/rotating parts of drill rig <u>2c.</u> Hand and arm fractures or contusions as a result of tripping and falling over </td><td> <u>2a.</u> Identify and (if possible) do not handle core that has sharp edges. <ul style="list-style-type: none"> ➢ Do not touch exposed surface of core unless you are wear gloves. ➢ Wear Kevlar™ cut-resistant gloves under nitrile gloves when handling core(s). <u>2b.</u> Do not place hands/fingers near moving/rotating parts of augers <ul style="list-style-type: none"> ➢ All equipment must be inspected prior to use to ensure all safety shut down switches are working. ➢ Have all bystanders keep a minimum of 3 feet away from moving/rotating parts ➢ Do not wear excessively loose, baggy clothing, or jewelry; Don leather gloves <u>2c.</u> Identify and remove any debris or non-essential equipment that is found in the work area to eliminate the tripping hazard. <ul style="list-style-type: none"> ➢ All tools, equipment of objects that may create a trip hazard must be placed in secured location or cleaned up and disposed of. </td></tr> </tbody> </table>			Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures	A. Bedrock Drilling 1. Mobilizing to location, beginning drilling	<u>1a.</u> Cuts to hand or fingers as a result of being caught in moving/rotating parts of drill rig <u>1b.</u> Back/body sprain/strain from lifting, moving or carrying equipment /materials <u>1c.</u> Respiratory irritation/inflammation, headache, nausea, dizziness, caused by exposure to hazardous atmosphere. <u>1d.</u> Lacerations to skin/eyes that could result from contact with flying debris from drill rig <u>1e.</u> Hearing loss caused by excessive noise during operation of drill rig	<u>1a.</u> Do not place hands/fingers near moving/rotating parts of augers <ul style="list-style-type: none"> ➢ All equipment must be inspected prior to use to ensure all safety shut down switches are working. ➢ Have all bystanders keep a minimum of 3 feet away from moving/rotating parts ➢ Do not wear excessively loose, baggy clothing, or jewelry. Ensure long hair is tied back. ➢ Don leather gloves <u>1b.</u> Determine whether the item must be lifted - can it be left in place or pushed/pulled into place? <ul style="list-style-type: none"> ➢ Ensure path is level and clear of debris/obstacles. ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area. <u>1c.</u> Eliminate hazardous atmosphere by venting or degassing the area. <ul style="list-style-type: none"> ➢ Monitor work area with PID and comply with action levels document in HASP table 1. ➢ If hazardous atmosphere can't be eliminated with engineering controls, respirator upgrade may be necessary. ➢ Only those enrolled in a Medical Monitoring Program and with a current fit test (w/in past 12 months) may don a respirator. ➢ If respirator upgrade is required, contact office LHSO, Site Operations/Project Management before proceeding. <u>1d.</u> Be aware of high pressure air and/or water near the drill head. <ul style="list-style-type: none"> ➢ Ensure all equipment is inspected and all safeguards are working and in place (E-Stop, guards...). ➢ Ensure all non-essential personnel are 15 feet from operation of equipment. ➢ Be alert for rock dust near the coring unit. ➢ Don safety glasses, may have to upgrade to face shield. <u>1e.</u> Hearing protection should be worn if noise levels exceed 85 dBA or if noise level is unknown (e.g., measurement device is not available or has not been pre-determined) <ul style="list-style-type: none"> ➢ Create an exclusion zone around the work area so that third parties are not exposed to hazardous noise levels. ➢ Don ear plugs and/or ear muffs. ➢ Double hearing protection (ear plugs and ear muffs) may be necessary if levels are found to be above 100 db. 	2. Collecting bedrock cores (if necessary)	<u>2a.</u> Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges on core <u>2b.</u> Cuts to hand or fingers as a result of being caught in moving/rotating parts of drill rig <u>2c.</u> Hand and arm fractures or contusions as a result of tripping and falling over	<u>2a.</u> Identify and (if possible) do not handle core that has sharp edges. <ul style="list-style-type: none"> ➢ Do not touch exposed surface of core unless you are wear gloves. ➢ Wear Kevlar™ cut-resistant gloves under nitrile gloves when handling core(s). <u>2b.</u> Do not place hands/fingers near moving/rotating parts of augers <ul style="list-style-type: none"> ➢ All equipment must be inspected prior to use to ensure all safety shut down switches are working. ➢ Have all bystanders keep a minimum of 3 feet away from moving/rotating parts ➢ Do not wear excessively loose, baggy clothing, or jewelry; Don leather gloves <u>2c.</u> Identify and remove any debris or non-essential equipment that is found in the work area to eliminate the tripping hazard. <ul style="list-style-type: none"> ➢ All tools, equipment of objects that may create a trip hazard must be placed in secured location or cleaned up and disposed of.
Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures									
A. Bedrock Drilling 1. Mobilizing to location, beginning drilling	<u>1a.</u> Cuts to hand or fingers as a result of being caught in moving/rotating parts of drill rig <u>1b.</u> Back/body sprain/strain from lifting, moving or carrying equipment /materials <u>1c.</u> Respiratory irritation/inflammation, headache, nausea, dizziness, caused by exposure to hazardous atmosphere. <u>1d.</u> Lacerations to skin/eyes that could result from contact with flying debris from drill rig <u>1e.</u> Hearing loss caused by excessive noise during operation of drill rig	<u>1a.</u> Do not place hands/fingers near moving/rotating parts of augers <ul style="list-style-type: none"> ➢ All equipment must be inspected prior to use to ensure all safety shut down switches are working. ➢ Have all bystanders keep a minimum of 3 feet away from moving/rotating parts ➢ Do not wear excessively loose, baggy clothing, or jewelry. Ensure long hair is tied back. ➢ Don leather gloves <u>1b.</u> Determine whether the item must be lifted - can it be left in place or pushed/pulled into place? <ul style="list-style-type: none"> ➢ Ensure path is level and clear of debris/obstacles. ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area. <u>1c.</u> Eliminate hazardous atmosphere by venting or degassing the area. <ul style="list-style-type: none"> ➢ Monitor work area with PID and comply with action levels document in HASP table 1. ➢ If hazardous atmosphere can't be eliminated with engineering controls, respirator upgrade may be necessary. ➢ Only those enrolled in a Medical Monitoring Program and with a current fit test (w/in past 12 months) may don a respirator. ➢ If respirator upgrade is required, contact office LHSO, Site Operations/Project Management before proceeding. <u>1d.</u> Be aware of high pressure air and/or water near the drill head. <ul style="list-style-type: none"> ➢ Ensure all equipment is inspected and all safeguards are working and in place (E-Stop, guards...). ➢ Ensure all non-essential personnel are 15 feet from operation of equipment. ➢ Be alert for rock dust near the coring unit. ➢ Don safety glasses, may have to upgrade to face shield. <u>1e.</u> Hearing protection should be worn if noise levels exceed 85 dBA or if noise level is unknown (e.g., measurement device is not available or has not been pre-determined) <ul style="list-style-type: none"> ➢ Create an exclusion zone around the work area so that third parties are not exposed to hazardous noise levels. ➢ Don ear plugs and/or ear muffs. ➢ Double hearing protection (ear plugs and ear muffs) may be necessary if levels are found to be above 100 db. 									
2. Collecting bedrock cores (if necessary)	<u>2a.</u> Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges on core <u>2b.</u> Cuts to hand or fingers as a result of being caught in moving/rotating parts of drill rig <u>2c.</u> Hand and arm fractures or contusions as a result of tripping and falling over	<u>2a.</u> Identify and (if possible) do not handle core that has sharp edges. <ul style="list-style-type: none"> ➢ Do not touch exposed surface of core unless you are wear gloves. ➢ Wear Kevlar™ cut-resistant gloves under nitrile gloves when handling core(s). <u>2b.</u> Do not place hands/fingers near moving/rotating parts of augers <ul style="list-style-type: none"> ➢ All equipment must be inspected prior to use to ensure all safety shut down switches are working. ➢ Have all bystanders keep a minimum of 3 feet away from moving/rotating parts ➢ Do not wear excessively loose, baggy clothing, or jewelry; Don leather gloves <u>2c.</u> Identify and remove any debris or non-essential equipment that is found in the work area to eliminate the tripping hazard. <ul style="list-style-type: none"> ➢ All tools, equipment of objects that may create a trip hazard must be placed in secured location or cleaned up and disposed of. 									

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

	equipment/debris remaining in work area	<ul style="list-style-type: none"> ➢ Wear safety boots with skid / puncture resistant soles that comply with GES requirements.
3. Stem/ Core removal	<p><u>3a.</u> Cuts to hand or fingers as a result of being caught in moving/rotating parts of drill rig</p> <p><u>3b.</u> Back/body sprain/strain from lifting, moving or carrying equipment /materials</p> <p><u>3c.</u> Lacerations to skin/ eyes that could result from contact with flying debris from drill rig</p> <p><u>3d.</u> Burns from a fire that occurs from faulty equipment or ignition of flammable vapors</p>	<p><u>3a.</u> Do not place hands/fingers near moving/rotating parts of augers</p> <ul style="list-style-type: none"> ➢ All equipment must be inspected prior to use to ensure all safety shut down switches are working. ➢ Have all bystanders keep a minimum of 3 feet away from moving/rotating parts ➢ Do not wear excessively loose, baggy clothing, or jewelry. ➢ Don leather gloves <p><u>3b.</u> Determine whether the item must be lifted - can it be left in place or pushed/pulled into place?</p> <ul style="list-style-type: none"> ➢ Ensure path is level and clear of debris/obstacles. ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area. <p><u>3c.</u> Be aware of high pressure air and/or water near the drill head.</p> <ul style="list-style-type: none"> ➢ Ensure all equipment is inspected and all safeguards are working and in place (E-Stop, guards...). ➢ Ensure all non-essential personnel are 15 feet from operation of equipment. ➢ Be alert for rock dust near the coring unit. ➢ Don safety glasses, may have to upgrade to face shield. <p><u>3d.</u> Place one 20-lb fire extinguisher within 10' of the drilling location</p> <ul style="list-style-type: none"> ➢ When welding steel casing together in borehole, the entire borehole is the hot work area. Options for managing are to erect a barrier to prevent sparks from travelling down borehole, perform stratified air monitoring down length of borehole before welding, inert borehole/add fresh ambient air to dilute any vapors present. ➢ Alternately, have driller bring threaded casing to site to eliminate the need for welding.
4. Core removal	<p><u>4a.</u> Back/body sprain/strain from lifting, moving or carrying cores</p> <p><u>4b.</u> Hand and arm fractures or contusions as a result of tripping and falling over equipment/debris remaining in work area</p> <p><u>4c.</u> Respiratory irritation/inflammation, headache, nausea, dizziness, caused by exposure to hydrocarbon vapor.</p>	<p><u>4a.</u> Ensure path is level and clear of debris/obstacles.</p> <ul style="list-style-type: none"> ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area. <p><u>4b.</u> Identify and remove any debris or non-essential equipment that is found in the work area to eliminate the tripping hazard.</p> <ul style="list-style-type: none"> ➢ All tools, equipment of objects that may create a trip hazard must be placed in secured location or cleaned up and disposed of. ➢ Wear safety boots with skid / puncture resistant soles that comply with GES requirements. <p><u>4c.</u> Eliminate hazardous atmosphere by venting or degassing the area.</p> <ul style="list-style-type: none"> ➢ Monitor work area with PID and comply with HASP action levels found in Table 1. ➢ If hazardous atmosphere can't be eliminated with engineering controls, respirator upgrade may be necessary. ➢ Only those enrolled in a Medical Monitoring Program and with a current fit test (w/i past 12 months) may don a respirator. ➢ If respirator upgrade is required, contact office LHSO, Site Operations/Project Management before proceeding.
C. Pressure Grouting 1. Grouting steel casing or PVC riser in place using a Tremie pipe	<u>1a.</u> Respiratory / skin irritation that could result from inhalation / contact with nuisance dust and grout.	<p><u>1a.</u> Avoid breathing grout dust by placing yourself upwind from the point where opening bags or mixing the grout is occurring.</p> <ul style="list-style-type: none"> ➢ Avoid skin/ eye contact with grout by not getting closer than 5-feet to where grout is being mixed/ used. ➢ Use safety glasses or goggles to minimize eye-grout contact. ➢ Wear a half-face APR with HEPA filter if needed for comfort.
On-site edits:		

Job Loss Analysis (JLA)

Page 1 of 2

JLA Title: Drum Removal (Mechanical) – Utilizing a Truck Mounted Lift Arm

Date Developed: 2/22/2005	Revised Date: 1/4/2023	Revision #: 010
Initial Development Team: Rich Brown, Tech Manager/ Mark Lancaster		
Latest Revision by: Kara Gioulis, RHSM		
Quality Review by: Mark Lancaster, RHSM		

REQUIRED PPE: Air Purifying Respirator; Ear Muffs; Ear Plugs; Face Shield; Fire Retardant Clothing; Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); Goggles; Hard Hat; Safety Glasses; Safety-toed Boots; Shirt (Highly-Visible Short/Long Sleeve); Tychem Suit; Tyvek Suit; Vest (Highly Visible Reflective Striped); **Other:** Enter other required PPE.

TASK-SPECIFIC TOOLS AND EQUIPMENT: Orange flags (direct vehicle traffic) and extra cones / flags (delineate area around lift arm)

Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures
A. Heavy Equipment 1. Inspecting of equipment (Lift Arm)	<p>1a. Fractures /contusions to body due to contact with moving vehicles.</p> <p>1b. Cuts to hand or fingers as a result of being caught in moving/ rotating parts of lift arm equipment</p>	<p>1a. Utilize cones/barricades/safety fence to establish the work zone – Comply with GES Traffic Control program.</p> <ul style="list-style-type: none"> ➢ Position work truck between work area and on-coming traffic. ➢ All staff not involved in the activity must remain 25 feet outside of work area ➢ Use "spotter" to warn personnel of approaching vehicles in high traffic areas. ➢ Don high visible sleeved shirt or outerwear, such as high visible traffic vests or clothing. <p>1b. Keep all body parts (fingers / hands / arms...) are 2 feet away from any moving parts.</p> <ul style="list-style-type: none"> ➢ Ensure lift arm and other equipment are inspected per manufacture requirements prior to begin drum lifting / removal. ➢ Inspect equipment for leaks and damaged components ➢ Ensure operator is trained and qualified to perform inspections. ➢ Don safety glasses, safety toe booths, hi-visible clothing and leather glove
B. Perform Loading Operations 1. Staging truck in area of drums	1a. Fractures /contusions to body due to contact with moving truck while moving to/from drum location.	<p>1a. Never back up truck without a spotter</p> <ul style="list-style-type: none"> ➢ If the need to redirect 3rd party traffic ensure traffic control plan is discussed and verify individuals (spotters) responsibilities. ➢ Spotters should not be within 15ft of truck during movement. ➢ Spotter and operator must remain in eye-contact and be aware of verbal / hand communications. ➢ Don hi-visible clothing.
2. Staging of drums and lift operations	<p>1a. Back/body sprain/strain from lifting, moving or carrying drums to staging area (onto lift arm)</p> <p>1b. Cuts to hand or fingers as a result of being caught between lift arm and drums</p>	<p>1a. Ensure path is level and clear of debris/obstacles.</p> <ul style="list-style-type: none"> ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area. ➢ When handling any items/materials or equipment don leather gloves. <p>1b. Operator will discuss with on-site staff areas of hazards and ensure no one places body parts in the identified area (lift arm, between drums, bed of truck (staging area) etc.</p> <ul style="list-style-type: none"> ➢ Do not place hands/fingers near any area between equipment (lift arm) and drums either during loading or unloading of drums. ➢ Do not wear excessively loose, baggy clothing, or jewelry. ➢ Don leather gloves.

3. Damage to overhead Utilities	<p><u>1a.</u> Electrocution/ shock due to contact with overhead energized electrical lines during lifting of drums.</p>	<p><u>1a.</u> All over head utilities will be identified prior to operating lift arm. Notify / contact energized line utility to 1) de-energize lines & certify such, 2) move line(s) or 3) drape energized lines with insulating curtain.</p> <ul style="list-style-type: none"> ➢ If voltage of overhead lines is < 50K maintain a minimum distance of 10ft between equipment and energized line(s). Add 4 inches to 10ft distance for increments of 10K in voltage. ➢ If voltage is unknown, maintain a minimum distance to energized line of 20 feet between equipment and energized line(s). ➢ Use "spotter" to observe equipment set up, ensuring no contact with overhead obstacles. ➢ All staff not performing the removal of drums will maintain a distance of 15ft, will not touch any equipment that may become energized (truck and lift arm), and will continue act as a spotter
4. Lifting / placing drums on to truck (elevated Loads)	<p><u>1a.</u> Fractures/ Contusions to head/torso as a result of being contacted by a falling drums</p>	<p><u>1a.</u> Maintain a 15 foot distance from elevated drums and all associated moving equipment</p> <ul style="list-style-type: none"> ➢ Do not walk under elevated drums; ensure drums are secure during movement; use a spotter when moving drums. ➢ Ensure designated spotter understands and complies with responsibilities (communication signals, location to stand...) ➢ No individual should be within 15ft of lift and no individual should ever attempt to guide drum during lift or stand in staging area of drum being moved (ground surface of truck bed). <p><i>Note: If any drums are filled with soil or any other material, the drum can only be filled to a maximum of two-thirds full</i></p>
<i>On-site edits:</i>		

Job Loss Analysis (JLA)

Page 1 of 2

JLA Title: Drum Removal using Lift gate

Date Developed: 2/23/2005 Revised Date: 1/4/2023		Revision #: 06 This JLA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JLA.
Initial Development Team: Chip Markovich, Staff Geologist / J. Pachy, RHSSE		
Latest Revision by: Basith Mohammed, Regional HSSE Manager		
Quality Review by: Tom Baylis, CIH; VP HSSE		
REQUIRED PPE: <input type="checkbox"/> Air Purifying Respirator; <input type="checkbox"/> Ear Muffs; <input checked="" type="checkbox"/> Ear Plugs; <input type="checkbox"/> Face Shield; <input type="checkbox"/> Fire Retardant Clothing; <input checked="" type="checkbox"/> Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); <input type="checkbox"/> Goggles; <input type="checkbox"/> Hard Hat; <input checked="" type="checkbox"/> Safety Glasses; <input checked="" type="checkbox"/> Safety-toed Boots; <input checked="" type="checkbox"/> Shirt (Highly-Visible Short/Long Sleeve); <input type="checkbox"/> Tychem Suit; <input type="checkbox"/> Tyvek Suit; <input type="checkbox"/> Vest (Highly Visible Reflective Striped); Other: Enter other required PPE.		
TASK-SPECIFIC TOOLS AND EQUIPMENT: Chain saw		
Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures
1. Work zone setup	<u>1a.</u> Fractures/ contusions to body due to contact with moving vehicles	<u>1a.</u> Utilize cones/barricades/safety fence to establish the work zone – Comply with GES Traffic Control program. <ul style="list-style-type: none"> ➤ Position work truck between work area and on-coming traffic. ➤ All staff not involved in the activity must remain 25 feet outside of work area ➤ Use "spotter" to warn personnel of approaching vehicles in high traffic areas. Don high visible sleeved shirt or outerwear, such as high visible traffic vests or clothing
2. Backing vehicle / equipment into work zone	<u>2a.</u> Fractures/ contusions to body due to contact with moving vehicles	<u>2a.</u> Never back up a vehicle without a spotter. <ul style="list-style-type: none"> ➤ Ensure spotter understand responsibilities (positioning, hand signals...). ➤ Ensure all non-essential personnel are 20 feet from vehicle movement. Note: If any drums are filled with soil or any material, the drum can only be filled a maximum of 2/3 full.
3. Moving drums	<u>3a.</u> Amputation, cuts, to fingers and hands as a result of being caught between truck and lift gate as well as between drums and dolly <u>3b.</u> Back/body sprain/strain from lifting, moving drums <u>3c.</u> Hand and arm fractures or contusions as a result of tripping and falling on uneven work area. <u>3d.</u> Fractures/ contusions to head/ torso/body as a	<u>3a.</u> Do not place any part of your body between vehicle parts or drums (i.e., bed of truck, stabilizing arms, etc.). <ul style="list-style-type: none"> ➤ Don safety glasses and leather gloves when handling <u>3b.</u> All drums must be moved by mechanical means (ie, drum dolly/cart) <ul style="list-style-type: none"> ➤ Utilize a buddy system to move drums in place for loading onto equipment ➤ When placing drums on dolly, do not twist at waist, move legs positioning drums. ➤ Wear leather gloves and when handling /moving drums. <u>3c.</u> Inspect the work area and look for uneven areas that may create a tripping hazard. Ensure travel path is clear. <u>3d.</u> Maintain a 20 foot distance from elevated drums and moving equipment. <ul style="list-style-type: none"> ➤ If drum becomes unstable let it fall do not attempt to "catch"

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

	result of contact with falling drums	
4. Elevate drums using lift gate/ equipment	4a. Cuts, contusions or crush to hands, arms, legs or body due to contact with falling material	<p>4a. Never stand/travel below elevated loads.</p> <ul style="list-style-type: none"> ➢ Maintain a 20 foot distance away from all associated equipment if you are not the load arm operator.
5. Placing drums onto truck	5a. Cuts, contusions or crush to hands, arms or other body parts due to contact with drums / truck	<p>5a. While loading vehicles, employ the use of a spotter to protect personnel working around heavy equipment.</p> <ul style="list-style-type: none"> ➢ Keep a distance of 20 feet away from the vehicle while acting as a spotter. ➢ Keep eye contact with the operator at all time. <p>Establish hand / verbal signals with the operator prior to moving the vehicle.</p>
<i>On-site edits:</i>		

Job Loss Analysis (JLA)

Page 1 of 2

JLA Title: Gauging Liquid Levels in Groundwater Monitoring Wells

Date Developed: 2/28/2005	Revised Date: 1/4/2023	Revision #: 017
Initial Development Team: Brian Brittain, Sr. Environ Tech/ Courtney Reese, PM		This JLA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JLA.
Latest Revision by: Mark Lancaster, RHSM		
Quality Review by: Tom Baylis, CIH; VP, HSSE		
REQUIRED PPE: <input type="checkbox"/> Air Purifying Respirator; <input type="checkbox"/> Ear Muffs; <input type="checkbox"/> Ear Plugs; <input type="checkbox"/> Face Shield; <input type="checkbox"/> Fire Retardant Clothing; <input checked="" type="checkbox"/> Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); <input type="checkbox"/> Goggles; <input type="checkbox"/> Hard Hat; <input checked="" type="checkbox"/> Safety Glasses; <input checked="" type="checkbox"/> Safety-toed Boots; <input checked="" type="checkbox"/> Shirt (Highly-Visible Short/Long Sleeve); <input type="checkbox"/> Tychem Suit; <input type="checkbox"/> Tyvek Suit; <input type="checkbox"/> Vest (Highly Visible Reflective Striped); Other: Enter other required PPE.		
TASK-SPECIFIC TOOLS AND EQUIPMENT: Click here to enter tools and equipment.		
Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures
A. Locate Wells 1. Locate Wells	<u>1a.</u> Hand and arm fractures or contusions as a result of tripping and falling when walking or working on uneven surfaces <u>1b.</u> Fractures/contusions to body due to contact with moving vehicles.	<u>1a.</u> Inspect the work area and look for uneven areas that may create a tripping hazard. <ul style="list-style-type: none"> ➢ Plan walking path through work area to avoid the uneven areas ➢ If the path of travel is obstructed (lighting, over growth, clutter...) utilize a walking stick and probe ahead, walk slowly and use caution. ➢ Don safety boots with skid / puncture resistant soles that comply with GES requirements. <u>1b.</u> Utilize cones/barricades/safety fence to establish the work zone – Comply with GES Traffic Control program. <ul style="list-style-type: none"> ➢ Position work vehicle between work area and on-coming traffic. ➢ Do not permit access to work zone by non-essential personnel. ➢ Inform facility personnel of work (restricted) area. ➢ Use "spotter" to warn personnel of approaching vehicles in high traffic areas. ➢ Don high visible sleeved shirt or outerwear, such as high visible traffic vests or clothing. ➢ If working alongside an active roadway, where vehicular traffic is heavy, dawn/dusk hours, or if weather is overcast or rainy, high visible outwear with reflective striping must be worn.
2. Inspect and Open Wells	<u>2a.</u> Skin punctures/bites from contact with debris/insects/animals inside well lid <u>2b.</u> Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of well, well lid or well box <u>2c.</u> Back/body sprain/strain from lifting, moving or carrying equipment/materials to well <u>2d.</u> Shoulder/muscle sprain resulting from using a socket wrench to loosen and remove bolts from the lid	<u>2a.</u> Visually inspect area around well lid for any signs of debris/insects/animals <ul style="list-style-type: none"> ➢ Clear any debris from around the well ➢ Remove lid towards you to allow any insects/animals to escape away from you ➢ Keep hands/arms away from well lid <u>2b.</u> Remove manhole covers so that they do not pinch fingers. <ul style="list-style-type: none"> ➢ Keep body parts (hands, fingers) out from between the lid and well opening. ➢ Use a crowbar/pry bar to remove the lid or cap ➢ Avoid kneeling or use kneeling pads when kneeling on hard and uneven surfaces. ➢ Don cut resistant gloves <u>2c.</u> Determine whether the item must be lifted - can it be left in place or pushed/pulled into place? <ul style="list-style-type: none"> ➢ Ensure path is level and clear of debris/obstacles. ➢ When lifting, bend at the knees, not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area <u>2d.</u> Ensure your wrists are straight when using a wrench. <ul style="list-style-type: none"> ➢ Be sure that the opening of the socket is in full contact with the bolt before you apply pressure. ➢ Pull, don't push/over-reach. Use a slow, steady motion. If the bolt cannot be loosened with normal force, contact office to discuss options. ➢ Kneel on a solid surface with one foot planted firmly on the floor – do not lean into the work. ➢ Don leather gloves. <p>Note: Never use hand sockets with power or impact wrenches. Replace sockets showing cracks or wear.</p>

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

	<p>2e. Abrasions/Cuts to hands from contact with ground surface while loosening bolts from the well lid or removing gripper plug</p>	<p>2e. Use extension or a deep well socket on socket wrench to increase hand placement/distance to ground surface.</p> <ul style="list-style-type: none"> ➢ Pull wrench to loosen bolts using a slow, steady motion ➢ Twist handle on top of gripper plug to flatten gasket and allow for easier removal ➢ Don Cut Resistant/Leather gloves
B. Conduct Liquid Gauging 1. Insert interface probe into well and record liquid level reading in site log book	<p>1a. Respiratory irritation/inflammation, headache, nausea, dizziness, caused by exposure to hazardous atmosphere.</p>	<p>1a. Discuss and implement monitoring and action levels requirements stated in the HASP</p> <ul style="list-style-type: none"> ➢ If organic vapors are present, replace the well cap and do not proceed until a PID is obtained to scan the atmosphere ensuring that concentrations are below 5 ppm. ➢ If respirator upgrade is required, contact PM, RHSSE/CHSSE before proceeding. <p>Note: Be aware that there may be elevated levels of gasoline or product vapors in the wells.</p>
C. Replace Well Plug and Cover	<p>1a. Fractures or cuts to the fingers when securing well plug into well casing.</p> <p>1b. Fractures or cuts fingers when replacing well cover over well.</p>	<p>1a. Grasp well plug from the top bringing it straight down onto the well casing.</p> <ul style="list-style-type: none"> ➢ Twist handle on top to flatten gasket and allow for easier insertion into the well ➢ Keep fingers away from the sides of the well plug and well casing while pushing down to secure it ➢ Ensure cut resistant gloves are donned <p>1b. Slide lid over well opening, keeping fingers away from opening</p> <ul style="list-style-type: none"> ➢ Use crowbar/pry bar to aide in placement of lid into annulus ➢ Keep fingers out from between the lid and annulus ➢ Ensure cut resistant gloves are donned
On-site edits:		

Job Safety Analysis (JSA)

