# SITE SPECIFIC HEALTH AND SAFETY PLAN



# FORMER PALL CORPORATION FACILITY NYSDEC SITE No. 1-30-053B 30 SEA CLIFF AVENUE GLEN COVE, NEW YORK 11542

Prepared for:

Pall Corporation 30 Sea Cliff Avenue Glen Cove, New York 11542

PREPARED BY: Darriel J. Smith, PE

REVIEWED BY:

The information contained in this HASP is provided for the protection of the health and safety of Apex Environmental, Inc. personnel and subcontractors working under the direct supervision and control of Apex Environmental, Inc. on projects involving hazardous waste operations. The information included in this document is designed to identify, evaluate and control safety and health hazards, and provide for emergency response for site a ctivities. This HASP will remain on the project site for reference by workers during each phase of the project. Apex Environmental, Inc. assumes no liability for, or responsibility to, any other parties for the accuracy or completeness of information included in the HASP or reliance upon this HASP by any other party.

October 26, 2004



Apex Environmental, Inc.

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# 8.0 EMERGENCY RESPONSE/PLANNING

# 8.1 Emergency Telephone Numbers / Directions to Hospital

The following telephone numbers and directions to the hospital from the site are provided to expedite emergency assistance if needed at the site.

**Nearest Hospital:** 

North Shore University Hospital at Glen Cove

101 St. Andrews Lane, Glen Cove, N.Y.

Hospital Emergency/General Tel. No.:

(516) 674 - 7300

See Figure 2 for map and directions to hospital.

**Fire Department:** 

911

**Police Department:** 

911

Ambulance:

911

CHEMTREC (Chemical Transportation Emergency Center)

24 Hour Tel. No.:

800-424-9300

Chemtrec 2501 M Street, NW Washington, D. C. 20037

**Poison Control Center:** 

800-336-6997

**Project Manager:** 

Daniel Smith:

(631) 207-3700 ext 102 Office

(914) 319-9375 Cell

Client Contact:

Farsad Fotouhi:

(516) 801-9308 East Hills, NY Office

(734) 913-6130 Ann Arbor, MI Office

(734) 368-3238 Cell

**H&S Manager:** 

Stephen Arena

(860) 282- 1700 X17

(203) 520-9665 (CELL)

Site H&S Officer:

**Tom Stolworthy** 

(631) 207-3700 ext 101 Office

(973) 420-8403



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# **FIGURES**

Figure 1:

Site Plan

Figure 2:

**Hospital Route** 

# **APPENDICES**

Appendix A: Material Safety Data Sheets (MSDS) and Related Safety and Health

Information for Hazardous Materials Anticipated to be found at the Job Site

Appendix B: Job Safety Analysis Forms



Appendix C Daily Tailgate Safety Meeting Forms

Appendix D: Environmental Monitoring and Calibration Forms

Appendix E: Emergency / Accident Report Form

Appendix F: Respiratory Protection Program

Appendix G: Confined Space Entry Permit Forms

Appendix H: Site Specific HASP Amendment Form

Appendix I: Daily Sign In/Out Log



# SITE SPECIFIC HEALTH AND SAFETY PLAN FORMER PALL CORPORATION FACILITY

# FORMER PALL CORPORATION FACILITY 30 SEA CLIFF AVENUE GLEN COVE, NEW YORK 11542

### 1.0 HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT

This form is to be signed by each Apex employee and contractor/subcontractor who will be present during this project. This Health and Safety Plan Acknowledgement must be signed prior to the person commencing work at the project site.

By signing this form, personnel acknowledge that they have read and understand the contents of this Site Specific Health and Safety Plan (SSHASP) and the hazards associated with the project, the control measures and procedures to follow to protect site personnel, property and the community during the course of this project.

Personnel also understand that on a daily basis, mandatory safety meetings will be held prior to starting the day's activities and attended by all on-site project personnel. Project personnel also acknowledge that they agree to perform all activities in a safe manner in accordance with the SSHASP. The purpose of the daily tailgate safety meetings is to discuss potential hazards, control measures and other pertinent information needed for communicating potential project hazards of daily activities at the site.

NAME	<u>SIGNATURE</u>	<u>DATE</u>



# 2.0 INTRODUCTION

This comprehensive site specific Health and Safety Plan (HASP) is needed for the following types of operations in which employee exposures to safety or health hazards are anticipated:

- Clean-up operations required by a governmental body, which involves
  hazardous substances that are conducted at uncontrolled hazardous waste
  sites, including, but not limited to, the EPA's National Priority Site List (NPL),
  state priority site lists, sites recommended for the EPA NPL, and initial
  investigations of government identified sites which are conducted before the
  presence or absence of hazardous substances has been ascertained;
- Corrective actions involving clean-up operations at sites covered by the Resource Conservation and Recovery Act of 1976 (RCRA);
- Voluntary clean-up operations at sites recognized by federal, state, local or other governmental bodies as uncontrolled hazardous waste sites;
- Operations involving hazardous wastes that are conducted at treatment, storage and disposal (TSD) facilities regulated by 40 CFR Parts 264 and 265 pursuant to RCRA, or by agencies under agreement with the USEPA to implement RCRA regulations; and,
- Emergency response operations for releases of, or substantial threats of releases of, hazardous substances, without regard to the location of the hazard.

# 2.1 Site History and Description

The Pall site is currently vacant. No chlorinated solvents are used at the facility. The August Thomsen property located on the northern side of the site consists of a single story structure that currently houses operations including production of pastry bags, and assembly of miscellaneous pastry bag accessories.

The site is located in the Sea Cliff Industrial Area, an area that has been used for variable industrial processes from the 1940s to the present. Pall has operated its Sea Cliff Avenue facility since the early 1950s. At various points during that time, the site operations included administration, sales and marketing, pilot studies, product performance evaluations, machining, and manufacturing.

In 1958, Pall constructed what is now the August Thomsen building. From 1958 until 1971, the current August Thomsen building was used by Pall's subsidiary, Glen Components, Inc.,



as a precision machine shop providing parts to Pall's other divisions. Chlorinated solvents<sup>1</sup> had been used at the site until approximately 1971 at which time their use was discontinued<sup>2</sup>.

The following is a summary of the history of site ownership and operations:

- 1918: The current Pall building is constructed at the site.<sup>3</sup>
- 1918 through early 1950's: The site is operated as an icehouse until purchase and occupancy by Pall in the early 1950's.
- 1958: Pall builds the Glen Components building (the current August Thomsen building). Glen Components initiates operations.
- 1958 through 1971: Glen Components operates in the current August Thomsen building<sup>4</sup>. Pall operates in the main plant building. Chlorinated solvents were used in operations at both facilities.
- 1971 through October 15, 1999: August Thomsen occupies the 36 Sea Cliff Avenue site. Pall operates out of the 30 Sea Cliff Avenue building. Pall did not use chlorinated solvents for manufacturing at the site.
- October 15, 1999 to 2003: August Thomsen occupies the 36 Sea Cliff
  Avenue site. Pall conducts limited operations out of a section of the 30 Sea
  Cliff Avenue building. Tweezerman operates in the remainder of the 30 Sea
  Cliff Avenue site. Pall does not use chlorinated solvents at the site.
- 2003 to Present: August Thomsen occupies the 36 Sea Cliff Avenue site. The Pall site is vacant.

A site plan is provided in *Figure 1*. The route to the nearest hospital in the event of en emergency is provided, with directions, in *Figure 2*.



<sup>&</sup>lt;sup>1</sup> For the purposes of this report, chlorinated solvents and chlorinated VOCs shall mean Tetrachloroethene, Trichloroethene, and their respective degradation products. Freons<sup>®</sup>, while technically chlorinated solvents, shall be discussed independently as necessary.

<sup>&</sup>lt;sup>2</sup> Some chlorinated solvents may have been purchased for use at the facil ity after 1971 for lab research and development purposes. However, these purchases were infrequent and only consisted of very small quantities.

<sup>&</sup>lt;sup>3</sup> Several additions and modifications to the original building layout have been made since initial construction. These modifications are not relevant to the environmental work at the site.

<sup>&</sup>lt;sup>1</sup> Several additions and modifications to the original building layout have been made since initial construction. These modifications are not relevant to the environmental work at the site.

# 2.2 Historical Information on Hazardous Material Usage/Disposal at the Site

Apex Environmental, Inc. (Apex) was retained by Pall Corporation, Inc. (Pall) to provide investigation, design, and pilot testing services at the site located 30 Sea Cliff Avenue, City of Glen Cove, Nassau County, New York. There have been numerous studies indicating the types, nature, and levels of contaminants at the site and in the anticipated work zones. The Remedial Investigation Report, Feasibility Study Report, and Phase I Pilot Test Report are therefore incorporated into this document by reference. In general, the contaminants of concern are chlorinated VOCs and Freons® in groundwater, and to a much lesser extent, in soil.

# 2.2.1 Anticipated Contaminant Levels at Site

Recent (2003-2004) environmental reports or other information indicate that the following contaminants and contaminant levels have been identified.

CONTAMINANT	MEDIA	CONCENTRATION RANGE OF CONTAMINANT	COMMENTS
Tetrachloroethene	Groundwater	ND to 6,600 ug/l	
Trichloroethene	Groundwater	ND to 2,700 ug/l	
1,2-Dichloroethene	Groundwater	ND to 7,600 ug/l	
1,1-Dichloroethane	Groundwater	ND to 150 ug/l	
Vinyl Chloride	Groundwater	ND to 850 ug/l	
Chloroethane	Groundwater	ND to 4 ug/l	
Freon 113	Groundwater	ND to 1,700 ug/l	Includes generic names
1,1,1-Trichloroethane	Groundwater	ND to 74 ug/l	
Benzene	Groundwater	ND to 3 ug/l	
Toluene	Groundwater	ND to 13 ug/l	
Methylene Chloride	Groundwater	ND to 130 ug/l	Possible Lab Artifact
Acetone	Groundwater	ND to 10,000 ug/l	Possible Lab Artifact

# 2.2.2 Occupational Exposure Limits for Contaminants in Air

The contaminants identified in Section 2.2.1 have the following associated exposure limits established by the Occupational Safety and Health Administration (OSHA), American Conference of Governmental Industrial Hygienists (ACGIH) or the National Institute of Occupational Safety and Health (NIOSH):



CONTAMINANT	OSHA LIMIT PEL / STEL / C	ACGIH LIMIT TLV / STEL	NIOSH LIMIT
	(ppm)	(ppm)	(ppm)
Tetrachloroethene	100 / 100 / 200	25 / 100	NA
Trichloroethene	100 / 100 / 200	50 / 100	1,000
1,2-Dichloroethene	200 / 250 / NA	200 / 250	NA
1,1-Dichloroethane	100 / NA / NA	100 / NA / NA	4,000
Vinyl Chloride	5 / NA / NA	1 / NA / NA	NA
Chloroethane	1,000 / NA / NA	100 / NA / NA	3,800
Freon 113	1,000 / NA / NA	1,000 / 1,250	2,000
1,1,1-Trichloroethane	350 / NA / NA	350 / 450	4,000
Benzene	1 / 5	0.5 / 2.5	3,000
Toluene	200 / NA / NA	50	2,000
Methylene Chloride	500 / NA	100 / 500	5,000
Acetone	750 / 1,000	500 / NA	20,000

PEL = Permissible Exposure Limit

STEL = Short Term Exposure Limit

C = Ceiling Value

TLV = Threshold Limit Value

REL = Recommended Exposure Limit

Generic material safety data sheets (MSDS) or other safety and health information have been provided as a reference in *Appendix A*.

# 2.3 Facility Description/Known or Anticipated Hazardous Area

The Pall facility consists of an abandoned two story concrete block building located on 30 Sea Cliff Avenue (Section 21, Block H, Lot 37) and several small sheds formerly used for chemical storage. The site is relatively flat with a gentle slope toward the northeast corner. The majority of the site is paved. The site is located in the Sea Cliff Industrial Area and is bordered by Photocircuits Corporation to the south, Associated Draperies and August Thomson to the west, and The Glen Cove Daycare Center to the Northeast. Route 107 runs along the east side of the property and Sea Cliff Avenue along the south. The site is accessible by two driveways which run along both sides of the Pall building. The attached map or site plan in *Figure 1*, indicates the general location of the project activities. Bodies of water associated with the project site include the Glen Cove Creek which runs from the southwest corner to the Northwest corner just parallel to the site and the Carney Street Well Field property which is located just north of the Pall site.



This health and safety plan (HASP) is being prepared for Apex personnel to use, as guidance in conducting work activities at the site is a safe manner. Known or anticipated hazardous areas or conditions for the site have been tabulated below:

# 2.4 Known or Anticipated Hazardous Areas or Conditions

- Work Zone around drill rig
- Sea Cliff Avenue vehicular activity during drilling operation
- Work Zone around injection equipment and injection wells



# 3.0 WORK PLAN ELEMENTS

The work plan tasks and task objectives for this project are tabulated below.

# 3.1 Project Tasks and Objectives

TASK #	DESCRIPTION	OBJECTIVE
ī	Baseline Sampling	All on-site monitoring wells (shallow, intermediate and deep) and the upgradient wells located on Sea Cliff Avenue will be sampled prior to the injection event. Several off-site wells will also be included in the sampling program
2	Installation of (4) new Monitoring well couplets	New monitoring wells will be installed along Sea Cliff Avenue to monitor upgradient groundwater quality and to evaluate its impact, if any, on pilot test operations and results.
3	Injection of Fenton's Reagent	Fenton's Reagent (hydrogen peroxide in the presence of an inorganic catalyst) will be injected to evaluate the effectiveness of in-situ chemical oxidation to degrade the contaminants of concern. Chemicals to be injected include FeSO <sub>4</sub> :7H <sub>2</sub> O, H <sub>2</sub> SO <sub>4</sub> , and H <sub>2</sub> O <sub>2</sub> .
4	Monitoring during injection event	At least one round of full field parameters will be collected daily. Monitoring of key indicating parameters such as temperature and pressure will be collected more frequently to evaluate pilot test effectiveness.
5	Soil Gas Vapor Monitoring	Soil Gas Vapor monitoring will occur frequently with soil gas being analyzed on-site with a portable gas chromatograph during injection event to evaluate possible off-gassing during groundwater plume reactions / volatilization.
6	Post-Injection Monitoring	Several rounds of monitoring will occur after final injection event. Field monitoring for the first week will be done on a daily basis with weekly monitoring for the next three weeks. Analytical sampling will be done at (5) days, (30) days and (60) days after final injection event. Monitoring will be used to evaluate the long-term effectiveness of the tested remedy.
7	Hazardous Waste Storage and Disposal	Any hazardous waste created during the injection event will be stored on site in 55 gallon drums in the former drum storage area. It will be disposed of properly after completion of injection event.



# 4.0 HAZARD ANALYSIS AND CONTROL MEASURES

A variety of potential hazards are believed associated with the project scope of work. The following table can be used to identify anticipated hazards for the project based on the project scope of work and site conditions. The hazards have been checked for the project tasks. This hazard checklist has been provided as a guide for developing control measures to be implemented to protect worker health and safety.

Relevant Job Safety Analysis (JSA) Forms are provided in Appendix B.

# 4.1 Hazard Analysis Matrix

HAZARD	SITE INSPECTION SURVEY	DRILLING, BORING, WELLS, ETC.	SAMPLING SOIL, WATER, AIR, ETC.	PUMP/ PILOT TEST	REMED. SYSTEM INSTALL.	EXCAV., TRENCH, TANKS,	0 & M
CHEMICAL			X	Х	X		Х
BIOHAZARD							
RADIATION							
HEAT STRESS							X
COLD STRESS		_ X	X	X			Х
INSECT BITES							
ANIMAL/SNAKE							
BITES _							
WATER							
DROWNING							
POISONOUS							
PLANTS							
NOISE		X	X		Χ		Χ
CONFINED							
SPACES_							
UNDERGROUND		X					
UTILITIES							
OVERHEAD		X					
UTILITIES							
VEHICULAR	X	X	X	Х			
TRAFFIC							
CONSTRUCTION							
MECHANICAL				X			
ELECTRICAL	_			Х			
LANDFILL or							
SEWER GASES							
RADON or OTHER							
GASES							
SLIPS/FALLS	_X	X	Х	X			
INCLEMENT		Х		Х			
WEATHER							
DRUM HANDLING		X		X			
PHYSICAL/BACK INJURY		Х		Х			



HAZARD	SITE INSPECTION SURVEY	DRILLING, BORING, WELLS, ETC.	SAMPLING SOIL, WATER, AIR, ETC.	PUMP/ PILOT TEST	REMED. SYSTEM INSTALL.	EXCAV., TRENCH, TANKS,	O & M
HIGH CRIME AREA							
FLAMMABLE MATERIALS							
STATIC ELECTRICITY							
WELDING, CUTTING or BRAZING							
HIGH PRESSURE STEAM, WATER, or AIR				х			
DUSTY CONDITION		x					

# 4.2 Control Measures for Anticipated Work Activities Hazards

_		
TASK	HAZARD	CONTROL MEASURE
1, 4, 6, 5	MECHANICAL	Only small sampling pumps will be utilized so mechanical hazards are minimized. Operators of all field monitoring equipment will be properly trained on its use.
	TRAFFIC	Use of traffic cones, caution tape, and traffic vests.
2	MECHANICAL	All personnel not directly involved in drilling will stand clear of augers. Since heavy objects will be used, hardhats and steel toe boots will be mandatory.
	ELECTRICAL / UNDERGROUND UTILITIES	Subsurface utilities will be marked out and cleared prior to drilling. Proper grounding of the drill rig will be performed and tested daily. Hand digging will be utilized.
	TRAFFIC	Use of traffic cones, caution tape, traffic vest
	DRUM HANDLING	Drums will be moved to drum storage area with a drum dolly, person moving drum will wear a back brace
3	MECHANICAL	Trained, experienced operator from US Peroxide to assist in operation of pumping equipment A spill kit will be on-site to remedy any small spills during injection event. A neutralizing solution of sodium metabisulfite will be on-site to stop any unwanted hydrogen peroxide reactions after dilution with water
	HIGH PRESSURE	Injection event will start with a gravity feed then proceed to pumping if exothermic reaction is controlled, cam locks used on all hoses will be taped and/or strapped; pressure will be monitored with gauges.
7	MECHANICAL	Caution to be used while loading / unloading drums or roll-offs with



TASK	HAZARD	CONTROL MEASURE
	_	waste for disposal. Identify "pinch points" and moving parts of all machinery for waste handling prior to operation.

# 4.3 Control Measures for Anticipated Contamination Hazards

TASK	HAZARD	CONTROL MEASURE
1, 2, 4, 5, 6 and 7	CHEMICAL	Modified Level D (Personal Protective Equipment including steel toed boots, safety glasses, hard hat and traffic vest), spill kits onsite, sodium Metabisulfite to neutralize hydrogen peroxide. All field staff will receive a special training session on proper chemical handling and use of hydrogen peroxide, ferrous sulfate and acids.
3, 4, 6	HIGH PRESSURE AND TEMP. DUE TO CHEMICAL REACTION.	Thermocouples and pressure gauges will be used to monitor subsurface pressures and temperatures during injection events. Work will be stopped if the groundwater temperature exceeds 120 Degrees F for two consecutive readings during Fenton's injections. Pressure in the subsurface will be maintained below 10 Psig. Work will be stopped if the subsurface pressure exceeds 10 psig at a distance of more than 10 feet from the injection wells.
5	CHEMICAL	Soil gas monitoring will be performed to evaluate potential for off- gassing during pilot test activities. Work will be stopped if OSHA action levels are exceeded in breathing zones. NYSDEC will be contacted to evaluate continuation of pilot test activities.
7	CHEMICAL	Waste profiles will be completed to identify hazards and confirm waste composition.

# 4.4 Control Measures for Anticipated Environmental Hazards

TASK	HAZARD	CONTROL MEASURE
All	INCLEMENT WEATHER	No drilling or other field activities will be done during heavy rains, snow, thunderstorms or high winds.
	COLD STRESS	Insulated Coveralls, glove liners, hand warmers, heated building will be accessible
	INSECTS	Insects repellant and long sleeve clothing to be worn if insects are a problem in the field. Bee sting kit to be available in First Aid Kit



# 5.0 PROJECT STANDARD OPERATING PROCEDURES AND PRACTICES

All site personnel must adhere to the following standard operating procedures and practices.