Page 1 of 3

JLA Title: Geo-probing/Soil Sampling

Date Developed: 2/7/2005	Revised Date: 1/3/2023	Revision #: 018
Initial Development Team: Carl Farley, Jr. Driller / Bill Lovenberg, Geo-probe Manager		This JLA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JLA.
Latest Revision by: Mark Lancaster, Regional HSSE Manager		
Quality Review by: Tom Baylis, CIH; VP HSSE		
REQUIRED PPE: <input type="checkbox"/> Air Purifying Respirator; <input type="checkbox"/> Ear Muffs; <input checked="" type="checkbox"/> Ear Plugs; <input type="checkbox"/> Face Shield; <input type="checkbox"/> Fire Retardant Clothing; <input checked="" type="checkbox"/> Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); <input type="checkbox"/> Goggles; <input checked="" type="checkbox"/> Hard Hat; <input checked="" type="checkbox"/> Safety Glasses; <input checked="" type="checkbox"/> Safety-toed Boots; <input checked="" type="checkbox"/> Shirt (Highly-Visible Short/Long Sleeve); <input type="checkbox"/> Tychem Suit; <input type="checkbox"/> Tyvek Suit; <input checked="" type="checkbox"/> Vest (Highly Visible Reflective Striped); Other: Enter other required PPE.		
TASK-SPECIFIC TOOLS AND EQUIPMENT: Lockout/tag-out kit. Spill response kit/spill pad - used under hydraulic equipment when work activities occur on a permeable surface such as grass or gravel. Geo-Probe cutting tool.		
Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures
A. Lockout/Tag-out 1. Prior to Geo-probing ensure all subsurface electric utilities are Locked out	1a. Electrocution/shock due to contact with underground energized electrical lines.	<p>1a. Obtain up-to-date as-built plan to identify any subsurface utilities or obstructions.</p> <ul style="list-style-type: none"> ➢ To the extent possible, LO/TO all sources of electricity in the vicinity of the all subsurface work. ➢ Locate all sources of electricity to site features. ➢ Notify all affected employees on-site of the de-energized condition. ➢ Comply with all LOTO procedures and permits
B. Mobilize to probe/sampling Location 1. Setup Geo-probe and decontamination area for equipment	1a. Fractures /contusions due to contact with moving vehicles. 1b. Cuts, contusions or burns to the hands, arms or other body parts due to contact with high pressure water stream	<p>1a. Utilize cones/barricades/safety fence to establish the work zone – Comply with GES Traffic Control program.</p> <ul style="list-style-type: none"> ➢ Position work vehicle between work area and on-coming traffic. ➢ Do not permit access to work zone by non-essential personnel. ➢ Use "spotter" to warn personnel of approaching vehicles in high traffic areas. ➢ Don high visible sleeved shirt or outerwear, such as high visible traffic vests or clothing. ➢ If working alongside an active roadway, where vehicular traffic is heavy, dawn/dusk hours, or if weather is overcast or rainy, high visible outwear with reflective stripping must be worn. <p>1b. Do not direct pressure washer stream towards hands or feet.</p> <ul style="list-style-type: none"> ➢ All staff not involved in the activity must remain 25 feet outside of work area ➢ Ensure all hoses / connection are secured and rated for pressure ➢ Wear leather gloves and a face shield with safety glasses underneath.
2. Open/cut concrete, asphalt, or soil at soil sampling location	2a. Lacerations to skin/eyes that could result from contact with flying debris during saw cutting	<p>2a. Ensure individual is trained and complies with safe operations of equipment.</p> <ul style="list-style-type: none"> ➢ Ensure all equipment is inspected and all safeguards are working and in place (E-Stop, guards...). ➢ Ensure all non-essential personnel are 15 feet from operation of equipment. ➢ Don safety glasses; upgrade to face shield if flying debris.
3. Hand clear soil boring location to assure no underground improvements / utilities	3a. Back/body sprain/strain from conducting hand clearing activities	<p>3a. While operating the hand auger, be aware that it is easy to overexert yourself.</p> <ul style="list-style-type: none"> ➢ Hand clear slowly, do not force through soil; you may contact/break underground lines ("soft dig" technologies are strongly recommended). ➢ Ensure that the hand clearing creates a borehole clearance of at least 2 inches wider than the widest drilling tool. ➢ Use the strength in your upper arms to turn the hand auger; Do not to twist your upper body at the waist while using the auger. ➢ Add handle extensions as needed so that your back can remain straight and there is no need to bend your waist. ➢ Ensure handle extensions are at the height, for individual using auger, to prevent arms extending above shoulder height in order to prevent awkward body positioning and possible back strain. ➢ Keep your feet shoulder width apart for stability. ➢ Keep your face / head away from the handle of the auger. Should this tool break loose during use you will avoid injury. ➢ Non-essential individuals should remain clear of the auger handle length plus 1 foot away from where the auguring is occurring. <p>Note: This tool can cause damage to underground structures so it should never be advanced with excessive force! If you cannot turn the hand auger easily, stop and move to a new location</p>

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

<p>C. Soil Sampling</p> <p>1. Begin Geo-probing, soil boring</p>	<p>1a. Cuts to hand or fingers as a result of being caught in moving/rotating parts of Geo-probe</p> <p>1b. Respiratory irritation/inflammation, headache, nausea, dizziness, caused by exposure to hazardous atmosphere.</p> <p>1c. Irritation / burns to hand, arms and other body parts that result from skin contact with soil samples</p> <p>1a. Do not place hands/fingers near moving/rotating parts of Geo-probe</p> <ul style="list-style-type: none"> ➢ All equipment must be inspected prior to use to ensure all safety shut down switches are working. ➢ Have all bystanders keep a minimum of 3 feet away from moving/rotating parts ➢ Do not wear excessively loose, baggy clothing, or jewelry. Ensure long hair is tied back. ➢ Don leather or level 2 cut-resistant gloves <p>1b. Eliminate hazardous atmosphere by venting or degassing the area.</p> <ul style="list-style-type: none"> ➢ Monitor work area with PID and comply with action levels document in HASP table 1. ➢ If hazardous atmosphere can't be eliminated with engineering controls, respirator upgrade may be necessary. ➢ Only those enrolled in a Medical Monitoring Program and with a current fit test (w/in past 12 months) may don a respirator. ➢ If respirator upgrade is required, contact office RHSSE, Site Operations/Project Management before proceeding. <p>1c. Review SDS and understand signs/symptoms of exposure and first aid measures.</p> <ul style="list-style-type: none"> ➢ Don long sleeve shirt, long pants and chemical resistant gloves.
<p>2. Add rods during probe/sampling activities</p>	<p>1a. cuts to hand or fingers as a result of being caught in moving/ rotating parts of Geo-probe</p> <p>1b. Irritation / burns to hand, arms and other body parts that result from skin contact with soil samples</p> <p>1a. Do not place hands/fingers near moving/rotating parts of Geo-probe</p> <ul style="list-style-type: none"> ➢ All equipment must be inspected prior to use to ensure all safety shut down switches are working. ➢ Have all bystanders keep a minimum of 3 feet away from moving/rotating parts ➢ Do not wear excessively loose, baggy clothing, or jewelry. Ensure long hair is tied back. ➢ Don leather gloves <p>1b. Review SDS and understand signs/symptoms of exposure and first aid measures.</p> <ul style="list-style-type: none"> ➢ Don long sleeve shirt, long pants and chemical resistant gloves. .
<p>3. Collecting soil samples/ removal of acetate sleeve from direct-push sampler</p> <p>.</p> 	<p>2a. Hand and arm fractures or contusions as a result of tripping and falling over equipment/debris remaining in work area</p> <p>2b. Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of cutting tools, glassware, and acetate sleeve.</p> <p>2d. Back/body sprain/strain from excessive force while removing acetate sleeve</p> <p>2a. Identify and remove any debris or non-essential equipment that is found in the work area to eliminate the tripping hazard.</p> <ul style="list-style-type: none"> ➢ All tools, equipment of objects that may create a trip hazard must be placed in secured location or cleaned up and disposed of. ➢ Wear safety boots with skid / puncture resistant soles that comply with GES requirements. <p>2b. Use approved geo-probe liner cutting tool instead of retractable blade knife whenever cutting geo-probe liners.</p> <ul style="list-style-type: none"> ➢ When cutting geo-probe liners secure the liner in holder and pull geo-probe liner from one end to the other with both hands keeping all body parts out of the cutting path (line of fire of the cutting tool). ➢ Make sure blades are sharp and all guards are in place before starting a cut. Inspect the cutting equipment prior to start of cut. ➢ Pull cutting tool from one end to the other with both hands, keeping all body parts out of the cutting path. ➢ Have bystanders maintain a 3 foot distance from the cutting operation at all times. ➢ Inspect sample jars prior to handing to ensure that no cracks or other signs of breakage are present. If handling materials or equipment that has sharp edges, avoid contact with the material. ➢ Don Level II Cut Resistant Gloves. <p>NOTE: The use of utility and / or personal knives (i.e., Stanley knives, box cutters, pocket knives) is STRICTLY PROHIBITED</p> <p>2d. If the acetate sleeve cannot be removed by normal means, then the truck deck extruder will be used or the direct-push sampling device will be taken back to the shop for removal of the sleeve after the soil sample is removed.</p> <p>Note: Never attempt to remove the sleeve by using a pulling or jerking motion. This action could possibly cause a strain to occur. Also if a sleeve breaks off onto the end of the drive head, the drive head should be placed into a vice and needle nose pliers used to slowly remove the liner piece from the drive head.</p> <p>NOTE: Only a subcontractor, who has the training, are to perform cutting activities on an acetate liner.</p>
<p>On-site edits:</p>	

Job Loss Analysis (JLA)

Page 1 of 3

JLA Title: Groundwater Sampling - Bailer

Date Developed: 2/8/2005	Revised Date: 1/12/2023	Revision #: 014
Initial Development Team: Scott Martin, Case Manager Lilian Garcia, Associate Geologist		This JLA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JLA.
Latest Revision by: Kara Gioulis, RHSM		
Quality Review by: Tom Baylis, CIH; VP HSSE		
REQUIRED PPE: <input type="checkbox"/> Air Purifying Respirator; <input type="checkbox"/> Ear Muffs; <input type="checkbox"/> Ear Plugs; <input type="checkbox"/> Face Shield; <input type="checkbox"/> Fire Retardant Clothing; <input checked="" type="checkbox"/> Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); <input type="checkbox"/> Goggles; <input type="checkbox"/> Hard Hat; <input checked="" type="checkbox"/> Safety Glasses; <input checked="" type="checkbox"/> Safety-toed Boots; <input checked="" type="checkbox"/> Shirt (Highly-Visible Short/Long Sleeve); <input type="checkbox"/> Tychem Suit; <input type="checkbox"/> Tyvek Suit; <input checked="" type="checkbox"/> Vest (Highly Visible Reflective Striped); Other: Enter other required PPE.		
TASK-SPECIFIC TOOLS AND EQUIPMENT: Bailer		
Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures
A. Locate and Open Wells	<p>1. Locate wells</p> <p>1a. Hand and arm fractures or contusions as a result of tripping and falling over tools/equipment, or when walking or working on uneven surfaces</p> <p>1b. Fractures /contusions due to contact with moving vehicles.</p>	<p>1a. Inspect the work area and look for uneven areas that may create a tripping hazard.</p> <ul style="list-style-type: none"> ➢ Plan walking path through work area to avoid the uneven areas ➢ If the path of travel is obstructed (lighting, over growth, clutter...) utilize a walking stick and probe ahead, and walk slowly. ➢ Decide where tools and equipment will be stored, out of walking pathways – use the vehicle trunk/bed/tailgate when practical ➢ Take care to route cords & tubing via shortest route possible, and keep contained on spool or in bucket for deep wells ➢ Don safety boots with skid / puncture resistant soles that comply with GES requirements. <p>1b. Utilize cones/barricades/safety fence to establish the work zone – Comply with GES Traffic Control program.</p> <ul style="list-style-type: none"> ➢ Position work vehicle between work area and on-coming traffic. ➢ Do not permit access to work zone by non-essential personnel. ➢ Inform facility personnel of work (restricted) area. ➢ Use "spotter" to warn personnel of approaching vehicles in high traffic areas. ➢ Don high visible sleeved shirt or outerwear, such as high visible traffic vests or clothing. ➢ If working alongside an active roadway, where vehicular traffic is heavy, dawn/dusk hours, or if weather is overcast or rainy, high visible outwear with reflective striping must be worn.
2. Open wells	<p>2a. Cuts or contusions to the hands, fingers, and arms from contact with ground, sharp edges of well, well lid or well box. Skin punctures/bites from contact with insects/animals inside well lid</p> <p>2b. Back/body sprain/strain from lifting, moving well lids/covers</p> <p>2c. Shoulder/body sprain/ resulting from using a socket wrench to loosen and remove bolts from the lid</p> <p>2d. Cuts, contusions to knees or legs when kneeling on hard surfaces when opening well.</p>	<p>2a. Remove well / manhole covers so that they do not pinch fingers.</p> <ul style="list-style-type: none"> ➢ Keep body parts (hands, fingers) out from between the lid and well opening. ➢ Use a crowbar/ply bar to remove the lid or cap. ➢ Twist handle on top of gripper plug to flatten gasket and allow for easier removal ➢ Don Level II cut resistant gloves ➢ Visually inspect area around well lid for any signs of insects/animals ➢ Remove lid towards you to allow any insects/animals to escape away from you ➢ Keep hands/arms away from well lid <p>2b. Ensure path is level and clear of debris/obstacles.</p> <ul style="list-style-type: none"> ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area <p>2c. Ensure your wrists are straight when using a wrench.</p> <ul style="list-style-type: none"> ➢ Be sure that the opening of the socket is in full contact with the bolt before you apply pressure. ➢ Pull, don't push. Use a slow, steady motion. If the bolt cannot be loosened with normal force, contact office to discuss options. ➢ Kneel on a solid surface with one foot planted firmly on the floor and don't lean into the work. <p>Note: Never use hand sockets with power or impact wrenches. Replace sockets showing cracks or wear.</p> <p>2d. Inspect and eliminate any debris found on the ground prior to kneeling.</p> <ul style="list-style-type: none"> ➢ If possible, avoid kneeling on ground or hard surface instead crouch down bending at the knees. ➢ Use kneeling pads when kneeling on hard surfaces.

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

B. Conduct Liquid Gauging 1. Insert interface probe into well and record readings in site log book	<u>1a.</u> Respiratory or skin irritation/inflammation, headache, nausea, dizziness, caused by exposure to site contaminants / organic vapors	<u>1a.</u> Do not splash purged water on clothing or skin. ➢ Discuss and implement monitoring and action levels requirements stated in the HASP ➢ If organic vapors are present, replace the well cap and do not proceed until a PID is obtained to scan the atmosphere ensuring that concentrations are below the HASP action levels. ➢ If respirator upgrade is required, contact Project Management, RHSSE before proceeding. ➢ Don required PPE (safety glasses, long pants, nitrile sampling gloves, sleeved shirts). Note: Be aware that there may be elevated levels of gasoline or product vapors in the wells.
C. Purge Monitoring Well 1. Set up of equipment; insert bailer into monitoring well and purge water into container at surface	<u>1a.</u> Respiratory or skin irritation/inflammation, headache, nausea, dizziness, caused by exposure to site contaminants/ organic vapors. <u>1b.</u> Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of cutting tools while cutting bailer string <u>1c.</u> Back/body sprain / strain from bailing purge water <u>1d.</u> Back/body sprain / strain from lifting cooler other equipment	<u>1a.</u> Monitor work area with PID and comply with action levels document in HASP table 1 if organic vapors are present. ➢ Read and Comply with all requirements stated in the SDS/MSDS ➢ Do not splash purged water on clothing or skin. ➢ Don required PPE (safety glasses, long pants, nitrile sampling gloves over cut resistant gloves, sleeved shirts). <u>1b.</u> Ensure the cutting instrument(s) used are the approved tool for the job, ➢ Individual is trained on the safe usage and are equipped with "self-retracting" blades that CANNOT be overridden by the user (i.e. held out or locked open) or blades that are guarded and do not allow the blade to come in contact with the user. ➢ Ensure blades are sharp and all guards are in place before starting a cut. ➢ Inspect the cutting equipment prior to start of cut. ➢ Cut away from your body and keep hands out of the path of cutting tools. ➢ Don Kevlar Level II Cut Resistant Gloves under nitrile sampling gloves. NOTE: The use of utility and / or personal knives (i.e., Stanley knives, box cutters, pocket knives) is STRICTLY PROHIBITED <u>1c.</u> Take frequent breaks as needed to prevent fatigue to shoulder and arm muscles caused by bailing water. ➢ Be aware of the signs and symptoms of repetitive stress injuries and report all symptoms immediately <u>1d.</u> Determine whether the items must be lifted - can it be left in place or pushed/pulled into place? ➢ Ensure path is level and clear of debris/obstacles. ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area
D. Conduct Groundwater Sampling 1. Insert disposable bailer into monitoring well to collect water	<u>1a.</u> Irritation or burns to hand, arms and other body parts that result from skin contact with site contaminants	<u>1a.</u> Do not splash purged water on clothing or skin. ➢ Don required PPE (safety glasses, long pants, nitrile sampling gloves over cut resistant gloves, sleeved shirt)
2. Collect groundwater in sampling container	<u>2a.</u> Irritation or burns to eyes, hand, arms and other body parts that result from skin contact with site contaminants and preservatives <u>2b.</u> Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of glassware	<u>2a.</u> Do not splash purged water on clothing or skin. ➢ Sample preservative may have leaked from a container or multiple containers; sample preservatives consist of various types of acids that include HCL, HNO3, and H2SO4 – hand and skin protection is necessary ➢ Where handling preservatives, review SDS and understand signs/symptoms of exposure and first aid measures. ➢ Don PPE (safety glasses, long pants, nitrile sampling gloves, sleeved shirt) <u>2b.</u> Ensure glassware is free of sharp edges and is not broken prior to filling sample. ➢ If glassware is broken, discard. ➢ Ensure threads of vial do not contain small pieces of silt or sand. ➢ When securing cap on vial, do not over tighten or vial could break. ➢ Don nitrile sampling gloves over cut resistant gloves.
E. Decontamination 1. Soak/spray durable equipment to prevent cross-contamination	<u>1a.</u> Irritation or burns to hand, arms, eyes and other body parts that result from skin contact with decontamination materials	<u>1a.</u> Avoid splashing decontamination material or purge water on clothing or skin. ➢ When cleaning equipment do not spray decontamination material into the wind or near face/eyes. ➢ Don required PPE (safety glasses, long pants, nitrile sampling gloves over cut resistant gloves, sleeved shirt)

F. Replace Well Cap and Cover 1. Replace well cap and cover	<p>1a. Fractures or cuts to the fingers when securing well plug into well casing.</p> <p>1b. Fractures or cuts fingers when replacing well cover over well.</p>	<p>1a. Grasp well plug from the top bringing it straight down onto the well casing.</p> <ul style="list-style-type: none">➢ Twist handle on top to flatten gasket and allow for easier insertion into the well➢ Keep fingers away from the sides of the well plug and well casing while pushing down to secure it➢ Ensure cut resistant gloves are donned <p>1b. Slide lid over well opening, keeping fingers away from opening</p> <ul style="list-style-type: none">➢ Use crowbar/pry bar to aide in placement of lid into annulus➢ Keep fingers out from between the lid and annulus➢ Ensure cut resistant gloves are donned
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Job Loss Analysis (JLA)

Page 1 of 2

JLA Title: Groundwater Sampling – Powered Pumps

Date Developed: 2/8/2005	Revised Date: 9/25/2024	Revision #: 013
Initial Development Team: Scott Martin, Project Env Sci/ Valerie Wood, Project Env. Scientist		This JLA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JLA.
Latest Revision by: Kara Gioulis, RHSM		
Quality Review by: Tom Baylis, VP HSSE		
REQUIRED PPE: <input type="checkbox"/> Air Purifying Respirator; <input type="checkbox"/> Ear Muffs; <input type="checkbox"/> Ear Plugs; <input type="checkbox"/> Face Shield; <input type="checkbox"/> Fire Retardant Clothing; <input checked="" type="checkbox"/> Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); <input type="checkbox"/> Goggles; <input type="checkbox"/> Hard Hat; <input checked="" type="checkbox"/> Safety Glasses; <input checked="" type="checkbox"/> Safety-toed Boots; <input checked="" type="checkbox"/> Shirt (Highly-Visible Short/Long Sleeve); <input type="checkbox"/> Tychem Suit; <input type="checkbox"/> Tyvek Suit; <input checked="" type="checkbox"/> Vest (Highly Visible Reflective Striped); Other: Enter other required PPE.		
TASK-SPECIFIC TOOLS AND EQUIPMENT: LEL (to be used if within 35 feet of an ignition source); PID (if organic vapors are probable), Peristaltic/Monsoon/Whale pump		
Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures
A. Locate and Open Onsite Well 1. Set up Traffic Control and Inspect and Open/Close wells	<p>1a. Hand and arm fractures or contusions as a result of tripping and falling when walking or working on uneven surfaces</p> <p>1b. Fractures /contusions due to contact with moving vehicles.</p> <p>1c. Cuts or contusions to the hands, fingers, arms or other body parts due to contact with sharp edges of well, well lid or well box - Skin punctures/bites from contact with insects/animals inside well lid</p> <p>1d. Back/body sprain/strain from lifting, moving or carrying equipment /materials</p> <p>1e. Shoulder/body sprain/ from using a socket wrench to loosen and remove bolts from the lid</p> <p>1f. Cuts, contusions to knees or legs when kneeling on hard surfaces when opening well.</p>	<p>1a. Inspect the work area and look for uneven areas that may create a tripping hazard. Plan walking path through work area to avoid the uneven areas</p> <ul style="list-style-type: none"> ➢ If the path of travel is obstructed (lighting, over growth, clutter...), remove obstructions if possible, demarcate, utilize a walking stick and probe ahead, walk slowly and use caution. ➢ Don safety boots with skid / puncture resistant soles that comply with GES requirements. <p>1b. Utilize cones/barricades/safety fence to establish the work zone – Comply with GES Traffic Control program.</p> <ul style="list-style-type: none"> ➢ Position work vehicle between work area and on-coming traffic. ➢ Inform facility personnel of work (restricted) area. ➢ Use "spotter" to warn personnel of approaching vehicles in high traffic areas. ➢ Don high visible sleeved shirt or outerwear, such as high visible traffic vests or clothing. ➢ If working alongside an active roadway, where vehicular traffic is heavy, dawn/dusk hours, or if weather if overcast or rainy, high visible outwear with reflective striping must be worn. <p>1c. Remove well / manhole covers so that they do not pinch fingers.</p> <ul style="list-style-type: none"> ➢ Keep body parts (hands, fingers) out from between the lid and well opening. ➢ Use a crowbar or a pry bar to remove the lid or cap. ➢ Don leather gloves ➢ Visually inspect area around well lid for any signs of insects/animals. Remove lid towards you to allow any insects/animals to escape away from you. Keep hands/arms away from well lid <p>1d. Determine whether the item must be lifted - can it be left in place or pushed/pulled into place?</p> <ul style="list-style-type: none"> ➢ Ensure path is level and clear of debris/obstacles. ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area <p>1e. Ensure your wrists are straight when using a wrench.</p> <ul style="list-style-type: none"> ➢ Be sure that the opening of the socket is in full contact with the bolt before you apply pressure. ➢ Pull, don't push. Use a slow, steady motion. If the bolt cannot be loosened with normal force, contact office to discuss options. ➢ Kneel with knee protection on a solid surface with one foot planted firmly on the floor and don't lean into the work. <p>1f. Inspect and eliminate any debris found on the ground prior to kneeling.</p> <ul style="list-style-type: none"> ➢ If possible, avoid kneeling on ground or hard surface; instead crouch down bending at the knees. ➢ Use kneeling pads when kneeling on hard surfaces.
B. Conduct Liquid Gauging 1. Insert interface probe into well and record liquid level reading in site log book	1a. Respiratory or skin irritation/inflammation, headache, nausea, dizziness, caused by exposure to site contaminants / organic vapors	<p>1a. Do not splash purged water on clothing or skin.</p> <ul style="list-style-type: none"> ➢ Discuss and implement monitoring and action levels requirements stated in the HASP ➢ If organic vapors are present, replace the well cap and do not proceed until a PID is obtained to scan the atmosphere ensuring that concentrations are below 5 ppm. ➢ If respirator upgrade is required, contact CHSSE, Site Operations/Project Management before proceeding. ➢ Don nitrile sampling gloves

C. Purge Monitoring Well 1. Set up of equipment; insert tubing into monitoring well and purge water into approved container at surface	<p>1a. Respiratory/skin irritation/inflammation, headache, dizziness from exposure to purged water or hazardous atmosphere</p> <p>1b. Irritation or burns to hand, arms and other body parts that result from skin contact with battery (power purge pump)</p> <p>1c. Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of cutting tools, pieces of equipment,</p> <p>1d. Back/body sprain / strain while lifting/lowering pump into well.</p> <p>1e. Electrocution/ burns to hands/ skin resulting from contact with release of stored electrical energy. (battery / wiring)</p> <p>1f. Burns to hands/ arms or body due to fire that can result from the ignition of flammable vapors in the well.</p> <p>1h. Fractures/Contusions head due to contact of overhead hazards</p> <p>1a. Perform atmospheric monitoring and comply with action levels stated in the Site Specific HASP.</p> <ul style="list-style-type: none"> ➢ Before cutting tubing, ensure both ends are secured (i.e. by holding them) so the bottom portion doesn't 'snap back' after cutting, and splash purged water. <p>1b. Prior to carrying battery, inspect it to ensure that there is no visible leaking acid.</p> <ul style="list-style-type: none"> ➢ Recommended to place battery in a container to prevent acid from contacting personnel and equipment. <p>1c. Ensure the cutting instrument(s) used are the approved tool for cutting polyethylene tubing and are equipped with "self-retracting" blades that CANNOT be overridden by the user (i.e. held out or locked open) or blades that are guarded and do not allow the blade to come in contact with the user.</p> <ul style="list-style-type: none"> ➢ The use of utility and / or personal knives (i.e., Stanley knives, box cutters, pocket knives) is STRICTLY PROHIBITED. ➢ Keeping all body parts out of the cutting path (line of fire of the cutting tool). ➢ Inspect the cutting equipment prior to start of cut. ➢ Don Kevlar Level II Cut Resistant Gloves. <p>1d. Take frequent breaks as needed to prevent fatigue to shoulder and arm muscles caused by pulling pump.</p> <ul style="list-style-type: none"> ➢ Ensure path is level and clear of debris/obstacles. ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. <p>1e. If using an energy source to power and electric pump, refer to the owner's manual for setup procedures.</p> <ul style="list-style-type: none"> ➢ When using a battery (external or vehicle battery), make sure that the polarity is correct (i.e., positive to positive, etc.). ➢ Inspect the portable and or vehicle battery cables and leads - If the connection is loose, repair or replace the cord. ➢ Don safety boots and gloves that are electrically rated for task with electrical safety rating that comply with GES requirements. <p>1f. Eliminate/control ignition sources (i.e. no smoking, no hot work in unapproved/untested areas)</p> <ul style="list-style-type: none"> ➢ Relocate/protect combustible materials that are within 35' of work area and complete Hot Work Permit for qualifying activities ➢ Monitor with CGI/LEL meter to ensure LEL is below 10% if PID readings indicate potential for flammable atmosphere. ➢ Protect/cover pumps during heavy rain events (tarp, plastic bag, tonneau cover) to prevent water accumulation which could cause pump to malfunction, spark, and/or catch on fire ➢ Implement all Hot Work protocols including Fire Watch, monitoring area for 30 minutes, having two 20lb fire extinguishers located in immediate area if necessary. <p>Note: if purge water is added to 55 gallon drum ensure drum is inspected and secured. Note: Ensure all site drains (storm drains, catch basins...) are covered to prevent accidental spills.</p> <p>1h. A visual inspection of overhead tree branches and vegetation should be conducted prior to starting a job task; Suspicious or dead branches will need to be removed prior to performing the job task; Working in a wooded area during high winds should be avoided and re-evaluate conditions after a storm; Note: Recommend donning hard hat.</p>
D. Conduct Groundwater Sampling 1. Insert pump into monitoring well to collect water for sampling	<p>1a. Skin irritation or other health effects from exposure to site contaminants</p> <p>1a. Do not splash purged water on clothing or skin or release to grade.</p> <p>Take frequent breaks as needed to prevent fatigue to shoulder and arm muscles caused by bailing water.</p> <ul style="list-style-type: none"> ➢ Be aware of the signs and symptoms of repetitive stress injuries and report all symptoms immediately. ➢ If sample collection activity causes splashing, slow the sample collection process to prevent the loss of water. ➢ Don nitrile gloves and safety glasses.
2. Collect groundwater in sampling container	<p>2a. Irritation or burns to eyes, hand, arms and other body parts that result from skin contact with site contaminants and preservatives</p> <p>2b. Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of glassware</p> <p>2a. Do not splash purged water on clothing or skin.</p> <ul style="list-style-type: none"> ➢ Sample preservative may have leaked from a container or multiple containers; sample preservatives consist of various types of acids that include HCL, HNO3, and H2SO4 – hand and skin protection is necessary ➢ Where handling preservatives, review MSDS/SDS and understand signs/symptoms of exposure and first aid measures. ➢ Don safety glasses and nitrile sampling gloves. <p>2b. Ensure glassware is free of sharp edges and is not broken prior to filling sample.</p> <ul style="list-style-type: none"> ➢ If glassware is broken, discard. ➢ Ensure threads of vial do not contain small pieces of silt or sand. ➢ When securing cap on vial, do not over tighten or vial could break. ➢ Don Kevlar Level II Cut Resistant Gloves.
E. Decontamination 1. Soak/spray durable equipment to prevent cross-contamination between multiple well locations	<p>1a. Irritation or burns to hand, arms, eyes and other body parts that result from skin contact with decontamination materials</p> <p>1a. Avoid splashing decontamination material or purge water on clothing or skin.</p> <ul style="list-style-type: none"> ➢ When cleaning equipment do not spray decontamination material into the wind or near face/eyes. ➢ Don safety glasses and nitrile sampling gloves

Note: When using non-intrinsically safe pumps within 35 feet of a vapor source, within the critical zone as defined by client-specific protocols, or when there are noticeable gasoline vapor odors, the atmosphere must be tested with a combustible gas indicator so that it can be determined if the atmosphere contains less than 10% of the LEL. **Note:** Tie a rope or line to the pump that can be used to raise and lower pump from the well. Do not lower or raise the pump by pulling on the electrical feeds.

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

Job Loss Analysis (JLA)

Page 1 of 2

JLA Title: Hand Auger Use (Soil Sampling)

Date Developed: 2/8/2005	Revised Date: 1/4/2023	Revision #: 016 This JLA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JLA.									
REQUIRED PPE: <input type="checkbox"/> Air Purifying Respirator; <input type="checkbox"/> Ear Muffs; <input type="checkbox"/> Ear Plugs; <input type="checkbox"/> Face Shield; <input type="checkbox"/> Fire Retardant Clothing; <input checked="" type="checkbox"/> Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); <input type="checkbox"/> Goggles; <input type="checkbox"/> Hard Hat; <input checked="" type="checkbox"/> Safety Glasses; <input checked="" type="checkbox"/> Safety-toed Boots; <input checked="" type="checkbox"/> Shirt (Highly-Visible Short/Long Sleeve); <input type="checkbox"/> Tychem Suit; <input type="checkbox"/> Tyvek Suit; <input checked="" type="checkbox"/> Vest (Highly Visible Reflective Striped); Other: Enter other required PPE.											
TASK-SPECIFIC TOOLS AND EQUIPMENT: hand auger, PID, LEL											
<table border="1"> <thead> <tr> <th>Activity/Sequence of Job Tasks</th><th>Potential Hazards</th><th>Risk Control Measures</th></tr> </thead> <tbody> <tr> <td>A. Prepping surface area before use of Hand Auger to Collect/Clear Soil 1. Hand clear surface soil with spade or shovel.</td><td> <u>1a.</u> Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of spade shovel, splinters from handle or touching subsurface material <u>1b.</u> Back sprain/strain from repetitive use of the shovel </td><td> <u>1a.</u> If handling materials or equipment that have sharp edges; i.e. shovel, or subsurface materials, avoid contact with the material. ➤ Visually inspect area or object prior to handling. ➤ Wear Kevlar Level II Cut Resistant Gloves. <u>1b.</u> When performing any type of physical labor, individuals need to be sure not to strain/stress your body. Place feet shoulder width apart and maintain good balance. Do not twist body ➤ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➤ Take plenty of breaks to rest muscles and take in fluids. ➤ Ensure work area is free of hazards or confined area that may not allow full range of motion to maintain body positioning and technique. ➤ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/i 15' of work area. Warning: If any evidence of pea-stone or non-native material is observed during hand clearing, drilling, excavation, or any subsurface activity, all subsurface work must stop and the project manager and/or the senior office manager must be contacted immediately. </td></tr> <tr> <td>2. Use hand auger to collect soil samples</td><td> <u>2a.</u> Irritation burns, etc. that result from skin contact with site contaminants <u>2b.</u> Back sprain/ strain when using the hand auger </td><td> <u>2a.</u> Avoid contact with soil by using the hand auger slowly ➤ Wear sleeved shirt, long pants and chemical resistant gloves. <u>2b.</u> While operating the hand auger, be aware that it is easy to overexert yourself. <i>Be sure not to twist your upper body at the waist while using the auger. This motion can cause injury to your back.</i> ➤ Use the strength in your upper arms to turn the hand auger. ➤ Add handle extensions as needed so that your back can remain straight and there is no need to bend your waist and to ensure you are not over extending your shoulders too high or too low. ➤ Ensure handle extensions are at the height, for individual using auger, to prevent arms extending above shoulder height in order to prevent awkward body positioning and possible back strain. ➤ Keep your feet shoulder width apart for stability. ➤ Keep your face / head away from the handle of the auger. Should this tool break loose during use you will avoid injury. ➤ Individuals who are not involved in the work activity should remain clear of the auger handle length plus 1 foot away from where the augering is occurring. Note: This tool can cause damage to underground structures so it should never be advanced with excessive force! If you cannot turn the hand auger easily, stop and move to a new location </td></tr> </tbody> </table>			Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures	A. Prepping surface area before use of Hand Auger to Collect/Clear Soil 1. Hand clear surface soil with spade or shovel.	<u>1a.</u> Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of spade shovel, splinters from handle or touching subsurface material <u>1b.</u> Back sprain/strain from repetitive use of the shovel	<u>1a.</u> If handling materials or equipment that have sharp edges; i.e. shovel, or subsurface materials, avoid contact with the material. ➤ Visually inspect area or object prior to handling. ➤ Wear Kevlar Level II Cut Resistant Gloves. <u>1b.</u> When performing any type of physical labor, individuals need to be sure not to strain/stress your body. Place feet shoulder width apart and maintain good balance. Do not twist body ➤ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➤ Take plenty of breaks to rest muscles and take in fluids. ➤ Ensure work area is free of hazards or confined area that may not allow full range of motion to maintain body positioning and technique. ➤ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/i 15' of work area. Warning: If any evidence of pea-stone or non-native material is observed during hand clearing, drilling, excavation, or any subsurface activity, all subsurface work must stop and the project manager and/or the senior office manager must be contacted immediately.	2. Use hand auger to collect soil samples	<u>2a.</u> Irritation burns, etc. that result from skin contact with site contaminants <u>2b.</u> Back sprain/ strain when using the hand auger	<u>2a.</u> Avoid contact with soil by using the hand auger slowly ➤ Wear sleeved shirt, long pants and chemical resistant gloves. <u>2b.</u> While operating the hand auger, be aware that it is easy to overexert yourself. <i>Be sure not to twist your upper body at the waist while using the auger. This motion can cause injury to your back.</i> ➤ Use the strength in your upper arms to turn the hand auger. ➤ Add handle extensions as needed so that your back can remain straight and there is no need to bend your waist and to ensure you are not over extending your shoulders too high or too low. ➤ Ensure handle extensions are at the height, for individual using auger, to prevent arms extending above shoulder height in order to prevent awkward body positioning and possible back strain. ➤ Keep your feet shoulder width apart for stability. ➤ Keep your face / head away from the handle of the auger. Should this tool break loose during use you will avoid injury. ➤ Individuals who are not involved in the work activity should remain clear of the auger handle length plus 1 foot away from where the augering is occurring. Note: This tool can cause damage to underground structures so it should never be advanced with excessive force! 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Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures									
A. Prepping surface area before use of Hand Auger to Collect/Clear Soil 1. Hand clear surface soil with spade or shovel.	<u>1a.</u> Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of spade shovel, splinters from handle or touching subsurface material <u>1b.</u> Back sprain/strain from repetitive use of the shovel	<u>1a.</u> If handling materials or equipment that have sharp edges; i.e. shovel, or subsurface materials, avoid contact with the material. ➤ Visually inspect area or object prior to handling. ➤ Wear Kevlar Level II Cut Resistant Gloves. <u>1b.</u> When performing any type of physical labor, individuals need to be sure not to strain/stress your body. Place feet shoulder width apart and maintain good balance. Do not twist body ➤ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➤ Take plenty of breaks to rest muscles and take in fluids. ➤ Ensure work area is free of hazards or confined area that may not allow full range of motion to maintain body positioning and technique. ➤ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/i 15' of work area. Warning: If any evidence of pea-stone or non-native material is observed during hand clearing, drilling, excavation, or any subsurface activity, all subsurface work must stop and the project manager and/or the senior office manager must be contacted immediately.									
2. Use hand auger to collect soil samples	<u>2a.</u> Irritation burns, etc. that result from skin contact with site contaminants <u>2b.</u> Back sprain/ strain when using the hand auger	<u>2a.</u> Avoid contact with soil by using the hand auger slowly ➤ Wear sleeved shirt, long pants and chemical resistant gloves. <u>2b.</u> While operating the hand auger, be aware that it is easy to overexert yourself. <i>Be sure not to twist your upper body at the waist while using the auger. This motion can cause injury to your back.</i> ➤ Use the strength in your upper arms to turn the hand auger. ➤ Add handle extensions as needed so that your back can remain straight and there is no need to bend your waist and to ensure you are not over extending your shoulders too high or too low. ➤ Ensure handle extensions are at the height, for individual using auger, to prevent arms extending above shoulder height in order to prevent awkward body positioning and possible back strain. ➤ Keep your feet shoulder width apart for stability. ➤ Keep your face / head away from the handle of the auger. Should this tool break loose during use you will avoid injury. ➤ Individuals who are not involved in the work activity should remain clear of the auger handle length plus 1 foot away from where the augering is occurring. Note: This tool can cause damage to underground structures so it should never be advanced with excessive force! If you cannot turn the hand auger easily, stop and move to a new location									

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

	<p><u>2c.</u> Hand and arm fractures or contusions as a result of tripping and falling over debris remaining in work area or open boreholes or soil piles.</p>	<p><u>2c.</u> Set up cones and flags to identify trip hazards associated with boreholes/stockpile inside the work zone.</p> <ul style="list-style-type: none"> ➢ Complete or backfill an open borehole ASAP. ➢ Identify and remove any debris or non-essential equipment that is found in the work area to eliminate the tripping hazard. ➢ Wear safety toed boots with skid resistant soles that comply with GES requirements.
3. Sample and classify impacted soil	<p><u>3a.</u> Irritation burns, etc. that result from skin contact with site contaminants</p> <p><u>3b.</u> Cuts or contusions to the hands, arms or other body parts due to contact with sharp debris from the soil.</p> <p><u>3c.</u> Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of broken bottle glassware.</p>	<p><u>3a.</u> Use small trowel to transfer soil contents to container, do not use hands.</p> <ul style="list-style-type: none"> ➢ Wear sleeved shirt, long pants and chemical resistant gloves. <p><u>3b.</u> Inspect soils by using a small trowel to loosen compacted soil that may contain sharp debris.</p> <ul style="list-style-type: none"> ➢ Use a small trowel to take sample; do not take sample with hands. ➢ Wear Kevlar Level II Cut Resistant Gloves. <p><u>3c.</u> Inspect sample bottles prior to handling to ensure there are no cracks or areas that could fail.</p> <ul style="list-style-type: none"> ➢ Wear Kevlar Level II Cut Resistant Gloves.
<i>On-site edits:</i>		

Job Loss Analysis (JLA)

Page 1 of 2

JLA Title: Motor Vehicle Driving/Use

Date Developed: 9/15/2008	Revised Date: 2/6/2024	Revision #: 014
Initial Development Team: Jordan Wilcox, Jr. Env. Sci. / J. Pachy, RHSSE		This JLA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JLA.
Latest Revision by: Kara Gioulis, RHSO; Basith Mohammed, RHSSEM		
Quality Review by: Tom Baylis, VP HSSE		

REQUIRED PPE: Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); Hard Hat; Safety Glasses; Safety-toed Boots; Shirt (Highly-Visible Short/Long Sleeve); **Other:** Enter other required PPE.

TASK-SPECIFIC TOOLS AND EQUIPMENT: Fire extinguisher; First aid kit; Yellow flashing light; Roadside emergency kit

Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures
A. Conduct a pre-trip or pre-use inspection of the vehicle prior to driving as well as a vehicle walk around (360° inspection)	1a. Hand and arm fractures or contusions as a result of tripping and falling when walking or working on uneven surfaces	<p>1a. Inspect the work area and look for uneven areas that may create a tripping hazard.</p> <ul style="list-style-type: none"> ➢ Plan walking path through work area to avoid the uneven areas ➢ Remove any material or equipment from pathway prior to conducting inspection ➢ Don hi-visible clothing, safety glasses, add leather gloves / nitrile gloves if handling any part of vehicle
B. Driving 1. Driving to and from the site or while driving onsite.	1a. Fractures /contusions due to contact with moving vehicles due to traffic conditions or other vehicles 1b. Fractures /contusions due to contact with moving vehicles while driving onsite	<p>1a. Ensure driver is awake / alert prior to departing and that, if driving with passenger they remain awake and alert during driving.</p> <ul style="list-style-type: none"> ➢ Look ahead a minimum of 15 seconds to identify potential oncoming hazards. ➢ Maintain 4-second minimum following distance (increase distance due to weather conditions). ➢ Avoid focusing on any one object for more than 2 seconds. ➢ Scan the road, area around vehicle, and mirrors every 5-8 seconds. ➢ Stay out of other vehicles blind spots. ➢ Do not drive in clusters of traffic (i.e., adjust speed to give cushion between your vehicle and others). ➢ Utilize turn signals as required by law at all times ➢ Maintain speed; slower depending on road surface (e.g., dirt, concrete, asphalt, gravel). ➢ Drive posted speed limits (e.g., city, country roads, and highway). ➢ Do not tailgate vehicles in front of you. ➢ Pay attention for pedestrians. ➢ Check for and yield to emergency vehicles. ➢ Place two hands on steering wheel at 9 and 3 position. (or as steering wheel allows) ➢ Obey traffic signals. ➢ Use particular caution in construction zones. ➢ NOTE: All GES vehicles must be driven with low-beam head lights on. Also, Smoking is not permitted in GES vehicles. <p>1b. Ensure driver is awake / alert prior to departing and that, if driving with passenger they remain awake and alert during driving.</p> <ul style="list-style-type: none"> ➢ Drive slowly (less than 10 mph) while onsite and conduct the following: ➢ Pay attention for pedestrians. ➢ Check for and yield to emergency vehicles. ➢ Place two hands on steering wheel at 9 and 3 position (if applicable). ➢ Obey onsite signs or signals. ➢ Use particular caution near onsite work zone(s). ➢ When backing, use a spotter at all times and ensure that the pre-determined hand signals have been discussed during the tailgate meeting and implemented. ➢ Stay out of other vehicles blind spots. ➢ Make eye contact with other drivers and ensure they see you ➢ Seat belts must be worn by all occupants at all times while driving to and from the site and while driving onsite ➢ Cell phone usage and texting is not permitted at any time while driving. ➢ Prepare vehicle for weather conditions prior to departure. ➢ Snow/Ice <ul style="list-style-type: none"> ▪ Scrape snow/ice from entire vehicle (e.g., hood, roof, windows, etc.). ▪ Add extra weight to back of trucks to increase traction.

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

		<ul style="list-style-type: none"> ▪ Maintain speed for conditions. <p>➢ Fog <ul style="list-style-type: none"> ▪ Turn on fog lights. ▪ Maintain for conditions. </p> <p>➢ Rain <ul style="list-style-type: none"> ▪ Ensure windows are defogged prior to mobilization. ▪ Utilize windshield wipers in all rainy conditions. ▪ Consider alternative routes based on flooding potential of roadway. ▪ Maintain speed for conditions. </p> <p>1c. 3rd party injuries or accidents caused by unsecure equipment in truck bed</p> <p>1c. Inspect truck bed load.</p> <p>➢ Check coolers, drums, and toolboxes to make sure all lids, caps, and tops are latched and tightened.</p> <p>➢ Use ratchet-straps to secure load from shifting or falling from truck bed.</p> <p>➢ Close and lock tailgate before mobilizing to site.</p> <p>➢ Place light objects that could be blown out of truck bed in cab</p> <p>➢ Don safety glasses, leather gloves and hi-visible clothing when loading truck bed</p>
C. Parking and accessing vehicle	1a. Fractures /contusions due to contact with moving vehicles	<p>1a. Ensure driver is awake / alert prior to departing and that, if driving with passenger they remain awake and alert during driving.</p> <p>➢ Maneuver vehicle slowly within parking lot.</p> <p>➢ Ensure vehicle is legally parked.</p> <p>➢ Back into space (required on Terminal sites and Natural Gas well pads).</p> <p>➢ Ensure nothing is located at rear of vehicle prior to mobilization.</p> <p>➢ Get out and inspect space and vehicle if unsure of potential or unseen hazards.</p> <p>➢ For automatic transmissions: When parked, the vehicle must be placed into park and the emergency (parking brake applied).</p> <p>➢ For manual transmissions: the emergency brake must be applied and wheel chocks used to prevent the vehicle from rolling</p> <p>➢ Wheel chocks must be used for large vehicles when parked/positioned on uneven surfaces; front & back of each rear tire.</p> <p>➢ Wheel chocks must be used (front & back of each rear tire) on all vehicles working at the site/ vehicles with manual transmission parked on sloping surfaces</p> <p>➢ When parked and unhooked from a vehicle, trailers must have a wheel chock placed in front of and behind each rear wheel.</p> <p>➢ Place vehicle between yourself and traffic, when possible</p> <p>➢ Ensure vehicle cab and bed are locked before leaving the vehicle at the end of the task or day.</p>
1. Parking		
2. Accessing/working from vehicle	<p>2a. Pinch point between tailgate and truck bed</p> <p>2b. Cuts from contacting sharp edges on sides of open tailgate</p> <p>2c. Muscle strain/sprain from over-reaching over side of bed</p>	<p>2a. Do not place hands between truck bed and tailgate when opening or closing the tailgate</p> <p>2b. Be aware of sharp edges on sides of open tailgate; allow clearance when walking around vehicle</p> <p>2c. Avoid reaching over side of bed to retrieve or move items; instead, climb into bed (using 3 points of contact) to relocate items towards back of bed for easier retrieval</p>
On-site edits:		

Job Loss Analysis (JLA)

Page 1 of 2

JLA Title: MW Development Using Waterra/ Submersible Pump (Whale Pump)

Date Developed: 02/01/2005	Revised Date: 1/3/2023	Revision #: 011 This JLA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JLA.
Initial Development Team: Jaime Pena (Sr Env Tech) / Alfonso Munoz (Geo)		
Latest Revision by: Luke Side, Field Technician		
Quality Review by: Tom Baylis, VP HSSE		
REQUIRED PPE: <input type="checkbox"/> Air Purifying Respirator; <input type="checkbox"/> Ear Muffs; <input type="checkbox"/> Ear Plugs; <input type="checkbox"/> Face Shield; <input type="checkbox"/> Fire Retardant Clothing; <input checked="" type="checkbox"/> Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); <input type="checkbox"/> Goggles; <input type="checkbox"/> Hard Hat; <input checked="" type="checkbox"/> Safety Glasses; <input checked="" type="checkbox"/> Safety-toed Boots; <input checked="" type="checkbox"/> Shirt (Highly-Visible Short/Long Sleeve); <input type="checkbox"/> Tychem Suit; <input type="checkbox"/> Tyvek Suit; <input checked="" type="checkbox"/> Vest (Highly Visible Reflective Striped); Other: Enter other required PPE.		
TASK-SPECIFIC TOOLS AND EQUIPMENT: Sorbent sock/ pillows, LEL meter		
Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures
A. Locate and Open Onsite Wells 1. Inspect and open wells	<u>1a.</u> Fractures/contusions to hands/ fingers due to contact between well box edge and lid or plug <u>1b.</u> Back/waist strain that could result from lifting well lids.	<u>1a.</u> Avoid placing fingers/ hands between the well box/well lid and casing/gripper plug > Utilize crowbar or pry bar to remove well lids > Twist handle on top of gripper plug to flatten gasket and allow for easier removal > Don leather gloves for this task. <u>1b.</u> When lifting and removing covers, bend down at the knees and lift with your legs rather than bending and lifting with your back. Keep your back straight. Do not twist at waist. > If the object weighs more than 50lbs or is awkwardly-shaped; ask for assistance with the lift.
B. Well Development 1. Setup pump and check valve, tubing, ring, and generator	<u>1a.</u> Skin/respiratory tract irritation due to exposure to hydrocarbons in well. <u>1b.</u> Fractures/contusions to hands/ arms/ legs/ torsos as a result from slipping/tripping and falling over material. <u>1c.</u> Chemical burns to skin that could result from contact with acid from battery used to power purge pump. <u>1d.</u> Fractures/contusions to hands/ fingers due to being caught between two surfaces or exposure to sharp edges/ burrs <u>1e.</u> Burns to skin that could result from the ignition of flammable vapors <u>1f.</u> Shock from contact with battery terminals and clips when connecting to batteries.	<u>1a.</u> Avoid splashing of water or well material by slowly inserting tubing into well. > Don safety glasses/ long pants/ long-sleeved shirt/ leather palm gloves/, steel-toed boots. <u>1b.</u> Keep tools/ equipment in their storage areas when not in use. > Setup work area to minimize the number of hoses/ equipment positioned in walk-ways. > Identify and remove slip/ trip/ fall/ hazards in proposed walking path prior to transiting. <u>1c.</u> Prior to lifting and carrying battery from GES vehicle to sample location; inspect the battery to ensure that there is no visible sign of leaking acid. > It is recommended that the battery be placed and carried to location in a carrying container that would prevent acid from contacting personnel and equipment. > Don leather work gloves with latex gloves underneath. <u>1d.</u> Do not place fingers or hands in between lids and compartments or surfaces where they could get pinched. > Don leather work gloves. <u>1e.</u> The potential for spark generation should be considered when using alligator clips and powering off of a battery. > Ensure that the LEL reading does not exceed 10% of the LEL or that flammable vapors are not present in the area, prior to attaching the leads. > Hotwork Permit shall be filled out. Note: When using non-intrinsically safe pumps within 35 feet of a vapor source (i.e. whale pump for well development), within the critical zone as defined by client-specific protocols, or when there are noticeable gasoline vapor odors, the atmosphere must be tested with a combustible gas indicator so that it can be determined if the atmosphere contains less than 10% of the LEL. <u>1f.</u> When connecting to terminals, hold clips in area in back and not near the grasping part of the clip
2. Operate generator, pump, during well screen flush.	<u>2a.</u> Back/shoulder or muscular strain due to repetitive motion while operating pump <u>2b.</u> Skin/ eye irritation due to contact with contaminated groundwater. <u>2c.</u> Fractures/contusions to hands/ arms/ legs/ torso due to	<u>2a.</u> Take frequent breaks as needed to prevent fatigue to shoulder and arm muscles caused by bailing water. > Watch for signs/ symptoms of repetitive motion stress injuries and report all symptoms immediately. > Pace rate of bailing to reduce stress to shoulder/ arm. <u>2b.</u> direct groundwater away from work area. > Don safety glasses / nitrile gloves and long-sleeved shirt. <u>2c.</u> Immediately clean up spilled groundwater using spill pillows or socks to contain any release or impacted water spill. > Do not step or walk through puddles or other areas where there is evidence of spilled liquids.

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

	slipping on spilled groundwater and falling.	
3. Remove piping from well	<p><u>3a.</u> Skin irritation due to exposure to dissolved contaminants in groundwater splashed onto skin during piping removal activities.</p> <p><u>3b.</u> Back/waist strain that could result from lifting piping from well casing.</p>	<p><u>3a.</u> Remove piping slowly to minimize splashing of groundwater.</p> <ul style="list-style-type: none"> ➢ Don safety glasses/ nitrile gloves and long-sleeved shirt. <p><u>3b.</u> Bend down at the knees and lift with your legs rather than bending and lifting with your back.</p> <ul style="list-style-type: none"> ➢ Keep your back straight and do not twist at waist. ➢ Keep the object being lifted close to the body while lifting. If the object weighs more than 50 lbs or is awkwardly shaped; ask for assistance with the lift.
C. Decontamination 1. Decontaminate durable equipment (pump/ piping/ etc.)	<u>1a.</u> Skin/ eye irritation due to contact with decontamination chemicals.	<p><u>1a.</u> Avoid contact with all decontamination chemicals including Liquinox, Simple Green, Methanol and any other solvents used on sampling equipment.</p> <ul style="list-style-type: none"> ➢ Don safety glasses/ long pants/ long-sleeved shirt/ steel-toed boots/ nitrile gloves.
2. Replace well cap and cover	<u>2a</u> Fractures/abrasions to finger/ hands due to placing between well lid/well rim or plug, or on sharp edges/ burrs	<p><u>2a.</u> Avoid placing fingers/ hands between the well box/well lid and casing/gripper plug</p> <ul style="list-style-type: none"> ➢ Twist handle on top to flatten gasket and allow for easier insertion into the well ➢ Keep fingers away from the sides of the well plug and well casing while pushing down to secure it ➢ Don leather gloves for this task.
On-site edits:		

Job Loss Analysis (JLA)

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JLA Title: Offsite and OnSite Clearing of Overgrowth (Vegetation)

Date Developed: 9/15/2008	Revised Date: 1/5/2023	Revision #: 013
Initial Development Team: Phil Tidd, Tech. Serv. Super. / Kyle Slabik, RHSO		This JLA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JLA.
Latest Revision by: Basith Mohammed, RHSSE Manager		
Quality Review by: Tom Baylis, CIH; VP HSSE		

REQUIRED PPE: Air Purifying Respirator; Ear Muffs; Ear Plugs; Face Shield; Fire Retardant Clothing; Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); Goggles; Hard

Hat; Safety Glasses; Safety-toed Boots; Shirt (Highly-Visible Short/Long Sleeve); Tychem Suit; Tyvek Suit; Vest (Highly Visible Reflective Striped); **Other:** Enter other required PPE.

TASK-SPECIFIC TOOLS AND EQUIPMENT:

Cutting / gardening tools, Face shield, chaps or insect repellant as necessary

Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures
1. Preparation and use of hand held gardening tool	<p>1a. Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of gardening tools</p> <p>1b. Hand and arm fractures or contusions as a result of tripping and falling when walking or working on uneven surfaces/overgrowth</p> <p>1c. Back/body sprain/strain from overexertion while using tool</p> <p>1d. Skin irritation/anaphylactic shock that could result from bites or stings from poisonous insects.</p> <p>1e. Lacerations/ punctures to the skin that could result from bite/ attack by wild or domestic animal</p>	<p>1a. Make sure blades are sharp and all guards are in place before starting a cut.</p> <ul style="list-style-type: none"> ➢ Ensure individual is trained to use tools required to perform overgrowth removal. ➢ Inspect the cutting equipment prior to start of cut. ➢ Pick up tool from handle end only. ➢ Keep sharp end of tool down when not in use or traveling with. ➢ Cut away from your body and keep hands out of the path of cutting tools. ➢ Have bystanders maintain a 3 foot distance from the cutting operation at all times. ➢ Don cut resistant gloves to avoid contact with sharp edges of cutting blade(s) <p>Note: Inspect vegetation to ensure it is not poisonous. Also, RoundUp or other products may be utilized to remove/kill vegetation.</p> <p>1b. Inspect the work area and look for uneven areas that may create a tripping hazard.</p> <ul style="list-style-type: none"> ➢ Plan walking path through work area to avoid the uneven areas ➢ If the path of travel is obstructed (lighting, over growth, clutter...) utilize a walking stick and probe ahead, walk slowly and use caution. ➢ If necessary to work off ladder greater than 6 feet, consult CHSSE. ➢ Don safety boots with skid / puncture resistant soles that comply with GES requirements. <p>1c. Determine required tool for task (i.e., able to cut through vegetation).</p> <ul style="list-style-type: none"> ➢ Maintain a body position when using tools that includes feet shoulder length apart; hold tool at chest height, keeping tool in front of you). ➢ Take breaks as designated during tailgate meeting (consider hot or inclement weather conditions). ➢ For sites requiring extended periods of time to clear overgrowth extend the breaks. <p>Note: The use of utility, pocket, box cutting and Stanley knives are STRICTLY PROHIBITED. This includes machetes.</p> <p>1d. Spray wasp/ hornet nests with insect repellent from a distance recommended by the manufacturer. Determine size and location of nest as professionals may have to be consulted.</p> <ul style="list-style-type: none"> ➢ Utilizing insect repellent with DEET is strongly recommended. ➢ Do not spray your skin directly. ➢ Perform daily tick check, If ticks are found on the skin remove per GES protocol, and upgrade skin protection ➢ Don long sleeve shirt, long pants with socks pulled over legs to reduce the likelihood of ticks contacting the skin. <p>1e. Identify wild animals (i.e. raccoons/ skunks/ feral cats/ snakes) in the vicinity of the work area.</p> <ul style="list-style-type: none"> ➢ Do not approach/ antagonize wild animals identified. ➢ Do not attempt to pet domestic animals and ensure all animals are secured from work zone. ➢ Don long sleeve shirt and leather gloves to minimize potential for bites to skin. ➢ Don snake chaps to prevent snake bites to shins.

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

	<p>1f. Heat stress or cold stress symptoms as a result of adverse weather conditions (extreme heat / cold, snow, rain, wind...)</p> <p>1g. Skin irritation / allergic reaction that could result from contact with poisonous plants.</p> <p>1h. Fractures/Contusions to torso / head due to contact of overhead hazards</p> <p>1f. Ensure weather forecast is monitored in field and in office.</p> <ul style="list-style-type: none"> ➢ During "suspected" weather concerns weather should be monitored at pre-determined time interval ➢ Review GES policy on severe weather (type, actions to take (shelter and first aid) and communications) ➢ Have a severe weather plan in place (located in HASP or JLA) and discuss throughout day as weather changes ➢ Staff, knowing seasonally weather conditions, should have required PPE and clothing (coats, hats, rain gear, extra dry clothing, sun screen...) <p>1g. Eliminate poison plants (i.e. poison ivy) by spraying area</p> <ul style="list-style-type: none"> ➢ Identify poisonous plants, such as poison ivy and poison oak. ➢ Wash hands and arms immediately with soap and water if skin contacts with poisonous plants occur. ➢ Do not approach or traverse areas where poisonous plants have been identified. ➢ Apply an over-the-counter barrier cream such as Ivy Block® to prevent poisonous plant oils contacting the skin. ➢ Don long pants with socks pulled over legs to prevent skin contact with plants. ➢ Don long sleeve shirt or Tyvek suit to minimize skin expose to plants. <p>1h. Inspect work area for any overhead hazards including overhead utilities and overhead trees and vegetation.</p> <ul style="list-style-type: none"> ➢ A visual inspection of overhead tree branches and vegetation should be conducted prior to starting a job task. ➢ Suspicious or dead branches will need to be removed prior to performing the job task. ➢ Working in a wooded area during high winds should be avoided and re-evaluate conditions after a storm. ➢ Don hard hat, safety glasses, leather gloves, hi-visible clothing and safety boots.
<i>On-site edits:</i>	

Job Loss Analysis (JLA)

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JLA Title: Packer Test

Date Developed: 3/13/2006 Revised Date: 1/5/2023		Revision #: 014 This JLA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JLA.
REQUIRED PPE: <input type="checkbox"/> Air Purifying Respirator; <input type="checkbox"/> Ear Muffs; <input type="checkbox"/> Ear Plugs; <input type="checkbox"/> Face Shield; <input type="checkbox"/> Fire Retardant Clothing; <input checked="" type="checkbox"/> Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); <input type="checkbox"/> Goggles; <input type="checkbox"/> Hard Hat; <input checked="" type="checkbox"/> Safety Glasses; <input checked="" type="checkbox"/> Safety-toed Boots; <input checked="" type="checkbox"/> Shirt (Highly-Visible Short/Long Sleeve); <input type="checkbox"/> Tychem Suit; <input type="checkbox"/> Tyvek Suit; <input type="checkbox"/> Vest (Highly Visible Reflective Striped); Other: Enter other required PPE.		
TASK-SPECIFIC TOOLS AND EQUIPMENT: Transducer, packers, or pump; Absorbent material; PID		
Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures
A. Mobilize to Location and Complete Work 1. Remove lock and protective cap from well	<u>1a.</u> Skin irritation/anaphylactic shock due to bites or stings from poisonous insects. <u>1b.</u> Respiratory irritation/inflammation, headache, nausea, dizziness, due to exposure to organic vapors <u>1c.</u> Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of well, well lid or well box	<u>1a.</u> Visually inspect and carefully open any outside enclosures that insects and small animals could potentially enter. <ul style="list-style-type: none"> ➢ Identify any wasp/hornet nests. ➢ Do not approach any wasp/ hornet nests identified. ➢ Don long sleeve shirt, long pants with socks pulled over legs to reduce the likelihood of ticks contacting the skin. ➢ Utilizing insect repellent with DEET is strongly recommended, follow package directions for application. <u>1b.</u> Eliminate hazardous atmosphere by venting or degassing the area. <ul style="list-style-type: none"> ➢ Monitor work area with PID and comply with HASP action levels. Note: HASP action levels are based on benzene in gasoline; other contaminants will require different action levels - consult CHSSE for guidance. ➢ If hazardous atmosphere can't be eliminated with engineering controls, respirator upgrade may be necessary. <input type="checkbox"/> Only those enrolled in a Medical Monitoring Program and with a current fit test (w/i past 12 months) may don a respirator. ➢ If respirator upgrade is required, contact CHSSE, Site Operations/Project Management before proceeding. <p><i>Note: Be aware that there may be elevated levels of gasoline or product vapors in the wells.</i></p> <u>1c.</u> Remove manhole covers so that they do not pinch fingers. <ul style="list-style-type: none"> ➢ Keep body parts (hands, fingers) out from between the lid and well opening. ➢ Use a crowbar/prybar to remove the lid or cap. ➢ Use kneeling pads when kneeling on hard surfaces. ➢ Don leather gloves.
2. Set up of truck mounted boom / jib crane and set up decontamination area for equipment	<u>2a.</u> Electrocution/shock due to contact with overhead energized electrical lines. <u>2b.</u> Hand and arm fractures or contusions due to tripping and falling over equipment/ debris remaining in work area	<u>2a.</u> Notify / contact energized line utility to 1) de-energize lines & certify such, 2) move line(s) or 3) drape energized lines with insulating curtain. <ul style="list-style-type: none"> ➢ If voltage is < 50K maintain a minimum distance of 10ft between equipment and energized line(s). Add 4 inches to 10ft distance for increments of 10K in voltage. ➢ If voltage is unknown, maintain a minimum distance to energized line of 20 feet between equipment and energized line(s). ➢ Ensure truck (boom / jib crane) is leveled and on smooth surface ➢ Use "spotter" to observe equipment set up, ensuring no contact with overhead obstacles. <u>2b.</u> Identify and remove any debris or non-essential equipment that is found in the work area to eliminate the tripping hazard. <ul style="list-style-type: none"> ➢ All tools, equipment or objects that may create a trip hazard must be placed in secured location or cleaned up and disposed of. ➢ Wear safety boots with skid / puncture resistant soles that comply with GES requirements.
3. Introduce transducer, packer(s), and/or pump into well to change water level elevation and collect readings	<u>3a.</u> Back/body sprain/strain from lifting, moving or utilizing equipment	<u>3a.</u> When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. <ul style="list-style-type: none"> ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area.