- 1. All safety equipment and protective clothing is to be kept clean and well maintained.
- All prescription eyeglasses in use will be safety glasses and will be compatible
  with respirators. Contact lenses should not be worn in areas where there is a
  potential for injury to the eye due to particulate, fume, vapors, gases or other
  air contaminant.
- 3. The Safety Officer will approve all disposable or reusable gloves worn on the site.
- 4. During periods of prolonged air-purifying respirator usage in contaminated areas, respirator filters will be changed according to the change-out schedule for the project, or sooner, if breakthrough is indicated. At a minimum, respirator cartridge filters will be changed on a daily basis.
- 5. Footwear used on site will be covered by rubber over boots when entering or working in the "hot zone" or "contamination reduction zone". Boots will be washed with water and detergent to remove dirt and contaminated sediment before leaving these work zones.
- 6. All personal protective equipment (PPE) used on site will be decontaminated or disposed of at the end of the workday. The Safety Officer will be responsible for ensuring decontamination of personal protective equipment before reuse.
- 7. All respirators will be individually assigned and not interchanged between workers without cleaning and sanitizing.
- 8. Any site personnel unable to pass a fit test as a result of facial hair or facial configuration shall not enter or work in an area that requires respiratory protection.
- 9. All project personnel shall have a vision or corrected vision to at least 20/40 in one eye.
- On-site personnel found to be disregarding any provisions of the HASP or SOP will, at the request of the Safety Officer, be barred from the project.
- 11. Used disposable outerwear will be removed upon leaving the hot zone and will be placed inside disposable containers provided for that purpose. These containers will be stored at the site at the designated staging area and the Contractor will be responsible for proper disposal of these materials at the completion of the project.



- 12. Tyvek™ suits, or other outer garments, which become torn or badly soiled will be replaced immediately.
- 13. Eating, drinking, chewing gum or tobacco, smoking, etc., will be prohibited in the hot and contamination reduction zones.
- 14. All personnel will thoroughly cleanse their hands, face, forearms and other exposed areas prior to eating smoking, drinking, or using the toilet facilities.
- **15.** Showers at the end of the shift are required for personnel who have worked in the hot zone.
- No alcohol or drugs (without prescription) will be allowed on-site at any time. Firearms are only allowed for security purposes, if allowed by the local law enforcement agency.
- 17. All personnel who are on medication should report it to the Safety Officer who will make a determination whether or not the individual be allowed to work and in what capacity. The Safety Officer may require a letter from the individual's personal physician stating what limitations, if any, the medication may impose on the individual.
- 18. At least one copy of these work practices shall be available for review at the job work site.
- 19. Legible and understandable, precautionary labels shall be affixed prominently to containers of contaminated scrap, waste, debris and clothing.
- 20. Removal of contaminated soil from protective clothing or equipment by blowing, shaking or any other means that disperse contaminants into the air is prohibited.
- 21. Transportation and disposal of contaminated materials shall comply with all applicable local, state, and federal regulations. The transporter and disposer will address these items.
- 22. Drummed contaminated materials shall be stored in tightly closed containers in well-ventilated areas.
- 23. Containers shall be moved only with the proper equipment and shall be secured to prevent dropping or loss of control during transport.
- 24. All trenching, shoring and excavation work must comply with all federal OSHA rules.
- 25. Portable or fixed emergency shower/eyewash stations shall be located near work activities and routinely checked to ensure that the equipment is functioning.



- 26. Before daily site operations begin, a tailgate safety meeting will be held to review the SSHASP concerns for the work activities and emergency response procedures. The Daily Tailgate Safety Meeting Logs will be maintained as part of the SSHASP. The Daily Tailgate Safety Meeting Form and Topics Guide are located in *Appendix C*.
- 27. A change in level of protection will be based on air monitoring equipment readings taken in the breathing zone. Air monitoring forms are provided in **Appendix D**.
- 28. 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.
- 29. Field personnel should not stand with their head directly over a container of hazardous material or well when it is being opened.
- 30. Events surrounding accidents/injuries will be recorded in the daily log. Document the incident on Apex's Incident Report and submit copies within 24 hours to the Corporate Human Resources Representative and Corporate Health and Safety Officer (see *Appendix E*).
- 31. First aid kit(s) and fire extinguisher(s) will be available in all company vehicles and on project sites for responding to emergency situations.
- Workers will not stand on drums.
- 33. All welding, cutting, burning, grinding or other open flame work in close proximity to the environmental/construction work site will require the issuance of a "Hot Work Permit". Due to the nature of the oxidizers used, "Hot Work" is prohibited on this project unless approved in writing by the Health and Safety Officer.
- 34. Lockout-tag out procedures will be followed prior to performing any work on equipment for controlling hazardous energy.
- 35. Only authorized entrants, attendants and supervisors trained in confined space entry procedures will be permitted to enter and conduct work in confined spaces. OSHA confined space entry standard requirements must be complied with.
- 36. Use of a "buddy system" will be used in hazardous areas.
- 37. Engineering controls and work practices shall be instituted to reduce and maintain employee exposure to, or below, the permissible exposure limits (PEL) for substances regulated by OSHA, except to the extent that such controls and practices are not feasible.



# 7.0 PERSONAL PROTECTIVE EQUIPMENT (PPE) AND CLOTHING

The minimum level of PPE to be worn for this project is (Level D). All work activities will commence in Modified Level D PPE. Air monitoring results will determine whether PPE will need to be upgraded to Level C or Level B. Whenever high pressure water rinsing is conducted, workers in the immediate area of the washer must wear a face shield in addition to Modified Level D PPE.

# 7.1 Categories of PPE

LEVEL OF PPE	PERSONAL PROTECTIVE EQUIPMENT
A	<ul> <li>Positive pressure full face-piece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA (NIOSH approved)</li> <li>Totally encapsulating chemical –protective suit</li> <li>Coveralls¹</li> <li>Long underwear¹</li> <li>Gloves, outer, chemical-resistant</li> <li>Gloves, inner, chemical-resistant</li> <li>Boots, chemical-resistant, steel toe and shank</li> <li>Hard hat (under suit)¹</li> <li>Disposable protective suit, gloves and boots (depending on suit construction, may be worn over totally-encapsulating suit)</li> </ul>
В	<ul> <li>Positive pressure, full-face piece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA (NIOSH approved)</li> <li>Hooded chemical-resistant clothing (overalls and long-sleeved jacket; coveralls; one or two-piece chemical-splash suit; disposable chemical-resistant overalls)</li> <li>Coveralls¹</li> <li>Gloves, outer, chemical-resistant</li> <li>Gloves, inner, chemical-resistant</li> <li>Boots, outer, chemical-resistant, steel toe and shank</li> <li>Boot-covers, outer, chemical-resistant (disposable)¹</li> <li>Face shield¹</li> <li>Hard hat¹</li> </ul>



LEVEL OF PPE	PERSONAL PROTECTIVE EQUIPMENT
С	<ul> <li>Full-face or half-mask, air purifying respirators (NIOSH approved)</li> <li>Hooded chemical-resistant clothing (overalls; two-piece chemical-splash suit; disposable chemical-resistant overalls)</li> <li>Coveralls¹</li> <li>Gloves, outer, chemical-resistant</li> <li>Gloves, inner, chemical-resistant</li> <li>Boots, outer, chemical-resistant steel toe and shank¹</li> <li>Boot-covers, outer, chemical-resistant (disposable)¹</li> <li>Hard hat¹</li> <li>Escape mask¹</li> <li>Face shield¹</li> </ul>
D	<ul> <li>Coveralls</li> <li>Gloves¹</li> <li>Boots/shoes, chemical-resistant steel toe and shank</li> <li>Boots, outer, chemical-resistant (disposable)¹</li> <li>Safety glasses with side shields, or chemical splash goggles</li> <li>Hard hat</li> <li>Escape mask¹</li> <li>Face shield¹</li> <li>Traffic vest¹</li> <li>Cooling vest¹</li> </ul>

<sup>&</sup>lt;sup>1</sup> optional, as applicable

# 7.2 Types of Hazards for Which Levels A, B, C and D Protection are Appropriate

PPE LEVEL		WHEN TO USE	
A	•	The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either the measured, or potential for, high concentration of atmospheric vapors, gases, or particulates of materials that are harmful to skin;	
	•	The site operation and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of	



PPE LEVEL	WHEN TO USE	
	being absorbed through the skin;	
	<ul> <li>Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible; or,</li> </ul>	
	<ul> <li>Operations are being conducted in confined, poorly ventilated areas, and the absence of conditions requiring Level A has not yet been determined.</li> </ul>	
В	<ul> <li>The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection;</li> </ul>	
	The atmosphere contains less than 19.5% oxygen; or,	
	<ul> <li>The presence of incompletely identified vapors or gases is indicated by a direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the skin.</li> </ul>	
	<ul> <li>Use of Level B involves atmospheres with IDLH concentrations of specific substances that present severe inhalation hazards and that do not represent a sever skin hazard, or do not meet the criteria for use of air-purifying respirators.</li> </ul>	
С	The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin;	
	The types of air contaminants have been identified, concentrations measured, and an air-purifying respirator is available that can remove the contaminants; and,	
	All criteria for the use of air-purifying respirators are met.	
D	The atmosphere contains no known hazard; and,	
	Work functions preclude splashes, immersion, or the potential for unexpected inhalation of, or contact with hazardous levels of any chemicals.	



Combinations of personal protective equipment other than those described for Levels A, B, C, and D protection may be more appropriate and may be used to provide the proper level of protection.

Air monitoring instrumentation-includes a Photo Ionization Detector (PID) with a 10.6 eV or greater lamp (check ionization potentials of volatile air contaminants in the NIOSH Pocket Guide to Chemical Hazards), Flame Ionization Detector (FID), Oxygen/LEL Meter, hand pump with colorimetric indicator tubes, Sound Level Meter and a Portable Gas Chromatograph. Readings will be taken periodically and documented in an air-monitoring log (Appendix D).

In addition to routine air monitoring, soil vapor monitoring will be performed in accordance with the scope of work required by the New York State Department of Health (NYSDOH) in their correspondence dated October 20, 2004. Additional details of the soil gas monitoring program are provided in the Pilot Test Work Plan Addendum (as amended).

# 7.3 Respiratory Protection Program

To control the incidence of occupational diseases, OSHA requires that hazardous air contaminant levels at Apex project sites be reduced to the lowest possible levels by instituting engineering controls and work practices designed to prevent atmospheric contamination. However, when such controls are not feasible or while they are in the process of being instituted, respirators may be used as a means of controlling employee exposure to hazardous air contaminants. The policies and procedures found in Apex's Respiratory Protection Program, *Appendix F*, are to be followed whenever respirators are used to control personal exposures to hazardous airborne substances.

All site workers required to wear respiratory protection must be included in a medical surveillance program. No worker on the project site is permitted to wear a respirator unless that individual has been medically qualified and has been found to be physically fit to wear respiratory protection, has had appropriate training on the use and limitations of the respirator and is knowledgeable of the requirements of the employer's Respiratory Protection Program.



### 8.0 EMERGENCY RESPONSE/PLANNING

# 8.1 Emergency Telephone Numbers / Directions to Hospital

The following telephone numbers and directions to the hospital from the site are provided to expedite emergency assistance if needed at the site.

**Nearest Hospital:** 

North Shore University Hospital at Glen Cove

101 St. Andrews Lane, Glen Cove, N.Y.

Hospital Emergency/General Tel. No.:

(516) 674 - 7300

See Figure 2 for map and directions to hospital.

Fire Department:

911

Police Department:

911

Ambulance:

911

**CHEMTREC (Chemical Transportation Emergency Center)** 

24 Hour Tel. No.:

800-424-9300

Chemtrec 2501 M Street, NW Washington, D. C. 20037

**Poison Control Center:** 

800-336-6997

Project Manager:

**Daniel Smith:** 

(631) 207-3700 ext 102 Office

(914) 319-9375 Cell

**Client Contact:** 

Farsad Fotouhi:

(516) 801-9308 East Hills, NY Office

(734) 913-6130 Ann Arbor, MI Office

(734) 368-3238 Cell

**H&S Manager:** 

Stephen Arena

(860) 282- 1700 X17

(203) 520- 9665 (CELL)

Site H&S Officer:

**Tom Stolworthy** 

(631) 207-3700 ext 101 Office

(973) 420-8403

### 8.2 Evacuation Procedures

If evacuation from the site is required due to an emergency such as a fire or explosion, the following action should be taken:

- First person recognizing need for evacuation will immediately notify all on-site personnel via voice, air horn or other means.
- Leave the area and report to a designated rally point established by the Site Health and Safety representative. For this project, the default rally point shall be the overpass of Route 107 at the front of the facility, immediately adjacent to the southeast corner of the property. This evacuation point may vary daily based upon site activities and weather conditions and location should be discussed at the Daily Tailgate Safety Meeting.
- Notify emergency medical services, if appropriate at 911.
- Account for all site personnel.
- Contact the Apex project manager and health and safety representative, and Client contact as soon as practical.
- Establish site security and control measures for the neighborhood safety until emergency responders arrive and take control.

# 8.3 Medical Emergency

Response to a medical emergency:

- Initially survey the situation; do not enter an area that could jeopardize your safety.
- Establish the level of consciousness and then call for help, informing the Emergency Medical Service (EMS) of the patient's condition.
- If the person is unconscious, perform a primary assessment by checking for arousal, airway, breathing and circulation. (only trained First Aid/CPR personnel should perform these tasks; state that you are medically trained).
- Conduct a secondary assessment to the conscious patient by checking for bleeding (control with direct pressure) and monitoring for vital signs.
- Do not move the person unless the location is hazardous.
- Provide First Aid to the level trained.



 Contact the project manager and health and safety representative as soon as practical and document the incident in a report to the health and safety representative.

# 8.4 Fire Emergency

Response to a fire emergency:

- Evacuate the area immediately and notify EMS.
- Extinguish small fires with an all-purpose fire extinguisher and provided that you have had training in the use of an extinguisher.
- Contact the project manager and health and safety representative and document the incident; document for the project file and send a copy to the health and safety representative.

# 8.5 Spill/Release of Hazardous Material

Response to a spill or release of hazardous material:

- Wear appropriate PPE and stay upwind of the incident.
- Turn off all sources of ignition and shut down pumps and valves to equipment in the immediate area; if possible, plug leaks and collect drippings in a container.
- Place absorbent around the incident site to soak up hazardous material.
- Call the fire department if potential for a fire exists.
- Determine if the client wants to repair the damage and whether a contractor has to be used.
- Advise the client of any release notification requirements for state or federal agencies and determine who is to complete and submit forms. Submit or report to regulatory agencies only if authorized to do so by client. Completely document interaction with client and regulatory agency. The project manager must contact the client or generator of the spill/release.
- Do not approve for transport, or transport contaminated environmental media until appropriate manifest or shipping paper have been completed and approved. Do not sign any manifest as a generator of waste. Discuss waste transportation issue with Corporate and Division representative prior to resolution for disposal.
- Notification must be made by the client, or by Apex, with permission from the client, to the proper governmental agencies. Spills/releases entering



waterways must be reported to the Coast Guard and the National Response Center at 800-424-8802.



# 9.0 TRAINING REQUIREMENTS

Site workers must have completed the following training programs:

- Field personnel must complete 40 hours of hazardous waste activity instruction (OSHA 29 CFR 1910.120/1926.65);
- Field personnel must complete 24 hours of supervised field instruction (29 CFR 1910.120/1926.65);
- Field personnel must complete 8 hours of refresher training each year (29 CFR 1910.120/1926.65);
- On-site supervisors/managers directly responsible for employees engaged in hazardous waste operations must have an additional 8 hours of supervisory training (29 CFR 1010.120/1926.65);
- Field personnel assigned to provide first aid assistance at the site must be trained in first aid/cardio-pulmonary resuscitation (CPR) and bloodborne pathogens training (1926.50)
- All site personnel must attend and participate in "Daily Safety Tailgate Meeting and document attendance (29 CFR 1910.120;
- Competent person training (29 CFR 1926, Subpart P) for on-site managers and supervisors (subcontractor) directly responsible for employees engaged in excavation/trenching operations;
- Hazard communication training on any hazardous substance's chemical and physical properties (29 CFR 1910.1200);
- Personal protective equipment training for personnel required to wear protective clothing (29 CFR 1910.132 and 134);
- Personnel performing air monitoring must be trained in the calibration, and operation of instrumentation used at the site (29 CFR 1910.120);
- Personnel required to extinguish small fires on site are required to be trained in the proper use of a fire extinguisher (29 CFR 1910.156/1926.150);
- All site personnel must review this HASP and be able to obtain emergency information, if needed. They must also be familiar with established emergency response and evacuation procedures for the site. This information is to be reviewed with all project personnel prior to commencement of field activities (29 CFR 1910.120);
- Workers required to enter confined spaces must be trained in the requirements of confined space entry (29 CFR 1910.146);



- Workers required to provide first aid must be trained in the hazards of blood borne pathogens (29 CFR 1910.1030);
- Other training, as required, to comply with OSHA health and safety standards.

Records of the training associated to personnel on-site shall be kept with the project manager on-site for the duration of the project.



### 10.0 MEDICAL SURVEILLANCE

Medical surveillance consisting of a baseline, annual and termination examination are required of all Apex employees and subcontractors, whose job may require working in environments with potential exposure to health hazards such as hazardous waste, petroleum products, materials, noise, lead and crystalline silica. Examination criteria and frequency will be determined by Apex's and subcontractor occupational physicians based upon guidance and regulatory requirements provided in the applicable OSHA Hazardous Waste Operation and Emergency Response Regulation (29 CFR 1910.120 or 29 CFR 1926.65). More frequent examinations may be performed at the recommendation of a qualified occupational physician.

Apex and subcontractors are also required to retain and provide employee access to medical and exposure monitoring records in compliance with OSHA 29 CFR 1910.1020 or 1926.33, Access to Employee Exposure and Medical Records.

### 10.1 Heat and Cold Stress Evaluation

Adverse and extreme weather or environmental conditions frequently become important considerations in planning and conducting work operations. Both indoors and outdoors, weather and working conditions can combine to create potentially hazardous extreme temperature conditions that can cause physical discomfort, loss of efficiency, impairment of judgment, and personal injury, even death. If the body's physiological processes fail to maintain a normal body temperature because of excessive heat or cold, a number of physical reactions can occur ranging from fatigue and abnormal behavior to collapse, unconsciousness, and ultimate death. In addition to the environmental factors affecting a worker, personal characteristics such as age, weight, fitness, medical condition and acclimatization are also important considerations in determining temperature stress of a worker.

One of the greatest factors affecting the levels of stress on workers can be the use of PPE. Even in moderate temperature environments, conditions inside protective clothing may be extreme enough to cause a temperature stress situation. Thus, addressing the hazards related to temperature extremes can help prevent injury and illness.

The ACGIH TLV and BEI booklet contains detailed information on heat and cold stress and is recommended to be used by Apex employees as a reference and supplement to our program.



# 10.1.1 Heat Related Illnesses

The stress of working in areas of high heat, humidity and radiant heat can cause a variety of strains on the body, including heat exhaustion or heat stroke; the latter can be fatal. Working in protective clothing and using respirators, particularly where use of other protective equipment is required, can significantly increase heat stress. Heat stress has occurred at various work locations including hazardous waste remediation sites at ambient temperatures less than 70°F when plastic suits were in use or strenuous work was required. The symptoms of heat stress need to be recognized and necessary actions implemented when they occur.

Heat stress can be a major hazard for Apex employees working at hazardous waste sites, inside confined spaces or in other areas, who are dressed in protective clothing. The same protective materials that protect the body from chemical exposure also limit the dissipation of body heat and moisture. Heat stress can occur very rapidly depending upon certain ambient conditions and work being performed. Heat stress can pose as great a danger to worker health as chemical exposure.

To minimize the potential for heat stress problems at the job site, Apex has developed guidelines on heat-related illnesses. *Table 1*, Forms, Symptoms and First Aid Measures for Heat Stress, should be reviewed by employees prior to job assignments and incorporated into health and safety plans (HASP) so that early symptoms of heat stress are recognizable by all employees and prompt corrective first aid measures can be taken to minimize the potential for more serious heat-related illnesses.

In the preliminary stages of heat stress, rashes, cramps, discomfort and drowsiness can occur resulting in impaired functional ability that threatens the safety of both the individual and coworkers. Continued heat stress can lead to heat stroke and death. Avoiding overprotection, careful training and frequent monitoring of workers who wear protective clothing, strategic scheduling of work and rest periods, and frequent replacement of fluids can protect against heat stress hazards.

Care must be taken when selecting chemical-protective clothing (CPC). The heat transfer characteristics of CPC may be an important factor in selection. Many CPC is virtually impermeable to moisture and evaporative cooling is limited. The thermal insulation value ("CLO" value) of CPC is a measure of the capacity of CPC to dissipate heat loss through means other than evaporation. The larger the CLO value, the greater the insulating properties of the garment and, consequently, the lower the heat transfer. Given other equivalent protective properties, clothing with the lowest CLO value should be selected in hot environments or for high work rates. Unfortunately, CLO values for clothing are not readily available by manufacturers.



Ambient temperature has a major influence on work mission duration as it affects both the worker and the protective integrity of the ensemble. Heat stress, which can occur even in relatively moderate temperatures, is the greatest immediate danger to an ensemble - encapsulated worker. Hot ambient temperatures and relatively elevated humidity levels also affect:

- The durability and flexibility of protective garments;
- The valve operation on suits and/or respirators;
- The concentration of airborne contaminants in the work zone; and
- The breakthrough time and permeation rats of chemicals.

Any of these factors has the potential for decreasing the duration of protection provided by a given piece of clothing or respiratory equipment. These factors must be considered in selecting appropriate PPE for the project. In addition, a person's body will need to be physiologically adjusted, or acclimatized, to working under hot conditions. The National Institute of Occupational Safety and Health (NIOSH) recommends a progressive six-day acclimatization period for the unacclimatized worker before allowing them to perform full work on a hot job site.

**Table 1**, Heat Related Illnesses summarizes the forms, symptoms and first aid measures for victims of heat stress. If more detailed information on heat stress is desired for a particular project, the American Conference of Governmental Industrial Hygienist (ACGIH) publishes a booklet, which can be used in the field as a reference on thermal stress. This booklet is entitled, *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.* The ACGIH booklet emphasizes the importance of acclimating individuals to hot environments and provides screening criteria for heat stress exposure provides examples of activities with metabolic rate categories and discusses controls for limiting heat strain.

Ways to reduce or prevent heat stress include use of body cooling devices and work time limits. Frequent rest cycles to cool down and replace the body fluids and electrolytes lost through perspiration should be employed to control heat related illnesses.



<u>Table 1</u> <u>Form, Symptom and First Aid Measures for Heat Stress</u>

FORM	SYMPTOMS	FIRST AID MEASURES
Heat Rash	"Prickly heat"      Ranges from slight irritation covering small areas of skin, to extensive irritation covering entire body	<ul> <li>Keep skin clean and dry for at least 12 hours per day</li> <li>Change wet clothing</li> </ul>
Heat Cramps	<ul> <li>Sweaty skin</li> <li>Painful muscle spasms</li> <li>Normal body temperature</li> </ul>	<ul> <li>Give fluids</li> <li>Gently massage cramped muscles</li> </ul>
Heat Exhaustion	<ul> <li>Clammy or pale skin</li> <li>Weakness and fatigue</li> <li>Profuse sweating</li> <li>Nausea, vomiting</li> <li>Disorientation</li> <li>Headache</li> <li>Normal or slightly elevated body temperature</li> </ul>	<ul> <li>Remove victim from heat</li> <li>Loosen clothing</li> <li>Sponge skin with cool water</li> <li>Fan victim but stop if victim shivers or develops goose bumps</li> <li>Give fluids. Give victim a drink solution of one pint water and one teaspoon salt every 30 minutes until victim recovers</li> <li>Obtain medical help if victim does not improve</li> </ul>



FORM	SYMPTOMS	FIRST AID MEASURES
Heat Stroke	Unconsciousness or mental confusion      Dizziness	<ul> <li>Get emergency medical aid immediately</li> </ul>
	Staggered walk	<ul> <li>Remove victim from heat</li> </ul>
	<ul><li>Appears to be agitated</li><li>Hot, dry skin</li></ul>	<ul> <li>Remove clothing, place victim in a cool bath, or apply cool compresses</li> </ul>
	Extremely high body temperature; could reach or exceed 105°  F	Do not give any fluids
		<ul> <li>Do not leave victim alone</li> </ul>
		<ul> <li>Do not allow victim to become so cold that victim shivers</li> </ul>
		<ul> <li>Do not give aspirin or other medication in an attempt to lower fever</li> </ul>

### 10.1.2 Cold Stress

The stress of working in a cold environment can cause a variety of strains on the body including constriction of blood vessels of the skin, shivering, localized frostbite or frostnip, and generalized hypothermia. The frequency of accidents may be higher in cold environments. Nerve impulses are slowed; exposed workers react sluggishly, fumble with their hands and become clumsy. There are also safety problems common to cold environments. They include ice, snow blindness, reflection from snow and the possibility of burns from contact with cold metal surfaces.

Thermal injury due to cold exposure can become a problem for Apex project field personnel. Systemic cold exposure is known as hypothermia. Localized cold exposure is generally considered to be categorized as frostbite.



Hypothermia is caused by a decrease in core body temperature below 96°F. The central (brain and spinal cord) and peripheral (skin and muscle) activity normally maintains the body temperature. Interference with any of these mechanisms can result in hypothermia, even in the absence of what is usually considered a "cold" ambient temperature. Symptoms of hypothermia include shivering, apathy, listlessness, sleepiness, and unconsciousness.

Frostbite is both a general and medical term given to areas of local cold injury. Unlike systemic hypothermia, frostbite rarely occurs unless the ambient temperature drops below freezing and usually less than 2°F. Symptoms of frostbite include a sudden blanching or whitening of the skin. The skin has a waxy or white appearance and is firm to the touch. Affected tissues are cold, pale and solid.

Prevention of cold-related illness can be aided by educating workers on recognizing the symptoms of frostbite and hypothermia and by identifying and limiting known risk factors. The workers should be provided with enclosed, heated shelters on, or adjacent to, the worksite, dry changes of clothing and warm drinks. When working in extremely cold climates, frequent work breaks should be encouraged.

To monitor site personnel for cold-related illnesses, commence oral temperature recordings at the job site:

- At the supervisor's discretion when suspicion is based on changes in a worker's performance or mental status;
- When a worker requests monitoring;
- As a screening measure, at least twice per shift, under extremely hazardous climatic conditions (for example, when the wind-chill is less than 20°F, or wind-chill is less than 30°F with precipitation); and
- As a screen measure whenever any person develops hypothermia.

Workers developing moderate hypothermia, in which the core temperature drops to 92°F, should not return to work for at least 48 hours, if adverse weather conditions continue.

The following table provides symptoms associated with a drop in core body temperature.



# <u>Table 2</u> PROGRESSIVE CLINICAL SYMPTOMS OF HYPOTHERMIA

CORE BODY TEMPERATURE (°F)	SYMPTOMS
99.6	Normal core body temperature
96.8	Metabolic rate increases
95.0	Maximum shivering
93.2	Victim conscious and responsive
91.4	Severe hypothermia
89.6-87.8	Consciousness clouded, blood pressure difficult to obtain, pupils dilated but react to light, shivering ceases
86.0-84.2	Progressive loss of consciousness, muscular rigidity increases, pulse and blood pressure difficult to get, respiratory rate decreases
78.8	Victim is seldom conscious
64.4	Lowest accidental hypothermia victim to recover

Apex employees must be trained to minimize the risk of the hazards of working in cold environments and periodically reinforced in the recognition of the physiologic responses of the body to cold stress. The use of insulated work clothing, warm shelters and work/warming regimens should be used to minimize the potential hazards of cold stress. Also, special attention should be given to equipment warm-up time and freeze protection for vessels, piping, equipment, tools, and walking/working surfaces. The American Conference of Governmental Industrial Hygienists (ACGIH) TLVs for cold stress should be used as a guideline.

Control measures to prevent cold related symptoms include:

- Prevent continuous exposure of skin when the wind-chill factor results in an equivalent temperature of -32 °C (-26 °F). Workers exposed to air temperatures of 2 °C (35.6 °F) or lower who become immersed in water or whose clothing gets wet should change into dry clothing immediately and be treated for hypothermia.
- Use heated warming shelters such as tents and cabins when work is performed continuously in an equivalent chill temperature o f -7°C (20°F) or below.
- Ensure frequent intake of warm, sweet, caffeine-free, non-alcoholic drinks or soup.
- Minimize sitting still or standing for long periods of time.



Ensure use of appropriate PPE. The correct clothing depends on the specific cold stress situation. It is important to preserve the air space between your body and the outer layer of clothing in order to retain body heat. The more air pockets each layer of clothing has, the better the insulation. However, the insulating effect is negated if the clothing interferes with the evaporation of sweat, or if the skin or clothing is wet.

# 10.2 Biological Monitoring

Biological monitoring will not need to be conducted during the course of the project.



### 11.0 ENVIRONMENTAL MONITORING PROGRAM

### 11.1 Air Monitoring

Air monitoring will need to be conducted during the course of this project. For both worker protection and soil gassing that may result from subsurface volatilization. Worker protection monitoring is addressed in this HASP. Soil gas monitoring is addressed in the Pilot Test Work Plan Addendum (as amended).

### 11.1.1 Area Monitoring: Frequency/Action Levels

Air monitoring will be conducted on a routine basis according to the work being performed using a PID instrument for total organic compound vapor determination, an O2/LEL meter to check lower explosive limits, and a portable gas chromatograph to monitor soil gas. Immediately dangerous to life or health (IDLH) conditions or development of flammable atmospheres will require more frequent monitoring and possibly continuous monitoring until the atmospheric condition improves. IDLH conditions **should not** occur with the services being provided and the configuration of the work areas.

In general, when conducting monitoring, expect possible rises in exposures associated with the following conditions:

- When work begins on a different area of the property or at the start of new operations;
- When handling hazardous materials other than those identified (e.g., gasoline for portable power tools in enclosed areas);
- When visible dust results from cleaning operations;
- When odors or symptoms of exposure are noted;
- When handling containers that are leaking; and,
- When working in obvious contaminated areas (e.g., product layer on standing water in pans or trenches).

### 11.1.3 Perimeter Air Monitoring Program: Frequency/Action Levels

Perimeter air monitoring will be needed during the course of this project. Soil gas vapor will be continuously sampled during injection event around the perimeter of the site.



### 11.2 Soil Sampling Program

Soil Sampling will only be conducted for borehole logging during the drilling operations. Soils will be screened and some samples may be sent to the lab for analysis.

### 11.3 Surface Water and Ground Water Sampling Program

Ground water sampling and monitoring will be performed throughout this project. All site personnel who are sampling or monitoring groundwater will be in modified level D and will have participated in a training course provided by the chemical manufacturer.

### 11.4 Noise Monitoring Program

Noise monitoring may be performed at the perimeter of the work zone during the beginning of the project if noise levels appear to pose a potential concern. Based upon the nature of activities planned, noise pollution should not be a significant concern.

### 11.5 Weather Monitoring

Weather will be monitored consistently. Work will cease during violent weather conditions (heavy rain, thunderstorms, snow, ice, high winds, etc.).

### 11.6 Maintenance & Calibration Requirements for Monitoring Instrumentation

Air and groundwater monitoring equipment will be maintained at 100% efficiency. If an instrument is not performing it will be replaced or repaired. Instruments will be calibrated on a daily basis and a calibration log will be kept.



### 12.0 WORK ZONES/SITE CONTROL

Work zones at the site will be established by the project manager (PM) and site health and safety representative to delineate high-traffic and hazardous locations and to contain contamination generated from field activities to the smallest area possible. Workers entering these work zones must wear appropriate PPE for that area. Work and support zones will be established from air monitoring data, required security measures and other conditions at the site.

Three primary work zones are to be demarcated. These include the Exclusion Zone (EZ), Contamination Reduction Zone (CRZ) and the Support Zone (SZ). Each zone will be established by the PM or SHSO prior to commencing daily activities. These zones will be determined in the field in conjunction with the Site Health and Safety Officer and marked in the field. Due to the nature of site activities, the EZ, CRZ and SZ will be re-defined as injections in certain areas are initiated and terminated. Work zones will be delineated on-site by fencing, cones, warning tape or other means deemed appropriate by the SHSO.

The EZ will contain areas where construction equipment is operating, where concrete is being cut, where contaminated soils are being excavated, moved or stored, and other locations where potential for exposure to organic vapors and contaminated dust exist on the property. At a minimum, Modified Level D PPE is required to be worn in these areas. Air monitoring will be conducted routinely in the EZ and documented. Use a minimum distance of ten (10) feet surrounding the EZ for the demarcation line. This will vary depending upon location to workers, public and traffic.

The CRZ will be an established corridor leading from the contaminated area (EZ) to the support zone. In some circumstances, the back end of the company pick-up truck may be used. The corridor will be identified by tape, cones, fencing or other barricades. Decontamination of personnel and equipment will occur in this zone. Vehicles and other larger pieces of equipment that may become contaminated can be decontaminated in a separate CRZ, which has ground containment to collect contaminated rinsewater.

The SZ will include all areas outside the EZ or CRZ where breaks will be taken, food and beverage may be consumed and general support for workers will be provided from this area.

When working in, or near a street, traffic vests and hardhat must be worn where vehicle hazards exist. Caution tape, flag-mounted cones, and other highly visible barriers must be used to alert traffic to the work being conducted. Where possible, a parked vehicle should protect the work area and strobe lights must be used. If needed, establish a traffic patternization plan for high traffic conditions. This should include a flag person, flashing



arrow signs and "Men Working" signs. A lane-closing permit will be required and police details should be used, when appropriate.

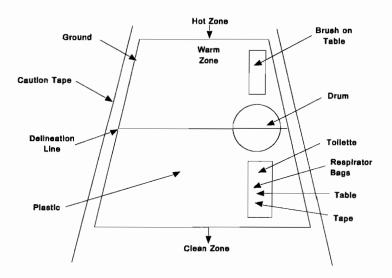


### 13.0 DECONTAMINATION PROCEDURES

Field equipment and personal protective equipment may become contaminated with residual contaminants during the site activities. It is important to halt the spread of contamination to vehicles, personnel and support areas by using appropriate decontamination procedures. Work clothing and Level D PPE must not be brought to workers' residences and left either at the site or in the company vehicle. Any laundering of contaminated clothing must be done by an approved laundering service and not at the workers home. The decontamination procedures discussed for workers and the area in other project work plans can be used and also can be supplemented by the following procedures.

 All water/detergent used in decontamination procedures should be stored in portable containers until sufficient quantities are stockpiled to facilitate disposal treatment. All disposable PPE and sampling equipment must be placed in plastic bags and temporarily stored in designed open-top drums. These drums will be disposed of in accordance to MA DEP guidelines, if required.

Typically, decontamination should occur in a corridor configuration with caution tape or other comparable methods used to delineate the corridor. An example decontamination corridor is inserted below.





The corridor should have plastic sheeting protecting the ground or floor. As workers exit the Exclusion Zone into the Contamination Reduction Zone, a table can be set up to hold brushes, which can be used to remove coarse contaminated debris from the PPE. Several plastic "kiddy" pools can be used to rinse rubber boots, and a drum used to collect contaminated materials or tools. Showers and toilette facilities should be located toward the end of the corridor. A table should also be available to store respirators and protective storage bags, monitoring equipment and other disposable supplies. Set up the decontamination corridor so that it is divided into a front and rear section. In the front section the following activities should occur:

- Gross contamination is removed with the brushes supplied on the table.
- Outer boot covers are removed and disposed of in the drum.
- The Tyvek suit is removed and disposed of in the drum.
- The outer gloves are removed and disposed of in the drum.

Workers should proceed to the rear portion of the corridor next and perform the following decontamination tasks:

- Remove respirator after it is rinsed of dust and contaminants.
- Remove the cartridges and dispose of in a second drum.
- Thoroughly clean the respirator and insert in the protective plastic bag.
- Inner gloves are removed and disposed of in the drum.
- Hands should be wiped clean with a toilette and disposed of in the drum.
- Showers may be taken, if warranted at this site in this section of the CRZ and personnel clothing changed.
- Worker exits the decon corridor.

The following decontamination procedures can be used:

**Field Equipment**: Equipment such as interface probes, bailers, hand tools, drill augers, sampling equipment and other items can be decontaminated with a solution of detergent and water. Equipment should be rinsed with clean water prior to leaving the site. Protect clean materials from exposure by covering with disposable covers such as plastic to minimize required decontamination activities. For example, a small plastic bag can be taped around



not-critical portions of air monitoring instrumentation, to protect from damaging electronics by water.

**Disposable PPE**: PPE including Tyvek suits, respirator cartridges and latex inner gloves can be disposed of according to state, federal and client requirements. Respirator cartridges must be changed out on a daily basis and a cartridge should not be used more than 8 hours. Cartridges can be disposed of in the drum of other contaminated field equipment and supplies.

Nondisposable PPE: Respirators should be wiped clean with a disinfecting alcohol pad prior to donning. Respirators should be decontaminated at the end of each day, if worn. Decontamination includes disassembly and cleaning, rinsing, sanitizing and drying all parts with approved cleaning and sanitizing agents. Reusable boots and gloves should be decontaminated on the outside with a solution of detergent and water and should be rinsed with clean water prior to leaving the site. As a general rule, boots and gloves that have been heavily contaminated should not be used for more than four weeks; after that time it is advisable to use new items.



### 14.0 CONFINED SPACES

There are no confined space entries anticipated for this project. However, should confined spaces be identified during the project and work personnel be required to enter to perform needed tasks, no Apex Environmental, Inc. or Apex subcontractors shall enter such an area without having training that meets OSHA requirements in 29 CFR 1910.146. Rescue arrangement will need to be arranged in advance of such activities and all involved personnel will be trained in the OSHA requirements for entrants, attendants and supervisors. A permit will be required for such work and will be posted at the entrance to the confined space.

No Apex employee or subcontractor shall enter an area identified as a confined space without using the CSE procedures and permit located in Appendix G. The purpose of the CSE procedure is to protect employees from potentially hazardous environments and to facilitate immediate rescue in an emergency situation. A CSE Permit must be posted at the entrance to each confined space.



### 15.0 SPILL CONTAINMENT PROGRAM

There will be complete visual inspection of chemical storage and conveyance system to verify system integrity. If any leakage is present, the Apex Environmental, Inc. Project Manager Daniel Smith at (631) 207-3700 ext 102 will be notified. A spill kit will be provided on-site to remedy any small spills during injection event. In addition, a neutralizing solution of sodium metabisulfite will be available on-site to stop any unwanted hydrogen peroxide reactions after dilution with water to less than  $5\%\ H_2O_2$ . The use of sodium metabisulfite will allow the controlled decomposition of  $H_2O_2$ .



### 16.0 EXCAVATION ACTIVITIES

There are excavation activities associated with this project. Four new monitoring well couplets will be installed prior to start of injection event. A shallow and intermediate well will be installed for each couplet to total depths of 17 ft. and 52 ft below grade surface. Air monitoring will be performed during drilling with an LEL/O<sub>2</sub> meter and a 2020 PID. The work zone will be delineated with traffic cones/barrels and caution tape. Drill cuttings and developmental water will be placed in 55 gal drums and stored in former drum storage area. One well couplet will be installed on Sea Cliff Avenue, one lane of the road will be closed and a flag man will be used to direct traffic during drilling operation. All proper permits will be acquired before drilling proceeds.



# 18.0 ENVIRONMENTAL, SAFETY AND HEALTH ROLES AND RESPONSIBILITIES OF PROJECT PERSONNEL

The following table summarizes personnel responsibilities at the job site. This information should be reviewed with all project personnel prior to commencing site activities.