4. Begin purging interval	<p>4a. Respiratory irritation/inflammation, headache, nausea, dizziness, caused by expose to organic vapor</p> <p>4b. Electrocution/ burns to hands/ skin resulting from contact with pump</p> <p>4c. Hand and arm fractures or contusions due to tripping and falling over cords/ piping</p>	<p>4a. Eliminate hazardous atmosphere by venting or degassing the area.</p> <ul style="list-style-type: none"> ➢ Monitor work area with PID and comply with HASP action levels. Note: HASP action levels are based on benzene in gasoline; other contaminants will require different actions levels - consult CHSSE for guidance. ➢ If hazardous atmosphere can't be eliminated with engineering controls, respirator upgrade may be necessary. <input type="checkbox"/> Only those enrolled in a Medical Monitoring Program and with a current fit test (w/i past 12 months) may don a respirator. ➢ If respirator upgrade is required, contact CHSSE, Site Operations/Project Management before proceeding. <p>4b. If using an energy source to power an electric pump, refer to the owner's manual for setup procedures.</p> <ul style="list-style-type: none"> ➢ When using a battery, make sure that the polarity is correct (i.e., positive to positive contact, etc.) ➢ If the connection is loose, repair or replace the cord. <p>4c. Identify and remove any debris or non-essential equipment that is found in the work area to eliminate the tripping hazard.</p> <ul style="list-style-type: none"> ➢ All cords and piping or objects that may create a trip hazard must be placed in secured location or cleaned up and disposed of. <p>Note: Inflatate packers, pump purge water into approved container at surface, monitor for recharge</p>
5. If needed, collect groundwater in sampling container	<p>5a. Irritation or burns to hand, arms and other body parts that result from skin contact with site contaminants</p> <p>5b. Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of glassware</p>	<p>5a. If handling chemicals, review MSDS/SDS and understand signs/symptoms of exposure and first aid measures.</p> <ul style="list-style-type: none"> ➢ Avoid contact with preservatives; these are commonly corrosive and can burn the skin/eyes on contact. ➢ Flush skin/eyes with water if contact is made ➢ Wear Kevlar cut resistant gloves underneath of nitrile gloves ➢ Don long sleeve shirt, long pants and chemical resistant gloves. <p>5b. Inspect cooler and all glassware prior to handling.</p> <ul style="list-style-type: none"> ➢ Don cut resistant gloves beneath disposable sampling gloves when handling glassware.
B. Decontamination of Packers and Pump Tools 1. Retrieve transducer, packer(s), and/or pump from well	1a. Back/body sprain/strain from lifting, removing or carrying transducer	<p>1a. Determine whether the item must be lifted - can it be left in place or pushed/pulled into place?</p> <ul style="list-style-type: none"> ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist when lowering transducer into well. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area. ➢ Don leather gloves or nitrile over cut resistant gloves.
2. Soak/spray durable equipment to prevent cross contamination between multiple well locations; store disposable equipment	<p>2a. Irritation or burns to hand, arms and other body parts due to skin contact with site contaminants</p> <p>2b. Back/body sprain/strain from lifting, moving or carrying equipment /materials (butts up/twist and shout)</p>	<p>2a. If handling chemicals, review MSDS/SDS and understand signs/symptoms of exposure and first aid measures.</p> <ul style="list-style-type: none"> ➢ Avoid contact with all decontamination chemicals including Liquinox and any other soaps or solvents used on drilling equipment ➢ Flush skin/eyes with water if contact is made ➢ Do not spray your face/body with water. ➢ If using a hot water/pressure beware of high temperature water can cause burns. Do not touch hot surface of the equipment ➢ PPE (e.g., eye protection, long pants, nitrile gloves over Kevlar gloves, shirt with sleeves, hard hat, steel-toe boots ➢ Use of face shield during high pressure washing to avoid splashing face. <p>2b. Determine whether the item must be lifted - can it be left in place or pushed/pulled into place?</p> <ul style="list-style-type: none"> ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area.
C. Demobilize to Next Location or Complete Scope 1. Preparation to mob to next location or leave site	1a. Electrocution/shock due to contact with overhead energized electrical lines.	<p>1a. Ensure an observer/spotter is watching the lowering of the drill rig mast so no lines or overhead obstacles are contacted.</p> <p>Note: While rig is moving on site, have spotters verify clearance so no overhead obstacles are contacted and no obstacles are hit while backing.</p>
On-site edits:		

Job Loss Analysis (JLA)

Page 1 of 2

JLA Title: Soil Drumming

Date Developed: 5/18/2005	Revised Date: 1/3/2023	Revision #: 014
Initial Development Team: Brian Brittain, Sr. Environ Tech / Hannah Corso, Staff Geologist; Sean Keefe, Jr. Geologist		This JLA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JLA.
Latest Revision by: Basith Mohammed, RHSSEM		
Quality Review by: Tom Baylis, CIH; VP, HSSE		

REQUIRED PPE: Air Purifying Respirator; Ear Muffs; Ear Plugs; Face Shield; Fire Retardant Clothing; Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); Goggles; Hard Hat; Safety Glasses; Safety-toed Boots; Shirt (Highly-Visible Short/Long Sleeve); Tychem Suit; Tyvek Suit; Vest (Highly Visible Reflective Striped); **Other:** Enter other required PPE.

TASK-SPECIFIC TOOLS AND EQUIPMENT: PID/ CGI-O2 meter/ Shovel/ Adjustable wrench or socket wrench

Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures
1. Mobilize to work area	<p>1a. Fractures /contusions to body due to contact with moving vehicles.</p>	<p>1a. Utilize cones/barricades/safety fence to establish the work zone – Comply with GES Traffic Control program.</p> <ul style="list-style-type: none"> ➢ Position work vehicle between work area and on-coming traffic. ➢ Do not permit access to work zone by non-essential personnel. ➢ Inform facility personnel of work (restricted) area. ➢ All staff not involved in the activity must remain 25 feet outside of work area ➢ Use "spotter" to warn personnel of approaching vehicles in high traffic areas. ➢ Don high visible sleeved shirt or outerwear, such as high visible traffic vests or clothing. ➢ If working alongside an active roadway, where vehicular traffic is heavy, dawn/dusk hours, or if weather is overcast or rainy, high visible outwear with reflective stripping must be worn. <p>Note: Review, inspect, and locate safety equipment including fire extinguisher, first aid kit, insect repellent, ice melt, PPE, etc.</p> <p>Note: Know location of first aid kit and eye wash</p>
2. Inspect staging area and move drum(s) into place	<p>2a. Hand and arm fractures or contusions as a result of tripping and falling over equipment/debris remaining in work area.</p> <p>2b. Back/body sprain/strain from lifting, moving or carrying equipment /materials (butts up/twist and shout)</p>	<p>2a. Identify and remove any debris or non-essential equipment that is found in the work area to eliminate the tripping hazard.</p> <ul style="list-style-type: none"> ➢ All tools, equipment or objects that may create a trip hazard must be placed in secured location or cleaned up and disposed of. ➢ Watch for the formation of snow covered ice during cold weather. <p>2b. Determine whether the item must be lifted - can it be left in place or pushed/pulled into place?</p> <ul style="list-style-type: none"> ➢ Ensure path is level and clear of debris/obstacles. ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area.
3. Remove drum lid	<p>3a. Cuts/fractures to the hands/ fingers as a result of being caught between drum lid and ring when removing drum ring.</p>	<p>3a. Keep fingers / hands away from sharp edges, from under lid and drum edge.</p> <ul style="list-style-type: none"> ➢ Avoid placing fingers on ring when loosening ring for removal ➢ Use leather work gloves or Kevlar cut-resistant gloves underneath nitrile gloves.
4. Load soil into drums	<p>4a. Back/body sprain/strain from lifting, moving or carrying shoveling loads of material. (butts up/twist and shout)</p> <p>4b. Irritation to hand, arms and other body parts that result from</p>	<p>4a. When shoveling bend at knees to scoop up load. Keep back straight. Lift load by using legs and do not twist at waist</p> <ul style="list-style-type: none"> ➢ Grasp shovel handle tightly: Position one hand at base of shovel handle and the other hand near the top of the handle. ➢ Do not shovel loads heavier than 50 pounds. ➢ Raise shovel/ load slowly up to drum edge. ➢ Keep drums close to area, do not lean to dump material, stay close to drum. <p>4b. If handling chemicals, review SDS and understand signs/symptoms of exposure and first aid measures.</p> <ul style="list-style-type: none"> ➢ Don long sleeve shirt, long pants and chemical resistant gloves.

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

	skin contact with site contaminants	
5. Securing/Moving/relocating drums	<p>5a. Fractures/cuts to the hands/fingers as a result of being caught between drum rim and drum ring (collar) when securing</p> <p>5b. Back/body sprain/strain from lifting, moving or carrying heavy drums not in accordance with safe lifting procedures. (butts up/twist and shout)</p> <p>5c. Hand and arm fractures or contusions as a result of tripping and falling when walking or working on uneven surfaces</p>	<p>5a. Do not place fingers/ hands in area between drum rim and drum ring (collar) when removing/ reinstalling the drum ring (collar).</p> <ul style="list-style-type: none"> ➢ Do not wear excessively loose, baggy clothing, or jewelry. ➢ Don leather gloves <p>5b. Determine whether the item must be lifted - can it be left in place or pushed/pulled into place?</p> <ul style="list-style-type: none"> ➢ Ensure path is level and clear of debris/obstacles. ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area. ➢ Use a forklift equipped with forklift drum lifter to move drums over soft surface (soil). ➢ DO NOT ATTEMPT TO "WALK" or "ROCK" DRUMS TO MOVE THEM. ➢ Drums can become unstable and easily tip-over causing possible damage/ personal injury as well as releasing the material contained. <p>5c. Inspect the work area and look for uneven areas that may create a tripping hazard.</p> <ul style="list-style-type: none"> ➢ If the path of travel is obstructed (lighting, over growth, clutter...) utilize a walking stick and probe ahead, walk slowly and use caution. ➢ Plan walking path through work area to avoid the uneven areas ➢ Don safety boots with skid / puncture resistant soles that comply with GES requirements.
On-site edits:		

GES DAILY SITE SAFETY CHECKLIST

Site Name: GTAC 8 Bishop Tube HSCA Site

Address: S Malin Road

East Whiteland Township, Chester County, PA

Task, Name, and date of entry: _____

This checklist is to be completed on a daily basis. The date should be noted in the space provided. The employee completing the checklist should verify that each item is correct and initial in the last space provided.

Date of field work:					
1. Proper training certificates have been obtained from all onsite personnel.					
2. The site-specific HASP has been reviewed and signed by GES employees and GES-hired subcontractors.					
3. The daily site-safety meeting has been conducted.					
4. Applicable JSAs are onsite, reviewed by staff to ensure all tasks/jobs are covered, and site specific JSA modifications occur when needed.					
5. Fire extinguishers are available for use and are fully charged.					
6. A fully-stocked first aid kit & eye wash bottle is readily available.					
7. Any potential tripping hazards have been removed from site.					
8. All vessels containing flammable or corrosive material are properly labeled.					
9. Proper personal protective equipment is being used for present conditions.					
10. Equipment onsite is checked and in safe working order.					
11. Safety cones and flags or barricades have been utilized to mark out work area along with all required signage (No Smoking, No Trespassing, Work Area...).					

Date of field work:					
12. No person onsite has the appearance of being under the influence of motor skill altering substances.					
13. All workers onsite are clothed in an appropriate manner (highly visible clothing, no tank tops, muscle shirts or shorts).					
14. Electrical power-operated tools shall be properly grounded and used with a Ground-Fault Circuit Interrupter (GFCI).					
15. All required permits (GES and/or client) are completed by an authorized individual.					
16. When working alone, has a phone call been placed to the PM to discuss site conditions, review the Scope of Work, LPS requirements, and coordinate communications for the day? Note: The frequency/ amount of additional calls from the field should be established during the PM's discussion with the individual. A call must always occur prior to leaving the site. (FILL IN OFFICE COMMUNICATION TIME)	TIME	TIME	TIME	TIME	TIME
17. Prior to leaving the site for the day, the GES site supervisor has conducted a meeting with onsite staff to review worker conditions (possible injuries), JSA revisions, discuss possible Near Losses/ Losses, and activities scheduled for the next day.					
18. All health and safety concerns have been communicated to the Local Health and Safety Officer and Project Manager					
I verify and initial that the above information is correct by initialing in the boxes to the right:					

Attachment C – Tailgate Meeting Topics

Tailgate Meeting Topics

- Introductions
- How is everyone feeling today?
- If working with new subcontractors, multiple subcontractors, or personnel that haven't worked together before, have everyone introduce themselves and their role.
- Review OSHA, LPS, and API credentials.
- Review that everyone is responsible for their own safety, and to look out for everyone else on site.
- Stop Work Reminder For All Present
- ALL on-site personnel have the ***AUTHORITY, OBLIGATION, and RESPONSIBILITY*** to stop the job at any time if they observe unsafe acts, situations, or conditions!
- Please report all Losses, Near Losses, injuries, and any other abnormal situations to the GES Site Supervisor immediately.
- HASP and Emergency Information
- Hospital location: (We do NOT transport seriously injured personnel). Call 911
- First aid kit, eye wash, fire extinguisher, fuel service emergency stop, and HASP locations
- Review of First Aid/CPR trained site personnel
- Review “emergency stop work” signal, establish safe muster point, smoking and break location(s)
- Discuss what type of site activities could trigger a “stop work” alert (injury, fuel delivery, unexpected 3rd party site intrusion, weather, etc.)
- Decontamination procedures
- Emergency procedures
- Discuss Scope Of Work For The Day
- What do we expect to accomplish today?
- Review the anticipated schedule, but emphasize the need to work safe. Safe operations cannot be replaced by “need for speed.”
- JSA Discussion Regarding The Day's Tasks
- Focus on Making every JSA Site Specific
- If working with subcontractors, empower them with the JSA review of the tasks they will be performing
- Challenge them as a “job expert” to share experiences

- “What conditions and challenges exist on this site today that are not accounted for in our JSAs?”
- Review and complete checklists and permits
- If necessary, insure appropriate spotters, and establish communications between spotters and equipment operators
- Equipment/Machinery/PPE Check
- Gas, grease and oil checked
- Safety devices checked and in working order
- Required and recommended Personal Protective Equipment (PPE) on site and in good condition (per JSA)
- Proper signage (Fence, traffic, drums, samples...)
- SPSA/Hazard Communication
- Ask all site personnel to communicate a SPSA they performed since coming on site (you first, and then go around to every individual on site.)
- Emphasize that SPSAs and Hazard Recognitions should be performed and shared constantly throughout the day, not just at Tailgate Safety Meetings and “Take 2 at 2 meetings”!
- Encourage and empower all site personnel to communicate SPSAs out loud as they are performing them to share experiences and increase site awareness
- Reminder - YOU are not only responsible for your own safety, but to look out for everyone else on site.
- Finally – Stress the need and benefit of LPSAs. They are the most powerful tool in our toolbox.

Attachment D – HSSE Policy, Procedure & Guidance - Policies and Procedures

- Drilling Protocol
- Gas Hazards Awareness Guidance
- Hazardous and Non-Hazardous Waste Management Program
- Hearing Protection
- Heat-Cold Stress Illness Prevention
- Injury Case Management
- Lead, Arsenic, Chromium & Metals Exposure Prevention Program
- Materials Storage and Handling

HSSE Policy, Procedure & Guidance

Policies and Procedures



Section 10: Drilling Procedure

The following have reviewed and authorized the issuance of the Policy, Procedure, & Guidance.

	<u>Name and Title</u>	<u>Date</u>
Initiator:	<i>Thomas Baylis, CIH, VP HSSE</i>	1/11/16
Guidance Committee	<i>Heather Cloud, Regional Operations Manager</i>	1/15/16
Guidance Committee	<i>Jon Agnew, Regional Operations Manager</i>	1/15/16
Guidance Committee:	<i>Douglass Liddell, Regional Operations Manager</i>	1/13/16
Guidance Committee	<i>David Zailik, Regional Operations Manager</i>	1/15/16
Chief Ex. Officer:	<i>Edward Van Woudenberg</i>	1/17/16

General Definitions

Policies prescribe certain behaviors or courses of action deemed expedient, prudent, and advantageous to the function of GES (“Policy”). As such, Policies are non-discretionary, the violation of which may result in severe consequences including, without limitation, termination of employment.

Procedures prescribe certain behavior or courses of action deemed expedient, prudent, and advantageous to achieve compliance with Policy (“Procedures”). As such, Procedures are non-discretionary, the violation of which may result in severe consequences including, without limitation, termination of employment.

Guidance provides suggested methodologies to achieve compliance with Policies and Procedures that are non-mandatory, or discretionary, in the reasonable judgment of the actor. The use of Guidance is designed to create efficiencies where the relevant circumstances may require a more flexible approach to compliance, allowing the actor to use his/her reasonable judgment.

Procedure for policy approval

1. Policy Recommendations shall be submitted via electronic mail to the Company’s General Counsel (“Counsel”).
2. Counsel shall, thereafter, upon gathering any other information required, if any, present the Recommendation to a Policy, Procedure and Guidance Committee (“Committee”) for consideration.
3. The Committee’s members shall be chosen by the President of the Company or his/her designee, with the roles and responsibilities of the same established collectively.
4. The Committee shall be empowered, as required, to take all necessary action to either draft such Recommendation for presentation and approval, or recommend rejection of such Recommendation, to the President who shall either approve the newly created Policy, Procedure, or Guidance, or reject the Recommendation.
5. Initiator records approval date and revision number in version identification block on document and signature page (revision number and date must match on both documents).

Policies and Procedures

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1.0 OBJECTIVE

The objective of this procedure is to prevent damage to subsurface structures (including tanks, lines, water lines, gas lines, electrical service, etc.) during drilling, Geo-probing/direct push sampling, augering, sampling, or other advancement operations.

2.0 SCOPE

This procedure establishes the requirements for on-site drilling operations, addressing the key issues and activities associated with safe drilling and boring operations.

ATTACHMENTS

Attachment 1 – Site Walkthrough – Utility and Service Line Determination Record

Attachment 2 – Drilling Protocol Checklist

Attachment 3 – Containment Construction

Attachment 4 – Variance Request Form

3.0 PRE-DRILLING PROCEDURE

3.1 Key Personnel and Responsibilities: The Project Manager (PM)/Site Supervisor.

- 3.1.1 PM will be responsible for fulfilling the objectives of this protocol by ensuring that this procedure is carried out by all of the employees, sub-contractors, and any other person acting on behalf of Groundwater & Environmental Services, Inc. (GES). The PM will also ensure that LPS is implemented during the drilling project that will include but not be limited to ensuring staff understand the need to conduct Loss Prevention Self Assessments, review and understand activity specific Job Loss Analyses (JLA) and schedule Loss Prevention Observations as necessary.
- 3.1.2 PM will ensure that all individuals working on Remediation projects are adequately trained and supervised.
- 3.1.3 For all non-critical zone drilling an email notification must be sent to RHSSE manager as an FYI of the upcoming work, this is not for approval but informational purposes only. Based on this notification, site visits may be planned by RHSSE personnel or Senior Management if feasible.
- 3.1.4 The Site Supervisor will practice sound investigation and drilling practices and employ all necessary measures to avoid damage to subsurface product systems and structures. The supervisor will also be responsible for ensuring that each appropriate JLA is reviewed by the project staff prior to project activities each day and immediately following the lunch time break.
- 3.1.5 Site Supervisor Qualifications: Personnel who oversee drilling activities shall satisfy GES oversight criteria requirements that would include but not be limited to the following qualifications:
 - Completed the OSHA 40-hour HAZWOPER training, annual 8-hour refresher course (if needed), and completed the three-day minimum field training requirements as specified in the GES Corporate HSSE Training Program.
 - Completed the OSHA HAZWOPER 8-hour supervisor-training course.
 - Trained in the requirements of this procedure.
 - Trained and understands client specific requirements. This will include but not be limited to knowledge of “Critical Zones” and client specific subsurface clearance protocols.
 - It is recommended that a Loss Prevention Observation (LPO) be conducted by a qualified/ experienced

GES employee on the individual who is providing oversight for the first time during the first or second day of the project. Depending on the outcome of the LPO, additional LPOs may need to be scheduled.

- When GES is required to provide oversight, at least one qualified GES employee will supervise subcontractor drilling activities. In addition, during drilling activities the individual who is providing oversight is not permitted to oversee other activities.
- The Project Manager will be the point of contact for the Site Supervisor in the event an exception to this protocol is requested. Once a variance request is communicated to the GES PM, the PM must complete the GES variance request form (**Attachment 4**) and provide the request to the GES VP HSSE, GES Client Program Manager, and Regional Operations Director for approval. Approval must be granted by the VP, HSSE *and* either the GES Client Program Manager or Regional Operations Director, per the “Attachment D of the Delegation of Authority - (HSSE)” (DoA). GES Policy HS-0062 Management of Change Requirements describes the variance request process.

- 3.2 Preparation Tasks: Gather all relevant information about the site prior to the site visit.
- 3.3 Obtain Permits: The GES PM is responsible for following all local, state and federal laws, obtaining all necessary permits and utility clearances, and securing site access permission.
- 3.4 Obtain Site Plans: The PM shall obtain as built drawings and/or site plans as available. NOTE: As-built drawings may not accurately depict the locations of improvements and subsurface features and should therefore not be solely relied upon to determine drilling locations.
- 3.5 Mark-outs: A dig-safe or mark-out call must occur and the required utility mark-outs completed in accordance with state and local requirements prior to any subsurface activities. It is also recommended that the Site Supervisor conduct a walkthrough of the site to locate all main electrical, gas, telephone and all other subsurface utilities. A Site Walkthrough Utility and Service Line Determination Record (**Attachment 1**) are provided to assist the Site Supervisor in identifying above ground and subsurface utilities.
- 3.6 On third party sites, close coordination with the site owner's representatives for mark outs, review of as-builts, and other information reviews should be conducted prior to work. It is recommended that a private utility mark-out company is contracted prior to performing subsurface activities so that the approximate location of any potential subsurface utility line is identified near the areas to be drilled. For any utility line which is identified within 10 feet of the well or boring location, it is recommended that a “soft-dig” contractor is utilized to verify the location and depth of the lines as well as the size and type of line.
- 3.7 Pre-construction meeting: Prior to the start of the project, it is recommended that a pre-construction meeting is held and attended by the GES PM, Project Engineer or their designee, designated site supervisor, and the subcontractors procured to perform the work; if possible extend invitation to Regional HSSE Manager. The pre-construction meeting activities shall include but not limited to a site walkthrough (if feasible) to delineate and determine all above ground utility and service lines, review project HSSE requirements, review planned drilling or boring locations, discuss the anticipated project schedule and other pertinent project information. It is recommended that meeting is held at least one week prior to the project start date with the attendance documented and the attendance sign-in sheet placed into the project file. If it is not feasible to hold this meeting onsite, this meeting shall be completed over the phone a week ahead of the job start or can be completed onsite on the day of the project start and include the discussion of topics outlined above.
- 3.8 Utilities: The locations of the following should be determined:
 - Electrical Lines, control boxes, and appliances.
 - Electrical breaker boxes.
 - Gas lines.
 - Pipelines.
 - Fiber Optic lines

- Steam lines, water lines
- Sanitary and storm-water sewer lines.
- Pressurized airlines.
- Underground storage tanks and associated vent and dispensing lines
- Cable lines

NOTE: Drill Rigs and vehicle masts or elevated structures shall be kept a minimum of 10 feet from overhead electrical lines for lines rated 50 kV or below. For lines over 50 kV the clearance must be 10 feet PLUS 0.4-inches for each 1 kV over 50 kV (1926.550 (a) (15) (i & ii) Subpart N). If the line voltage is unknown, then drill rigs and structures must be kept a minimum of 20 feet from the line.

3.8.1 Product Systems: Make every effort to speak with someone with historical site knowledge to gain information about the site (locations of former tanks, lines, etc.)

3.8.2 UST systems:

- When possible, inspect for the presence of a dispenser pan and determine whether piping is rigid or flexible.
- Visually inspect the location of the tank field, observation wells (if present), dispensers and vent stack(s).
- Document the orientation, arrangement, location, sizes, etc. of the tanks and manholes. Determine the burial depth of the tank field.
- Observe paving scars (i.e. fresh asphalt/concrete patches, scored asphalt/concrete).
- Document the location of the emergency shut off switch to the dispensers and become familiar with its use.

NOTE: This may indicate the location of product piping.

3.8.3 Existing Remediation Systems:

- Visually inspect the location of above ground components.
- Document the location of well manholes, sparge points, etc.

3.8.4 Existing liners or CAPs:

- Compare maps depicting the location of CAPs/liners with current site features.
- Depending on when the CAP/liner was installed, maps may be old and/or of poor quality; discuss proposed subsurface work and site history with property owner/representative.
- A land survey and/or test pits are recommended in advance of any subsurface work on sites with CAPs/liners, to confirm its location.
- Test pits, if performed, should be cleared first with vacuum digging only; use an air knife to assist with clearance only if necessary – but do so with caution, Hand augers should not be used, as they can puncture liners easily.
- Include any known information about the CAP's location or appearance in the Field Work Directive (i.e. black HDPE liner, clay layer, etc)

3.9 Selection of Drilling Locations:

3.9.1 Document, communicate and review the selected drilling locations.

3.9.2 The Site Supervisor shall establish drilling critical zones. Critical Zones are defined as the following:

- An area within 10-feet of the perimeter of the UST pit area.
- Within 10-feet of the drip line of the dispenser/rack canopy.
- Those areas within 10-feet of product/vent/instrument lines, gas lines, electrical conduits, sewer lines, water supply lines, telecommunications lines

- The area between the UST pit and the dispensers, between the dispensers/rack and the store/office building.
- Within street utility corridors (typically within a right-of-way easement).

3.9.3 The Site Supervisor should utilize the information collected to this point in combination with regulatory requirements and investigation objectives to select drilling locations.

3.9.4 If possible, the GES PM and Site Supervisor should avoid selecting locations within the critical zone.
3.9.5 Review Selected Locations with the Client and with the Project Manager.

NOTE: The Site Supervisor must not proceed with the investigation until the plan has been discussed with the client and approval to proceed has been granted. If relocation of a boring is necessary at any time and for any reason outside approved limits, the Site Supervisor must contact the client and GES PM prior to proceeding. Critical zone locations must also be approved by either the GES client program manager, VP, HSSE and / or RHSSE Manager during the pre-planning phase.

3.10 Required Notifications: Notify affected parties of planned work and avoid scheduling conflicts with other remediation or facility activities at the site. The Site Supervisor will notify the following persons as applicable:

3.10.1 Project Manager.

3.10.2 Retailer/ Terminal Manager/Operator for active locations.

3.10.3 Property Owner for private properties, when possible.

4.0 PROCEDURE FOR ON-SITE DRILLING: Identify to the fullest extent possible any improvements present in the sub-surface prior to advancing drilling tools in order to prevent damage to the improvements.

4.1 Safety:

4.1.1 The Site Supervisor shall complete the Drilling Protocol Checklist (**Attachment 2**) prior to commencing drilling operations.

4.1.2 A current Health and Safety Plan (HASP) must be available onsite at all times in accordance with OSHA 29 CFR 1910.120 and all employees and subcontractors must be familiar with attached JLAs and other information. GES Project Manager shall coordinate/solicit and obtain subcontractor JLA's for use at the drilling job.

4.1.3 All work areas shall be secured with safety cones, safety tape, construction fence, other barriers, or signs as appropriate. Construction of the drilling water containment if necessary, should be completed in accordance with the JLA guidance provided in **Attachment 3**.

4.1.4 The Site Supervisor must locate the emergency shut off switch for the dispensers and shall ensure all site personnel are familiar with their use.

4.1.5 A 20 lb. fire extinguisher and "No Smoking" signs must be present at all times.

4.2 Supervision:

4.2.1 A GES qualified Site Supervisor will be responsible for drilling operations and must have a copy of the GES and if applicable, the client Drilling Protocol on-site.