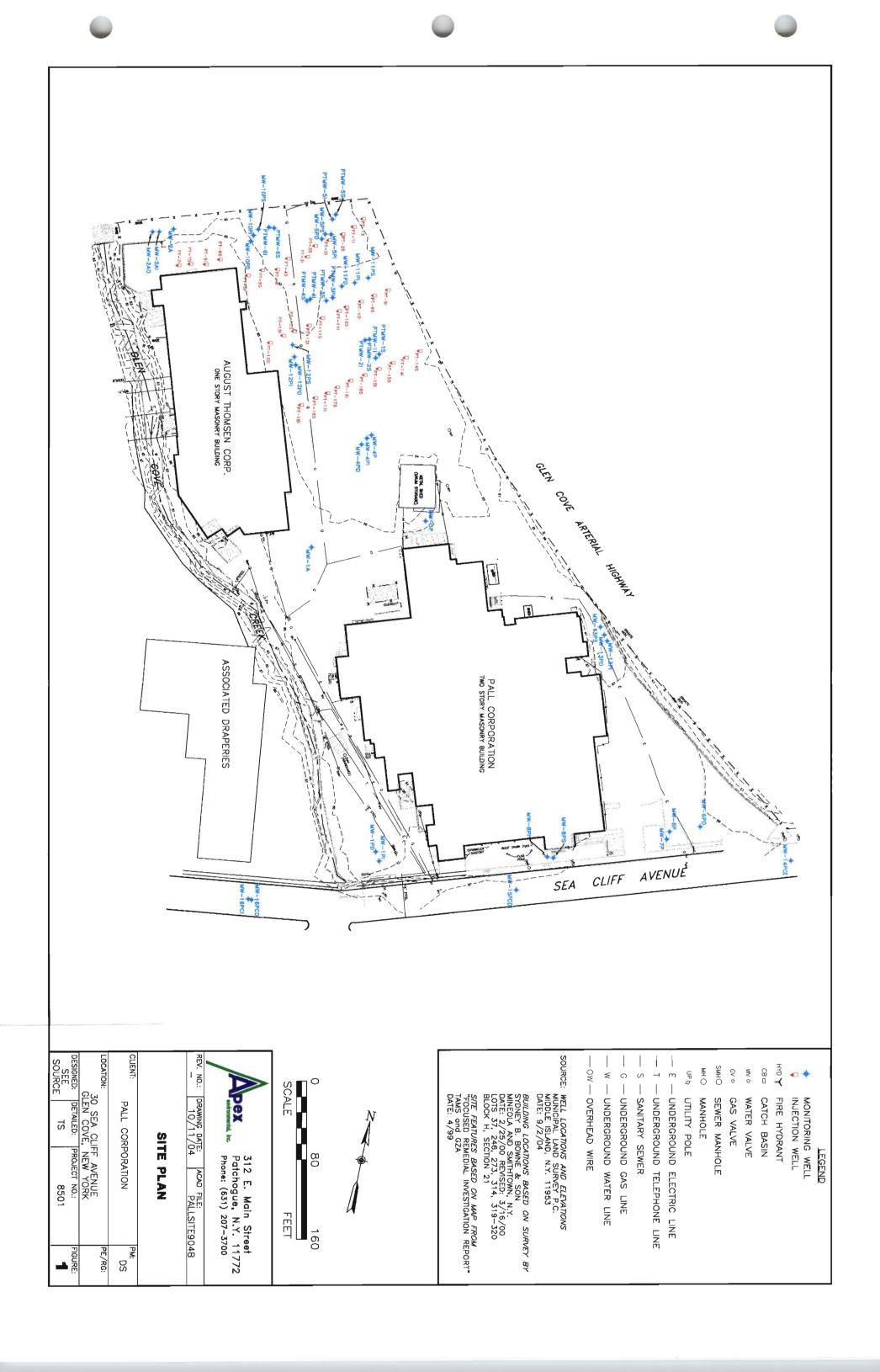
PERSONNEL	ROLES AND RESPONSIBILITIES
Program Managers	<ul> <li>Provides direction, management and resources to achieve goals and objectives of project</li> <li>Responsible for developing and implementing systems to ensure employees follow the HASP</li> </ul>
	<ul> <li>Responsible for general safety performance of employees and implementing a phased disciplinary program for employees violating health and safety programs</li> <li>Assigns and communicates safety and health responsibility to subordinates and holds subordinates accountable for their performance</li> </ul>
Project Managers	<ul> <li>Ensures that specific work tasks are properly prioritized, planned and conducted in a safe manner</li> </ul>
	<ul> <li>Verifies all site workers meet OSHA regulatory requirements</li> </ul>
	<ul> <li>Provides resources and equipment necessary to conduct and execute assigned tasks in a safe manner</li> </ul>
	<ul> <li>Designates an adequate number of health and safety specialists with the necessary authority and responsibility to develop and implement the HASP and to verify its effectiveness</li> </ul>
	<ul> <li>Provides periodic health and safety program reviews/audits to ensure program effectiveness and quality</li> </ul>
Health and Safety Specialists	Provides technical expertise necessary to carry out requirements and support work activities
-,	<ul> <li>Provides training on the HASP, Hazard Communication, and other project specific health and safety training</li> </ul>
	<ul> <li>Implements and enforces HASP requirements, with project personnel assigned to work under their jurisdiction</li> </ul>

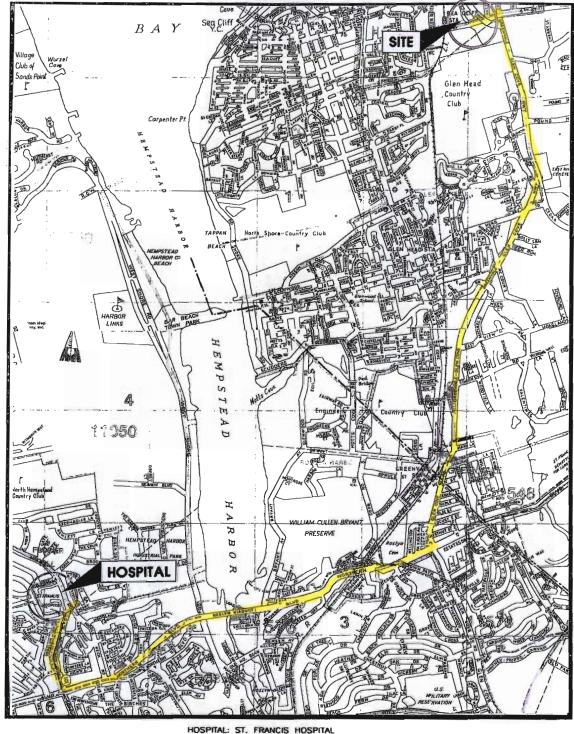


PERSONNEL	ROLES AND RESPONSIBILITIES
	Conducts initial site safety review and conducts exposure and environmental monitoring
	Ensures that adequate safety controls are maintained
	<ul> <li>Obtains related information on suspect hazardous materials to facilitate preparation of hazardous material abatement</li> </ul>
	<ul> <li>Ensures that appropriate health and safety-related project documentation is maintained for the project</li> </ul>
Site Laborers	<ul> <li>Conduct work in a safe manner in accordance with the HASP, other applicable safe work procedures and controls specified in permits</li> <li>such as hot work or confined space entry permits</li> <li>Appropriately uses assigned personal protective equipment</li> <li>Observes their work area surroundings for potential safety issues</li> <li>Reports unsafe work conditions or practices to the health and safety specialist/site safety and health officer</li> <li>Initiates feasible personal action to eliminate/mitigate unsafe conditions</li> </ul>
Visitors	<ul> <li>Remain outside designated work zones unless authorized by Project Manager to enter hot or contamination reduction zones wearing appropriate PPE</li> <li>Comply with all site specific HASP requirements including safe practices and levels of PPE</li> <li>Comply with training, medical surveillance and other requirements of the HASP, if access is permitted on the site</li> </ul>









HOSPITAL: ST. FRANCIS HOSPITAL 100 PORT WASHINGTON BLVD. ROSLYN, NEW YORK 11576 (516) 562-6100



312 E. Main Street Patchogue, N.Y. 11772 Phone: (631) 207–3700 DESIGNED:

DJS

DETAILED:

DJS

# HOSPITAL LOCATION MAP

DIRECTIONS FROM SITE TO HOSPITAL:

LEFT ONTO SEA CLIFF AVE., MAKE A RIGHT AT CEDAR SWAMP RD., LEFT AT TRAFFIC LIGHT ONTO GLEN COVE RD., TAKE GLEN COVE ROAD SOUTH TO NORTHERN BLVD. MAKE A RIGHT GO TO PORT WASHINGTON BLVD., MAKE A RIGHT, HOSPITAL IS ON THE LEFT TRS CLIENT: PALL CORPORATION

CHECKED: LOCATION:

DRAWING DATE: 10/26/04 FIGURE:

30 SEA CLIFF AVENUE GLEN COVE, NEW YORK

2

# APPENDIX A MATERIAL SAFETY DATA SHEETS

### MATERIAL SAFETY DATA SHEET

Hydrogen Peroxide (40 to 60%)



MSDS Ref. No.: 7722-84-1-4 **Date Approved:** 02/02/2004

Revision No.: 7

This document has been prepared to meet the requirements of the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200; the Canada's Workplace Hazardous Materials Information System (WHMIS) and, the EC Directive, 2001/58/EC.

### 1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Hydrogen Peroxide (40 to 60%)

ALTERNATE PRODUCT NAME(S): Durox® Reg. & LR 50%, Oxypure® 50%, Semiconductor Reg &

Seg 50%, Standard 50%, Technical 50%, Chlorate Grade 50%, Super

D® 50%

**GENERAL USE:** Durox® 50% Reg. and LR - meets the Food Chemical Codex

requirements for aseptic packaging and other food related

applications.

Oxypure® 50% - certified by NSF to meet NSF/ANSI Standard 60

requirements for drinking water treatment.

Standard 50% - most suitable for industrial bleaching, processing,

pollution abatement and general oxidation reactions.

Semiconductor Reg. & Seg. 50% - conforms to ACS and Semi Specs., for wafer etching and cleaning, and applications requiring

low residues.

Super D® 50% - meets US Pharmacopoeia specifications for 3% topical solutions when diluted with proper quality water. While manufactured to the USP standards or purity and to FMC's demanding ISO 9002 quality standards, FMC does not claim that its

Hydrogen Peroxide is manufactured in accordance with all

pharmaceutical cGMP conditions.

Technical 50% - essentially free of inorganic metals, suitable for

chemical synthesis.

Chlorate Grade 50% - specially formulated for use in chlorate

manufacture or processing.

SynergOx<sup>TM</sup> - combination of a proprietary catalyst and 50% hydrogen peroxide, at the point of use, for environmental

applications.

### MANUFACTURER

FMC CORPORATION Hydrogen Peroxide Division 1735 Market Street Philadelphia, PA 19103 (215) 299-6000 (General Information)

FMC of Canada Ltd. Hydrogen Peroxide Division PG Pulp Mill Road Prince George, BC V2N2S6 (250) 561-4200 (General Information)

### **EMERGENCY TELEPHONE NUMBERS**

Date: 02/02/2004

(800) 424-9300 (CHEMTREC - U.S.) (613) 996-6666 (CANUTEC) (303) 595-9048 (Medical - U.S. - Call Collect)

(281) 474-8750 (Plant: Pasadena, TX, US - Call Collect) (250) 561-4221 (Plant: Prince George, BC, Canada - Call Collect)

### 2. HAZARDS IDENTIFICATION

### **EMERGENCY OVERVIEW:**

- · Clear, colorless, odorless liquid
- Oxidizer.
- Contact with combustibles may cause fire.
- Decomposes yielding oxygen that supports combustion of organic matters and can cause overpressure
  if confined.
- Corrosive to eyes, nose, throat, lungs and gastrointestinal tract.

**POTENTIAL HEALTH EFFECTS:** Corrosive to eyes, skin, nose, throat and lungs. May cause irreversible tissue damage to the eyes including blindness.

### 3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	CAS#	Wt.%	EC No.	EC Class
Hydrogen Peroxide	7722-84-1	40 - 60	231-765-0	C, R34
Water	7732-18-5	40 - 60	231-791-2	Not classified as hazardous

### 4. FIRST AID MEASURES

**EYES:** Immediately flush with water for at least 15 minutes, lifting the upper and lower eyelids intermittently. See a medical doctor or ophthalmologist immediately.

**SKIN:** Immediately flush with plenty of water while removing contaminated clothing and/or shoes, and thoroughly wash with soap and water. See a medical doctor immediately.

Date: 02/02/2004

**INGESTION:** Rinse mouth with water. Dilute by giving 1 or 2 glasses of water. Do not induce vomiting. Never give anything by mouth to an unconscious person. See a medical doctor immediately.

**INHALATION:** Remove to fresh air. If breathing difficulty or discomfort occurs and persists, contact a medical doctor.

NOTES TO MEDICAL DOCTOR: Hydrogen peroxide at these concentrations is a strong oxidant. Direct contact with the eye is likely to cause corneal damage especially if not washed immediately. Careful ophthalmologic evaluation is recommended and the possibility of local corticosteroid therapy should be considered. Because of the likelihood of corrosive effects on the gastrointestinal tract after ingestion, and the unlikelihood of systemic effects, attempts at evacuating the stomach via emesis induction or gastric lavage should be avoided. There is a remote possibility, however, that a nasogastric or orogastric tube may be required for the reduction of severe distension due to gas formation.

### 5. FIRE FIGHTING MEASURES

**EXTINGUISHING MEDIA:** Flood with water.

**FIRE / EXPLOSION HAZARDS:** Product is non-combustible. On decomposition releases oxygen which may intensify fire.

FIRE FIGHTING PROCEDURES: Any tank or container surrounded by fire should be flooded with water for cooling. Wear full protective clothing and self-contained breathing apparatus.

FLAMMABLE LIMITS: Non-combustible

SENSITIVITY TO IMPACT: No data available

SENSITIVITY TO STATIC DISCHARGE: No data available

### 6. ACCIDENTAL RELEASE MEASURES

**RELEASE NOTES:** Dilute with a large volume of water and hold in a pond or diked area until hydrogen peroxide decomposes. Hydrogen peroxide may be decomposed by adding sodium metabisulfite or sodium sulfite after diluting to about 5%. Dispose according to methods outlined for waste disposal.

Date: 02/02/2004

Combustible materials exposed to hydrogen peroxide should be immediately submerged in or rinsed with large amounts of water to ensure that all hydrogen peroxide is removed. Residual hydrogen peroxide that is allowed to dry (upon evaporation hydrogen peroxide can concentrate) on organic materials such as paper, fabrics, cotton, leather, wood or other combustibles can cause the material to ignite and result in a fire.

### 7. HANDLING AND STORAGE

HANDLING: Wear chemical splash-type monogoggles and full-face shield, impervious clothing, such as rubber, PVC, etc., and rubber or neoprene gloves and shoes. Avoid cotton, wool and leather. Avoid excessive heat and contamination. Contamination may cause decomposition and generation of oxygen gas which could result in high pressures and possible container rupture. Hydrogen peroxide should be stored only in vented containers and transferred only in a prescribed manner (see FMC Technical Bulletins). Never return unused hydrogen peroxide to original container, empty drums should be triple rinsed with water before discarding. Utensils used for handling hydrogen peroxide should only be made of glass, stainless steel, aluminum or plastic.

**STORAGE:** Store drums in cool areas out of direct sunlight and away from combustibles. For bulk storage refer to FMC Technical Bulletins.

**COMMENTS:** VENTILATION: Provide mechanical general and/or local exhaust ventilation to prevent release of vapor or mist into the work environment.

### 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

#### **EXPOSURE LIMITS**

Chemical Name	ACGIH	OSHA	Supplier
Hydrogen Peroxide	1 ppm (TWA)	1 ppm (PEL)	

**ENGINEERING CONTROLS:** Ventilation should be provided to minimize the release of hydrogen peroxide vapors and mists into the work environment. Spills should be minimized or confined immediately to prevent release into the work area. Remove contaminated clothing immediately and wash before reuse.

### PERSONAL PROTECTIVE EQUIPMENT

**EYES AND FACE:** Use chemical splash-type monogoggles and a full-face shield made of polycarbonate, acetate, polycarbonate/acetate, PETG or thermoplastic.

Date: 02/02/2004

**RESPIRATORY:** If concentrations in excess of 10 ppm are expected, use NIOSH/DHHS approved self-contained breathing apparatus (SCBA), or other approved atmospheric-supplied respirator (ASR) equipment (e.g., a full-face airline respirator (ALR)). DO NOT use any form of air-purifying respirator (APR) or filtering facepiece (AKA dust mask), especially those containing oxidizable sorbants such as activated carbon.

**PROTECTIVE CLOTHING:** For body protection wear impervious clothing such as an approved splash protective suit made of SBR Rubber, PVC (PVC Outershell w/Polyester Substrate), Gore-Tex (Polyester trilaminate w/Gore-Tex), or a specialized HAZMAT Splash or Protective Suite (Level A, B, or C). For foot protection, wear approved boots made of NBR, PVC, Polyurethane, or neoprene. Overboots made of Latex or PVC, as well as firefighter boots or specialized HAZMAT boots are also permitted. DO NOT wear any form of boot or overboots made of nylon or nylon blends. DO NOT use cotton, wool or leather, as these materials react RAPIDLY with higher concentrations of hydrogen peroxide. Completely submerge hydrogen peroxide contaminated clothing or other materials in water prior to drying. Residual hydrogen peroxide, if allowed to dry on materials such as paper, fabrics, cotton, leather, wood or other combustibles can cause the material to ignite and result in a fire.

**GLOVES:** For hand protection, wear approved gloves made of nitrile, PVC, or neoprene. DO NOT use cotton, wool or leather for these materials react RAPIDLY with higher concentrations of hydrogen peroxide. Thoroughly rinse the outside of gloves with water prior to removal. Inspect regularly for leaks.

### 9. PHYSICAL AND CHEMICAL PROPERTIES

ODOR: Odorless

APPEARANCE: Clear, colorless liquid

**AUTOIGNITION TEMPERATURE:** Non-combustible

110°C (229°F) (40%); 114°C (237°F) (50%) **BOILING POINT:** 

COEFFICIENT OF OIL / WATER: Not available Not available

**EVAPORATION RATE:** Above 1 (Butyl Acetate = 1)

**FLASH POINT:** Non-combustible

-41.4°C (-42.5°F) (40%); -52°C (-62°F) (50%) FREEZING POINT:

**ODOR THRESHOLD:** Not available

**OXIDIZING PROPERTIES:** Strong oxidizer

100% PERCENT VOLATILE:

**DENSITY / WEIGHT PER VOLUME:** 

pH: (as is) 1.0 to 3.0

**SOLUBILITY IN WATER:** (in H<sub>2</sub>O % by wt) 100% Hydrogen Peroxide (40 to 60%) (7722-84-1-4)

**SPECIFIC GRAVITY:** 

 $(H_20 = 1) 1.15 @ 20^{\circ}C/4^{\circ}C (40\%); 1.19 @ 20^{\circ}C/4^{\circ}C$ 

Date: 02/02/2004

(50%)

**VAPOR DENSITY:** 

Not available (Air = 1)

**VAPOR PRESSURE:** 

22 mmHg @ 30°C (40%); 18.3 mmHg @ 30°C (50%)

**COMMENTS:** 

pH (1% solution): 5.0 - 6.0

### 10. STABILITY AND REACTIVITY

**CONDITIONS TO AVOID:** 

Excessive heat or contamination could cause

product to become unstable.

STABILITY:

Stable (heat and contamination could cause

decomposition)

**POLYMERIZATION:** 

Will not occur

**INCOMPATIBLE MATERIALS:** 

Reducing agents, wood, paper and other

combustibles, iron and other heavy metals, copper

alloys and caustic.

HAZARDOUS DECOMPOSITION PRODUCTS: Oxygen which supports combustion.

**COMMENTS:** Materials to Avoid: Dirt, organics, cyanides and combustibles such as wood, paper, oils, etc.

### 11. TOXICOLOGICAL INFORMATION

**EYE EFFECTS:** 70% hydrogen peroxide: Severe irritant (corrosive) (rabbit) [FMC Study Number: ICG/T-79.027]

SKIN EFFECTS: 50% hydrogen peroxide: Severe irritant (corrosive) (rabbit) [FMC Study Number: I89-1079]

**DERMAL LD<sub>50</sub>:** 70% hydrogen peroxide: > 6.5 g/kg (rabbit) [FMC Study Number: ICG/T-79.027]

ORAL LD<sub>50</sub>: 50% hydrogen peroxide: > 225 mg/kg (rat) [FMC Study Number: 186-914]

INHALATION LC<sub>50</sub>: 50% hydrogen peroxide: > 0.17 mg/l (rat) [FMC Study Number: I89-1080]

TARGET ORGANS: Eye, skin, nose, throat, lungs

ACUTE EFFECTS FROM OVEREXPOSURE: Severe irritant/corrosive to eyes, skin and gastrointestinal tract. May cause irreversible tissue damage to the eyes including blindness. Inhalation of mist or vapors may be severely irritating to nose, throat and lungs.

Date: 02/02/2004

CHRONIC EFFECTS FROM OVEREXPOSURE: The International Agency for Research on Cancer (IARC) has concluded that there is inadequate evidence for carcinogenicity of hydrogen peroxide in humans, but limited evidence in experimental animals (Group 3 - not classifiable as to its carcinogenicity to humans). The American Conference of Governmental Industrial Hygienists (ACGIH) has concluded that hydrogen peroxide is a Confirmed Animal Carcinogen with Unknown Relevance to Humans'(A3).

#### **CARCINOGENICITY:**

Chemical Name	IARC	NTP	OSHA	Other	
Hydrogen Peroxide	Listed	Not listed	Not listed	(ACGIH) Listed (A3,	
				Animal Carcinogen)	

### 12. ECOLOGICAL INFORMATION

**ECOTOXICOLOGICAL INFORMATION:** Channel catfish 96-hour LC<sub>50</sub> = 37.4 mg/L

Fathead minnow 96-hour  $LC_{50} = 16.4 \text{ mg/L}$ 

Daphnia magna 24-hour  $EC_{50} = 7.7 \text{ mg/L}$ 

Daphnia pulex 48-hour  $LC_{50} = 2.4 \text{ mg/L}$ 

Freshwater snail 96-hour LC<sub>50</sub> = 17.7 mg/L

For more information refer to ECETOC "Joint Assessment of Commodity Chemicals No. 22, Hydrogen Peroxide." ISSN-0773-6339, January 1993

CHEMICAL FATE INFORMATION: Hydrogen peroxide in the aquatic environment is subject to various reduction or oxidation processes and decomposes into water and oxygen. Hydrogen peroxide half-life in freshwater ranged from 8 hours to 20 days, in air from 10-20 hrs. and in soils from minutes to hours depending upon microbiological activity and metal contaminants.

### 13. DISPOSAL CONSIDERATIONS

**DISPOSAL METHOD:** An acceptable method of disposal is to dilute with a large amount of water and allow the hydrogen peroxide to decompose followed by discharge into a suitable treatment system in accordance with all regulatory agencies. The appropriate regulatory agencies should be contacted prior to disposal.

### 14. TRANSPORT INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION (DOT)

Hydrogen Peroxide (40 to 60%) (7722-84-1-4)

PROPER SHIPPING NAME: Hydrogen peroxide, aqueous solutions with

more than 40% but not more than 60%

Date: 02/02/2004

hydrogen peroxide.

PRIMARY HAZARD CLASS / DIVISION:

5.1 (Oxidizer)

UN/NA NUMBER:

UN 2014

**PACKING GROUP:** 

Π

LABEL(S):

Oxidizer, Corrosive

PLACARD(S):

5.1 (Oxidizer)

ADDITIONAL INFORMATION:

DOT Marking: Hydrogen Peroxide, aqueous solution with more than 40%, but not more than 60% Hydrogen Peroxide, UN

2014

Hazardous Substance/RQ: Not applicable

49 STCC Number: 4918775

DOT Spec: stainless steel/high purity aluminum cargo tanks and rail cars. UN Spec: HDPE drums. Contact FMC for

specific details.

### INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG)

PROPER SHIPPING NAME:

Hydrogen peroxide, aqueous solutions with not less than 20%, but not more than 60%

hydrogen peroxide.

## INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO) / INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)

PROPER SHIPPING NAME:

Hydrogen peroxide (40 - 60%) is forbidden on Passenger and Cargo Aircraft, as well as

Cargo Only Aircraft.

#### OTHER INFORMATION:

Protect from physical damage. Keep drums in upright position. Drums should not be stacked in transit. Do not store drum on wooden pallets.

### 15. REGULATORY INFORMATION

### **UNITED STATES**

SARA TITLE III (SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT)
SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355, APPENDIX A):

Hydrogen Peroxide > 52%, RQ: 1000 lbs. Planning Threshold: 10,000 lbs.

#### **SECTION 311 HAZARD CATEGORIES (40 CFR 370):**

Fire Hazard, Immediate (Acute) Health Hazard

### SECTION 312 THRESHOLD PLANNING QUANTITY (40 CFR 370):

The Threshold Planning Quantity (TPQ) for this product, if treated as a mixture, is 10,000 lbs; however, this product contains the following ingredients with a TPQ of less than 10,000 lbs.: None, (conc. <52%) (hydrogen peroxide, 1000 lbs. when conc is >52%)

Date: 02/02/2004

### **SECTION 313 REPORTABLE INGREDIENTS (40 CFR 372):**

Not listed

### CERCLA (COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT)

#### CERCLA DESIGNATION & REPORTABLE QUANTITIES (RQ) (40 CFR 302.4):

Unlisted (Hydrogen Peroxide); RQ = 100 lbs.; Ignitability, Corrosivity

#### TSCA (TOXIC SUBSTANCE CONTROL ACT)

#### TSCA INVENTORY STATUS (40 CFR 710):

Listed

### RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) RCRA IDENTIFICATION OF HAZARDOUS WASTE (40 CFR 261):

Waste Number: D001, D002

### **CANADA**

#### WHMIS (WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM):

Product Identification Number: 2014

Hazard Classification / Division: Class C (Oxidizer), Class D, Div. 2, Subdiv. B (Toxic), Class E

(Corrosive)

Ingredient Disclosure List: Listed

#### **EU EINECS NUMBERS:**

008-003-00-9 (hydrogen peroxide)

### INTERNATIONAL LISTINGS

Hydrogen peroxide:

China: Listed

Japan (ENCS): (1)-419

Korea: KE-20204

Philippines (PICCS): Listed

Date: 02/02/2004

### 16. OTHER INFORMATION

### HAZARD, RISK AND SAFETY PHRASE DESCRIPTIONS:

Hydrogen Peroxide:

EC Symbols:

 $\mathbf{C}$ 

(Corrosive)

EC Risk Phrases:

R34

(Causes burns)

EC Safety Phrases:

S1/2

(Keep locked up and out of reach of children.)

S3

S28

(Keep in a cool place.) (After contact with skin, wash immediately with plenty of water

and soap.)

S36/39

S45

(Wear suitable protective clothing. Wear eye / face protection.) (In case of accident or if you feel unwell, seek medical advice

immediately - show the label where possible.)

#### **HMIS**

Health	3
Flammability	0
Physical Hazard	1
Personal Protection (PPE)	Н

Protection = H (Safety goggles, gloves, apron, the use of a supplied air or SCBA respirator is required in lieu of a vapor cartridge respirator)

### HMIS = Hazardous Materials Identification System

### Degree of Hazard Code:

- 4 = Severe
- 3 = Serious
- 2 = Moderate
- 1 = Slight
- 0 = Minimal

#### **NFPA**

Health	3
Flammability	0
Reactivity	1
Special	OX

SPECIAL = OX (Oxidizer)

#### NFPA = National Fire Protection Association

Degree of Hazard Code:

- 4 = Extreme
- 3 = High
- 2 = Moderate

1 = Slight

0 = Insignificant

#### REVISION SUMMARY:

Changes in information are as follows:

New Format, as well as text changes and/or updates to one or more Sections of this MSDS.

Date: 02/02/2004

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NOTE: NFPA Reactivity is 3 - when greater than 52%

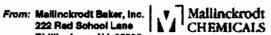
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### Material Safety Data Sheet

Phillipsburg, NJ 08865





24 Hour Emergency Telephone: 908-899-2161 CHEMTREC: 1-800-424-9300

National Response in Canada CANUTEC: 613-995-6686

Outside U.S. and Canada Chemtreo: 703-527-3887

NOTE: CHEMTREC, CANUTEC and Netional used only in the event of chemical emergencies involving a spill, leak, fire, exposure or socident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

### **FERROUS SULFATE**

### 1. Product Identification

Synonyms: Iron (II) sulfate (1:1)c; sulfuric acid, iron (2+) salt (1:1), heptahydrate

CAS No.: 7720-78-7 (Anhydrous) 7782-63-0 (heptahydrate)

Molecular Weight: 278

Chemical Formula: FeSO4 7H2O

**Product Codes:** 

J.T. Baker: 2063, 2070, 2074

Mallinckrodt: 5055, 5056, 5401, 5572

### 2. Composition/Information on Ingredients

Ingredient Hazardous	CAS No	Percent		
Ferrous Sulfate Yes	7720-78-7	99 - 100%		

### 3. Hazards Identification

### **Emergency Overview**

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE LIVER.

**SAF-T-DATA**(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Life) Flammability Rating: 0 - None Reactivity Rating: 1 - Slight Contact Rating: 2 - Moderate

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES

Storage Color Code: Green (General Storage)

#### **Potential Health Effects**

#### Inhalation:

Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath.

#### Ingestion:

Low toxicity in small quantities but larger dosages may cause nausea, vomiting, diarrhea, and black stool. Pink urine discoloration is a strong indicator of iron poisoning. Liver damage, coma, and death from iron poisoning has been recorded. Smaller doses are much more toxic to children.

#### **Skin Contact:**

Causes irritation to skin. Symptoms include redness, itching, and pain.

### **Eye Contact:**

Causes irritation, redness, and pain.

#### **Chronic Exposure:**

Severe or chronic ferrous sulfate poisonings may damage blood vessels. Large chronic doses cause rickets in infants. Chronic exposure may cause liver effects. Prolonged exposure of the eyes may cause discoloration.

### Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye problems, or impaired liver, kidney or respiratory function may be more susceptible to the effects of the substance.

### 4. First Aid Measures

### Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

#### **Ingestion:**

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.

#### Skin Contact:

Immediately flush skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

#### **Eve Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

### 5. Fire Fighting Measures

#### Fire:

Not considered to be a fire hazard.

### **Explosion:**

Not considered to be an explosion hazard.

### Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire.

#### **Special Information:**

Use protective clothing and breathing equipment appropriate for the surrounding fire.

### 6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

### 7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Maintain a constant temperature not to exceed 24 degrees centigrade (75 degrees fahrenheit). Fluctuating temperatures causes product oxidation. Do not use this product if coated with brownish-yellow basic ferric sulfate. Isolate from incompatible substances. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

### 8. Exposure Controls/Personal Protection

### **Airborne Exposure Limits:**

-ACGIH Threshold Limit Value (TLV):

1 mg/m3 (TWA) soluble iron salt as Fe

### **Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, Industrial Ventilation, A Manual of Recommended Practices, most recent edition, for details.

### Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, a half facepiece particulate respirator (NIOSH type N95 or better filters) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece particulate respirator (NIOSH type N100 filters) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

### **Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

#### **Eve Protection:**

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

### 9. Physical and Chemical Properties

#### Appearance:

Blue green crystals.

Odor:

Odorless.

**Solubility:** 

48.6 g/100 g water @ 50C (122F)

Density:

1.90

pH:

No information found.

% Volatiles by volume @ 21C (70F):
0
Boiling Point:
> 300C (> 572F) Decomposes.
Melting Point:
57C (135F) Loses water
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
No information found.
Evaporation Rate (BuAc=1):
No information found

### 10. Stability and Reactivity

### **Stability:**

Stable under ordinary conditions of use and storage. Looses water in dry air and oxidizes upon exposure to moisture, forming a brown coating of extremely corrosive basic ferric sulfate.

### **Hazardous Decomposition Products:**

Burning may produce sulfur oxides.

### **Hazardous Polymerization:**

This substance does not polymerize.

### Incompatibilities:

Alkalis, soluble carbonates, and oxidizing materials. Reacts in moist air to form ferric sulfate.

#### **Conditions to Avoid:**

Moisture.

### 11. Toxicological Information

Oral rat LD50: 319 mg/kg. Investigated as a tumo	J	J	
Ingredient Category	NTP Known	Carcinogen Anticipated	IARC
			<b></b> -
Ferrous Sulfate (7720-78-7) None	No	No	

### 12. Ecological Information

Environmental Fate: No information found. Environmental Toxicity: No information found.

### 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

### 14. Transport Information

Not regulated.

### 15. Regulatory Information

\Chemical Inventory Status - Part 1\	<b>-</b> -	<b>-</b>		
Ingredient Australia			Japan	
Ferrous Sulfate (7720-78-7) Yes	Yes	Yes	Yes	
\Chemical Inventory Status - Part 2\				
			anada	
Ingredient Phil.			NDSL	
				-
Ferrous Sulfate (7720-78-7) Yes	Yes	Yes	No	
\Federal, State & International Regulati	ons - 1	Part 1	L\ <del>-</del> -	
-SARA	302-		SAR	A
313				

Ingredient Chemical Catg.	RQ	TPQ	List	
Ferrous Sulfate (7720-78-7) No	No	No	No	
\Federal, State & International Rec	gulatio	ons - Pa	rt 2\	
		- <b>F</b>	RCRA-	-
TSCA- Ingredient	CERCL	A 26	51.33	8 (d)
Ferrous Sulfate (7720-78-7)	1000	<b>N</b> C	•	No
Chemical Weapons Convention: No TSCA 12 SARA 311/312: Acute: Yes Chronic: Yes Reactivity: No (Pure / Solid)				

Australian Hazchem Code: None allocated.

Poison Schedule: None allocated.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

### 16. Other Information

NFPA Ratings: Health: 1 Flammability: 0 Reactivity: 0

Label Hazard Warning:

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE LIVER.

### **Label Precautions:**

Avoid contact with eyes, skin and clothing.

Wash thoroughly after handling.

Avoid breathing dust.

Keep container closed.

Use only with adequate ventilation.

### Label First Aid:

If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

### **Product Use:**

Laboratory Reagent. Bulk pharmaceutical chemical.

**Revision Information:** 

MSDS Section(s) changed since last revision of document include: 3.

Disclaimer:

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**Prepared by:** Environmental Health & Safety Phone Number: (314) 654-1600 (U.S.A.)

### **Material Safety Data Sheet**



### **Sulfuric Acid**

### 1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Sulfuric Acid

OTHER/GENERIC NAMES: Battery acid

PRODUCT USE: Industrial

MANUFACTURER: **General Chemical Corporation** 

> 90 East Halsey Road Parsippany, NJ 07054

FOR MORE INFORMATION CALL: 973-515-1840

IN CASE OF EMERGENCY CALL:

800-631-8050

(Monday-Friday, 9:00am-4:30pm)

(24 Hours/Day, 7 Days/Week)

### 2. COMPOSITION/INFORMATION ON INGREDIENTS

**INGREDIENT NAME** 

Sulfuric acid Water

CAS NUMBER 7664-93-9

**WEIGHT %** 

7732-18-5

>51 Balance

Trace impurities and additional material names not listed above may appear in Section 15 of this MSDS. These materials may be listed for local "Right-To-Know" compliance and for other reasons.

OSHA Hazard Communication Standard:

This product is considered hazardous under the OSHA Hazard Communication Standard.

### 3. HAZARDS IDENTIFICATION

**EMERGENCY OVERVIEW:** Oily, colorless to slightly yellow, clear to turbid liquid. Odorless. Causes severe skin burns. Causes severe eye burns. Causes burns of the mouth, throat, and stomach.

#### POTENTIAL HEALTH HAZARDS

SKIN: Causes severe burns.

EYES: Liquid contact can cause irritation, corneal burns, and conjunctivitis. May result in severe or permanent

injury. May cause blindness.

INHALATION: Inhalation of fumes or acid mist can cause irritation or corrosive burns to the upper respiratory

system, including the nose, mouth and throat. May irritate the lungs. May cause pulmonary

edema.

INGESTION: Causes burns of the mouth, throat and stomach. May be fatal if swallowed. Hazards are also

applicable to dilute solutions.

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## Sulfuric Acid

DELAYED EFFECTS: Erosion of teeth, lesions of the skin, tracheo-bronchitis, mouth inflammation, conjuctivitis and gastritis. IARC and NTP have classified "strong inorganic acid mists containing sulfuric acid" as a known human carcinogen. This classification is for inorganic acid mists only and does not apply to sulfuric acid or sulfuric acid solutions. The basis for the classifications rests on several epidemiology studies which have several deficiencies. These studies did not account for exposure to other substances, some known to be animal or potential human carcinogens, social influences (smoking or alcohol consumption) and included small numbers of subjects. Based on the overall weight of evidence from all human and chronic animal studies, no definitive causal relationship between sulfuric acid mist exposure and respiratory tract cancer has been shown.

Ingredients found on one of the three OSHA designated carcinogen lists are listed below.

**INGREDIENT NAME** 

NTP STATUS

**IARC STATUS** 

**OSHA LIST** 

Sulfuric acid

Known carcinogen – sulfuric acid mist

1-Known carcinogen – sulfuric acid mist

Not listed

## FIRST AID MEASURES

SKIN: Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing while

washing. Get medical attention immediately.

EYES: Immediately flush eyes with large amounts of water for at least 15 minutes. Get immediate medical

attention.

INHALATION: If inhaled, remove to fresh air. If not breathing give artificial respiration, preferably mouth-to-mouth.

If breathing is difficult give oxygen. Get medical attention.

INGESTION: If swallowed, do NOT induce vomiting. Give victim two glasses of water. Call a physician

immediately. Never give anything by mouth to an unconscious person.

ADVICE TO PHYSICIAN: Treat symptomatically.

#### FIRE FIGHTING MEASURES

## **FLAMMABLE PROPERTIES**

FLASH POINT: Not applicable. Not applicable. FLASH POINT METHOD: **AUTOIGNITION TEMPERATURE:** Not applicable. **UPPER FLAME LIMIT (volume % in air):** Not applicable. Not applicable. LOWER FLAME LIMIT (volume % in air): FLAME PROPAGATION RATE (solids): Not applicable. **OSHA FLAMMABILITY CLASS:** Not flammable.

#### **EXTINGUISHING MEDIA:**

Water spray or fog may be used to knock down corrosive vapor cloud. Water may be applied to the sides of the containers exposed to flames provided the water does not come in contact with the tank contents.

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## Sulfuric Acid

#### **UNUSUAL FIRE AND EXPLOSION HAZARDS:**

Flammable and potentially explosive hydrogen gas can be generated inside metal drums and storage tanks. Concentrated sulfuric acid can ignite combustible materials on contact.

#### SPECIAL FIRE FIGHTING PRECAUTIONS/INSTRUCTIONS:

Do not use solid water streams near ruptured tanks or spills of sulfuric acid. Acid reacts violently with water and can spatter acid onto personnel. Wear approved positive-pressure self-contained breathing apparatus and protective clothing.

## 6. ACCIDENTAL RELEASE MEASURES

IN CASE OF SPILL OR OTHER RELEASE: (See section 8 for recommended personal protective equipment.)

Dilute small spills or leaks cautiously with plenty of water. Neutralize residue with sodium bicarbonate or other suitable neutralizing agent. When using carbonates for neutralization, adequate precautions should be taken to minimize hazards from carbon dioxide gas generation. No smoking in spill area. Major spills must be handled by a predetermined plan. Attempt to keep out of sewers.

Spills and releases may have to be reported to Federal and/or local authorities. See Section 15 regarding reporting requirements.

## 7. HANDLING AND STORAGE

NORMAL HANDLING: (See section 8 for recommended personal protective equipment.)

Avoid contact with skin, eyes and clothing. Avoid breathing mist. Use appropriate personnel protective equipment.

Do not add water to acid. When diluting, always add acid to water cautiously and with agitation. Use with adequate ventilation.

#### STORAGE RECOMMENDATIONS:

Protect from physical damage. Store in a cool, well-ventilated area away from combustibles and reactive chemicals. Keep out of sun and away from heat. Keep containers upright. No smoking in storage area.

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

#### **ENGINEERING CONTROLS:**

Sufficient to reduce vapor and acid mists to permissible levels. Packaging and unloading areas and open processing equipment may require mechanical exhaust systems. Corrosion-proof construction recommended. Closed ventilation systems (e.g. vapor hoods) are frequently used in the electronics industry.

#### PERSONAL PROTECTIVE EQUIPMENT

SKIN PROTECTION: As a minimum, wear acid-resistant, preferably rubber, gloves and apron. Acid

resistant boots, trousers and jacket may be used for increased protection.

EYE PROTECTION: Wear chemical safety goggles. Add a full faceshield for pouring liquids. Do not wear

contact lenses.

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## Sulfuric Acid

RESPIRATORY

Generally, none required. If misting conditions prevail, wear a NIOSH-approved

PROTECTION:

acid-mist respirator.

**ADDITIONAL** 

Provide eyewash stations and quick-drench shower facilities in or near areas of use

**RECOMMENDATIONS:** or handling.

#### **EXPOSURE GUIDELINES**

**INGREDIENT NAME** 

**ACGIH TLV** 

**OSHA PEL** 

**OTHER LIMIT** 

Sulfuric acid

 $1 \text{ mg/m}^3 - \text{TWA}$ 

 $1 \text{ mg/m}^3 - \text{TWA}$ 

COMPARED TO: Not applicable

15 mg/m<sup>3</sup> - IDLH

3 mg/m<sup>3</sup> – STEL

#### OTHER EXPOSURE LIMITS FOR POTENTIAL DECOMPOSITION PRODUCTS:

None.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:

Colorless to light yellow liquid

PHYSICAL STATE:

Liquid

MOLECULAR WEIGHT:

98.08 (H<sub>2</sub>SO<sub>4</sub>)

CHEMICAL FORMULA:

H<sub>2</sub>SO<sub>4</sub> (various concentrations) in water

ODOR:

Odorless

SPECIFIC GRAVITY (water = 1.0): SOLUBILITY IN WATER (weight %): 1.842 100%

pH:

0.9 (1% solution)

**BOILING POINT:** 

~310C (94%)

**MELTING POINT:** 

~ -27C (94%)

**VAPOR PRESSURE:** 

<0.001 mm Hg @ 20C

**VAPOR DENSITY (air = 1.0):** 

Not applicable

**EVAPORATION RATE:** 

Not applicable

% VOLATILES:

Not applicable

FLASH POINT: Not applicable

(Flash point method and additional flammability data are found in Section 5.)

## 10. STABILITY AND REACTIVITY

#### NORMALLY STABLE? (CONDITIONS TO AVOID):

Normally stable. Avoid temperatures greater than 300C: yields sulfur trioxide gas, which is toxic, corrosive, and an oxidizer.