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- 4.2.2 All surface removal, hand auger, digging and drilling will be performed; observed or supervised by the GES Site Supervisor at all times.
- 4.2.3 The Site Supervisor will ensure that the work is performed with due caution and will be alert for warning signs that could indicate the presence of underground tanks, lines, or other subsurface structures.
- 4.2.4 If any such indications arise, the work should immediately cease in the area and the GES PM shall be contacted.
- 4.3 Warning Signs - The following warning signs may indicate the presence of a sub-surface structure such as tanks/lines:
 - 4.3.1 Pea Gravel/Sand/ other non-native fill material. If any evidence of non-native fill material such as pea stone is observed during hand clearing or drilling, all subsurface work must stop and the Project Manager and/or the office Senior Office Manager contacted.
Note: When pea stone or non-native fill material is discovered at any time during subsurface activities, because of the safety concerns and the environmental impact that could result from contacting and damaging product lines or other critical zone utilities, all subsurface work must stop and must not continue until after the GES client program manager or VP, HSSE and the client have been notified and full approval has been granted to continue.
 - 4.3.2 The absence of soil recovery in the hand auger. This could indicate non-native fill material such as pea gravel has spilled out of the auger.
 - 4.3.3 Any unexpected departure from the native soil conditions as established in other onsite excavation/trenching digging.
 - 4.3.4 If any of the above warning signs or a suspicious condition is encountered, drilling in this area should immediately cease and the PM shall be contacted.
- 4.4 Drill Boring Sequence:
 - 4.4.1 If possible, the boring sequence should be planned such that the boring furthest from any suspected underground improvements is carried out first. This is done to determine the natural subsurface conditions and to allow the Site Supervisor to recognize fill conditions.
 - 4.4.2 Least impacted locations should be completed first if possible to prevent possible cross contamination.
- 4.5 Surface Removal for Paved Areas - Paving Removal: The following is recommended:
 - 4.5.1 Sufficient paving or surface improvement should be removed to allow clear visibility of the subsurface conditions during hand augering/ digging and allow excavation with hand tools.
 - 4.5.2 Drilling in an area of high risk may warrant a larger pavement opening.
 - 4.5.3 Monitoring Well Installations: 2ft x2ft minimum removal is suggested.
 - 4.5.4 Soil Borings/Push Type Samplers: 8in minimum removal is suggested.
- 4.6 Surface Removal Technique: The technique used should not pose a threat to subsurface structures. The only approved methods for completing holes within a paved area shall be to neatly saw-cut or core unless otherwise directed by the Client.

4.7 Subsurface Evaluation: Ensure that no subsurface improvements exist where drill or auger will penetrate.

4.7.1 In critical zones, a minimum evaluation to a depth of 8ft deep utilizing a non-destructive method such as manual hand clearing or vacuum digging is required.

4.7.2 In non-critical zones, a minimum evaluation to a depth of 5ft deep utilizing a non-destructive method such as hand clearing or vacuum digging is required.

4.7.3 Areas where utility or service lines have been identified or within site critical zones, a minimum evaluation to a depth of 8 ft deep shall be completed utilizing a non-destructive method such as hand clearing or vacuum digging. Where underground tanks or where lines are present that exceed a depth of 8 feet, clearance may need to be extended beyond 8 feet in these areas.
Note: Client specific protocols must always be satisfied with regards to hand clearing and other drilling requirements. Therefore, the most stringent approach either GES or our client's must be implemented.

4.7.4 Subsurface Clearance Approach: The method used to perform subsurface clearance should be compatible with the inherent risk associated with the type of facility/property, and the location of the drilling. Provided in the following sections is the approach that should be implemented to perform subsurface clearance and the various tools that are permitted for use:

- Only approved tools shall be used for subsurface clearance.
- The Site Supervisor should discuss tool requirements with the Client. Also, no subsurface activities are permitted within a critical zone until the client and the GES client Program Manager is notified of the planned activity. See note under 3.7.5 for approvals.
- Vacuum Digging: Vacuum digging (air knife or Vac-tron) has been proven to be a very effective and safe means of subsurface clearance and is recommended unless the soil or other material/issues prevents the use of a vacuum digging device. **Only the vac hose is permitted to be used to remove non-native fill material such as pea gravel. If there is difficulty removing non-native fill material with the vac hose, then work must stop and the GES PM notified.**
- Probing: If probing is necessary, it should occur by using a blunt or rounded tip and should be advanced by hand without excessive force. Digging bars, pry bars or other digging tool that are used to extend the hole depth and that may result in damage to subsurface utilities are not permitted. A digging bar can be used to loosen cobbles or rocks so they can be removed from the location. The use of the tool must be clearly described in the JLA and the JLA must be reviewed by each person prior to use.
- Hand Digging: Should be performed with a small spade shovel
- Hand Augering: The auger is to be turned slowly and not forced through the soil. It is recommended that an auger without sharp points (some augers have rounded edges) be used. **A hand auger should not be used to clear non-native fill material such a pea gravel**
- Post Hole Digging: Can be used for soil removal only in soil that has been probed. The post-hole shovel cannot be used to advance the hole beyond the depth or width of probing.

Note: In the event a drilling location is selected where it's apparent that additional soil or other fill material has been placed/added to the original ground surface level where utility or service lines have been identified (i.e., sloped area next to an existing building, landscaped area, etc.), the depth of the added soil will need to be taken into account or added to the required hand clearing depth.

4.7.5 Approval to deviate from this work scope may be granted on an exception basis for specific situations, such as undeveloped land. In addition, the GES Site Supervisor (oversight person) must stop all project activities and discuss the situation with the GES PM or senior office manager when client or GES requirements can not be implemented or when site conditions result that are not consistent with normal conditions. If a variance or exception is necessary, then individuals specified in section 3.1.5 must be contacted and their approval obtained.

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4.7.6 Additional exploratory methods (e.g., water drilling, electronic screening, etc.), which will achieve at least the same level of precautionary investigation and/ or drilling safety, should be reviewed with the GES PM prior to implementation.

4.8 Refusal:

4.8.1 Where natural subsurface conditions (e.g. cobbles/rocks, fill material, and/or bedrock) may prevent adequate probing and augering, a practical and sensible evaluation by the Site Supervisor will be the basis for determining if continuation of probing and augering is feasible.

4.8.2 In all cases, the Site Supervisor must employ all means necessary to prevent damaging subsurface product lines, tanks, or other utilities.

4.8.3 When conventional means of probing and augering cannot be utilized or the Site Supervisor feels that additional probing/augering is not feasible; the Site Supervisor must cease work in that specific area and contact the GES PM to discuss the matter. Once refusal is verified by the supervisor and onsite crew, drilling activities may begin.

4.9 Event Notification:

4.9.1 If any portion of a tank line, utility or other subsurface structures is encountered or if there is suspicion that one has been encountered, all work shall be halted, emergency conditions secured, and the required GES Management (PM, VP HSSE, Client Program manager) notified immediately.

4.9.2 If there is suspicion that the structure has been damaged, if applicable, the emergency shut-off switch should be activated.

4.9.3 The client should decide if additional hand clearing is required. If it is confirmed that a UST system has been encountered, the required GES Management should be consulted to determine what actions should be taken, such as performing a tightness test(s).

4.9.4 Under no circumstance is the area to be backfilled without notifying the required GES Management and receiving an approval to proceed.

4.10 Scheduling:

4.10.1 While evaluating the sub-surface may be time-consuming, it may be appropriate to perform the subsurface evaluation prior to the drill rig's arrival on-site.

4.10.2 If these activities are conducted prior to the actual drilling day, the augered holes must be adequately covered with road plates and/or backfilled. Care must be taken to prevent settlement of the material used to cover the holes.

4.10.3 In remote, idled, or access-controlled sites, augered/ probed holes can be left open during fieldwork. A red hazard cone shall be placed over each penetration that will not be drilled the same day.

4.11 Special Considerations for Welding Steel Casing:

4.11.1 When welding lengths of steel well casing together onsite (as is commonly done for bedrock wells), the hot work area must be defined and managed.

4.11.2 When welding in the borehole, the entire borehole would be considered to be the hot work area. Options for managing this hot work area are as follows.

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- Erect a barrier that would prevent sparks from traveling down to the bottom of the borehole.
- Conduct air monitoring in a stratified manner down the length of the borehole prior to welding.
- Inert the borehole, or add fresh ambient air to dilute any vapors present.

4.11.3 Alternately, pre-planning would include arrangements with the driller to bring threaded casing, which eliminates the need for welding onsite. This would be particularly useful in locations where higher contamination or vapor levels are anticipated or unknown.

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ATTACHMENT 1

SITE WALKTHROUGH – UTILITY AND SERVICE LINE DETERMINATION RECORD

HSSE Policy, Procedure & Guidance

Policies and Procedures



Policy #: 0010
Revision #: 10
Date: 11/5/2019

ATTACHMENT I Site Walkthrough Utility and Service Line Determination Record

Project/ Site Location: _____

Name of person performing walkthrough: _____ Date: _____

Utility	Description of Location found onsite	Approximate depth below ground surface	Method used to determine location
Electrical lines			
Gas lines			
Pipelines			
Steam lines			
Water lines			
Sanitary and Storm-water Sewer lines			
Pressured air-lines			
Tank vent lines			
Optical fiber lines			
Underground Storage Tanks			
Other			

HSSE Policy, Procedure & Guidance

Policies and Procedures



Policy #: 0010
Revision #: 10
Date: 11/5/2019

ATTACHMENT 2

DRILLING PROTOCOL CHECKLIST

HSSE Policy, Procedure & Guidance

Policies and Procedures



Policy #: 0010
Revision #: 10
Date: 11/5/2019

Drilling Protocol Checklist

Site Supervisor: _____ Date: _____

CHECKLIST

	YES	NO	N/A
Prior To Site Visit:			
Obtained necessary permits			
Obtained Site Plans (If plans are unavailable and subsurface			
Visually inspected location of above ground components			
Note location well manholes, sparge points, etc.			
Document selection of drilling locations			
Define the "Critical Zones"			
Obtain necessary traffic control devices to secure site or exclusion zone (reference section 4.1.3)			
Review selected locations with PM			
Conduct Utility Mark Out			
Site Visit:			
Note location of utility mark-outs and above ground utilities (Complete Walkthrough Record)			
Compared Site Plan to actual conditions			
Updated Site Plan, if necessary			
UST Systems:			
Inspected for presence of dispenser pan			
Inspected location of tank field			
Noted orientation, arrangement, location of tanks, manholes			
Noted location of Emergency Shut Off Switch			
Determined burial depth of tank field			
Noted paving scars			
Existing Remediation Systems:			
Visually inspected location of above ground components			
Note location well manholes, sparge points, etc.			
Document selection of drilling locations			
Define the "Critical Zones"			
Notified all affected parties of planned work			
Copy of Pre-Drilling Protocol available for site			
Health and Safety Plan (HASP) available for site			
Fire extinguisher and First Aid Kit available for site			
"No Smoking" signs available for site			
Safety Cones, Safety Tape, Construction Fence, other barriers available for site			
Developed Scope of Work and reviewed with all concerned			

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Policies and Procedures



Policy #: 0010
Revision #: 10
Date: 11/5/2019

ATTACHMENT 3

CONTAINMENT CONSTRUCTION

HSSE Policy, Procedure & Guidance



Policies and Procedures

Policy #: 0010
 Revision #: 10
 Date: 11/5/2019

JOB SAFETY ANALYSIS		DATE 7-22-05	<input checked="" type="checkbox"/> NEW <input type="checkbox"/> REVISED	PAGE 1 of _____
JLA TYPE CATEGORY Monitoring well drilling		WORK TYPE Well Construction Preparation	WORK ACTIVITY (Description) Containment Cell Construction	
DEVELOPMENT TEAM		POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
D. Demko		Project Coordinator		
T. Baylis		Director of Health & Safety		
REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT				
<input type="checkbox"/> LIFE VEST <input checked="" type="checkbox"/> HARD HAT <input type="checkbox"/> LIFELINE / BODY HARNESS <input checked="" type="checkbox"/> SAFETY GLASSES		<input type="checkbox"/> GOGGLES <input type="checkbox"/> FACE SHIELD <input type="checkbox"/> HEARING PROTECTION <input checked="" type="checkbox"/> SAFETY SHOES _____	<input type="checkbox"/> AIR PURIFYING RESPIRATOR <input type="checkbox"/> SUPPLIED RESPIRATOR <input type="checkbox"/> PPE CLOTHING _____	<input checked="" type="checkbox"/> GLOVES _____ <input type="checkbox"/> OTHER _____
¹JOB STEPS		²POTENTIAL HAZARDS	³CRITICAL ACTIONS	
Determine type of drilling to occur at job site (ie: air rotary, auger etc.)		None	Review with drilling contractor type, method and needs of drilling technique to be used.	
Review background geology and anticipated contaminant to be encountered at job site. Inspect job site location.		None	Collection of accurate data on site specific hydrogeology and contaminants for analysis.	
Define the management and disposal process for collection and removal of drilling returns		None	Set up containment, transportation and storage logistics for management of drilling returns.	
Assess site specific location for containment cell construction		Hazards relative to the proposed drilling location	Assess topographic slope and land surface features; assess potential receptors in area of activity	
Design containment cell to hold the desired volume of drilling fluids; select appropriate materials to maintain cell integrity and install containment cell		Hazards associated with handling materials, working with building tools.	Must design the containment cell to hold sufficient volume of fluids for rate of drilling fluids return/collection; must select the proper materials for cell construction based on cell volume and cell location.	
Ready the components of fluid removal from the cell, transport and storage/disposal locations to ensure adequate capacity		Hazards associated with equipment movement and handling of drilling return materials	Proper assessment and inspection of the containment cell construction and review of transport/storage elements for fluids management prior to drilling startup.	
Preparation of a contingency and response plan based on containment cell failure		Loss of cell contents may pose hazard to personnel working near the cell structure	Assess risk to personnel and the environment based on cell location and potential migration of contents from a loss scenario.	
Develop a communication protocol between the driller and site geologist to cease drilling when a pre-determined level of fluids in containment cell is reached.		Hazards associated with monitoring well construction and operation around a drilling rig.	Must determine an appropriate level for cell volume liquid containment/storage based on cell construction characteristics and placement location.	

HSSE Policy, Procedure & Guidance

Policies and Procedures



Policy #: 0010
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¹ Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

² A hazard is a potential danger. Break hazards into five types: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress / ergonomics / lifting techniques; **Exposure** - inhalation/skin hazards.

³ Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

HSSE Policy, Procedure & Guidance

Policies and Procedures



Policy #: 0010
Revision #: 10
Date: 11/5/2019

Attachment 4 GES HSSE VARIANCE REQUEST FORM

Requested by:	
GES Office:	
Date Requested:	
Project Location:	
Client name:	
Variance Requested:	
Reason for Variance:	
GES Client Program Manager Approval	
GES VP, HSSE Approval:	
GES Regional Manager Approval:	
Client Approval (if required):	

Section 68: Gas Hazards Awareness Guidance

The following have reviewed and authorized the issuance of the Policy, Procedure, & Guidance.

	<u>Name and Title</u>	<u>Date</u>
Initiator:	<i>Thomas Baylis, Director HSSE</i>	06/28/17
Guidance Committee:	<i>Doug Liddell, Regional Operations Manager</i>	06/28/17
Guidance Committee:	<i>David Zailik, Regional Operations Manager</i>	06/28/17
Guidance Committee:	<i>Heather Cloud, Regional Operations Manager</i>	06/28/17
Guidance Committee:	<i>Jon Agnew, Regional Operations Manager</i>	06/28/17
Chief Ex. Officer:	<i>Edward Van Woudenberg</i>	06/28/17

General Definitions

Policies prescribe certain behaviors or courses of action deemed expedient, prudent, and advantageous to the function of GES (“Policy”). As such, Policies are non-discretionary, the violation of which may result in severe consequences including, without limitation, termination of employment. As an analogy, Policies are to GES, as statutes are to a governed body.

Procedures prescribe certain behavior or courses of action deemed expedient, prudent, and advantageous to achieve compliance with Policy (“Procedures”). As such, Procedures are non-discretionary, the violation of which may result in severe consequences including, without limitation, termination of employment. As an analogy once again, Procedures are to GES, as regulations are to a governed body, meaning they describe how to comply with statutory requirements.

Guidance provides suggested methodologies to achieve compliance with Policies and Procedures that are non-mandatory, or discretionary, in the reasonable judgment of the actor. The use of Guidance is designed to create efficiencies where the relevant circumstances may require a more flexible approach to compliance, allowing the actor to use his/her reasonable judgment.

Procedure for policy approval

1. Policy Recommendations shall be submitted via electronic mail to the Company’s General Counsel (“Counsel”).
2. Counsel shall, thereafter, upon gathering any other information required, if any, present the Recommendation to a Policy, Procedure and Guidance Committee (“Committee”) for consideration.
3. The Committee’s members shall be chosen by the President of the Company or his/her designee, with the roles and responsibilities of the same established collectively.
4. The Committee shall be empowered, as required, to take all necessary action to either draft such Recommendation for presentation and approval, or recommend rejection of such Recommendation, to the President who shall either approve the newly created Policy, Procedure, or Guidance, or reject the Recommendation.
5. Initiator records approval date and revision number in version identification block on document and signature page (revision number and date must match on both documents).

HSSE Policy, Procedure & Guidance

Policies and Procedures



Policy #: 0068

Revision #: 2

Date: 01/20/2020

1.0 Introduction: Gases are a normally formless fluid that can occupy the space of an enclosure and which can be changed to the liquid or solid state only by the combined effect of increased pressure and decreased temperature. Some examples of gases are ozone, carbon dioxide, carbon monoxide, and chlorine. Gases that can displace breathing air can cause a range of respiratory illness via inhalation and can be lethal. This guidance document shall be used in conjunction with the GES permit system as needed.

2.0 Objective: Excessive concentrations of gases in ambient air that deplete oxygen from the air have been known to cause adverse health effects which range in severity from asphyxiation and death. The objective of the policy is to provide awareness of various gas hazards, potential impacts to employee health, and preventative measures to mitigate the risk of various gas hazards.

3.0 Responsibilities:

3.1 Corporate Health, Safety, Security, and Environment (HSSE) Vice President (VP) and Regional HSSE Managers/Officers shall:

- Maintain, review and update the Gas Hazard Awareness Program as needed.
- Provide guidance on Gas monitoring (upon request) and assist employees with the development of procedures to minimize the adverse effects of exposure to various gas hazards in the workplace.
- Provide training to employees that may be exposed to the gas hazards in the work atmosphere.

3.2 Site Field Supervisors and/or Project Managers shall:

- Review and comply with the provisions outlined in this program.
- Ensure all employees are properly trained before working in potential gas hazards or low oxygen atmospheres.
- Ensure employees are aware of the gas hazards in the workplace.

3.2 All GES employees, subcontractor personnel, and other onsite personnel shall:

- Review and comply with the provisions outlined in this document.
- Complete training before working in potential hazardous gas environments.
- Wear the appropriate PPE including respiratory protection PPE applicable to working in hazardous gas environments.
- Report gas exposure concerns to their supervisor.

4.0 Training: Training will be provided by GES Corporate HSSE VP or Regional HSSE Managers/Officers. GES Site supervisors and other staff will be trained in an initial training and once annually on general Gas Hazard/Exposure Awareness outlined in this guidance document. Site supervisors will be trained prior to overseeing personnel working in hazardous gas or oxygen depleted conditions. This will ensure that they are knowledgeable regarding the prevention, can monitor gas hazards, recognize exposure symptoms, and take preventative measures or exercise stop work authority when gas hazards are present in the work environment. All training records will be documented for a period of at least one year from the date of training.

5.0 Gas Hazards - Health Effects: Gas hazards are based on their chemical properties. Primarily when gas hazards are present, these gases displace oxygen, making the atmosphere hazardous to humans. Breathing an oxygen deficient atmosphere can have serious and immediate effects, including unconsciousness after only one or two breaths. Other gases in the ambient air also have a variety of hazardous health effects based on their chemical properties. Types of hazardous properties of different gases are summarized below:

5.1 Toxic gas hazards are classified according to the health effects they cause. These types of chemicals can be classified as irritants or asphyxiant.

5.2 Irritants are corrosive in action and can cause inflammation of mucous membranes. They can also stimulate changes in the respiratory process such as increasing resistance to airflow. Irritants are subdivided into two categories; primary and secondary.

- Primary Irritants - Affect the upper respiratory tract. Form non-toxic end products, which cause no systemic health problems. Examples: Hydrochloric Acid (HCl), Sulfur dioxide (SO₂), and Ammonia (NH₃)
- Secondary Irritants - Cause initial mucous irritation and produce toxic systemic effects due to their absorption on lung tissue. Examples: Chlorine (Cl₂), Bromine (Br₂), and Ozone (O₃) affect the upper and lower region of the respiratory tract while, Nitrogen Dioxide (NO₂), phosgene (COCl₂), and arsenic trichloride affect the terminal regions of the lung.

5.3 Asphyxiants are substances that have the capability to deprive living tissues of oxygen and are classified into simple and chemical.

- Simple Asphyxiants - are usually physiologically inert gases that act by accumulating in sufficient quantities to prevent an adequate amount of oxygen to body tissues. Asphyxiants are often associated with confined spaces and other forms of vessel entry. Examples: acetylene (C₂H₂), carbon dioxide (CO₂), ethane (C₂H₆), methane (CH₄), helium (He₂), hydrogen (H₂), and nitrogen (N₂).
- Chemical Asphyxiants - are able, through their individual or unique toxic action, to render the body incapable of utilizing oxygen. Examples: carbon monoxide (CO), hydrogen cyanide (HCN), and hydrogen sulfide (H₂S)

5.4 Failure to Detect Oxygen Deficient Atmosphere – Failure to detect an oxygen deficient (gas hazard enriched) atmosphere was a significant factor in several incidents including fatalities. When fatalities and injuries occurred in “open areas” (including areas with ventilation, laboratories, buildings, and outside in the vicinity of equipment), the hazard of asphyxiation was not expected and personnel were typically caught off guard.

5.5 Fatalities and Injuries during Attempted Rescue – One of the most difficult issues concerning hazardous atmosphere emergencies is the human instinct to aid someone in distress. Severe medical problems or even fatalities have resulted due to attempts to rescue injured persons in confined spaces.

6.0 Gas Hazards – Pre-Job Planning

6.1 Pre-job planning or a preliminary site evaluation will be conducted prior to starting work in suspect or confirmed hazardous gas exposure, flammable gases, and oxygen deficient environments. The preliminary site evaluation shall be reviewed and approved by the Project Manager and endorsed by Corporate VP HSSE or Regional HSSE Manager. The preliminary site evaluation will be documented in the project file for at least 1-year.

6.2 Air Monitoring: In order to identify and quantify airborne levels of gas hazards and safety and health hazards, air monitoring will be conducted at each site on initial entry with calibrated equipment. Periodic monitoring shall be also be conducted. Initial entry monitoring will be conducted to:

- To identify any Immediately Dangerous to Life and Health (IDLH) conditions
- Evaluate exposure over permissible exposure limits or published exposure levels

- Evaluate exposure over a radioactive material's dose limits
- Evaluate other dangerous conditions such as flammable atmospheres, oxygen-deficient environments, etc...

6.3 Pre-job planning will be conducted for projects/ operations involving potential hazardous gas exposure and this includes anytime an active purge is being applied to a system in or around equipment associated with work. Gas hazard preliminary site evaluation elements would include but not limited to:

- Documentation of all hazards and special personal protective equipment requirements.
- Identification and documentation of special precautions, equipment status, and personal safety equipment requirements prior to working in potential hazardous gas enriched environments.
- Documentation of initial air monitoring and continuous air monitoring frequency with appropriate calibrated portable gas meters.
- Establishing requirements to maintain posted warnings at all access points to confined space temporary openings.
- Documentation of gas hazard work area delineation personnel/traffic control setup if necessary.
- Documentation of appropriate signage that shall include adequate warning by stating Danger, Inert Gas Present or Possible Oxygen Deficient Environment.
- Confined Space Work Permits as necessary shall be implemented in accordance with Occupational Safety and Health Administration (OSHA) Confined Space Entry Requirements per Section 146 of the OSHA Standard for General Industry (29 CFR 1910). Examples of atmospheres that require a permit include:
 - Those having an oxygen concentration equal to or less than 19.5 percent;
 - Those having an oxygen concentration equal to or greater than 23.5 percent;
 - The presence of toxic gases in concentrations equal to or greater than the 8-hour time-weighted average for the gas; or
 - The presence of explosive or flammable gases equal to or greater than 10 percent of the lower flammable limit.

6.4 Gas Hazards Prevention

- If other methods, such as engineering controls, are not available or effective in controlling exposure to hazardous gas environments, suitable personal protective equipment (PPE) shall be donned. Choosing the right PPE for a particular job is essential. Safety Data Sheets (SDSs) should provide general guidance. Also obtain help from someone who knows how to evaluate the hazards of the job and how to select the proper PPE.
- Skin Exposure: When using gases that are harmful by skin contact, wear protective gloves, Tyvek suits, aprons or other clothing depending on the risk of skin contact. Choose clothing made of materials that resist penetration or damage by the chemical. The SDS should recommend appropriate materials. If it does not, contact the gas supplier for specific information.

- Eyes and Face Protection: Always wear eye protection when working with compressed gases. Avoid ordinary safety glasses. Use chemical safety goggles instead. In some cases, you should also wear a face shield (with safety glasses or goggles) to protect your face.
- Avoid Breathing Harmful Gases: If respirators must be used for breathing protection, follow the OSHA 29 CFR 1910.134(k)(5) and GES Policy HS - 0034 Respiratory Protection written respiratory protection programs to follow. Follow all GES and OSHA requirements for respirator use and approvals and personnel shall be a part of the GES Medical Monitoring Program.
- Sorbents in air-purifying respirator cartridges and canisters must be compatible with the chemical they are supposed to protect against. For example, oxidizable sorbents, such as activated charcoal, may not be acceptable if high concentrations of oxidizing gases are present. A hazardous reaction might occur. Keep in mind that air-purifying respirators do not protect against oxygen-deficient environments.
- Know and be familiar with the right PPE for use in emergencies as well as during normal operations.
- Personal Single-Gas and/or Multi-Gas Personal portable gas meters shall be used when necessary. These gas meters improve worker safety with wearable and hand-held personal gas monitors. These devices clearly alert users about potential risks and enable them to take immediate action.

7.0 Portable Gas Meters – Calibration

Portable gas monitoring instruments are designed to protect personnel from exposure to concentrations of hazardous gases in the workspace. Inaccuracy of portable air monitoring instruments will lead to serious health implications and fatalities. The following are the requirements for proper calibration of personal portable gas monitoring instrumentation:

- 7.1 All personal gas monitoring instruments shall be calibrated (measurement of accuracy relative to a known concentration of a gas) to prevent inaccurate hazardous gas and oxygen-deficient concentration readings that could lead to illness/injuries or fatalities.
- 7.2 Calibration of all gas monitoring instruments shall be conducted in accordance with the manufacturer's recommendations. The type and concentration of calibration gas, sample tubing, flow regulators, and calibrations adapters are key calibration elements. Only use certified calibration gases that are within their expiration dates.
- 7.3 Upon calibration, a current calibration sticker shall be affixed to the monitor of the gas meter which includes the current date of calibration and a due date for the next calibration.
- 7.4 Calibration documentation shall be maintained in the daily field log book or the instrument calibration log if applicable.
- 7.5 Bump Tests – Also known as a functional test:
 - Daily bump tests shall be conducted to verify calibration by exposing the instrument to a known concentration of a test gas and confirming the response of the monitors and glass sensor alarms.
 - Instruments should be zeroed before the bump test is completed.
 - If the instruments fails the bump test, a full calibration shall be conducted.

8.0 Gas Hazards Emergency Response: All employees shall adhere to the provisions of emergency planning and response per the provisions of Site Specific Health and Safety plan contingency/emergency plans.

Employees will be required to participate in drills to ensure the effectiveness of the emergency response. The following first aid, medical and incident notification approach will be implemented when there is a heat and cold stress injury-illness condition or a potential emergency:

- 8.1 If hazardous gas enriched or Oxygen deficient incident or injury occurs, an individual should immediately report any concerns to the GES oversight staff. The GES subcontractors shall immediately notify the GES onsite supervisor.
- 8.2 Following an assessment of the individual's condition by trained CPR/ First Aid trained staff or other onsite staff, if responding GES personnel feel that outside medical response personnel are necessary, then the 911 Emergency Response System shall be activated. This will be accomplished by dialing 911 and providing the 911 operator all of the information that is requested.
- 8.3 Immediately after initiating the emergency response system, the GES oversight person must verbally notify immediately his supervisor, PM and/or Regional HSSE Manager/Officer. The GES incident reporting requirements shall be followed.

9.0 References:

1. Columbia University in the City of New York. Potential Workplace Respiratory Hazards, <http://www.ehs.columbia.edu/RPPPWHazards.html>. Accessed 26 June 2017.
2. Safety and Health Information Bulletin SHIB-05-04-2004. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA). May 5, 2004. Online PDF accessed 23 June 2017.

HSSE Policy, Procedure & Guidance

Policies and Procedures



Policy #: 0016
Revision #: 5
Date: 01/12/2020

Section 16: Hazardous and Non-Hazardous Waste Management Program

The following have reviewed and authorized the issuance of the Policy, Procedure, & Guidance.

	<u>Name and Title</u>	<u>Date</u>
Initiator:	<i>Thomas Baylis, Director HSSE</i>	6/1/2016
Guidance Committee:	<i>Heather Cloud, Regional Operations Manager</i>	6/1/2016
Guidance Committee	<i>Jon Agnew, Regional Operations Manager</i>	6/1/2016
Guidance Committee	<i>Doug Liddell, Regional Operations Manager</i>	6/1/2016
Guidance Committee	<i>David Zailik, Regional Operations Manager</i>	6/1/2016
Chief Ex. Officer:	<i>Edward Van Woudenberg</i>	6/1/2016

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Policy #: 00018
Revision #: 5
Date: 01/12/2020

1.0 OBJECTIVE

This program ensures that the proper management of hazardous and non-hazardous waste in accordance with GES, Client and Federal, State or other requirements.