#### INCOMPATIBILITIES:

Nitro compounds, carbides, dienes, alcohols (when heated); causes explosions.

Oxidizing agents, such as chlorates and permanganates: causes fires and possible explosions.

Allyl compounds and aldehydes: undergoes polymerization, possibly violent.

Alkalies, amines, water, hydrated salts, carboxylic acid anhydrides, nitriles, olefinic organics, glycols, aqueous acids: causes strong exothermic reactions.

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<sup>&</sup>lt;sup>1</sup> = Limit established by General Chemical Corporation.

<sup>&</sup>lt;sup>2</sup> = Workplace Environmental Exposure Level (AIHA).

<sup>&</sup>lt;sup>3</sup> = Biological Exposure Index (ACGIH).



## Sulfuric Acid

Carbonates, cyanides, sulfides, sulfites, metals such as copper: yields toxic gases.

#### **HAZARDOUS DECOMPOSITION PRODUCTS:**

Sulfur trioxide gas.

## HAZARDOUS POLYMERIZATION:

Will not occur.

## 11. TOXICOLOGICAL INFORMATION

#### **IMMEDIATE (ACUTE) EFFECTS:**

 $LD_{50}$  (oral-rat): 2140 mg/kg  $LC_{50}$  (inhl-rat): 510 mg/m $^3$ /2 hr  $LC_{50}$  (inhl-mouse): 320 mg/m $^3$ /2 hr

## **DELAYED (SUBCHRONIC AND CHRONIC) EFFECTS:**

IARC and NTP have classified "strong inorganic acid mists containing sulfuric acid" as known human carcinogens. The state of California has also listed "strong inorganic acid mists containing sulfuric acid" on the Proposition 65 list as a cancer causing agent. No definitive causal relationship between sulfuric acid mist exposure and respiratory cancer has been shown.

#### OTHER DATA:

None.

## 12. ECOLOGICAL INFORMATION

24.5 ppm/24 hr./bluegill/lethal/fresh water 42.5 ppm/48 hr./prawn/LC<sub>50</sub>/salt water

## 13. DISPOSAL CONSIDERATIONS

## **RCRA**

Is the unused product a RCRA hazardous waste if discarded? Yes

If yes, the RCRA ID number is: D002

#### OTHER DISPOSAL CONSIDERATIONS:

The information offered in section 13 is for the product as shipped. Use and/or alterations to the product such as mixing with other materials may significantly change the characteristics of the material and alter the RCRA classification and the proper disposal method.

## 14. TRANSPORT INFORMATION

**US DOT HAZARD CLASS:** 

8. PG II

US DOT ID NUMBER: PROPER SHIPPING NAME:

UN1830 Sulfuric acid

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## Sulfuric Acid

For additional information on shipping regulations affecting this material, contact the information number found in Section 1.

#### 15. REGULATORY INFORMATION

## **TOXIC SUBSTANCES CONTROL ACT (TSCA)**

TSCA INVENTORY STATUS: Listed on the TSCA Inventory.

OTHER TSCA ISSUES: None.

#### **SARA TITLE III/CERCLA**

"Reportable Quantities" (RQs) and/or "Threshold Planning Quantities" (TPQs) exist for the following ingredients.

INGREDIENT NAME

SARA/CERCLA RQ (Ib)

SARA EHS TPQ (lb)

Sulfuric acid

1000

1000

Spills or releases resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center [(800) 424-8802] and to your Local Emergency Planning Committee.

SECTION 311 HAZARD CLASS: Immediate.

#### **SARA 313 TOXIC CHEMICALS:**

The following ingredients are SARA 313 "Toxic Chemicals" and may be subject to annual reporting requirements. CAS numbers and weight percents are found in Section 2.

**INGREDIENT NAME** 

COMMENT

Sulfuric acid

None

## **STATE RIGHT-TO-KNOW**

In addition to the ingredients found in Section 2, the following are listed for state right-to-know purposes.

**INGREDIENT NAME** 

WEIGHT % COMMENT

No ingredients listed in this section.

## ADDITIONAL REGULATORY INFORMATION:

"Strong inorganic acid mists containing sulfuric acid" has been listed on California Proposition 65 as a cancercausing agent.

#### WHMIS CLASSIFICATION (CANADA):

Listed on Canadian DSL and EU EINECS.

#### FOREIGN CHEMICAL CONTROL INVENTORY STATUS:

Listed on the Canadian DSL and EU EINECS.

## **16.OTHER INFORMATION**

CURRENT ISSUE DATE: May, 2003

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Sulfuric Acid

PREVIOUS ISSUE DATE: November, 2001

CHANGES TO MSDS FROM PREVIOUS ISSUE DATE ARE DUE TO THE FOLLOWING:

Addition of Prop 65 listing.

OTHER INFORMATION: None

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## Material Data Safety Sheet (MSDS): Acetone

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	13. Disposal Considerations	
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Note: This information sheet has been re-formatted for better clarity by the Department of Earth Sciences. Some of the data such as information on shipping and weapons treaties were intentionally left out. If you want to look at the complete MSDS, you can either check one of the hardcopy versions in the Department, contact the manufacturer, or check one of the various Web-based databases such as those compiled by BU's Office of Environmental Health & Safety (www.bu.edu/ehs/msds/index.htm).

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#### 1. Product Identification

#### **ACETONE**

MSDS Number: A0446 --- Effective Date: 04/09/98

Synonyms: Dimethylketone; 2-propanone; dimethylketal

CAS No.: 67-64-1

Molecular Weight: 58.08 Chemical Formula: (CH3)2CO

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## 2. Composition/Information on Ingredients

Ingredient	CAS#	Percent	Hazardous?
cetone	67-64-1	99-100%	Yes

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#### 3. Hazards Identification

## **Emergency Overview**

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.

## J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

\_\_\_\_\_\_

Health Rating: 1 - Slight

Flammability Rating: 4 - Extreme (Flammable)

Reactivity Rating: 2 - Moderate Contact Rating: 1 - Slight

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B

**EXTINGUISHER** 

Storage Color Code: Red (Flammable)

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#### "ytential Health Effects

## Inhalation:

Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache. Higher concentrations can produce central nervous system depression, narcosis, and unconsciousness.

## Ingestion:

Swallowing small amounts is not likely to produce harmful effects. Ingestion of larger amounts may produce abdominal pain, nausea and vomiting. Aspiration into lungs can produce severe lung damage and is a medical emergency. Other symptoms are expected to parallel inhalation.

#### Skin Contact:

Irritating due to defatting action on skin. Causes redness, pain, drying and cracking of the skin.

#### Eve Contact:

Vapors are irritating to the eyes. Splashes may cause severe irritation, with stinging, tearing, redness and pain.

#### Chronic Exposure:

Prolonged or repeated skin contact may produce severe irritation or dermatitis.

## Aggravation of Pre-existing Conditions:

Use of alcoholic beverages enhances toxic effects. Exposure may increase the toxic potential of chlorinated drocarbons, such as chloroform, trichloroethane.

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## 4. First Aid Measures

#### Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

## **Ingestion:**

Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately.

## Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

## **Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention.

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## Fire Fighting Measures

Fire:

Flash point: -20C (-4F) CC

Autoignition temperature: 465C (869F)

Flammable limits in air % by volume: lel: 2.5; uel: 12.8

Extremely Flammable Liquid and Vapor! Vapor may cause flash fire.

## **Explosion:**

Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Vapors can flow along surfaces to distant ignition source and flash back. Contact with strong oxidizers may cause fire. Sealed containers may rupture when heated. This material may produce a floating fire hazard. Sensitive to static discharge.

## Fire Extinguishing Media:

Dry chemical, alcohol foam or carbon dioxide. Water may be ineffective. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse vapors.

## **Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

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## Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB(tm) solvent adsorbent is recommended for spills of this product.

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## 7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Intainers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas would be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

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## 8. Exposure Controls/Personal Protection

**Airborne Exposure Limits:** 

- -OSHA Permissible Exposure Limit (PEL): 1000 ppm (TWA)
- -ACGIH Threshold Limit Value (TLV): 500 ppm (TWA), 750 ppm (STEL) A4 not classifiable as a human carcinogen

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, Industrial Ventilation, A Manual of Recommended Practices, most recent edition, for details.

Personal Respirators (NIOSH Approved):

the exposure limit is exceeded, a half-face organic vapor respirator may be worn for up to ten times the posure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency

or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING: Air-purifying appirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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## 9. Physical and Chemical Properties (Acetone)

Appearance:	Clear, colorless, volatile liquid.	
Odor:	Fragrant, mint-like	
Solubility:	Miscible in all proportions in water.	
Density:	0.79 @ 20C/4C	
pH:	No information found.	
Volatiles by volume @ 21C 70F):	100%	
Boiling Point:	56.5C (133F) @ 760 mm Hg	
Melting Point:	-95C (-139F)	
Vapor Density (Air=1):	2.0	
Vapor Pressure (mm Hg):	400 @ 39.5C (104F)	
Evaporation Rate (n-Butyl Acetate=1):	7.7	

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## 10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

**Hazardous Decomposition Products:** 

Carbon dioxide and carbon monoxide may form when heated to decomposition.

**Hazardous Polymerization:** 

Will not occur.

\_ompatibilities:

Concentrated nitric and sulfuric acid mixtures, oxidizing materials, chloroform, alkalis, chlorine compounds, acids, potassium t-butoxide.

## Conditions to Avoid:

<sup>1</sup>eat, flames, ignition sources and incompatibles.

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## 11. Toxicological Information

Oral rat LD50: 5800 mg/kg; Inhalation rat LC50: 50,100mg/m3; Irritation eye rabbit, Standard Draize, 20 mg severe; investigated as a tumorigen, mutagen, reproductive effector.

	NTP Carcinogen		
Ingredient	Known	Anticipated	IARC Category
Acetone (67-64-1)	No	No	None

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## . Ecological Information

#### **Environmental Fate:**

When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material is expected to readily biodegrade. When released to water, this material is expected to quickly evaporate. This material has a log octanol-water partition coefficient of less than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material may be moderately degraded by photolysis. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition.

**Environmental Toxicity:** 

This material is not expected to be toxic to aquatic life. The LC50/96-hour values for fish are over 100 mg/l.

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## 13. Disposal Considerations

natever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal

regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

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#### 16. Other Information

NFPA Ratings: Health: 1 Flammability: 3 Reactivity: 0

Label Hazard Warning:

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.

Label Precautions:

Keep away from heat, sparks and flame.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Avoid breathing vapor.

Avoid contact with eyes, skin and clothing.

Label First Aid:

Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting curs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an conscious person. Call a physician immediately. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

**Revision Information:** 

MSDS Section(s) changed since last revision of document include: 8.

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<b>l</b> )1	SCI	laim	ier:

\*

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\*

Prepared by: Strategic Services Division Phone Number: (314) 539-1600 (U.S.A.)

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# MALLINCKRODT SCIENCE PRODUCTS DIV -- BENZENE AR - BENZENE, TECHNICAL \*\*ATERIAL SAFETY DATA SHEET

→C: 6810 NIIN: 009738588

Manufacturer's CAGE: 62910

Part No. Indicator: A

Part Number/Trade Name: BENZENE AR

## General Information

Item Name: BENZENE, TECHNICAL

Company's Name: MALLINCKRODT INC., SCIENCE PRODUCTS DIVISION

Company's Street: PARIS BYPASS

Company's P. O. Box: M Company's City: PARIS Company's State: KY Company's Country: US Company's Zip Code: 40361

Company's Emerg Ph #: 314-982-5000
Company's Info Ph #: 314-982-5000
Record No. For Safety Entry: 002
Tot Safety Entries This Stk#: 002
Date MSDS Prepared: 01JAN87
Safety Data Review Date: 03JUN86
TSDS Serial Number: BGBDL
Taracteristic Code: F2

Unit Of Issue: BT

Unit Of Issue Container Qty: 500ML Type Of Container: BOTTLE,GLASS

## Ingredients/Identity Information

\_\_\_\_\_\_\_

Proprietary: NO

Ingredient: BENZENE (SARA III)
Ingredient Sequence Number: 01

Percent: >99

NIOSH (RTECS) Number: CY1400000

CAS Number: 71-43-2

OSHA PEL: 1PPM/5STEL;1910.1028

ACGIH TLV: 10 PPM; A2; 9192

\_\_\_\_\_\_\_

## Physical/Chemical Characteristics

Appearance And Odor: CLEAR COLORLESS LIQ; SWEET AROMATIC ODOR.

Boiling Point: 80C(176F)

Vapor Pressure (MM Hg/70 F): 100

Vapor Density (Air=1): 2.7

'ecific Gravity: 0.88

Evaporation Rate And Ref: 0.88 Solubility In Water: NEGLIGIBLE

Percent Volatiles By Volume: 100

## Fire and Explosion Hazard Data

Flash Point: -11C(12F)-C.C Lower Explosive Limit: 1.0 Upper Explosive Limit: 8.0

Extinguishing Media: DRY POWDER, FOAM, CARBON DIOXIDE

Special Fire Fighting Proc: WEAR SELF-CNTD BRTHG, APP H\*20 SPRAY TO COOL

CONTR.

Unusual Fire And Expl Hazrds: EXPLOSIVE VAPOR/AIR MIXTURES MAY FORM ABOVE

FLASH POINT.CONTAINER MAY EXPLODE IN HEAT OR FLAME.

## Reactivity Data

\_\_\_\_\_\_\_

Stability: YES

Cond To Avoid (Stability): IGNITION SOURCES.

Materials To Avoid: OXIDIZERS, CORROSIVE MATL (CLF\*3, H\*2SO\*4, K, CHROMIC

ANHYDRIDE)

Hazardous Decomp Products: TOXIC GASES & VAPOR SUCH AS CARBON MONOXIDE.

Hazardous Poly Occur: NO

#### **Health Hazard Data**

\_\_\_\_\_\_

#### Precautions for Safe Handling and Use

Steps If Matl Released/Spill: VENTILATE & EVAC AREA.USE PROTCTV CLOTHG & RESP PROTCTION FM VAP.CONTAIN & RECOVR LIQ WHEN POSS.SPILLS MAY BE ABSORBD W/SAND, VERMICULITE OR OHTER INERT, MATL & CONTAINERIZE FOR DISPOSAL.USE H\*20 SPRAY TO DISPRS VAPS, TO FLUSH AWAY/DILUTE SPILLS.RMV IGN Waste Disposal Method: WASHT CAN BE ATOMIZED IN A CHEMICAL INCINERATOR SUITABLE FOR BURNING HAZARDOUS WASTE & EQUIPPED W/AN AFTERBURNER & SCRUBBER SYSTEM.ENSURE COMPLIANCE W/LOCAL, STATE & FED REGS. CWA/CERCAL RQ: 1000LBS. Precautions-Handling/Storing: KEEP IN TIGHTLY CLOSED CONTNRS AT COOK, DRY, VENTILATED PLACE.PROTECT AGAINST PHY DAMAGE.OUTSIDE OR DETACHED STORAGE IS PREFERRED.KEEP AWAY FM OXIDIZERS

Other Precautions: AVOID BREATHING DUST.USE W/ADEQUATE VENTILATION.KEEP
CONTAINRS CLOSED.WASH THOROUGHLY AFTER HANDLING.AVOID,SKIN,EYES & CLOTHING

CONTACT;CANCER HAZARD; OVER EXPOSURE MAY CREATE CANCER RISK.

## **Control Measures**

Respiratory Protection: SUPPLIED AIR RESPIR/SCBA; ESCAPE: GAS MASK Ventilation: LOCAL EXHAUST TO MAINTN BELOW TLV.

**Protective Gloves: IMPERVIOUS** 

Eve Protection: GOGGLES/FACE SHIELD

her Protective Equipment: FULL PROTECTIVE CLOTHING, SAFETY SHOWER, EYE

WASH STATION

Suppl. Safety & Health Data: MSDS FM MFR DATED JAN 85 CONFORMS TO OSHA HAZ

COMM STD; BENZENE IS CARCINOGEN DEFINED BY IARC, MAK, NIOSH, NTP &

ACGIH-SEE ACGIH 1985, VOL 13, TABLE A3

\_\_\_\_\_\_\_

## **Transportation Data**

Trans Data Review Date: 86248

DOT PSN Code: BRS

DOT Proper Shipping Name: BENZENE

**DOT Class: 3** 

DOT ID Number: UN1114

DOT Pack Group: II

DOT Label: FLAMMABLE LIQUID

IMO PSN Code: BXB

IMO Proper Shipping Name: BENZENE IMO Regulations Page Number: 3185

IMO UN Number: 1114 IMO UN Class: 3.2

IMO Subsidiary Risk Label: -

IATA PSN Code: DBA TA UN ID Number: 1114

TA Proper Shipping Name: BENZENE

IATA UN Class: 3

IATA Label: FLAMMABLE LIQUID

AFI PSN Code: DBA

AFI Symbols: 0

AFI Prop. Shipping Name: BENZENE

AFI Class: 3

AFI ID Number: UN1114

AFI Pack Group: II

AFI Label: FLAMMABLE LIQUID

AFI Basic Pac Ref: 7-7

Additional Trans Data: DOT RQ: 1000LBS.

\_\_\_\_\_\_

#### Disposal Data

Disposal Data Review Date: 88321 Rec # For This Disp Entry: 02 Tot Disp Entries Per NSN: 002

Landfill Ban Item: YES

Disposal Supplemental Data: MSDS FM MFR DATED JAN 85 CONFORMS TO OSHA HAZ COMM STD; BENZENE IS CARCINOGEN DEFINED BY IARC, MAK, NIOSH, NTP & ACGIH-SEE ACGIH 1985, VOL 13, TABLE A3 IN CASE OF ACCIDENTAL EXPOSURE OR DISCHARGE,

ONSULT HEALTH AND SAFETY FILE FOR PRECAUTIONS.

1st EPA Haz Wst Code New: U019

1st EPA Haz Wst Name New: BENZENE

1st EPA Haz Wst Char New: TOXIC (T)

¹st EPA Acute Hazard New: NO
d EPA Haz Wst Code New: D001

2nd EPA Haz Wst Name New: IGNITIBLE 2nd EPA Haz Wst Char New: IGNITABILITY

2nd EPA Acute Hazard New: NO

\_\_\_\_\_\_\_

## Label Data

Label Required: YES Label Status: F

Special Hazard Precautions: MAY BE POISONOUS IF INHALED OR ABSORBED

THROUGH SKIN. VAPORS MAY CAUSE DIZZINESS OR SUFFOCATION. CONTACT MAY IRRITATE OR BURN SKIN AND EYES. FIRE MAY PRODUCE IRRITATING OR POISONOUS GASES. RUNOFF FROM FIRE CONTROL OR DILUTION WATER MAY CAUSE POLLUTION.

Label Name: MALLINCKRODT INC. SCIENCE PRODUCTS DIVISION

Label Street: PARIS BYPASS

Label P.O. Box: M Label City: PARIS Label State: KY

Label Zip Code: 40361 Label Country: US

Label Emergency Number: 314-982-5000

TL for this msds http://hazard.com. If you wish to change, add to, or lete information in this archive please sent updates to dan@hazard.com.



Product Information (203) 740-3471 / Emergency Assistance CHEMTREC 1-800-424-9300 or 202-483-7616

## **MATERIAL SAFETY DATA SHEETS**

Part Number/Trade Name: BENZENE This MSDS is valid for all grades and catalog numbers General Information Company's Name: PHARMCO PRODUCTS, Date MSDS Revised: Nishant-8/23/99 Safety Data Review Date: 8/23/99 Company's Street: 58 VALE RD. Preparer's Company: PHARMCO PRODUCTS, Company's City: BROOKFIELD INC. Company's State: CT Preparer's St Or P. O. Box: 58 VALE RD. Company's Zip Code: 06804 Preparer's City: BROOKFIELD Company's Emerg Ph #: (203) 740-3471 Preparer's State: CT Company's Info Ph #: (203) 740-3471 Preparer's Zip Code: 06804 Ingredients/Identity Information CAS Number: 71-43-2 Ingredient: BENZENE (SARA III) OSHA PEL: 1PPM/5STEL;1910.1028 Ingredient Sequence Number: 01 Percent: 100 ACGIH TLV: 10 PPM; A2; 9192 NIOSH (RTECS) Number: CY1400000 \_\_\_\_\_\_ Physical/Chemical Characteristics \_\_\_\_\_ Appearance And Odor: COLORLESS LIQUID. Specific Gravity: 0.88 AROMATIC HYDROCARBON ODOR Evaporation Rate And Ref: 5.1 (BUTYL **ACETATE** Boiling Point: 175F/79.4C Vapor Pressure (MM Hg/70 F): 167 Solubility In Water: NEGLIGIBLE Vapor Density (Air=1): 2.8 Percent Volatiles By Volume: 100 Fire and Explosion Hazard Data 

Flash Point: 10F,-12C TCC

MSDS 079, Rev 2.0 12/18/01 JC Benzene/Page 1 of 3 Lower Explosive Limit: 1.4 Upper Explosive Limit: 7.1

Extinguishing Media: CO\*2, FOAM, DRY CHEM & H\*20 FOG.

Special Fire Fighting Proc: USE H\*20 TO COOL EXPD CONTRS. USE SCBA & FULL

PROT.CLTHG.

Unusual Fire And Expl Hazrds: DO NOT USE DIRECT STREAM OF WATER. PRODUCT

WILL FLOAT & CAN BE REIGNITED ON SURFACE OF WATER

Reactivity Data

Stability: YES

Cond To Avoid (Stability): AVOID HEAT, SPARKS, OPEN FLAME & VAPOR

ACCUMULATION.

Materials To Avoid: STRONG OXIDIZING AGENTS.

Hazardous Decomp Products: CARBON MONOXIDE & UNIDENTIFIED ORGANIC COMPDS

MAY BE FORMED. Hazardous Poly Occur: NO

Health Hazard Data

Signs/Symptoms Of Overexp: FATIQUE, NAUSEA AND HEADACHE WHICH MAY BE FOLLOWED BY CONVULSIONS, LOSS OF CONSCIOUSNESS AND DEATH.\*
Emergency/First Aid Proc: INHALE: RMV TO FRESH AIR. IF NOT BRTHG GIVE CPR.
IMMED FLUSH EYES OR SKIN W/ PLENTY OF WATER. RMV CONTAM CLTHG & SHOES.

CALL

A PHYSICIAN

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: ELIM IGN SOURCES. ISOL HAZ AREA & CLEAR UNAUTHD PERS. WEAR RSPTR & PROT CLTHG. SHUT OFF SCE OF LEAK IF SAFE. DIKE & CONTAIN. WATER FOG TO SUPPR VAPOR. RMV W/ VAC TRUCK OR PUMP TO STOR

SOAK UP RESIDUE W/ABSORB. FLUSH AREA W/ WATER.

Waste Disposal Method: USE DISPOSAL FACIL APVD UNDER RCRA REGULATIONS FOR HAZ WASTE. USE NON-LEAKING CNTNR. SEAL TIGHT & LABEL PROPERLY. KEEP OUT OF SURFACE WATERS OR SEWERS ENTERING OR LEADING TO SURFACE WATERS. Precautions-Handling/Storing: STORE IN COOL, DRY, WELL VENT, LOW FIRE RISK AREA. PROTECT FROM PHYSICAL DAMAGE. AVOID ANY PHYSICAL CONTACT. KEEP CONTAINERS TIGHTLY CLOSED.

EMPTIED CONTAINERS CAN CONTAIN EXPLOSIVE VAPORS.

Control Measures

Respiratory Protection: IF EXCED TLV, NIOSH/MSHA APPR SELF-CNTND BRTHG APP

(POS PR MODE)

Ventilation: USE EXPLOSION-PROOF VENTILATION AS REO RO CNTRL VAPORS.

Protective Gloves: IMPERVIOUS

Eye Protection: CHEM SPLASH GOGGLES

Other Protective Equipment: WEAR IMPERVIOUS CLOTHING/BOOTS.

MSDS 079, Rev 2.0 12/18/01 JC Benzene/Page 2 of 3 Suppl. Safety & Health Data: MSDS DATED 20 APRIL 1982 \* PROLONGED & REPEATED EXPOSURE MAY CAUSE SERIOUS INJURY TO BLOOD FORMING ORGANS.

IS SUSPECTED OF CARCINOGENIC (LEUKEMIA) POTENTIAL IN MAN.

#### Transportation Data

DOT PSN Code: BRS

DOT Proper Shipping Name: BENZENE

DOT Class: 3

DOT ID Number: UN1114 DOT Pack Group: II

DOT Label: FLAMMABLE LIQUID

IMO PSN Code: BXB

IMO Proper Shipping Name: BENZENE IMO Regulations Page Number: 3185

IMO UN Number: 1114 IMO UN Class: 3.2

IMO Subsidiary Risk Label: -

IATA PSN Code: DBA

IATA UN ID Number: 1114

IATA Proper Shipping Name: BENZENE

IATA UN Class: 3

IATA Label: FLAMMABLE LIQUID

AFI Prop. Shipping Name: UNDER REVIEW Additional Trans Data: RO BENZENE IS 1000 LBS, ALSO SEE CLEAN WATER ACT. KEEP OUT OF SURFACE WATERS OR

**SEWERS** 

ENTERING OR LEADING TO SURFACE

WATERS.

\_\_\_\_\_\_

#### Disposal Data

Landfill Ban Item: YES

Disposal Supplemental Data: \* PROLONGED & REPEATED EXPOSURE MAY CAUSE SERIOUS

INJURY TO BLOOD FORMING ORGANS. BENZENE

IS SUSPECTED OF CARCINOGENIC (LEUKEMIA) POTENTIAL IN MAN. IN CASE OF ACCIDENTAL EXPOSURE OR DISCHARGE, CONSULT HEALTH AND SAFETY FILE FOR

PRECAUTIONS.

1st EPA Haz Wst Code New: U019 1st EPA Haz Wst Name New: BENZENE 1st EPA Haz Wst Char New: TOXIC (T) 1st EPA Acute Hazard New: NO 2nd EPA Haz Wst Code New: D001

2nd EPA Haz Wst Name New: IGNITIBLE 2nd EPA Haz Wst Char New: IGNITABILITY

2nd EPA Acute Hazard New: NO

#### Label Data

Special Hazard Precautions: MAY BE POISONOUS IF INHALED OR ABSORBED THROUGH SKIN. VAPORS MAY CAUSE DIZZINESS OR SUFFOCATION. CONTACT MAY IRRITATE OR BURN SKIN AND EYES. FIRE MAY PRODUCE IRRITATING OR POISONOUS GASES. RUNOFF FROM FIRE CONTROL OR DILUTION WATER MAY CAUSE POLLUTION.

The information contained herein is based on data considered to be accurate. However, no warranty is expressed regarding the accuracy of these data or the results to be obtained from the use thereof. It is the user's obligation to determine the conditions of safe use of the product.



Product Information (203) 740-3471 / Emergency Assistance CHEMTREC 1-800-424-9300 or 202-483-7616

## **MATERIAL SAFETY DATA SHEETS**

Part Number/Trade Name: DICHLOROETHANE This MSDS is valid for all grades and catalog numbers General Information \_\_\_\_\_\_\_\_ Company's Name: PHARMCO PRODUCTS, Date MSDS Revised: Nishant-8/23/99 Safety Data Review Date: 8/23/99 Company's Street: 58 VALE RD. Preparer's Company: PHARMCO PRODUCTS, Company's City: BROOKFIELD Company's State: CT Preparer's St Or P. O. Box: 58 VALE RD. Company's Zip Code: 06804 Preparer's City: BROOKFIELD Company's Emerg Ph #: (203) 740-3471 Preparer's State: CT Preparer's Zip Code: 06804 Company's Info Ph #: (203) 740-3471 Ingredients/Identity Information NIOSH (RTECS) Number: KI0525000 Proprietary: NO Ingredient: ETHANE, 1,2-DICHLORO;(1,2 CAS Number: 107-06-2 DICHLOROETHANE) (SARA III) OSHA PEL: 50 PPM/C,100PPM Ingredient Sequence Number: 01 ACGIH TLV: 10 PPM; 9293 Percent: 90-100 Physical/Chemical Characteristics Appearance And Odor: CLEAR LIQUID WITH Specific Gravity: 1.25 (H2O=1) SWEET ODOR LIKE CHLOROFORM Evaporation Rate And Ref: 0.27 (BUTYL Boiling Point: 183F,84C ACETATE=1) Melting Point: -33F,-36C Solubility In Water: SLIGHT (0.1-1%) Vapor Pressure (MM Hg/70 F): 62 Percent Volatiles By Volume: 100 Vapor Density (Air=1): 3.4

Fire and Explosion Hazard Data

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Flash Point: 55.4F,13.0C Flash Point Method: CC Lower Explosive Limit: 6.2%

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MSDS 091, Rev 2.0 12/18/01 JC Dichloroethane/Page 1 of 4 Upper Explosive Limit: 15.6%

Extinguishing Media: USE ALCOHOL FOAM, DRY CHEMICAL OR CARBON DIOXIDE.

WATER MAY BE INEFFECTIVE.

Special Fire Fighting Proc: WEAR NIOSH/MSHA APPRVD PRESS DEMAND SCBA & FULL PROT EQUIP (FP N). MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE W/

OUT RISK. USE WATER TO KEEP FIRE (SUPDAT)

Unusual Fire And Expl Hazrds: VAPS MAY FLOW ALONG SURFS TO DISTANT IGNIT SOURCES & FLASH BACK, CLOSED CONTAINERS EXPOSED TO HEAT MAY EXPLODE.

CONTACT WITH STRONG OXIDIZERS MAY (SUPP DATA)

\_\_\_\_\_\_

#### Reactivity Data

Stability: YES

Cond To Avoid (Stability): HEAT, SOURCES

OF IGNITION, FLAME.

Materials To Avoid: STRONG OXIDIZING

AGENTS.

Hazardous Decomp Products: HCL.

PHOSGENE (FP N).

Hazardous Poly Occur: NO

Conditions To Avoid (Poly): NOT

RELEVANT.

\_\_\_\_\_\_

#### Health Hazard Data

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

Route Of Entry - Inhalation: YES Route Of Entry - Skin: NO Route Of Entry - Ingestion: YES

Health Haz Acute And Chronic: VAPORS MAY BE IRRITATING TO SKIN, EYES, NOSE & THROAT. INHALATION OF VAPORS MAY CAUSE NAUSEA, VOMITING, HEADACHE, OR LOSS OF CONSCIOUSNESS. CHRONIC:MAY INCLUDE KIDNEY AND/OR LIVER DAMAGE.

CHLOROCARBON MATERIALS HAVE PRODUCED SENSITIZATION OF THE MYOCARDIUM

EPINEPHRINE IN LAB ANIMALS AND COULD (EFTS OF OVEREXPOSURE)

Carcinogenicity - NTP: YES Carcinogenicity - IARC: YES Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: ETHYLENE DICHLORIDE: GROUP 2 (NTP), GROUP 2B

Signs/Symptoms Of Overexp: HLTH HAZ:HAVE A SIMILAR EFFECT IN HUMANS. ADRENOMIMETICS (E.G., EPINEPHRINE) MAY BE CONTRA-INDICATED EXCEPT FOR LIFE SUSTAINING USES IN HUMANS ACUTELY OR CHRONICALLY EXPOSED TO **CHLOROCARBONS** 

(FP N).

Med Cond Aggravated By Exp: NONE IDENTIFIED.

Emergency/First Aid Proc: CALL MD. INGEST: IF CONSCIOUS, IMMEDIATELY INDUCE VOMITING. INHAL:MOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING DIFFICULT, GIVE OXYGEN. EYE: IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. SKIN:FLUSH WITH WATER.

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#### Precautions for Safe Handling and Use

Steps If Matl Released/Spill: WEAR NIOSH/MSHA APPRVD SCBA & FULL PROT CLTHG. SHUT OFF IGNIT SOURCES; NO FLARES, SMKNG OR FLAMES IN AREA. STOP LEAK IF YOU CAN DO SO W/OUT RISK. USE WATER SPRAY TO REDUCE VAPS, TAKE UP W/SAND OR OTHER NON-COMBUST ABSORB MATL & PLACE INTO (SUPP DATA)

Neutralizing Agent: SOLVENT ABSORBANT IS RECOMMENDED FOR SPILLS OF THIS PRODUCT.

Waste Disposal Method: DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL,

STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

Precautions-Handling/Storing: KEEP AWAY FROM HEAT, SPARKS, FLAME. KEEP IN

TIGHTLY CLOSED CONTAINER. USE W/ADEQUATE VENTILATION. STORE IN COOL, DRY,

WELL-VENT, FLAMM LIQ STOR AREA.

Other Precautions: AVOID CONTACT WITH EYES, SKIN & CLOTHING. AVOID

BREATHING VAPOR. BOND & GROUND CONTAINERS WHEN TRANSFERRING LIQUID. NO SMOKING IN AREA OF USE. DO NOT USE IN GEN VICIN OF ARC WELDING, OPEN FLAMES

OR HOT SURFS. HEAT &/OR UV RADIA MAY (SUPDAT)

#### Control Measures

\_\_\_\_\_\_

Respiratory Protection: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE

CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS ABOVE 10 PPM, A NIOSH/MSHA

APPROVED SCBA IS ADVISED.

Ventilation: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV

REQUIREMENTS.

Protective Gloves: NEOPRENE GLOVES.

Eye Protection: CHEM WORK GOGG/FULL LENGTH FSHLD (FP N). Other Protective Equipment: UNIFORM AND PROTECTIVE SUIT. Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING.

Suppl. Safety & Health Data: FIRE FIGHT PROC: EXPOSED CONTAINERS COOL.

EXPLO HAZ:CAUSE FIRE. THERMAL DECOMP PRODUCTS MAY INCLUDE HCL & PHOSGENE (FP N). SPILL PROC:CONTAINER FOR LATER DISPOSAL. FLUSH AREA WITH WATER.

OTHER PREC: CAUSE THE FORMATION OF HCL AND PHOSGENE (FP N).

#### Transportation Data

Trans Data Review Date: 92349

DOT PSN Code: GAP

DOT Proper Shipping Name: ETHYLENE

DICHLORIDE DOT Class: 3

DOT ID Number: UN1184 DOT Pack Group: II

DOT Label: FLAMMABLE LIQUID, POISON

IMO PSN Code: GVF

IMO Proper Shipping Name: ETHYLENE

DICHLORIDE

IMO Regulations Page Number: 3224

IMO UN Number: 1184 IMO UN Class: 3.2

IMO Subsidiary Risk Label: TOXIC \*

IATA PSN Code: LIA

IATA UN ID Number: 1184

IATA Proper Shipping Name: ETHYLENE

DICHLORIDE IATA UN Class: 3

IATA Subsidiary Risk Class: 6.1

IATA Label: FLAMMABLE LIQUID & TOXIC

AFI PSN Code: LIA AFI Symbols: T

AFI Prop. Shipping Name: ETHYLENE

DICHLORIDE AFI Class: 3

AFI ID Number: UN1184

AFI Pack Group: II

AFI Label: FLAMMABLE LIQUID & POISON

AFI Basic Pac Ref: 7-7

Disposal Data

Refer to applicable regional, state and federal codes.

\_\_\_\_\_

#### Label Data

Label Required: YES

Technical Review Date: 06MAY92

Label Date: 06MAY92

Label Status: G

Common Name: H076, 1,2-DICHLOROETHANE Chronic Hazard: YES

Signal Word: DANGER!
Acute Health Hazard-Severe: X

Contact Hazard-Moderate: X Fire Hazard-Severe: X

Reactivity Hazard-Slight: X

Special Hazard Precautions: FLAMMABLE LIQUID! STORE IN A COOL, DRY, WELL VENTILATED, FLAMMABLE LIQUID STORAGE AREA. KEEP AWAY FROM

HEAT, SPARKS,

Protect Respiratory: Y

FLAME. ACUTE: VAPORS MAY BE IRRITATING TO SKIN, EYES, NOSE AND

THROAT.

INHALATION OF VAPORS MAY CAUSE NAUSEA, VOMITING, HEADACHE, OR

LOSS OF

CONSCIOUSNESS. CHRONIC EFFECTS OF OVEREXPOSURE MAY INCLUDE KIDNEY

AND/OR

LIVER DAMAGE. CHLOROCARBON MATERIALS HAVE CAUSED

SENSITIZATION OF THE

MYOCARDIUM TO EPINEPHRINE IN LAB ANIMALS AND COULD HAVE A SIMILAR

EFFECT IN

HUMANS. DICHLOROETHANE IS A LISTED

CARCINOGEN. Protect Eye: Y Protect Skin: Y

The information contained herein is based on data considered to be accurate. However, no warranty is expressed regarding the accuracy of these data or the results to be obtained from the use thereof. It is the user's obligation to determine the conditions of safe use of the product.



## 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC.

959 ROUTE 46 EAST

PARSIPPANY, NEW JERSEY 07054-0624

**EMERGENCY CONTACT:** 

CHEMTREC 1-800-424-9300

INFORMATION CONTACT:

973-257-1100

SUBSTANCE: ETHYL CHLORIDE

#### TRADE NAMES/SYNONYMS:

MTG MSDS 32; CHLOROETHANE; MONOCHLOROETHANE; MURIATIC ETHER; KELENE; HYDROCHLORIC ETHER; ETHER HYDROCHLORIC; ETHER MURIATIC; NARCOTILE; AETHYLIS; CHELEN; CHLORETHYL; CHLORIDUM; CHLORYL; CHLORYL ANESTHETIC; ETHER CHLORATUS; AETHYLIS CHLORIDUM; STCC 4908162; UN 1037; C2H5CL; MAT08880; RTECS KH7525000

CHEMICAL FAMILY: halogenated, aliphatic

CREATION DATE: Jan 24 1989 REVISION DATE: Jun 20 2003

## 2. COMPOSITION, INFORMATION ON INGREDIENTS

**COMPONENT:** ETHYL CHLORIDE

CAS NUMBER: 75-00-3 PERCENTAGE: 100.0

## 3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=4 REACTIVITY=0

## **EMERGENCY OVERVIEW:**

PHYSICAL FORM: gas

MAJOR HEALTH HAZARDS: eye irritation, central nervous system depression

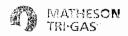
PHYSICAL HAZARDS: Flammable gas. May cause flash fire.

#### POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EXPOSURE: irritation, nausea, vomiting, irregular heartbeat, headache, symptoms of





drunkenness

LONG TERM EXPOSURE: disorientation, kidney damage, liver damage

**SKIN CONTACT:** 

SHORT TERM EXPOSURE: irritation, blisters

LONG TERM EXPOSURE: same as effects reported in short term exposure

**EYE CONTACT:** 

SHORT TERM EXPOSURE: irritation, blurred vision

LONG TERM EXPOSURE: same as effects reported in short term exposure

**INGESTION:** 

SHORT TERM EXPOSURE: same as effects reported in other routes of exposure, sore throat, frostbite,

headache

LONG TERM EXPOSURE: no information is available

## 4. FIRST AID MEASURES

**INHALATION:** If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

**SKIN CONTACT:** If frostbite or freezing occur, immediately flush with plenty of lukewarm water (105-115 F; 41-46 C). DO NOT USE HOT WATER. If warm water is not available, gently wrap affected parts in blankets. Get immediate medical attention.

**EYE CONTACT:** Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

**INGESTION:** Contact local poison control center or physician immediately. Never make an unconscious person vomit or drink fluids. When vomiting occurs, keep head lower than hips to help prevent aspiration. If person is unconscious, turn head to side. Get medical attention.

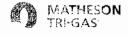
#### 5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Severe fire hazard. Severe explosion hazard. Vapor/air mixtures are explosive. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back.

**EXTINGUISHING MEDIA:** regular dry chemical, carbon dioxide, water, regular foam

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: 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).



Water may be ineffective.

FLASH POINT: -58 F (-50 C) (CC) LOWER FLAMMABLE LIMIT: 3.8% UPPER FLAMMABLE LIMIT: 15.4%

**AUTOIGNITION:** 966 F (519 C)

## 6. ACCIDENTAL RELEASE MEASURES

#### **WATER RELEASE:**

Subject to California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). Keep out of water supplies and sewers.

#### OCCUPATIONAL RELEASE:

Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Small spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Large spills: Dike for later disposal. Remove sources of ignition. Keep unnecessary people away, isolate hazard area and deny entry. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

## 7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. Subject to storage regulations: U.S. OSHA 29 CFR 1910.101. Grounding and bonding required. Protect from physical damage. Store outside or in a detached building. Store with flammable liquids. Keep separated from incompatible substances. Avoid contact with light. Store in a cool, dry place. Store in a well-ventilated area. Keep separated from incompatible substances.

## 8. EXPOSURE CONTROLS, PERSONAL PROTECTION

## EXPOSURE LIMITS: ETHYL CHLORIDE:

1000 ppm (2600 mg/m3) OSHA TWA

100 ppm ACGIH TWA (skin)

**VENTILATION:** Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Ensure compliance with applicable exposure limits.

**EYE PROTECTION:** For the gas: Eye protection not required, but recommended. For the liquid: Wear splash resistant safety goggles. Contact lenses should not be worn. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.