2.0 SCOPE

This procedure outlines the requirements for ensuring the proper management of accumulated hazardous and non-hazardous waste. It also describes the requirements for the proper disposal/ removal of the waste from a GES work location. The non-hazardous and hazardous waste stream(s) that this procedure will address includes but is not limited to the following:

- 2.1 Petroleum impacted soil and groundwater.
- 2.2 Gasoline, fuels or other petroleum products.
- 2.3 Waste that may have been generated by hazardous material releases or clean-up activities
- 2.4 RCRA Listed and Characteristic Waste
- 2.5 Outlines the requirements for the storage of hazardous and non-hazardous waste storage containers. These waste containers include but are not limited to containers that store impacted and non-impacted soil, groundwater, and other impacted and non-impacted material.

Note: GES will comply with the most stringent HSSE requirements whether that is from the Client or GES'

3.0 RESPONSIBILITY

The GES Corporate Health, Safety, Security and Environmental (HSSE) Department will ensure that these procedures are followed and will revise them to conform to changes in environmental regulations, waste classification, or generator status.

4.0 PROCEDURE

- 4.1 Impacted soils and groundwater generated by assessment and remediation activities are typically classified as listed hazardous waste. In addition, materials that are shown to have certain hazard characteristics will also be managed as hazardous waste.
- 4.2 Each hazardous waste and non-hazardous waste storage drum should be stored in a location that is secure from traffic and/or other activities that could result in damage. Storage requirements or recommendations must be discussed with the client.
- 4.3 Waste handling and Storage: Only one drum shall be used at a time to accumulate waste within an onsite storage area (now termed a "Central Accumulation Area", for hazardous wastes). The following procedure must be followed:
 - 4.3.1 Select the proper drum (metal or plastic) to store impacted material or product.
 - 4.3.2 A plastic drum should only be used if corrosive waste or oxidizers are generated.
 - 4.3.3 If a metal drum that previously held another product is used for waste storage, the drum must be drained completely and triple rinsed with potable water by area personnel. The drum contents

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Policy #: 0016
Revision #: 5
Date: 01/12/2020

must be captured and containerized in an appropriate container. The rinse solution should be held and removed from the site as non-hazardous waste.

- 4.3.4 Inspect the drum to ensure that no holes from corrosion or damage are present.
- 4.3.5 If the drum previously held another material other than the current waste solvent, remove any markings that pertain to the previously held material.
- 4.3.6 Before any waste is placed in a drum, a “Hazardous Waste” or “Non-hazardous Waste” label must be placed on the drum. Typically this task will be performed by the Site Supervisor or an individual who has been assigned this responsibility. The required label elements are as follows – use a permanent-marking pen:
 - “Hazardous Waste” or “Non-hazardous Waste”
 - Indication of the hazard(s) associated with the material
 - The Department of Transportation’s (DOT) proper shipping name, such as “Gasoline”, in the blank space for “Contents”. If the waste consists of a mixture, print the most hazardous material that makes up the solution. A solution that has gasoline and other less hazardous flammable liquids would be indicated as “Flammable Liquid NOS (gasoline)”
 - Accumulation start date (the date that the waste was first place into the drum)
 - Any applicable EPA waste code(s)
- 4.3.7 Place the label on the side of the drum, near the top in an area where the label will be visible.
- 4.3.8 If the waste has been determined to be hazardous, the storage period for each drum begins the day (date) that the waste is first placed into the container. The maximum storage period (90 days for large quantity generators and 180 days for small quantity generators) is required by the Federal Resource Conservation and Recovery Act (RCRA). Do not mix waste streams.
- 4.3.9 Minimize splashing and spills by carefully and slowly pouring waste into the drums.
- 4.3.10 Keep the drum(s) closed except when adding waste material. Ensure that the bung caps are placed back on the drum and hand-tightened so that no liquid or vapors are permitted to escape.
- 4.3.11 If the drum is fitted with a funnel that is equipped with a cover, make sure that this cover is hand-tightened into the funnel.
- 4.3.12 When transferring flammable liquids from one container to another, they must be bonded together to dissipate any static charges that are generated by movement of the liquid. Also, the receptacle (i.e. drum, or other container into which the liquid is poured) must be grounded.
- 4.3.13 Any drums containing free/pooling flammable liquids must have an earth ground (i.e. drums containing only socks are not required to be grounded). This can be accomplished using any one of the following methods (see “Engineering Guidance Note – Grounding and Bonding Issues” for more details):
 - Use an air knife, hydrovac, and/or hand auger to create a 4-inch (minimum) hole to 6 inches less than the rod length. Install the rod and backfill the hole with native material making sure to compact the material around the ground rod
 - Use an alternative style of electrode/electrode system. This could be a plate style electrode or horizontal style electrode.
Note: If you are in a freezing climate, these could require significant burial depths (e.g., below the frost line).
 - Obtain a variance from the GES and the client subsurface clearance protocol to allow “blind” driving of grounding electrode.

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Policy #: 0016
Revision #: 5
Date: 01/12/2020

Note: Take indigenous moisture and soil type into consideration when selecting this option. A driven electrode does not necessarily produce the best ground!

- Locate and use an already installed alternative grounding electrode (e.g., underground water pipe, concrete encased electrode).

Note: It is important to verify that the capacity of the alternative electrode/grounding system can accommodate the additional added load.

- 4.3.14 While stored onsite, each Hazardous Waste storage container must be inspected weekly and Non-hazardous waste container must be inspected, at a minimum, quarterly to ensure that the proper marking and labeling has been placed onto and remains on the outside of the container, no spills or no container failure is apparent. If the waste is considered a RCRA hazardous waste, then the inspection must ensure that the storage date has not exceeded the required storage period.
- 4.3.15 The GES oversight person must notify the GES Project Manager when a waste storage drum onsite is estimated to be approximately three-quarters full by visible inspection. No drum should be filled greater than 75% of its total capacity. The project manager in turn should notify the client of the condition and a removal will be scheduled.
- 4.3.16 The drum must remain in the Central Accumulation Area until removed by the GES approved waste removal transporter (subcontractor.) If more waste is generated while awaiting the drum pick-up, then the waste should be placed in a separate storage drum.
- 4.3.17 After the full drum(s) is picked up by the removal contractor and transported off site, a new waste drum is put in its place.

4.4 Waste Removal

- 4.4.1 The GES Project Manager (PM) or local office waste coordinator must provide to each field person who is assigned the task of overseeing waste removal from a site location, the name and location of the approved client waste disposal facility.
- 4.4.2 Every effort shall be made to ensure GES personnel are on site for all scheduled Hazardous and Non-hazardous drum pick up. Contact client if necessary. This is to ensure proper management of client waste streams.
- 4.4.3 When scheduling waste removal the PM or waste coordinator must ensure that the waste transportation contractor provides the name of the approved client facility that the waste will be transported to for disposal. The communication with the contractor must be documented with the name of the intended disposal facility indicated within the documentation.
- 4.4.4 Only a waste (material) transportation company that has been approved through the GES Pre-qualification process can be selected for removing waste material from a GES project location.
- 4.4.5 Prior to removal, the GES waste coordinator (GES PM or designated person) must request that the intended waste manifest (draft) is faxed to the local GES office. The coordinator must review the manifest and verify that the approved client disposal facility is identified on the manifest. The reviewed manifest must then be provided to the GES employee who will sign the manifest in the field “on behalf of the client”.
 - If required, ensure that the employee signing the manifest has been approved/permited by the client to do so..
- 4.4.6 Depending on State, local or client requirements, in addition to reviewing the manifest, the GES PM or local waste coordinator may also need to verify the waste transportation company has

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satisfied DOT compliance. This action could include but is not limited to obtaining the following information:

- DOT Number
- License Plate numbers for the truck(s) that are proposed for transporting the waste material offsite
- State specific registration information (if applicable)

- 4.4.7 The GES PM or waste coordinator must either coordinate/ communicate directly with or ensure that the field personnel have communicated with the transportation subcontractor, and verify and validate that the subcontractor is aware of the proper waste disposal facility. Field staff should always observe the waste being loaded onto the transportation vehicle.
- 4.4.8 The waste removal contractor is required to bring either a hazardous waste or non-hazardous waste manifest to the site. The manifest that is brought to the site by the removal contractor must be reviewed (compared with the copy of the manifest provided by the GES waste coordinator) and approved by the GES employee providing oversight. In the event that GES has agreed to sign a manifest and has been granted authority by the client to sign them, the GES representative will sign the manifest “on behalf of the client.” If client authorization is not provided, the manifest will be directed to the client (waste generator) for signature,
- 4.4.9 Prior to signing the manifest, the GES over sight person is required to compare the faxed (draft) manifest to the manifest that will travel with waste to the approved client disposal facility. The evaluation should ensure that the manifest is complete and that the approved (similar) disposal facility is identified on each manifest. If the manifest is not complete or the disposal facility is not accurate, the waste removal activity should be stopped and the local GES PM or waste coordinator notified.
- 4.4.10 Prior to the waste transporter leaving the site, the GES over sight person must speak with the vehicle operator and confirm the destination of the waste and ensure that that waste is being transported to an approved facility. . In addition to requesting the waste destination, the GES oversight person should reconfirm with the waste transporter, the required client destination by reminding the transporter or asking the transporter to provide the name of the intended disposal facility. This communication must be documented in the appropriate site (field) log.
- 4.4.11 Prior to leaving the site, the GES over sight person must inspect the truck and verify that the truck does not require decontamination. If decontamination is required, then the truck will be directed to an established decontamination area onsite and undergo the required decontamination prior to leaving the site. Decontamination will be verified by the GES over sight person prior to allowing the truck to leave the site.

4.5 Certificates of Disposal and Certificates of Destruction

- 4.5.1 Upon written request from the client, GES will pass through to the client Certificates of Disposal or Certificates of Destruction for wastes managed under GES's scope of work. It should be noted that not all the Treatment, Storage, Disposal Facilities (TSDF) provide these certificates. However, GES will endeavor to obtain these certificates for the client when requested and if available from the TSDF. GES will collaborate with the client in the selection of the TSDF for the waste(s) being managed by GES request from the client to have a formal written request issued as part of the scope of work

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- 4.5.2 The GES Project Manager (PM) will be responsible to submit the certificates to the client on a regular basis and as they become available from the TSDF handling the wastes.
- 4.5.3 It should be noted and conveyed to the client that GES is not be responsible for the accuracy or timeliness of the development and transmittal of Certificates of Destruction or Certificates of Disposal from the TSDF.

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Section 20: Hearing Protection Policy

The following have reviewed and authorized the issuance of the Policy, Procedure, & Guidance.

	<u>Name and Title</u>	<u>Date</u>
Initiator:	<i>Thomas Baylis, CIH, VP HSSE</i>	7/8/16
Guidance Committee:	<i>Doug Liddell, Regional Operations Manager</i>	7/8/16
Guidance Committee:	<i>Heather Cloud, Regional Operations Manager</i>	7/8/16
Guidance Committee:	<i>Jon Agnew, Regional Operations Manager</i>	7/8/16
Guidance Committee:	<i>David Zailik, Regional Operations Manager</i>	7/8/16
Chief Ex. Officer:	<i>Edward Van Woudenberg</i>	7/8/16

General Definitions

Policies prescribe certain behaviors or courses of action deemed expedient, prudent, and advantageous to the function of GES (“Policy”). As such, Policies are non-discretionary, the violation of which may result in severe consequences including, without limitation, termination of employment. As an analogy, Policies are to GES, as statutes are to a governed body.

Procedures prescribe certain behavior or courses of action deemed expedient, prudent, and advantageous to achieve compliance with Policy (“Procedures”). As such, Procedures are non-discretionary, the violation of which may result in severe consequences including, without limitation, termination of employment. As an analogy once again, Procedures are to GES, as regulations are to a governed body, meaning they describe how to comply with statutory requirements.

Guidance provides suggested methodologies to achieve compliance with Policies and Procedures that are non-mandatory, or discretionary, in the reasonable judgment of the actor. The use of Guidance is designed to create efficiencies where the relevant circumstances may require a more flexible approach to compliance, allowing the actor to use his/her reasonable judgment.

Procedure for policy approval

1. Policy Recommendations shall be submitted via electronic mail to the Company’s General Counsel (“Counsel”).
2. Counsel shall, thereafter, upon gathering any other information required, if any, present the Recommendation to a Policy, Procedure and Guidance Committee (“Committee”) for consideration.
3. The Committee’s members shall be chosen by the President of the Company or his/her designee, with the roles and responsibilities of the same established collectively.
4. The Committee shall be empowered, as required, to take all necessary action to either draft such Recommendation for presentation and approval, or recommend rejection of such Recommendation, to the President who shall either approve the newly created Policy, Procedure, or Guidance, or reject the Recommendation.
5. Initiator records approval date and revision number in version identification block on document and signature page (revision number and date must match on both documents).

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Policy #: 0020
Revision #: 5
Date: 01/08/2020

1.0 OBJECTIVE

The objective of this procedure is to clearly specify how Hearing Protection Devices are to be selected and used by the employees of Groundwater & Environmental Services, Inc. (GES) for employee protection against noise levels that may cause hearing loss and/or exceed the requirements of regulatory standards.

2.0 SCOPE

This program covers the use and selection of all elements of hearing protection whenever such protection is used by the salaried or hourly employees of GES. Although employees of GES are not required to operate equipment generating noise levels in excess of those acceptable under 29 CFR 1910.95, some work site locations and/or activities could generate noise levels which would require the use of hearing protection devices. This document is not intended to serve as a "Hearing Conservation Program" as defined under 29 CFR 1910.95, but is intended to provide the guidelines under which employees can protect themselves when exposed to noise hazards.

3.0 ADMINISTRATION AND GENERAL INFORMATION

3.1 This program covers the use of any hearing protection device to protect the wearer from exposure to noise levels that could result in permanent loss of hearing in the work place. Available protection includes:

- 3.1.1 Disposable earplugs
- 3.1.2 Ear muffs

3.2 The Hearing Protection Program described herein is based upon the following government regulations and industry standards:

- 3.2.1 CFR Title 29 Part 1910.95 Occupational Noise Exposure
- 3.2.2 CFR Title 29 Part 1926.52 Occupational Noise Exposure

3.3 According to the above regulations, hearing protection devices shall be worn whenever the following permissible exposure levels (Table G-16, 29 CFR 1910.95) are exceeded:

- 3.3.1 Permissible Noise Exposures

Duration per Day, Hours	Sound Level dBA
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25	115

- 3.3.2 It shall be the policy of GES to utilize appropriate engineering controls whenever available to reduce the potential for noise hazards in the work place which would require the use of hearing protection. Hearing protection shall be used in addition to, or in place of, such engineering controls whenever reduction of noise to safe levels cannot be accomplished.

3.3.3 Within GES, this program shall be administered by GES Director, Corporate Health and Safety hereafter called the Program Administrator, and the designated Regional Health and Safety Managers/Officers, who together shall be responsible for the generation and execution of all portions of the program, and who will have the necessary authority to assure that all requirements of this program are properly fulfilled.

4.0 STANDARD OPERATING PROCEDURES

4.1 Selection of Hearing Protection Devices

4.1.1 The Local operations personnel will be responsible for the selection of proper hearing protection on a site specific basis, shall make that selection based upon the noise hazards to which the employees are likely to be exposed (as reported by GES Project Managers and/or GES on-site personnel).

4.1.2 When GES is employed as a subcontractor at a facility where the client has the responsibility for determining the health hazards at the site or location, and consequently controls the selection of personal protective equipment, including hearing protection, the Program Administrator or his/her agent shall obtain a copy of the health and safety program containing that information. GES employees shall be informed of the hazards present at the work location, and Personal Protective Equipment and hearing protection shall be utilized in accordance with that plan.

4.1.3 When GES is employed as the prime contractor at a facility known or suspected to contain noise hazards which may require the use of hearing protection, the Project Manager, in conjunction with the Regional HSSE Manager/Officer, shall have the responsibility to determine the noise hazards present through application of appropriate audiometric measuring instruments. Based upon those results, the Regional HSSE Manager/Officer will be responsible to select and furnish hearing protection to GES employees exposed to such noise hazards, and to notify subcontractors of the determination of necessary hearing protection so that they can furnish their employees with the proper equipment.

4.1.4 Should noise hazards be found which would preclude the use of the hearing protection available at the work site, and employees are not able to remove themselves from the proximity of the noise source to sufficiently reduce the noise to acceptable levels as defined below, employees shall immediately leave the site. Hearing protection must be made available for use when staff are exposed to noise levels that approach or exceed 85 dBA. As a general rule of thumb (and in the absence of field instrumentation), an acceptable noise level will be at a location sufficiently distant from the noise source that two individuals standing side by side can converse and be understood when speaking in a normal voice.

4.1.5 GES has selected the following Personal Protective Equipment to be used by its employees, based upon the typical hazards encountered at their work sites:

4.1.5.1 MAX-plugs (NRR 33) - Howard Leight Industrial; or other comparable brand/model of earplugs

4.1.5.2 Ear muffs (NRR 20-25) - various brands and models

5.0 EMPLOYEE TRAINING

5.1 All employees who are required to use hearing protection devices will successfully complete a Hearing Conservation Training prior to initial assignment that shall include, but not be limited to the following

topics, which are addressed in the 40-Hour HAZWOPER Training Course and 8-Hour Annual Refresher Course:

- 5.1.1 The contents of 29 CFR 1910.95.
- 5.1.2 The contents of this HEARING PROTECTION PROGRAM.
- 5.1.3 The effects of noise on hearing.
- 5.1.4 The purpose of hearing protection, its selection, use, care and limitations.
- 5.1.5 The purpose of audiometric testing, and an explanation of the test procedure.

5.2 All training shall be updated to be consistent with changes in the PPE and work processes that include instruction on the proper use and fit of hearing protectors.

6.0 MEDICAL SURVEILLANCE

- 6.1 As part of the company Medical Surveillance Program, medical examinations, including audiograms, are performed on all employees. Notification of the results of this testing is sent to each employee after each exam, and any changes or trends are noted. Under the provisions of 29 CFR 1910.120(f), medical examinations are performed at the start of employment, annually and at exit from covered positions. In some cases an extension may be granted by the Medical Review Officer, however, no more than 2 years will be permitted between examinations. The initial audiogram serves as the baseline, is required prior to any field assignment or noise exposure, and each audiograms taken thereafter are compared to that baseline and changes noted by the examining physician. Employees will be instructed to avoid high noise levels for at least 14 hours prior to receiving his or her baseline exam. Hearing protection requirements for individuals are consequently altered as necessary.
- 6.2 If an audiogram suggests impairment (either a threshold shift or noticeable loss on the baseline), it will be necessary to have the individual retested under ideal circumstances. Prior to testing, all individuals should refrain from noise exposure for 16 hours. There is no mechanism to ensure that this recommendation has been followed and frequently this is not practical from the employer's perspective.
- 6.3 Audiometric testing must be conducted by either an audiologist, a CAOHC certified technician or the physician. The exception to this is the audiometer equipped with a microprocessor that brackets the individual's response in a fashion consistent with that of a trained technician.
- 6.4 Hearing loss, as defined by 29 CFR 1910.95, considers only 2000 HZ, 3000 HZ, and 4000 HZ. The GES medical provider will use these frequencies to identify threshold shifts.
- 6.5 The results of a single audiogram cannot be considered diagnostic. Using the Council of Accreditation in Occupational Hearing Conservation (CAOHC) criteria, however, apparent losses in auditory acuity can be suspected. When two or more audiograms are available on the same individual, evaluation for threshold shift will be conducted in accordance with the guidelines set forth in 29 CFR 1910.95. The distinction between a Standard Threshold Shift and Temporary Threshold Shift is made by repeat evaluation.
- 6.6 If a standard threshold shift results, the GES medical provider will alert GES and the employee within 10 days of the test. Unless a physician determines that the standard threshold shift is not work related or aggravated by occupational noise exposure, GES shall ensure that the following steps are taken:
 - 6.6.1 GES employees who are not using hearing protectors shall be fitted with hearing protectors, trained in their use and care, and required to use them.

- 6.6.2 GES employees already using hearing protectors shall be refitted and retrained in the use of hearing protectors and provided with hearing protectors offering greater attenuation if necessary.
- 6.6.3 The GES employee who was determined to have a standard Threshold Shift shall be referred for an additional audio logical evaluation or examination, as appropriate. The examination will be required if additional testing is necessary or if GES suspects that a medical pathology of the ear is caused or aggravated by the wearing of hearing protectors.
- 6.6.4 The GES employee will be informed of the need for an audio logical examination if a medical pathology of the ear is unrelated to the use of hearing protectors is suspected.

7.0 USE OF HEARING PROTECTION

- 7.1 When needed, hearing protection will be provided free of cost to the employee.
- 7.2 It shall be the responsibility of all employees to properly inspect, store and use hearing protection devices issued to them. Whenever problems or defects are discovered in any of the issued hearing protection, the employee shall contact the Local Site Manager, who will issue an appropriate replacement.
- 7.3 The Local Site Manager shall maintain an adequate stock of hearing protection devices and insure that such devices are available to employees. Each GES employee will be given an opportunity to select their hearing protection from local office stock of hearing protection devices.
- 7.4 The Local Site Manager shall conduct monthly inspections of random work sites to ascertain that hearing protection devices are being properly stored, correctly used, and conscientiously worn.
- 7.5 Corporate Health and Safety shall maintain records concerning the training, sting, and any special circumstances of all employees whose duties subject them to this program.

8.0 PROGRAM/SOP MODIFICATIONS

Whenever modifications in hearing protection needs are required through changes in work scope, equipment changes or modification, revision of federal regulations or standards, or any action that would necessitate a change in any of the contents of this Hearing Protection Program, such changes shall be made, and everyone affected by those changes notified and retrained, if necessary. All such modifications shall be made in writing, and the nature of the modification noted and dated.

Section 66: Heat and Cold Stress/Illness Prevention Guidance

The following have reviewed and authorized the issuance of the Policy, Procedure, & Guidance.

	<u>Name and Title</u>	<u>Date</u>
Initiator:	<i>Thomas Baylis, Director HSSE</i>	6/7/17
Guidance Committee:	<i>Doug Liddell, Regional Operations Manager</i>	6/7/17
Guidance Committee:	<i>David Zailik, Regional Operations Manager</i>	6/7/17
Guidance Committee:	<i>Heather Cloud, Regional Operations Manager</i>	6/7/17
Guidance Committee:	<i>Jon Agnew, Regional Operations Manager</i>	6/7/17
Chief Ex. Officer:	<i>Edward Van Woudenberg</i>	6/7/17

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Guidance provides suggested methodologies to achieve compliance with Policies and Procedures that are non-mandatory, or discretionary, in the reasonable judgment of the actor. The use of Guidance is designed to create efficiencies where the relevant circumstances may require a more flexible approach to compliance, allowing the actor to use his/her reasonable judgment.

Procedure for policy approval

1. Policy Recommendations shall be submitted via electronic mail to the Company’s General Counsel (“Counsel”).
2. Counsel shall, thereafter, upon gathering any other information required, if any, present the Recommendation to a Policy, Procedure and Guidance Committee (“Committee”) for consideration.
3. The Committee’s members shall be chosen by the President of the Company or his/her designee, with the roles and responsibilities of the same established collectively.
4. The Committee shall be empowered, as required, to take all necessary action to either draft such Recommendation for presentation and approval, or recommend rejection of such Recommendation, to the President who shall either approve the newly created Policy, Procedure, or Guidance, or reject the Recommendation.
5. Initiator records approval date and revision number in version identification block on document and signature page (revision number and date must match on both documents).

1.0 **Introduction:** Heat/cold stress may occur at any time work is being performed at temperature extremes. If the body's physiological processes fail to maintain a normal body temperature because of excessive heat or cold temperatures, a number of physical reactions can occur, with symptoms ranging from mild to very significant (fatal). This document provides the approach/procedures to prevent heat and cold stress illnesses.

ATTACHMENTS

Attachment 1 – Heat Index/Heat Stress Risk Levels and Associated Protective Measures

Attachment 2 - The Cold Stress Equation and Wind Chill Factor Calculation Table

Attachment 3 - Cold Stress – Work/Warm up Schedule for a 4-hour Shift

2.0 **Objective:** Heat and cold stress can contribute to adverse health effects which range in severity from discomfort to a significant health impact and possibly death. The objective of this guidance is to provide procedures and practices for safely working in temperature extremes to prevent and minimize the effects of heat and cold stress.

3.0 **Responsibilities:**

3.1 Corporate Health, Safety, Security, and Environment (HSSE) Vice President (VP) and Regional HSSE Managers/Officers shall:

- Maintain, review and update the Heat and Cold Stress requirements as needed.
- Provide monitoring (upon request) and assist employees with the development of procedures to minimize the adverse effects of heat and cold stress in the workplace.
- Provide training to employees affected by heat and cold.

3.2 Site Field Supervisors and/or Project Managers shall:

- Review and comply with the provisions outlined in this document.
- Ensure all employees are properly trained before working in extreme temperature conditions.
- Assess the day-to-day heat or cold stresses on employees.
- Assess employees work load and assigning work and rest schedules as needed.
- Provide continuous protective oversight of the field staff working in extreme temperatures.
- Ensure all employees have the appropriate personal protective equipment (PPE) prior to working in extreme temperature conditions.
- Ensure employees are familiar with this safety policy.

3.2 All GES employees, subcontractor personnel, and other onsite personnel shall:

- Review and comply with the provisions outlined in this document.
- Complete training before working in extreme temperature conditions.
- Wear the appropriate PPE including clothing applicable to hot/cold conditions.
- Report heat and cold stress concerns to their supervisor.

4.0 **Training:** Training will be provided by GES Corporate HSSE VP or Regional HSSE Managers/Officers. GES Site supervisors and other staff will receive initial training and annually on heat/cold stress assessment, prevention, and management requirements described in this document. Site supervisors will be trained prior to overseeing personnel working in Heat and Cold Stress conditions. This will ensure that they are knowledgeable regarding the prevention, can recognize heat/cold stress illness symptoms and will be able to treat the various forms of heat/cold stress illnesses. All training records will be documented for a period of at least one year from the date of training.

5.0 **Heat Stress Illnesses/Treatment, Assessment and Prevention**

5.1 Heat Stress Illnesses/Treatment: While working in hot weather conditions, the human body may not be able to maintain a normal temperature just by sweating. If this happens, heat-related illnesses may occur. The most common health problems caused by hot temperature extremes include:

- 5.1.1 Heat stroke – This is the most serious heat related effect. Heat stroke occurs when the body temperature increases above 104°F. Signs and symptoms of heat stroke are confusion, loss of consciousness and lack of perspiration. This condition must be treated as a medical emergency and the employee must receive immediate medical attention.
- 5.1.2 Heat exhaustion – Signs and symptoms of heat exhaustion include headache, nausea, dizziness, weakness, irritability, confusion, thirst, heavy perspiration and a body temperature greater than 100.4°F. Employees experiencing heat exhaustion should be moved to a cool area, given fluids to drink and given cold compresses for their head, face and neck. Depending on the severity, individuals may need to be transported to a clinic to be evaluated and possibly monitored by medical personnel.
- 5.1.3 Heat cramps – Signs and symptoms of heat cramps include muscle pains usually caused by the loss of body salts/fluids. Employees should replace fluid loss by drinking water and/or carbohydrate-electrolyte replacement liquids (e.g. Gatorade) every 15 to 20 minutes.
- 5.1.4 Heat rash – Heat rash is caused by excessive perspiration and looks like a red cluster of pimples or small blisters. Heat rash usually appears on the neck, upper chest, in the groin, under the breasts and in elbow creases. Treatment for heat rash is to provide a cooler, less humid environment.
- 5.1.5 Dehydration – Dehydration is a major factor in most heat disorders. Signs and symptoms of dehydration include increasing thirst, dry mouth, weakness or light-headedness (particularly if worse upon standing), and a darkening of the urine or a decrease in urination. Dehydration can be reversed or put back in balance by drinking fluids that contain electrolytes (i.e. Gatorade) that are lost during work related activities. Avoid caffeinated drinks and during non-work hours, alcoholic beverages.

5.2 Heat Stress Assessment

- 5.2.1 For strenuous field activities that are part of on-going site work activities in hot weather, the following assessment procedures should be considered to monitor the body's physiological response to heat, and to manage the work cycle, even if workers are not wearing impervious clothing. One or more of the following procedures could be instituted to prevent heat stress when the temperature exceeds 70°F and shared with all GES and subcontractor staff.
- 5.2.2 Measure Heart Rate - Heart rate (HR) should be measured by the radial pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats/ minute. If the HR is higher, the next work period should be shortened by 33%, while the length of the rest period stays the same. If the pulse rate still exceeds 110 beats/ minute at the beginning of the next rest period, the following work cycle should be further shortened by 33%. The procedure is continued until the heart rate is maintained under 110 beats per minute.
- 5.2.3 Measure Body Temperature - When ambient temperatures are over 90°F, body temperatures should be measured with a clinical thermometer as early as possible in the resting period. Oral temperature (OT) at the beginning of the rest period should be shortened by 33%, while the length of the rest period stays the same. If the OT exceeds 99.6°F at the beginning of the next rest period, the following work cycle should be further

shortened by 33%. The procedure is continued until the body temperature is maintained below 99.6°F.

5.2.4 Physiological Monitoring Schedule - The following suggested frequency of physiological monitoring schedule for fit and acclimated workers shall be used as a guideline:

Suggested Frequency of Physiological Monitoring for Fit and Acclimatized Workers ^(a)		
Adjusted Air Temperature ^(b)	For workers with normal work clothes (E.g. Level D), conduct monitoring	For workers wearing impermeable protective clothing (E.g. Level D), conduct monitoring
87.5°F	After each 90 minutes of work	After 30 minutes of work
82.5°F – 87.5°F	After each 90 minutes of work	After 60 minutes of work
77.5°F – 82.5°F	After each 120 minutes of work	After 90 minutes of work
72.5°F – 77.5°F	After each 150 minutes of work	After 120 minutes of work

(a) Assumes work levels of 250 kilocalories/hour (e.g., a moderate work level). Consider increasing the frequency for heavy work rates.
(b) ADJUSTED TEMPERATURE = Actual temperature + 13 X (% sunshine factor)

Source: OSHA - https://www.osha.gov/SLTC/heatillness/heat_index/monitoring_workers.html

5.2.5 If outside temperatures exceed 95°F, work activities may need to stop until a heat stress prevention plan is developed to ensure that planned work activities and conditions do not place staff at risk to a heat stress related illness. Heat stress prevention plan elements would include but not limited to:

- Implementation of a conservative Work/rest schedule
- Provide a shelter that would provide cover and a cool place for onsite staff to take a break.
- Implement a system to monitor heat stress illness.
- Ensure that the proper replacement fluids are provided for rehydration.

5.2.6 The length of work period is governed by Frequency of Physiological Monitoring. The length of the rest period is governed by physiological parameters (heart rate and oral temperature). For example, if an individual's heart rate exceeds 110 beats/minute at the beginning of the rest period, that individual will remain on rest-time until his/her heart rate drops well below 110 beats/minute and their next work period (=duration of time before suggested physiological monitoring) is decreased by 33%.

5.3 Heat Stress Illness prevention

The best approach is preventative heat stress management via the following steps:

5.3.1 Because individual susceptibility varies, it is difficult to predict just who will be affected by heat stress and when. However, there are certain personal risk factors can reduce the body's natural ability to withstand high temperatures. GES site supervisors should take into account employee fitness for working in hot environments and shall assess personal risk factors (as listed below) before work assignments where there is a risk of heat related illness to the employees.

- Weight - Workers who are overweight are less efficient at losing heat.
- Poor physical condition - Being physically fit aids your ability to cope with the increased demands that heat places on your body.

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- Previous heat illnesses - Workers are more sensitive to heat if they have experienced a previous heat-related illness.
- Age - As the body ages, its sweat glands become less efficient. Workers over the age of 40 may therefore have trouble with hot environments. Acclimatization to the heat and physical fitness can offset some age-related problems.
- Heart disease or high blood pressure - In order to pump blood to the skin and cool the body, the heart rate increases. This can cause stress on the heart.
- Recent other illness - Workers with recent illnesses involving diarrhea, vomiting, or fever have an increased risk of dehydration and heat stress because their bodies have lost salt and water.
- Alcohol consumption - Alcohol consumption during the previous 24 hours leads to dehydration and increased risk of heat stress.
- Medication - Certain drugs may cause heat intolerance by reducing sweating or increasing urination. People who work in a hot environment should consult their physician or pharmacist before taking medications.
- Lack of acclimatization - When exposed to heat for a few days, the body will adapt and become more efficient in dealing with raised environmental temperatures. This process is called acclimatization. Acclimatization usually takes 6 to 7 days. Benefits include lower pulse rate and more stable blood pressure; more efficient sweating (causing better evaporative cooling); and improved ability to maintain normal body temperatures.

5.3.2 Potable (drinking) water must be available to staff prior to and during each work shift. GES will provide potable drinking water and drinks that will replenish lost electrolytes (e.g. Gatorade, PowerAde, etc.). It is the responsibility of the GES PM and site supervisor to ensure that drinking water supplies and other liquids with electrolytes are made available to all field personnel working in Heat Stress conditions. GES will also provide disposable 4-8 ounce cups, water coolers, ice, and potable drinking water maintained at 50 – 60°F. Site supervisors and outdoor field work supervisors will monitor, encourage, and ensure that:

- Workers will drink at least 16 ounces of water before beginning work, such as in the morning or after lunch.
- Workers will drink 1 to 2 of these cups of water every 20 minutes for a total of 1 to 2 gallons per day.
- In addition to drinking water, workers should also drink liquid drinks that will replenish lost electrolytes.
- Workers will take adequate breaks and rehydrate in accordance with the OSHA Heat Index recommendations.
- Utilize cool areas for rest breaks.
- The intake of caffeinated drinks such as coffee is discouraged during working hours.
- Frequently monitor for signs of heat stress.

5.3.3 Acclimate workers to site work conditions by slowly increasing workloads, i.e., do not begin site work activities with extremely demanding activities.

5.3.4 If deemed appropriate, provide cooling devices to aid natural body heat regulation. These devices, however, add weight and their use should be balanced against worker efficiency.

An example of a cooling aid is long cotton underwear, which acts as a wick to absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing.

- 5.3.5 In extremely hot weather, conduct field activities during the cooler parts of the day such as in the early morning and evening.
- 5.3.6 Ensure that adequate shelter (shade) is available to protect personnel against heat as well as cold, rain, snow, etc., which can decrease physical efficiency and increase the probability of both heat and cold stress. If possible, always set up a rest area and the command post in the shade.
- 5.3.7 In hot weather, rotate shifts of workers wearing impervious clothing.
- 5.3.8 Good hygienic standards must be maintained by frequent changes of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately report the issue to their manager, and if necessary, medical personnel will be consulted.
- 5.3.9 Heat Index – The Heat Index is a single numeric value that uses both temperature and humidity to inform the public on how the weather outdoors “feels”. The higher the Heat Index, the hotter the weather feels. OSHA has used the Heat Index to assign protective measures for workers as the Heat Index increases. These protective measures may reduce the likelihood of heat related illnesses.

The Heat Index/Heat Stress Risk Levels and Associated Protective Measures are contained in **Attachment 1**.

6.0 Cold Stress Illnesses/Treatment, Assessment and Prevention: During cold weather, an employee's body will use energy to maintain a normal internal body temperature. This will result in a shift of blood flow from employee's extremities (hands, feet and legs) and outer skin to the employee's core (chest and abdomen). If this happens, cold-related illnesses and injuries may occur if exposed to cold conditions for an extended period of time.

6.1 **Cold Stress Illnesses:** The most common health problems caused by cold work environments include:

- 6.1.1 Hypothermia – Hypothermia is a potentially serious health condition. Hypothermia occurs when body heat is lost faster than it can be replaced. When the core body temperature drops to approximately 95°F, the onset of symptoms normally begins. The employee may begin to shiver, lose coordination, have slurred speech, and fumble with items in the hand. The employee's skin will likely be pale and cold. As the body temperature continues to fall these symptoms will worsen and shivering will stop. Once the body temperature falls to around 85°F severe hypothermia will develop and the person may become unconscious, and at 78°F, vital organs may begin to fail.

Treatment depends on the severity of the hypothermia. For cases of mild hypothermia move to warm area and stay active. Remove wet clothes and replace with dry clothes or blankets, cover the head. To promote metabolism and assist in raising internal core temperature drink a warm (not hot) sugary drink. Avoid drinks with caffeine. For more severe cases do all the above, plus contact emergency medical personnel (Call 911 for an ambulance), cover all extremities completely, place very warm objects, such as hot packs or water bottles on the victim's head, neck, chest and groin. Arms and legs should be warmed last. In cases of severe hypothermia, treat the employee very gently and do not apply external heat to re-warm. Hospital treatment is required.

6.1.2 Frostbite – Frostbite occurs when the skin actually freezes and loses water. In severe cases, amputation of the frostbitten area may be required. While frostbite usually occurs when the temperatures are 30° F or lower, wind chill factors can allow frostbite to occur in above freezing temperatures. Frostbite typically affects the extremities, particularly the feet and hands. The affected body part will be cold, tingling, stinging or aching followed by numbness. Skin color turns red, then purple, then white, and is cold to the touch. There may be blisters in severe cases.

Do not rub the area to warm it. Wrap the area in a soft cloth, move the employee to a warm area, and contact medical personnel. Do not leave the employee alone. If help is delayed, immerse in warm (maximum 105 °F), not hot, water. Do not pour water directly on affected part. If there is a chance that the affected part will get cold again do not warm. Repeated heating and cooling of the skin may cause severe tissue damage.

6.1.3 Trench Foot – Trench Foot is caused by having feet exposed to damp, unsanitary and cold conditions including water at temperatures above freezing for long periods of time. It is similar to frostbite, but considered less severe. Symptoms usually consist of tingling, itching or burning sensation. Blisters may be present.

For treatment, soak feet in warm water, then wrap with dry cloth bandages. Drink a warm, sugary drink. Seek medical attention if necessary.

6.1.4 Dehydration – It is easy to become dehydrated during cold weather. Signs of dehydration include increasing thirst, dry mouth, weakness or light-headedness (particularly if worse upon standing), and a darkening of the urine or a decrease in urination. Dehydration can be reversed or put back in balance by drinking fluids that contain electrolytes (i.e. Gatorade) that are lost during work related activities. Avoid caffeinated drinks

6.2 Cold Stress Assessment

6.2.1 The Cold Stress Equation – OSHA has incorporated information obtained from the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values into the Cold Stress Equation. As the temperature decreases and/or the wind speed increases, the potential for cold stress related illnesses and injuries increases. The Cold Stress Equation is contained in **Attachment 2**. A Cold Stress – Work/Warm up Schedule for a 4-hour Shift is included in **Attachment 3**.

6.2.2 Wind Chill - Wind Chill is not the actual temperature, but rather how wind and cold actually feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature.

6.3 Cold Stress Prevention

6.3.1 Cold related illnesses and injuries are dangerous and potentially life threatening, however, they can be prevented. Prevention methods include the following:

6.3.2 Acclimation – Employees exposed to the cold should be physically fit, without any circulatory, metabolic, or neurologic diseases that may place them at increased risk for hypothermia. A new employee should not be required to work in the cold full time during the first days of employment until they become adjusted to the working conditions and required protective clothing. New employees should be introduced to the work schedule slowly and be trained accordingly.

6.3.3 For employees working indoors, the best way to prevent cold-related illness is to make the work environment warmer. Where and if possible, use heaters to warm the work area.

Alternatively, decrease the general ventilation as much as possible by closing windows or doors.

6.3.4 For employees working outdoors or working indoors without heat, take scheduled breaks in warm areas. If available, use wind barricades to block the wind from the employees. Ensure there is plenty of water to drink and take water breaks as needed. Immediately report any problems to a supervisor. Supervisors should consider scheduling the most work for the warmest part of day, assigning extra employees to high demand tasks that will require longer periods in cold areas. All employees should watch out for the safety of their coworkers.

6.3.5 Personal Protective Equipment (PPE) – PPE is an important factor in preventing cold stress related illnesses and injuries. Employees should adhere to the following clothing recommendations when dressing for work in a cold environment:

- Wear at least three layers of clothing; an inner layer of wool, silk or synthetic to wick moisture away from the body; a middle layer of wool or synthetic to provide insulation even when wet; an outer wind and rain protection layer that allows some ventilation to prevent overheating.
- Wear a hat or hood; up to 40% of body heat can be lost when the head is left exposed.
- Wear insulated boots or other footwear.
- Do not wear tight clothing; loose clothing provides better ventilation.
- Keep a change of clothing available in case work clothes become wet.

6.4 **Winter Weather related conditions and prevention:** In addition to cold stress, there are other winter weather related hazards that workers may be exposed to when performing tasks such as Work Zone Traffic Safety, Driving, removing snow from work areas, walking/working on and near snow covered areas, and working near downed or damaged power lines. Due to the extreme cold temperatures there is a potential for freezing temperatures, snowstorms, icy roads, snow covered work areas, and slippery sidewalks – all of which present a variety of health and safety hazards. This section will address the preventative aspects of winter weather related hazards at the workplace or even while at home.

6.4.1 Work Zone Traffic Safety: Workers being struck by vehicles or mobile equipment lead to many work zone fatalities or injuries annually. Drivers may skid, or lose control of their vehicles more easily when driving on snow and/or ice covered roads. It is therefore, important to properly set up work zones with the traffic controls identified by signs, cones, barrels, and barriers, to protect workers. Follow the GES minimum traffic control requirements when setting up traffic control.

6.4.2 Snow shoveling: Improper use of snow shovels, combined with overextension and overexertion of muscles, increases your susceptibility to musculoskeletal injuries. When shoveling, do not twist your body, but instead, use your legs to shift your weight, switching sides frequently.

6.4.3 Driving: Although employers cannot control roadway conditions, they can promote safe driving behavior by ensuring workers will:

- Recognize the hazards of winter weather driving, for example, driving on snow/ice covered roads
- Are properly trained for driving in winter weather conditions; and are licensed (as applicable) for the vehicles they operate.

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- Follow the GES Safe Driving Policy that includes effective maintenance program for all vehicles and mechanized equipment that workers are required to operate.

GES employees shall inspect the following GES vehicle systems to determine if they are working properly:

- Brakes, Cooling System, Electrical System including batteries, Engine, Exhaust System, Tires (for proper tread depth and no signs of damage or uneven wear; and proper tire inflation), Oil, and Visibility Systems: Inspect all exterior lights, defrosters (windshield and rear window), and wipers. Install winter windshield wipers.

A winter emergency kit with the following items is recommended in vehicles:

- Windshield ice scraper, Snow brush, Flashlight with extra batteries, Shovel, Traction aids (bag of sand or cat litter), Jumper cables, Water/Snacks, Blankets, change of clothes

6.4.4 Walking/Working on and near snow covered areas: GES personnel will evaluate snow removal tasks for hazards and plan how to do the work safely. Workers should be aware of the potential for unexpected hazards due to the weather conditions, for example, layers of ice can form as the environmental temperature drops, making surfaces even more slippery.

- A surface that is weighed down by snow and areas of accumulated unstable snow and ice must be inspected by a competent person (Project Manager or Corporate/Regional HSSE Manager) to determine if it is structurally safe for workers to access the work area. All work has to be stopped if it is not practical to mitigate the snow accumulated unstable areas.
- To prevent slips, trips, and falls, employers should clear walking surfaces of snow and ice, and spread deicer such as salt, as quickly as possible after a winter storm. GES will provide appropriate materials such as sand, salt, or any other deicing material as required to eliminate or mitigate the slips, trips, and falls hazards.
- In addition, the following precautions will help reduce the likelihood of injuries:
 - Wear proper footwear such as pair of insulated and water resistant boots with good rubber treads or rubber over-shoes with good treads when walking on snow or ice is unavoidable.
 - Take short steps and walk at a slower pace so you can react quickly to a change in traction, when walking on an icy or snow-covered walkway.
 - Don't carry or swing heavy loads, such as large boxes, cases or purses that may cause you to become off balance when you are walking.
 - Don't step on uneven surfaces. Avoid steps or curbs with ice on them

6.4.5 Working near downed or damaged power lines: Working near downed or damaged power lines due to severe winter weather conditions is a critical activity that poses electrocution hazards during severe winter weather conditions. Assume all power lines are energized and stay clear of any downed or damaged power lines. Establish a safe distance from power lines and report any incidents to the responsible authority.

7.1 Heat and Cold Stress Illness Emergency Response: The following first aid, medical and incident notification approach will be implemented when there is a heat and cold stress injury-illness condition or a potential emergency:

- 7.1.1 If a heat or cold stress condition or injury occurs, an individual should immediately report any concern to the GES oversight staff. The GES subcontractors shall immediately notify the GES onsite supervisor.
- 7.1.2 Individuals who are certified in Cardiopulmonary Resuscitation (CPR)/ First aid will evaluate the employees' condition; if no CPR/First Aid trained staff in onsite, GES trained employee will be requested to respond to the individual's location from the nearest office.
- 7.1.3 Following an assessment of the individual's condition by trained CPR/ First Aid trained staff or other onsite staff, if responding GES personnel feel that outside medical response personnel are necessary, then the 911 Emergency Response System will be activated. This will be accomplished by dialing 911 and providing the 911 operator all of the information that is requested.
- 7.1.4 Immediately after initiating the emergency response system, the GES oversight person must verbally notify immediately his supervisor, PM and/or Regional HSSE Manager/Officer. The GES incident reporting requirements shall be followed.
- 7.1.5 The following additional requirements will be implemented for managing heat and cold stress related illnesses and emergencies:
 - All field personnel are equipped with cell phones that can be used in the event of an emergency.
 - If an employee requires medical treatment beyond basic first aid for their heat/cold stress condition, then the employee if capable shall be instructed to see the local occupational physician that the local office uses for physical examinations.
 - The employee will not be permitted to drive themselves to the local clinic. A fellow employee will be required to drive/ escort the injured person to the local clinic.
 - Each GES supervisor or individual who is providing oversight of field activities must be trained to assess and determine if there are any heat/cold stress related illnesses. This would include but not limited to Red Cross CPR/ 1st aid, GES requirements for managing first aid and medical emergencies (heat/cold stress related illnesses) or other heat/cold stress management care training.

8.0 References:

1. Occupational Safety and Health Administration (OSHA). Occupational Heat Exposure, <https://www.osha.gov/SLTC/heatstress/>. Accessed 22 May 2017.
2. Occupational Safety and Health Administration (OSHA). Heat Index and Heat Stress Levels, https://www.osha.gov/SLTC/heatillness/heat_index/monitoring_workers.html. Accessed 23 May 2017.
3. National Weather Service (NWS) National Oceanic and Atmospheric Administration (NOAA), www.nws.noaa.gov/om/heat/heat_index.shtml. Accessed 23 May 2017

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4. Occupational Safety and Health Administration (OSHA). Winter Weather Hazards, https://www.osha.gov/dts/weather/winter_weather/hazards_precautions.html#workzonesafety. Accessed 22 May 2017.
5. National Weather Service (NWS) – Central Regional Headquarters (CRH) NOAA, <http://www.crh.noaa.gov/Image/gid/WCM/awareness/winterdangers.pdf>. Accessed 23 May 2017.
6. Occupational Safety and Health Administration (OSHA). Wind Chill Tables, https://www.osha.gov/dts/weather/winter_weather/windchill_table.pdf. Accessed 22 May 2017.

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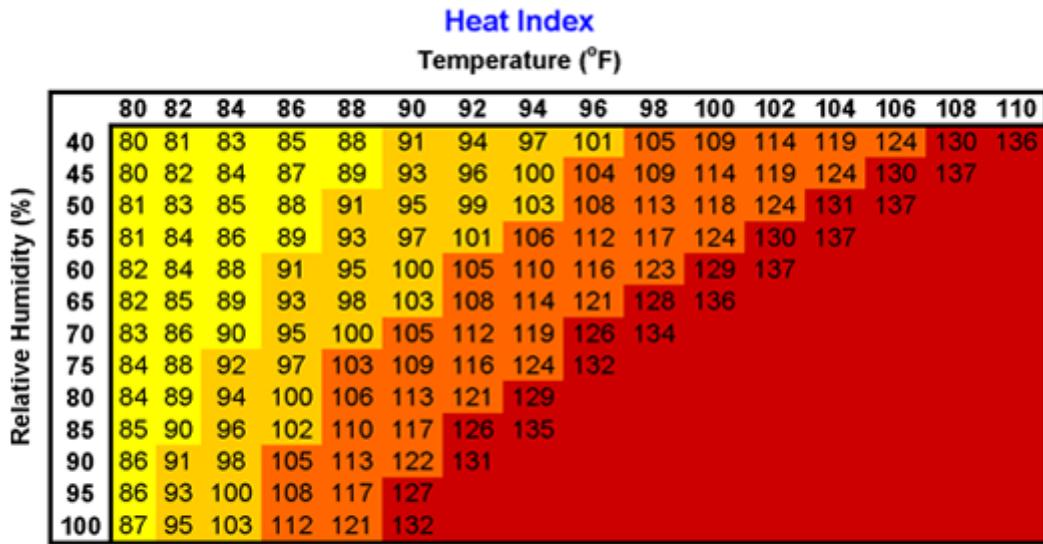
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ATTACHMENT 1

Heat Index/Heat Stress Risk Levels and Associated Protective Measures

Heat Index/Heat Stress Risk Levels and Associated Protective Measures

NOAA's National Weather Service



Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

■ Caution ■ Extreme Caution ■ Danger ■ Extreme Danger

The most critical actions employers should take to help prevent heat-related illness at each risk level:

Heat Index	Risk Level	Protective Measures
<91°F	Lower (Caution)	<ul style="list-style-type: none"> Provide drinking water Ensure that adequate medical services are available Plan ahead for times when heat index is higher, including worker heat safety training Encourage workers to wear sunscreen Acclimatize workers <p>If workers must wear heavy protective clothing, perform strenuous activity or work in the direct sun, additional precautions are recommended to protect workers from heat-related illness.*</p>
91°F to 103°F	Moderate	<p>In addition to the steps listed above:</p> <ul style="list-style-type: none"> Remind workers to drink water often (about 4 cups/hour)** Review heat-related illness topics with workers: how to recognize heat-related illness, how to prevent it, and what to do if someone gets sick Schedule frequent breaks in a cool, shaded area Acclimatize workers Set up buddy system/instruct supervisors to watch workers for signs of heat-related illness <p>If workers must wear heavy protective clothing, perform strenuous activity or work in the direct sun, additional precautions are recommended to protect workers from heat-related illness.*</p> <ul style="list-style-type: none"> Schedule activities at a time when the heat index is lower Develop work/rest schedules Monitor workers closely
103°F to	High	In addition to the steps listed above:

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115°F		<ul style="list-style-type: none">▪ Alert workers of high risk conditions▪ Actively encourage workers to drink plenty of water (about 4 cups/hour)**▪ Limit physical exertion (e.g. use mechanical lifts)▪ Have a knowledgeable person at the worksite who is well-informed about heat-related illness and able to determine appropriate work/rest schedules▪ Establish and enforce work/rest schedules▪ Adjust work activities (e.g., reschedule work, pace/rotate jobs)▪ Use cooling techniques▪ Watch/communicate with workers at all times When possible, reschedule activities to a time when heat index is lower
>115°F	Very High to Extreme	<p>Reschedule non-essential activity for days with a reduced heat index or to a time when the heat index is lower. Move essential work tasks to the coolest part of the work shift; consider earlier start times, split shifts, or evening and night shifts. Strenuous work tasks and those requiring the use of heavy or non-breathable clothing or impermeable chemical protective clothing should not be conducted when the heat index is at or above 115°F.</p> <p>If essential work must be done, in addition to the steps listed above:</p> <ul style="list-style-type: none">▪ Alert workers of extreme heat hazards▪ Establish water drinking schedule (about 4 cups/hour)**▪ Develop and enforce protective work/rest schedules▪ Conduct physiological monitoring (e.g., pulse, temperature, etc.)▪ Stop work if essential control methods are inadequate or unavailable.

*The heat index is a simple tool and a useful guide for employers making decisions about protecting workers in hot weather. It does not account for certain conditions that contribute additional risk, such as physical exertion. Consider taking the steps at the next highest risk level to protect workers from the added risks posed by:

- Working in the direct sun (can add up to 15°F to the heat index value)
- Wearing heavy clothing or protective gear

**Under most circumstances, fluid intake should not exceed 6 cups per hour or 12 quarts per day. This makes it particularly important to reduce work rates, reschedule work, or enforce work/rest schedules.

Source: https://www.osha.gov/SLTC/heatillness/heat_index/protective_measures.html

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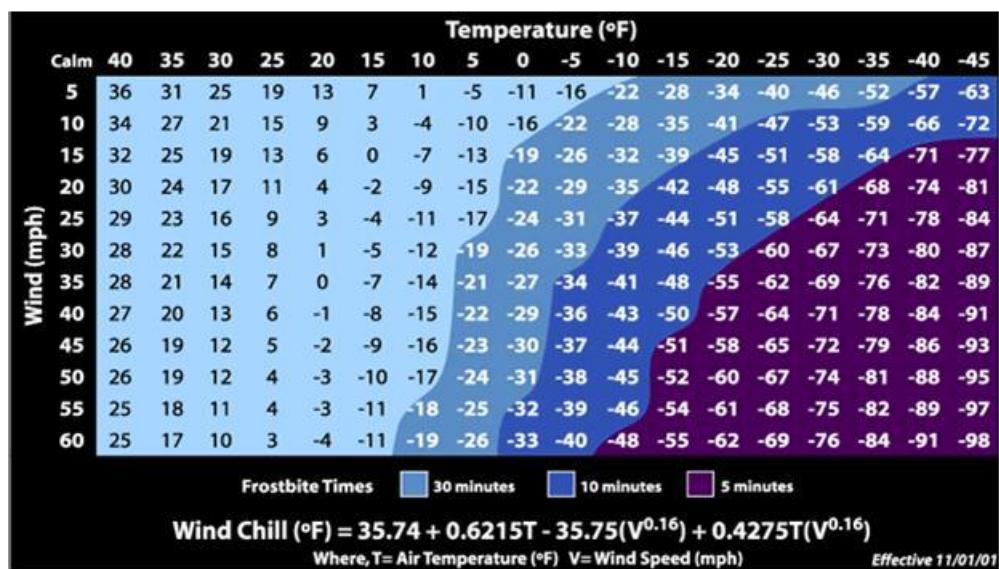
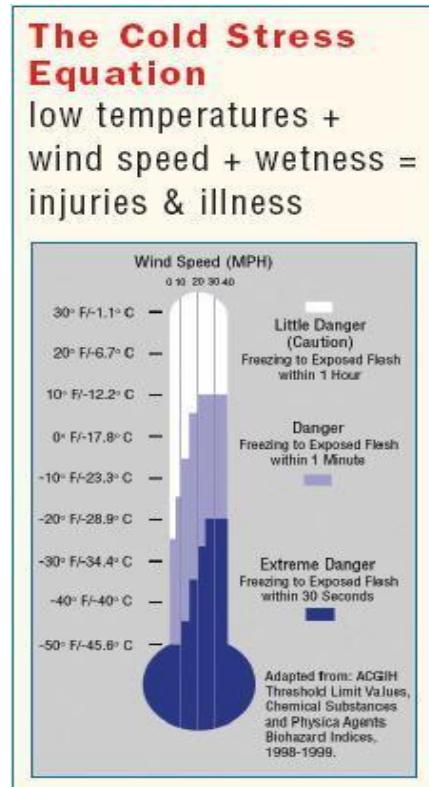
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ATTACHMENT 2

The Cold Stress Equation and Wind Chill Factor Calculation Table



Source: <http://www.crh.noaa.gov/Image/gid/WCM/awareness/winterdangers.pdf>

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ATTACHMENT 3

Cold Stress – Work/Warm up Schedule for a 4-hour Shift

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Work/Warm-up Schedule for a 4-Hour Shift

Air Temperature--Sunny Sky °C (approximate)	No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind		
	Maximum Work Period	Number of Breaks									
-15 to -19	(Normal Breaks) 1		(Normal Breaks) 1		75 min	2	55 min	3	40 min	4	
-20 to -24	(Normal Breaks) 1		75 min	2	55 min	3	40 min	4	30 min	5	
-25 to -29	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease		
-30 to -34	55 min	3	40 min	4	30 min	5					
-35 to -39	40 min	4	30 min	5							
-40 to -44	30 min	5	Non-emergency work should cease								
-45 & below	Non-emergency work should cease										

Schedule applies to any 4-hour work period with moderate to heavy work activity; with warm-up periods of ten (10) minutes in a warm location and with an extended break (e.g. lunch) at the end of the 4-hour work period in a warm location.

Adapted from ACGIH 2012 TLVs

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Policy #: 0026a
Revision #: 7
Date: 01/08/2020

Section 26: Injury Case Management Policy

The following have reviewed and authorized the issuance of the Policy, Procedure, & Guidance.

	<u>Name and Title</u>	<u>Date</u>
Initiator:	<i>Thomas Baylis, CIH, VP HSSE</i>	7/8/16
Guidance Committee:	<i>Doug Liddell, Regional Operations Manager</i>	7/8/16
Guidance Committee:	<i>Heather Cloud, Regional Operations Manager</i>	7/8/16
Guidance Committee:	<i>Jon Agnew, Regional Operations Manager</i>	7/8/16
Guidance Committee:	<i>David Zailik, Regional Operations Manager</i>	7/8/16
Chief Ex. Officer:	<i>Edward Van Woudenberg</i>	7/8/16

General Definitions

Policies prescribe certain behaviors or courses of action deemed expedient, prudent, and advantageous to the function of GES (“Policy”). As such, Policies are non-discretionary, the violation of which may result in severe consequences including, without limitation, termination of employment. As an analogy, Policies are to GES, as statutes are to a governed body.

Procedures prescribe certain behavior or courses of action deemed expedient, prudent, and advantageous to achieve compliance with Policy (“Procedures”). As such, Procedures are non-discretionary, the violation of which may result in severe consequences including, without limitation, termination of employment. As an analogy once again, Procedures are to GES, as regulations are to a governed body, meaning they describe how to comply with statutory requirements.

Guidance provides suggested methodologies to achieve compliance with Policies and Procedures that are non-mandatory, or discretionary, in the reasonable judgment of the actor. The use of Guidance is designed to create efficiencies where the relevant circumstances may require a more flexible approach to compliance, allowing the actor to use his/her reasonable judgment.

Procedure for policy approval

1. Policy Recommendations shall be submitted via electronic mail to the Company’s General Counsel (“Counsel”).
2. Counsel shall, thereafter, upon gathering any other information required, if any, present the Recommendation to a Policy, Procedure and Guidance Committee (“Committee”) for consideration.
3. The Committee’s members shall be chosen by the President of the Company or his/her designee, with the roles and responsibilities of the same established collectively.
4. The Committee shall be empowered, as required, to take all necessary action to either draft such Recommendation for presentation and approval, or recommend rejection of such Recommendation, to the President who shall either approve the newly created Policy, Procedure, or Guidance, or reject the Recommendation.
5. Initiator records approval date and revision number in version identification block on document and signature page (revision number and date must match on both documents).

HSSE Policy, Procedure & Guidance

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Policy #: 0026a
Revision #: 7
Date: 01/08/2020

1.0 OBJECTIVE

The objective of this procedure is to ensure that proper injury care is provided to an injured individual and that each injury is effectively managed on as well as offsite.

2.0 SCOPE

This program covers the reporting and proper care of each injured individual. This procedure shall be implemented in conjunction with the GES Medical and First Aid Procedure and (Blood borne Pathogen) Infection Control Plan.

ATTACHMENT(S)

Attachment 1 – Injury Case Management Flowchart.

3.0 INJURY CASE MANAGEMENT

3.1 Procedure: Medical injuries or emergencies within each office or field location will be managed by the following method:

- 3.1.1 If an injury or medical condition occurs that cannot be treated by providing basic first aid to the individual, the Regional HSSE Manager/Officer and site manager are notified.
- 3.1.2 Individuals who are certified in cardiopulmonary resuscitation (CPR)/ first aid will be requested to respond to the individual's location. Following the evaluation, the GES VP, HSSE should be contacted regarding the individual's condition and injury case management approach that should be implemented in the office or at a project location. The VP HSSE will also contact Work Care, Inc., the GES third part injury case management provider. Work Care will provide injury case management support during the management and care of the individual.
- 3.1.3 Following an assessment of the individual's condition, if responding GES personnel feel that outside emergency medical response personnel are necessary, the 911 emergency response system will be activated.
 - 3.1.3.1 The 911 emergency operator shall be provided all of the information that is requested. It should be noted that in some GES offices the number 9 must be dialed prior to dialing 911.
 - 3.1.3.2 The injured individual (GES or subcontractor employee) must be accompanied by other GES staff (i.e., PM, Regional HSSE Manager/Officer, site manager, site supervisor) so that desired injury management information will be communicated to the attending physician.
- 3.1.4 If an individual requires medical treatment beyond basic first aid, but the initial assessment determines that the individual does not require emergency care, then:
 - 3.1.4.1 The individual will be scheduled for an appointment at the local offices occupational clinic near each office. If the injured individual is a subcontractor, then the individual will be directed to visit an occupational clinic established by the subcontracting company. If there is no clinic established, the individual will be scheduled at a GES clinic.
 - 3.1.4.2 The individual will be accompanied to their examination by a representative of the local GES office or other GES or subcontractor management staff so that the desired injury management information that would include but will not be limited to: any required or alternative medication and/or any work place restrictions, is discussed with the attending physician.
 - 3.1.4.3 The GES VP, HSSE will also contact the attending physician regarding the examination, diagnosis and the GES injury management approach.
 - 3.1.4.4 GES VP, HSSE will also inform the current GES Injury Case Management Coordinator (Work Care, Inc.) and Worker's Compensation Insurance Carrier regarding the injury and the current status of the individual.

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Note: As indicated, subcontractor injuries must be managed in a similar manner.

3.2 This program shall be administered by GES VP, HSSE and the designated Regional HSSE Manager/Officer, site manager, who together shall be responsible for the generation and execution of all portions of the program. These individuals will also have the necessary authority to ensure that all requirements of this program are properly fulfilled.

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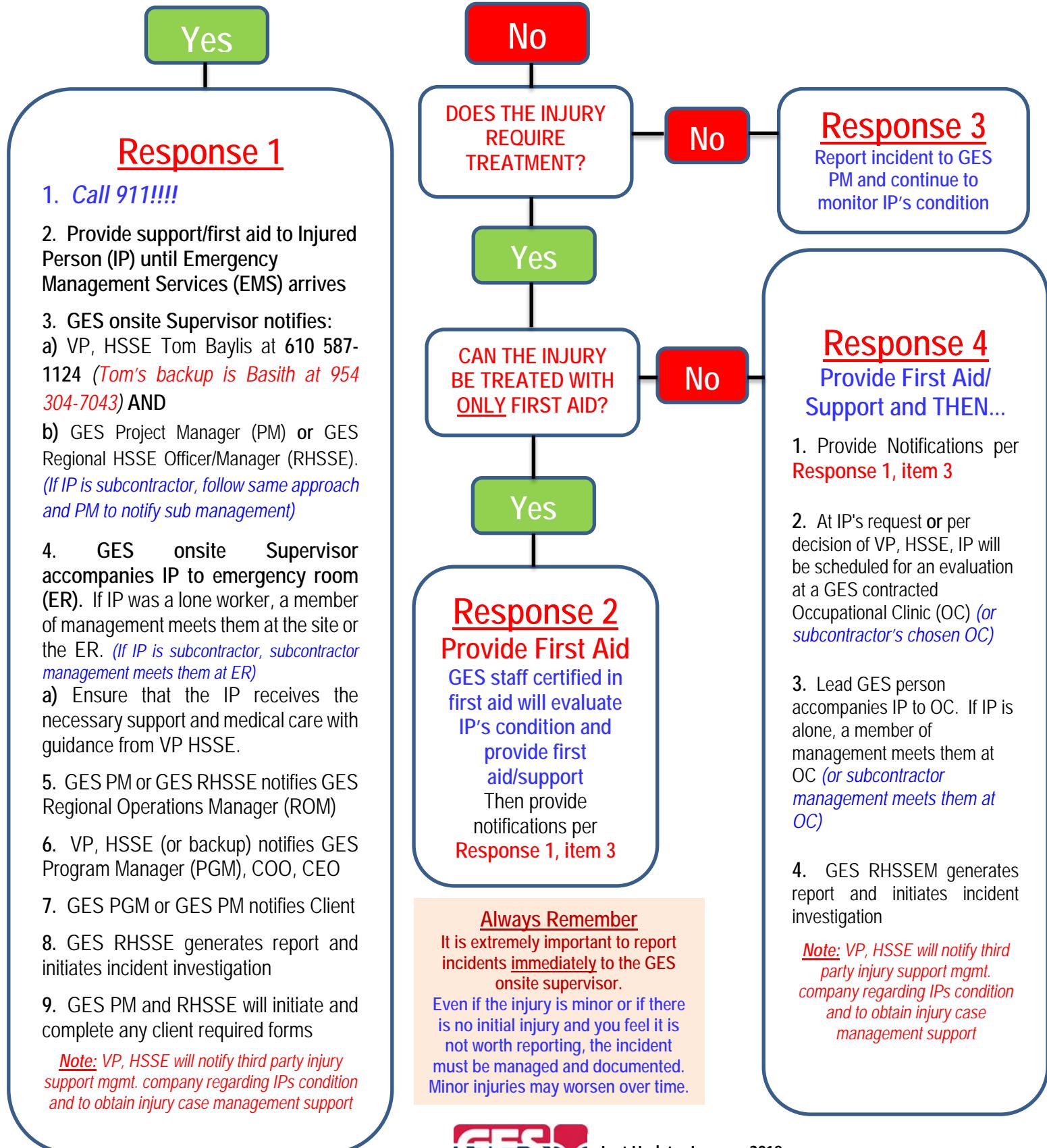
ATTACHMENT 1

Injury Case Management Flowchart

GES PROJECT INJURY CASE MANAGEMENT

If an incident/injury occurs on-site to a GES or a subcontractor employee, **the incident/injury must be immediately reported to the GES Onsite Supervisor**. If a subcontractor is injured, also notify subcontractor management.

DOES THE INJURY REQUIRE EMERGENCY MEDICAL ATTENTION?



Section 22: Lead, Arsenic, Chromium & Metals Exposure Prevention Program

The following have reviewed and authorized the issuance of the Policy, Procedure, & Guidance.

	<u>Name and Title</u>	<u>Date</u>
Initiator:	<i>Thomas Baylis, Director HSSE</i>	7/15/16
Guidance Committee:	<i>Doug Liddell, Regional Operations Manager</i>	7/15/16
Guidance Committee:	<i>Jon Agnew, Regional Operations Manager</i>	7/15/16
Guidance Committee:	<i>Heather Cloud, Regional Operations Manager</i>	7/15/16
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5. Initiator records approval date and revision number in version identification block on document and signature page (revision number and date must match on both documents).

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Policy #: 0022
Revision #: 7
Date: 1/15/2020

1.0 Objective

The objective of this program is to ensure that measures are implemented that will prevent worker exposure to onsite contaminants specifically metal contamination, during environmental assessments and remediation activities.

2.0 Scope

This program must be implemented during onsite activities when a project site is suspected or is known to have metal [lead, arsenic, chromium or other heavy (toxic) metal] contamination. This program will be implemented in conjunction with the GES Health and Safety Planning (HASP), Personal Protective Equipment, and Respiratory Protection Programs. The Site Specific HASP will act as the compliance program for each project location. The HASP will address each worker task and responsibility, evaluate potential contaminant (metal) sources, equipment used onsite, and assess each hazard. This program and site specific HASP will be available onsite and shall be evaluated as required or at least annually and amended as needed.

REFERENCED REGULATION(S)

1. Occupational Safety and Health Administration (OSHA) – “29 CFR 1910.1025” “lead”
2. Occupational Safety and Health Administration (OSHA) – “29 CFR 1910.10.18” “arsenic”
3. Occupational Safety and Health Administration (OSHA) – “29 CFR 1910.1026” “hexavalent chromium”
4. OSHA – “29 CFR 1910.134” “Respiratory Protection-Personal Protective Equipment”
5. OSHA – “29 CFR 1910.133” “Eye and Face Protection-Personal Protective Equipment”
6. National Institute for Occupational Safety and Health (NIOSH)

3.0 General Requirements

3.1 Training: As required by the GES training program, each GES field employee who may receive exposure to hazardous materials that will include lead, arsenic, chromium and other heavy metals/materials, shall receive the appropriate initial and 8 hours of annual (refresher) training. Annual training will provide information that includes but not limited to the following:

3.1.1 Respiratory protection requirements – General and site specific respiratory protection requirements shall be discussed as well as components of the GES respiratory protection program such as proper respirator and filter cartridge selection, cleaning and storage, use requirements and limitations.

3.1.2 Health and other Hazards associated with metals that include but not limited to lead, arsenic and hexavalent chromium. The health effects for metals such as lead include but are not limited to the following:

- 3.1.2.1 Loss of appetite,
- 3.1.2.2 Nausea
- 3.1.2.3 Headache,
- 3.1.2.4 Joint or muscle aches,
- 3.1.2.5 Long term effects such as nervous system, urinary and reproductive systems.

3.1.3 Site control requirements – Control measures shall be discussed that could be implemented to limit or prevent fugitive dust (airborne particulate) from migrating into the worker breathing zone or migrating offsite and impacting clean areas. This is especially important when multi-contractors or companies are working onsite. Measures would include:

- 3.1.3.1 Wetting impacted soils by sprinkler or spraying systems when airborne particulate is observed.
- 3.1.3.2 Use of foam or other suppression system

3.1.3.3 All spills or releases must be cleaned immediately. Methods for cleaning will include but not limited to the following: HEPA filtered vacuums, dry or wet sweeping, shoveling or other appropriate methods.

3.1.4 Components of the GES Medical Surveillance Program – This would include frequency of the medical exam, medical monitoring protocol, and exposure testing.

3.1.5 All training materials will be available on the GES SharePoint and training will be properly documented that includes the employee's name, training date, and the name of the instructor.

3.2 Workplace Monitoring: GES requires that a Site Specific Health and Safety Plan (HASP) is developed for every project. One of the primary components of the HASP is site air monitoring program which consists of the following approaches:

3.2.1 When heavy metals that include but are not limited to lead, arsenic, hexavalent chromium, cadmium are potential site contaminants, GES will determine a breathing zone Action Level (AL) that takes into account soil concentrations and the established Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL). No one should receive exposure above the PEL (0.05 mg/M³ for lead, 0.01 mg/ M³ for arsenic and 0.005 mg/M³ for hexavalent chromium) without adequate protection.

3.2.1.1 A particulate monitor will be used during project activities to determine breathing zone particulate (metal) concentrations.

3.2.1.2 Engineering and work practices must be implemented to reduce exposure to lowest feasible level. If controls are not feasible, additional engineering/ work controls must be implemented or respiratory protection used. If particulate levels exceed the established HASP AL, onsite personnel will upgrade to level C Personal Protective Equipment and will don a National Institute of Occupational Safety and Health (NIOSH) approved half-face air-purifying respirator with a high efficiency particulate air (HEPA) filter.

Note: All required PPE will be provided to employees without cost.

3.2.1.3 If airborne breathing concentrations of metals such as lead, arsenic or chromium exceed the maximum use concentration of the respiratory protection cited in Section 3.2.1.2 and the proper engineering controls have not been implemented, all work activities will cease until the proper respiratory protection is provided. This would include a full face air purifying or powered air purifying respirator.

Note: All required personal protective equipment will be provided to each GES employee at no cost.

3.2.2 Lead, chromium, arsenic and other metals may be found onsite in materials such as paints, lead containing solder, batteries, circuit boards, cathode ray tubes, leaded glass, and construction material. When heavy metals are known to be site contaminants and onsite soil concentrations exceed regulatory standards such as for hexavalent chromium or lead, the following onsite air monitoring approach shall be implemented:

3.2.2.1 Air samples will be collected using sample media connected to a battery powered personal sampling pump. Target metals will be collected by drawing the test atmosphere through a 0.8 micron mixed cellulose ester filter (MCEF).

3.2.2.2 The inlet of the sampling train shall be positioned in the breathing zone of the worker. Air sampling pumps will be calibrated before and after each sample period with a representative sample train in-line and an average flow rate for the sampling period was calculated. The volume of air drawn through the sampling media will be calculated based on the sampling period and the average flow rate

3.2.2.3 After collection, samples will be properly packaged and submitted to the contract analytical laboratory with a chain-of-custody form identifying each sample and its associated sample volume.

The laboratory selected to perform the required analyses shall be accredited by the American Industrial Hygiene Association (AIHA)

3.2.2.4 Personal air sample results will be evaluated by the project Certified Industrial Hygienist (CIH). The air sample results will be compared to established OSHA PELs. In addition, the results will be used for the following:

- 3.2.2.4.1 To establish whether a change in procedures, site conditions or personnel is warranted.
- 3.2.2.4.2 To determine whether the proper worker protection was used during site activities.
- 3.2.2.4.3 To determine if engineering controls such as the implementation of a dust suppression system is warranted.

Note: If dust suppression or other engineering controls are not feasible or ineffective, respiratory protection described in Section 3.2.1.2 will be required.

3.2.2.5 The results of the personal samples will be provided to each worker evaluated within 15 days of receipt from the contract laboratory.

3.3 Medical Surveillance Requirements: Any individual who is exposed above PEL concentrations for more than 30 days or is exposed during an emergency response must enroll in the GES Medical Surveillance program. The Medical Surveillance Program is also designed to establish baseline data and is required for those employees whose work may bring them into contact with hazardous substances, chemicals or hazardous physical agents such as noise. The content of this physical is outlined in the GES Medical Surveillance Protocol. In addition, the examination provides information that serves as a check on the effectiveness of GES' HSSE Program.

- 3.3.1 If site conditions or air monitoring requirements warrant blood lead or other metal exposure testing, the GES medical provider (Workcare) will be consulted and the proper testing requirements and schedule developed that will comply with OSHA requirements.
- 3.3.2 If a GES employee's blood lead levels or other medical conditions exceed required limits stated in applicable material specific OSHA standards, the individual will be properly notified (i.e., for lead within 5 workdays) and the appropriate measures taken to reduce exposures.
- 3.3.3 All employee medical surveillance, exposure monitoring and training records will be maintained.

3.4 As indicated previously, GES is required to develop and implement a site specific HASP for each project (site). One of the HASP requirements is that site specific Decontamination Program is implemented for personnel and equipment. Each plan will be reviewed and amended annually if needed.

- 3.4.1 Personnel decontamination facilities are required to have washing and changing facilities that are maintained free of contamination. All staff must wash their face and hands following work activities
- 3.4.2 The required PPE for a task will be indicated in the site specific HASP and task specific Job Safety Analysis (JSA). All required task specific PPE will be provided at no cost to site personnel.
- 3.4.3 Equipment decontamination facilities are required to remove all residual contamination from drill rigs, excavating equipment and hand and power tools. Equipment decontamination requirements will be developed based on equipment used, site operations, and onsite contamination levels.

3.5 Workplace Warning Requirements. For lead or other hazardous metal such as hexavalent chromium or arsenic a regulated area will be established. The warning for a regulated area for lead will have the following:

3.5.1 When work activities cause or may cause airborne concentrations of lead that exceed the OSHA PEL of 0.05 mg/M³, the following work area sign or notification will be posted:

HSSE Policy, Procedure & Guidance

Policies and Procedures



Policy #: 0022

Revision #: 7

Date: 01/15/2020

WARNING LEAD WORK AREA
POISON
NO SMOKING OR EATING

3.5.2 Each sign posted on site is required to be readily visible and if necessary illuminated.

HSSE Policy, Procedure & Guidance

Policies and Procedures



Policy #: 0024
Revision #: 10
Date: 01/9/2020

Section 24: Materials Storage and Handling

The following have reviewed and authorized the issuance of the Policy, Procedure, & Guidance.

	<u>Name and Title</u>	<u>Date</u>
Initiator:	<i>Thomas Baylis, CIH; VP, HSSE</i>	5/23/16
Guidance Committee:	<i>Doug Liddell, Regional Operations Manager</i>	6/18/16
Guidance Committee:	<i>Jon Agnew, Regional Operations Manager</i>	6/18/16
Guidance Committee:	<i>Heather Cloud, Regional Operations Manager</i>	6/18/16
Guidance Committee:	<i>David Zailik, Regional Operations Manager</i>	6/18/16
Chief Ex. Officer:	<i>Edward Van Woudenberg</i>	6/18/16

General Definitions

Policies prescribe certain behaviors or courses of action deemed expedient, prudent, and advantageous to the function of GES (“Policy”). As such, Policies are non-discretionary, the violation of which may result in severe consequences including, without limitation, termination of employment. As an analogy, Policies are to GES, as statutes are to a governed body.

Procedures prescribe certain behavior or courses of action deemed expedient, prudent, and advantageous to achieve compliance with Policy (“Procedures”). As such, Procedures are non-discretionary, the violation of which may result in severe consequences including, without limitation, termination of employment. As an analogy once again, Procedures are to GES, as regulations are to a governed body, meaning they describe how to comply with statutory requirements.

Guidance provides suggested methodologies to achieve compliance with Policies and Procedures that are non-mandatory, or discretionary, in the reasonable judgment of the actor. The use of Guidance is designed to create efficiencies where the relevant circumstances may require a more flexible approach to compliance, allowing the actor to use his/her reasonable judgment.

Procedure for policy approval

1. Policy Recommendations shall be submitted via electronic mail to the Company’s General Counsel (“Counsel”).
2. Counsel shall, thereafter, upon gathering any other information required, if any, present the Recommendation to a Policy, Procedure and Guidance Committee (“Committee”) for consideration.
3. The Committee’s members shall be chosen by the President of the Company or his/her designee, with the roles and responsibilities of the same established collectively.
4. The Committee shall be empowered, as required, to take all necessary action to either draft such Recommendation for presentation and approval, or recommend rejection of such Recommendation, to the President who shall either approve the newly created Policy, Procedure, or Guidance, or reject the Recommendation.
5. Initiator records approval date and revision number in version identification block on document and signature page (revision number and date must match on both documents).

HSSE Policy, Procedure & Guidance

Policies and Procedures



Policy #: 0024
Revision #: 10
Date: 01/9/2020

1.0 Purpose

This procedure presents the requirements for the control of hazards associated with the handling, storage, and management of materials at each GES project location. Following the requirements of this program will minimize hazards and prevent injuries to personnel when performing project activities.

2.0 Scope

This program applies to all GES employees and subcontractors working at the GES offices and other work locations. The requirements of the program will be followed whenever persons handle or store materials.

3.0 Definitions

Subcontractors/ Vendors. Individuals or firms hired by GES who store, handle or transport materials. Subcontractors and vendors will be trained by their employer on the requirements of their company's Material Handling Procedures and the GES requirements prior to beginning a project.

4.0 References

Handling Materials (29 CFR) 1910.176

Compressed Gases (29 CFR 1910.101)

Flammable and Combustible Liquids (29 CFR 1910.106)

5.0 Responsibilities

All personnel working at a GES work location including subcontractors and vendors will be instructed in the requirements of this material handling/management program and will follow the procedures discussed in this document. Subcontractors who will work at a GES project location must ensure that their personnel are trained in the requirements of their company's Material Handling Program prior to assigning personnel to a GES site.

The subcontractor's supervisor will ensure that their personnel:

- Are instructed in the requirements for storing and handling materials properly.
- Have the appropriate types and quantities of materials needed for safe management.

6.0 Material Handling and Storage (General Requirements)

This program establishes the minimum requirements for the storage and handling of materials. This program will be followed to ensure that personnel understand and follow proper handling and storage of materials.

NOTE: all materials that may be stored on site must be stored in a secured location and in compliance with all regulatory agencies (OSHA, DOT, Home Land Security...). If materials are to be stored overnight a security plan must be created and approved by Project Manager, Subcontractor and CHSSE

6.1 This program will provide requirements for:

- Storing and handling materials such as:
 - lumber
 - cement and other sacked materials
 - piping and steel
 - flammable materials

- compressed gases

6.2 All materials shall be segregated as to kind, composition, use, size and length. Stored materials shall be placed in neat, orderly manner that are safe from falling. If materials are stacked they shall be stepped back as the height increases, and should be secured by cross-piling or cross tying. Materials shall be stored to allow proper space for passageways. When materials are placed near or in employee walkways, they shall be well guarded, have suitable warning signs in the daytime, and have red lights on and around them at night.

6.3 Contractors shall collect and dispose of all scrap or waste materials promptly. The disposal hazardous material shall comply with the requirements of the Resource Conservation and Recovery Act (RCRA).

6.4 **Lumber:** Lumber shall be stacked on solid level sills. Cross strips or cross piling should be used where the pile is more than four feet high and the top of each pile should be kept level when the lumber is being removed. Used lumber should have all nails removed before it is piled. When handling or manually transporting long boards, two men should be used and care exercised at corners and crosswalks.

6.5 **Sacked Materials**

6.5.1 Sacked materials, including fertilizers, lime, and cement, should be carefully piled when placed in storage and carefully removed so as to keep piles in a stable condition. Piles should not be more than ten sacks high. Materials should not be piled on a floor or scaffold until strength of the supporting members has been evaluated by qualified persons and determined to be strong enough to support the weight.

6.5.2 The first four end bags should be cross-piled in two separate tiers up to the fifth bag, where a step back of one bag in every five should be made. Beginning with the fifth bag, only one cross tier is necessary. The back tier should be stepped back one bag in every five, the same as the end tiers. In outer tiers, cement should be piled with the mouths of bags facing the center of the pile.

6.5.3 Lime and cement, when exposed to dampness or water, forms slaked lime and may cause serious burns. It should, therefore, be stored in a dry place, preferably above ground, and should never be stored in a general warehouse. Subcontractor personnel handling sacked cement and lime should wear goggles, clothing made of durable materials with snug-fitting neck, wrist, and should be encouraged to use a protective cream on exposed skin surfaces. Fertilizers shall be handled and applied in accordance with the requirements specified in the Safety Data Sheets (SDS) for the product.

6.4 **Pipe and Steel Storage**

6.4.1 Pipe and steel such as angle iron should be stored on specially designed sills or racks, and should be blocked to prevent rolling. When pipe is stored by stacking, it should be piled perpendicular to the preceding layer and each piece should be securely blocked to prevent rolling.

6.4.2 When removing pipe, personnel should work from the end of the pile as much as possible to facilitate handling the object and avoid injury if the material moves. Pipe larger than two inches in diameter should be handled by using a hardwood pipe stick, dolly, or crane.

6.4.3 Any pipe weighing over 50 pounds should be handled mechanically, for example using a hoist or fork lift. When lifting material using a hoist or crane attention must be given to the type of sling to use (i.e. wire, manila, nylon, or plastic rope) and consideration to several factors, including strength of the sling, weight of the object and possible slippage.

6.4.4 Slings and chokers used for lifting must have a safety factor of 5 to 1. When handling long lengths of pipe, two individuals should perform the lifting and care should be used at corners.

6.5 Flammable Products

6.5.1 Flammable products should be protected during handling to prevent loss of identification through damage to container markings, tags, etc. Containers which are not properly labeled:

- May be improperly handled,
- Result in the improper use of the contents, and
- Lead to a possible fire hazard, damage to equipment, or operating failure.

6.5.2 Outdoor storage of primary and secondary storage containers require care to avoid contamination. Moisture and dirt in lubricating oil, gasoline, or other products may cause the equipment to malfunction or fail, with possible hazard to personnel. The storage area should be free of accumulations of spilled products or debris.

6.5.3 Pumps, cans, funnels and other dispensing equipment should be clean and free of contamination. Damaged or faulty dispensing equipment should be repaired immediately or tagged and taken out of service. When not in use, dispensing equipment should be stored in a safe place. Containers, nozzles or guns of dispensing equipment should be properly identified, in order to prevent product mix, possible chemical reaction, or fire. Appropriate fire protection should be provided at storage locations, including fire resistant construction, and stationary fire suppression systems. Suitable fire extinguishers (type ABC Dry Chemical or B) located within the area or adjacent to it.

6.5.4 The flammable liquid storage area shall be:

- Free of spillage at all times, and
- Properly ventilated and lighted.
- Smoking should be prohibited at all flammable liquid storage areas. Warning signs should be posted to identify the storage area and ensure that individuals are familiar with the policy.

6.5.5 Drums containing free product or other flammable liquids shall be electrically grounded. ***Buckets or other containers used for collecting bailed product from wells shall be constructed of metal. This approach will allow the two containers (bucket & drum) to be bonded together with a metal wire during transfer, to dissipate any static charge.***

6.5.6 Personnel having access to storage areas should be trained in the characteristics of each material and required handling precautions as required in the GES and subcontractor's Hazard Communication (HAZCOM) Program. Care shall be taken in the handling of all containers so that damage does not result and identification is not removed. Whenever positive identification is not possible, the contents should not be used. Containers used to store and dispense flammable liquids should be approved for such use and liquids should only be dispensed into approved containers which have not previously contained an incompatible material.

6.5.7 Containers used for storage, transport, and/or dispensing of flammable liquids must comply with 29 CFR 1926.152(a)(1), and fall into one of two categories:

- **“Approved safety cans”** are metal or polyethylene safety cans that bear the approval of either Underwriter’s Laboratory (UL-listed – *NOT UL-Classified*) or Factory Mutual (FM Approved), available in Types I & II.
 - These are permitted when the can remains on-property and will not be transported with flammable liquids inside.
- **“Department of Transportation approved containers”** are metal safety cans that bear the approval of the Department of Transportation (DOT Approved).
 - These are required in commercial vehicles that transport flammables on public roads and highways (unless transporting less than 1/3 gallon – then an approved safety can is permitted)

6.6 The Proper Use of Flammable Liquids

6.6.1 Only approved solvents which are listed in the subcontractor's Hazard Communication (HAZCOM) Program shall be used for cleaning operations. Gasoline should never be used as a cleaning agent. In addition to this, the following precautions should be complied with:

- Never use flammable liquids in the presence of possible ignition sources.
- Never apply heat to flammable liquids or solvents unless the manufacturer of the product specifically indicates the procedures to perform this safety.
- Dispose of all wiping rags, etc. in approved containers.

6.6.2 Personnel who handle flammable liquids or petroleum products should be aware of the potential toxic effects associated with inhalation and dermal contact. Handling procedures and personnel protective equipment worn by workers shall comply with the requirements described in the MSDS/SDS and the facility HAZCOM Program and Personal Protective Equipment (PPE) Program.

6.7 Compressed Air and Cylinder Management

6.7.1 Each compressed air system must be inspected and tested monthly. Inspection and system tests would include but be limited to testing each safety valve to ensure that each is in good operating condition and that each control/indicating device has been constructed, installed, and located so that each cannot be rendered inactive.

6.7.2 Cylinders shall be visually inspected to ensure that each cylinder is in a safe condition, stored at assigned locations, secured upright to a wall or vertical support by means of restraining straps or chains and have protective valve covers in place. Charged and empty cylinders shall be stored separately with the storage layout designed to allow old stock to be removed first with a minimum handling of other cylinders. Storage locations should be prominently posted with the name of the gases to be stored and with "No Smoking" signs where appropriate. Cylinders shall also be protected against:

- An excessive rise in temperature and storage near sources of heat and flammable substances such as oil, gasoline, waste, etc.
- Continuous dampness or contact with salt and other corrosive chemicals.
- Contact with objects that may cut or cause abrasions on the cylinder's metal surface.
- Contact with heavy moving objects for examples elevators, fork trucks, or overhead materials.
- Contact with electrical wires.

6.7.3 Cylinders shall be properly labeled and should be grouped by types of gas, and groups arranged to take into account the gases contained.

- 6.7.4 Caps shall be placed on the cylinders during transportation and handling, but shall not be used as a means of lifting the cylinder. Also, dragging or sliding cylinders shall be avoided. A hand truck or similar device shall be used, even over short distances, to move cylinders.
- 6.7.5 Compressed gases should be handled only by experienced and properly instructed persons. Valve protective caps should not be removed until personnel are ready to withdraw contents or connect the cylinder to a system. It is important to make sure that the threads on regulators or other auxiliary equipment are the same as those on the cylinder valve outlets. Regulators, gauges, hoses and other equipment for use with a particular gas or group of gases must not be used on cylinders containing gases having different properties.
- 6.7.6 Compressed gases should never be used to dust off clothing or cleaning unless the pressure has been reduced to less than 30 psi. Using pressure above this level could cause serious injury to the eyes or body.
- 6.7.7 For each compressed air system, the air receiver must be equipped with a pressure gauge that is equipped with pressure relief safety valves that prevent the pressure in the receiver from exceeding the allowable pressure by 10 percent.
- 6.7.8 Each air receiver drain valve shall be opened and drained as required by manufacturer's requirements/instructions so that excessive liquid/moisture does not build up in the receiver.

Attachment E – Pre-Entry Meeting Notes

PRE-ENTRY MEETING NOTES/ATTENDANCE

(Include date, length of meeting, names of personnel in attendance, topics of discussion, comments and concerns, etc.)

Attachment F – Sign Off Sheets

SITE SAFETY AND HEALTH PLAN COMPLIANCE AGREEMENT

All project personnel, including visitors, must follow the requirements of this Site Safety Plan. In order to document individual agreement with this requirement, all personnel must complete this "Site Safety and Health Plan Compliance Agreement." These agreements will be kept in this Site Safety Plan and will become part of the permanent project record upon completion of site activities.

By signing below, I have read the Site Health and Safety Plan (HASP), or I have been verbally advised of its contents. I understand, and I agree to comply with all of its provisions. I understand that I could be prohibited from working on the project, and I may be subject to disciplinary actions for violating any of the health and safety requirements specified in the HASP.

Attachment G – Injury Case Management Flowchart

GES PROJECT INJURY CASE MANAGEMENT

If an incident/injury occurs on-site to a GES or a subcontractor employee, **the incident/injury must be immediately reported to the GES Onsite Supervisor**. If a subcontractor is injured also notify subcontractor management.

DOES THE INJURY REQUIRE EMERGENCY MEDICAL ATTENTION?