**CLOTHING:** For the gas: Protective clothing is not required. For the liquid: Wear appropriate protective, cold insulating clothing.

**GLOVES:** Wear insulated gloves.

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

## 3800 ppm

Any supplied-air respirator.

Any self-contained breathing apparatus with a full facepiece.

#### Escape -

Any air-purifying respirator with a full facepiece and an organic vapor canister.

Any appropriate escape-type, self-contained breathing apparatus.

## For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Any self-contained breathing apparatus with a full facepiece.

#### 9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: gas ODOR: Not available

**MOLECULAR WEIGHT: 64.52** 

**MOLECULAR FORMULA: C2-H5-CL** 

**BOILING POINT:** 54 F (12 C) **FREEZING POINT:** -213 F (-136 C)

VAPOR PRESSURE: 1000 mmHg @ 20 C

VAPOR DENSITY (air=1): 2.2

SPECIFIC GRAVITY (water=1): 0.9

WATER SOLUBILITY: 0.6%

PH: Not applicable

VOLATILITY: Not applicable
ODOR THRESHOLD: Not available
EVAPORATION RATE: Not applicable

COEFFICIENT OF WATER/OIL DISTRIBUTION: Not applicable

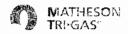
**SOLVENT SOLUBILITY:** 

Soluble: alcohol, ether, organic solvents

## 10. STABILITY AND REACTIVITY

**REACTIVITY:** Stable at normal temperatures and pressure. May react on contact with water. May release toxic and/or flammable gases.

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.

**INCOMPATIBILITIES:** metals, oxidizing materials

#### HAZARDOUS DECOMPOSITION:

Thermal decomposition products: acid halides, phosgene

**POLYMERIZATION:** Will not polymerize.

## 11. TOXICOLOGICAL INFORMATION

## ETHYL CHLORIDE:

#### **TOXICITY DATA:**

152 gm/m3/2 hour(s) inhalation-rat LC50

CARCINOGEN STATUS: IARC: Human No Adequate Data, Animal Limited Evidence, Group 3;

ACGIH: A3 -Animal Carcinogen

#### **LOCAL EFFECTS:**

Irritant: eye

## **ACUTE TOXICITY LEVEL:**

Slightly Toxic: inhalation

TARGET ORGANS: central nervous system

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: heart or respiratory disorders, kidney

disorders, liver disorders

TUMORIGENIC DATA: Available. MUTAGENIC DATA: Available.

**REPRODUCTIVE EFFECTS DATA:** Available.

ADDITIONAL DATA: May be excreted in breast milk. Alcohol may enhance the toxic effects. Stimulants

such as epinephrine may induce ventricular fibrillation.

## 12. ECOLOGICAL INFORMATION

Not available

#### 13. DISPOSAL CONSIDERATIONS

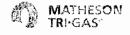
Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): D001. Dispose in accordance with all applicable regulations.

## 14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:

PROPER SHIPPING NAME: Ethyl chloride





**ID NUMBER:** UN1037

HAZARD CLASS OR DIVISION: 2.1 LABELING REQUIREMENTS: 2.1 QUANTITY LIMITATIONS:

PASSENGER AIRCRAFT OR RAILCAR: Forbidden

CARGO AIRCRAFT ONLY: 150 kg

## CANADIAN TRANSPORTATION OF DANGEROUS GOODS:

SHIPPING NAME: Ethyl chloride

**UN NUMBER: UN1037** 

CLASS: 2.1

## 15. REGULATORY INFORMATION

## **U.S. REGULATIONS:**

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):

Chloroethane (Ethyl chloride): 100 LBS RQ

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30): Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.40): Not regulated.

## SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370.21):

ACUTE: Yes CHRONIC: No FIRE: Yes

REACTIVE: Yes

SUDDEN RELEASE: No

## SARA TITLE III SECTION 313 (40 CFR 372.65):

Chloroethane (Ethyl chloride)

OSHA PROCESS SAFETY (29CFR1910.119): Not regulated.

## **STATE REGULATIONS:**

California Proposition 65:

Known to the state of California to cause the following:

Chloroethane (Ethyl chloride)

Cancer (Jul 01, 1990)

## **CANADIAN REGULATIONS:**

WHMIS CLASSIFICATION: AB

## **NATIONAL INVENTORY STATUS:**



U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CANADA INVENTORY (DSL/NDSL): Not determined.

## 16. OTHER INFORMATION

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The MSDS format adheres to the standards and regulatory requirements of the United States and may not meet regulatory requirements in other countries.

> DuPont Page 1 Material Safety Data Sheet

FREON 113 REFRIGERANT

Revised 20-APR-2004

\_\_\_\_\_

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Material Identification

"FREON" is a registered trademark of DuPont.

Corporate MSDS Number : DU000126

Formula

: CC12FCC1F2

Molecular Weight : 187.38

Tradenames and Synonyms

#### TRICHLOROTRIFLUOROETHANE

1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE

"FREON" TF SOLVENT

"FREON" TF CLEANING AGENT

"FREON" PRECISION CLEANING AGENT

"FREON" TF

"FREON" PCA

"FREON" TF 113

#### Company Identification

## MANUFACTURER/DISTRIBUTOR

DuPont Fluoroproducts 1007 Market Street Wilmington, DE 19898

#### PHONE NUMBERS

Product Information: 1-800-441-7515 (outside the U.S.

302-774-1000)

Transport Emergency : CHEMTREC 1-800-424-9300(outside U.S.

703-527-3887)

Medical Emergency : 1-800-441-3637 (outside the U.S.

302-774-1000)

## COMPOSITION/INFORMATION ON INGREDIENTS

Components

Material

\*1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE

CAS Number

76-13-1 100

("FREON" 113)

\* Disclosure as a toxic chemical is required under Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372.

#### HAZARDS IDENTIFICATION

#### # Potential Health Effects

Short-term overexposure by inhalation may cause central nervous system depression with dizziness, confusion, incoordination, drowsiness or unconsciousness. Repeated and/or prolonged exposure may cause suffocation, if air is displaced by vapors, irregular heart beat with a strange sensation in the chest, "heart thumping", apprehension, lightheadedness, feeling of fainting, dizziness, weakness, sometimes progressing to loss of consciousness and death.

Short-term overexposure by skin contact may cause defatting of the skin with itching, redness or rash. Significant skin permeation, and systemic toxicity, after contact appears unlikely.

Short-term overexposure by eye contact may cause irritation with tearing, pain or blurred vision.

The major ingestion hazard is aspiration (liquid entering the lungs during ingestion or vomiting) which may result in "chemical pneumonia". Symptoms include coughing, gasping, choking, shortness of breath, bluish discoloration of the skin, rapid breathing and heart rate, and fever. Pulmonary edema or bleeding, drowsiness, confusion, coma and seizures may occur in more serious cases. Symptoms may develop immediately or as late as 24 hours after exposure, depending on how much chemical entered the lungs.

#### Carcinogenicity Information

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

\_\_\_\_\_\_

#### FIRST AID MEASURES

#### First Aid

#### INHALATION

If inhaled, immediately remove to fresh air. Keep person calm. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

#### SKIN CONTACT

Flush skin with water after contact. Wash contaminated clothing before reuse.

#### EYE CONTACT

#### DuPont Material Safety Data Sheet

#### (FIRST AID MEASURES - Continued)

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

#### INGESTION

If swallowed, do not induce vomiting. Immediately give 2 glasses of water. Never give anything by mouth to an unconscious person. Call a physician.

#### Notes to Physicians

Activated charcoal mixture may be beneficial. Suspend 50 g activated charcoal in 400 mL water and mix well. Administer 5 mL/kg, or 350 mL for an average adult.

Because of the danger of aspiration, emesis or gastric lavage should not be employed unless the risk is justified by the presence of additional toxic substances. Activated charcoal may be given but should be used with caution since it may induce vomiting.

THIS MATERIAL MAY MAKE THE HEART MORE SUSCEPTIBLE TO ARRHYTHMIAS. Catecholamines such as adrenaline, and other compounds having similar effects, should be reserved for emergencies and then used only with special caution.

Skin discomfort caused by de-fatting after contact with certain solvents may be relieved by application of emollient creams or lotions.

#### FIRE FIGHTING MEASURES

Flammable Properties

Flash Point Autodecomposition : Will not burn : 300 C (572 F)

Fire and Explosion Hazards:

Drums may rupture under fire conditions. Decomposition may occur.

#### Extinguishing Media

As appropriate for combustibles in area.

## Fire Fighting Instructions

Use water spray or fog to cool container. Self-contained breathing apparatus (SCBA) is required if drums rupture and contents are spilled under fire conditions.

ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel)

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

#### Accidental Release Measures

Ventilate area. Do not flush into sewers. Dike spill. Collect on absorbent material and transfer to steel drums for recovery or disposal. Use self-contained breathing apparatus (SCBA) for large spills. Comply with Federal, State, and local regulations on reporting releases.

#### HANDLING AND STORAGE \_\_\_\_\_\_

Handling (Personnel)

Avoid breathing vapors and prolonged skin exposure. Use with sufficient ventilation to keep employee exposure below recommended limits.

Storage

Clean, dry area. Do not heat above 125 deg F.

#### EXPOSURE CONTROLS/PERSONAL PROTECTION

\_\_\_\_\_\_

Engineering Controls

Normal ventilation for standard use procedures is generally adequate. Local exhaust should be used when large amounts are released. Mechanical ventilation should be used in low or enclosed places.

Personal Protective Equipment

Impervious gloves should be used to avoid prolonged or repeated exposure. Chemical splash goggles should be worn as needed to prevent eye contact. Under normal use conditions, no respiratory protection is required when using this product. Self-contained breathing apparatus (SCBA) is required if a large spill occurs.

Exposure Guidelines

Applicable Exposure Limits

1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE

: 1,000 ppm, 7,600 mg/m3, 8 Hr. TWA : 1,000 ppm, 7,670 mg/m3, 8 Hr. TWA, A4 (OSHA) TLV (ACGIH)

STEL 1,250 ppm, 9,590 mg/m3, A4

AEL \* (DuPont) : None Established

\* AEL is DuPont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

#### PHYSICAL AND CHEMICAL PROPERTIES

#### Physical Data

Boiling Point

: 48 C (118 F) : 6.46 psia at 25 deg C (77 deg F) Vapor Pressure

: 2.9 (Air = 1.0) Vapor Density

at 25 deg C (77 deg F)

% Volatiles : 100 WT% Evaporation Rate : (CC14 = 1)Greater than 1

: 0.02 WT% @ 25 C (77 F) Solubility in Water

: Neutral

Odor : Slight ethereal

Form : Liquid

Color : Clear, colorless

Density : 1.57 g/cc at 25 deg C (77 deg F) - Liquid

### STABILITY AND REACTIVITY

\_\_\_\_\_\_\_

#### Chemical Stability

Material is stable. However, avoid open flames and high temperatures.

#### Incompatibility with Other Materials

Incompatible with alkali or alkaline earth metals- powdered Al, Zn, Be, etc.

#### Polymerization

Polymerization will not occur.

#### Other Hazards

#### Decomposition

: Decomposition products are hazardous. This compound can be decomposed by high temperatures (open flames, glowing metal surfaces, etc.) forming hydrochloric and hydrofluoric acids, and possibly carbonyl halides.

#### TOXICOLOGICAL INFORMATION

\_\_\_\_\_\_

#### # Animal Data

SKIN: ALD, rabbit: >11,000 mg/k
INGESTION: LD50, rat: 43,000 mg/kg
INHALATION: 4 hour, LC50, rat: 50,000 ppm

Animal testing indicates this material is a slight eye irritant.

Animal testing indicates this material is a mild skin irritant, and is a skin sensitizer. Repeated exposure caused inflammation of the skin and pathological changes of the liver.

Single exposure by ingestion caused pathological changes of the lungs, liver, stomach, gastrointestinal tract, kidneys. Other effects include lethargy, and altered respiratory rate. Repeated exposure caused increased mortality.

Single exposure by inhalation caused pathological changes of the kidneys, liver, lungs and increased lung weight. Other effects include altered respiratory rate, incoordination, excessive activity, tremors or convulsions, inactivity or anaesthesia, cardiac sensitization, a potentially fatal disturbance of heart rhythm associated with a heightened sensitivity to the action of epinephrine, cyanosis and increased mortality.

Long-term exposure caused decreased body weight. Other effects include altered hematology and clinical chemistry.

Reproductive data on rats show no change in reproductive performance.

This material has not produced genetic damage in bacterial cultures. In mammalian cell cultures this material has caused genetic toxicity. In animal testing, this material has not caused permanent genetic damage in reproductive cells of mammals (has not produced heritable genetic damage).

In animal testing this material has not caused carcinogenicity or developmental toxicity.

	2024FR DuPont Page 7 Material Safety Data Sheet
	ECOLOGICAL INFORMATION
#	Ecotoxicological Information
	Aquatic Toxicity:
	96-hour LC50, rainbow trout: 7.4 mg/L 96 hour LC50, fathead minnows: 1250 mg/L
	DISPOSAL CONSIDERATIONS
	Waste Disposal
	Comply with Federal, State, and local regulations. Remove to a permitted waste disposal facility. EPA Hazardous Waste Nos. F001 and F002 may apply to waste materials.
	TRANSPORTATION INFORMATION
	Shipping Information
	Shipping Containers
	Tank Cars. Tank Trucks.
	Drums NOT REGULATED AS A HAZARDOUS MATERIAL BY DOT OR IMO.
	REGULATORY INFORMATION
	U.S. Federal Regulations
	TSCA Inventory Status : Reported/Included.
	TITLE III HAZARD CLASSIFICATIONS SECTIONS 311, 312
	Acute : Yes Chronic : No Fire : No Reactivity : No Pressure : No

HAZARDOUS CHEMICAL LISTS

Hazardous Substance - No
CERCLA Hazardous Substance - No
SARA Toxic Chemical - See Components Section

SARA Extremely

OTHER INFORMATION

NFPA, NPCA-HMIS

NPCA-HMIS Rating

Health Flammability : 0 Reactivity

Personal Protection rating to be supplied by user depending on use conditions.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS: MSDS Coordinator

: DuPont Fluoroproducts Address : Wilmington, DE 19898 : (800) 441-7515 Telephone

# Indicates updated section.

This information is based upon technical information believed to be reliable. It is subject to revision as additional knowledge and experience is gained.

End of MSDS

# Clemson

# Material Safety Data Sheet for Me

Environmental Health and Safety

To return to the page you just left, select the "back" button on yo

Clemson Home

MSDS for METHYLENE CHLORIDE

**EHS Home** 

1 - PRODUCT IDENTIFICATION

**Environment** 

PRODUCT NAME: METHYLENE CHLORIDE

Occupational Health

FORMULA: CH2CL2F ORMULA WT: 84.93

CAS NO.: 75-09-2

**Biological** 

NIOSH/RTECS NO.: PA8050000

Safety

COMMON SYNONYMS: DICHLOROMETHANE; METHYLENE DICHLO

METHANE DICHLORIDE

Chemical

PRODUCT CODES: 9324,9341,Q480,9330,5378,5531,9315,9329,9264

**EFFECTIVE: 10/24/86** 

Safety

REVISION #03

Radiation

PRECAUTIONARY LABELLING BAKER SAF-T-DATA(TM) SYSTEM

Safety

HEALTH - 3 SEVERE (CANCER CAUSING)

FLAMMABILITY - 1 SLIGHT

Satallite Facilities REACTIVITY - 1 SLIGHT

ies CONTACT - 2 MODERATE

HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZA

GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLO

Comprehensive

EHS Plan

LABORATORY PROTECTIVE EQUIPMENT

On-line PRECAUTIONARY LABEL STATEMENTS

training

POISON DANGER

EHS Contact

CAUSES IRRITATION

<u>List</u>

HARMFUL IF ABSORBED THROUGH SKIN
MAY BE FATAL IF SWALLOWED OR INHALED

NOTE: REPORTED AS CAUSING CANCER IN LABORATORY ANIMALS.

DUE CARE.

AVOID CONTACT WITH EYES, SKIN, CLOTHING.

KEEP IN TIGHTLY CLOSED CONTAINER. WASH THOROUGHLY AFTE

SAF-T-DATA(TM) STORAGE COLOR CODE: BLUE (HEALTH)

\_\_\_\_\_\_

2 - HAZARDOUS COMPONENTS



Email EHS

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You are here:

<u>Home</u> >> <u>Training</u> >> <u>Msds</u> >> Material Safety Data Sheet for Methylene Chloride

Aren't you glad someone knows where you are?

COMPONENT % CAS NO.
METHYLENE CHLORIDE 90-100 75-09-2

3 - PHYSICAL DATA

BOILING POINT: 40 C (104 F) VAPOR PRESSURE(MM HG): 350

MELTING POINT: -95 C (-139 F) VAPOR DENSITY(AIR=1): 2.9

SPECIFIC GRAVITY: 1.32 EVAPORATION RATE: 27.5 (H2O=1) (BUTYL ACETATE=1)

SOLUBILITY(H2O): MODERATE (1 TO 10 %) % VOLATILES BY VOLUM

APPEARANCE & ODOR: COLORLESS, VOLATILE LIQUID WITH PENETRATING, ETHER-LIKE ODOR.

4 - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP N/A NFPA 704M RATING: 2-1-0

FLAMMABLE LIMITS: UPPER - 19 % LOWER - 12 %

FIRE EXTINGUISHING MEDIA
USE EXTINGUISHING MEDIA APPROPRIATE FOR SURROUNDING FI

SPECIAL FIRE-FIGHTING PROCEDURES

FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT A SELF-CONTAINED

BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POS PRESSURE MODE.

MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT WATER

TO KEEP FIRE-EXPOSED CONTAINERS COOL.

UNUSUAL FIRE & EXPLOSION HAZARDS CLOSED CONTAINERS EXPOSED TO HEAT MAY EXPLODE.

TOXIC GASES PRODUCED HYDROGEN CHLORIDE, PHOSGENE, CARI MONOXIDE, CARBON DIOXIDE

5 - HEALTH HAZARD DATA

ACGIH DENOTES THAT THIS SUBSTANCE IS SUSPECT OF CARCINOG POTENTIAL FOR MAN.

THRESHOLD LIMIT VALUE (TLV/TWA): 350 MG/M3 (100 PPM)

SHORT-TERM EXPOSURE LIMIT (STEL): 1740 MG/M3 ( 500 PPM) PERMISSIBLE EXPOSURE LIMIT (PEL): MG/M3 ( 500 PPM)

TOXICITY: LD50 (ORAL-RAT)(MG/KG) - 2524 LD50 (IPR-MOUSE)(MG/KG) - 1500 LD50 (SCU-MOUSE)(MG/KG) - 6460 LC50 (INHAL-RAT-)(G/M3) - 88

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

# EFFECTS OF OVEREXPOSURE

INHALATION AND INGESTION ARE HARMFUL AND MAY BE FATAL. INHALATION MAY CAUSE HEADACHE, NAUSEA, VOMITING, DIZZIN SUFFOCATION, LOWER BLOOD PRESSURE, CENTRAL NERVOUS SYSTEM INHALATION OF VAPORS MAY CAUSE SEVERE IRRITATION OF THE SYSTEM. LIQUID MAY BE IRRITATING TO SKIN AND EYES. PROLONG MAY RESULT IN DERMATITIS. EYE CONTACT MAY RESULT IN TEMP DAMAGE.

INGESTION MAY CAUSE NAUSEA, VOMITING, GASTROINTESTINAL I BURNS TO MOUTH AND THROAT.

TARGET ORGANS

SKIN, CARDIOVASCULAR SYSTEM, CENTRAL NERVOUS SYSTEM, EYI

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE NONE IDENTIFIED

ROUTES OF ENTRY INHALATION, INGESTION, SKIN CONTACT, EYE CONTACT

EMERGENCY AND FIRST AID PROCEDURES CALL A PHYSICIAN.

IF SWALLOWED, DO NOT INDUCE VOMITING.

IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE AR' RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN. IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES WITH PLENTY OF A THE FACTOR OF MINISTERS.

FOR AT LEAST 15 MINUTES. FLUSH SKIN WITH WATER.

ACCEPTABLE MAXIMUM PEAK ABOVE THE ACCEPTANCE CEILING (FOR AN 8 HOUR SHIFT = 2000 PPM FOR 5 MINUTES IN ANY 2HOURS = 1000 PPM

6 - REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCC

CONDITIONS TO AVOID: HEAT, FLAME, OTHER SOURCES OF IGNITI

INCOMPATIBLES: ALKALI METALS, STRONG OXIDIZING AGENTS, ST BASES, OXIDES OF NITROGEN, ZINC, ALUMINUM, WATER, MAGNESIUM, AMINES

DECOMPOSITION PRODUCTS: HYDROGEN CHLORIDE, PHOSGENE, CARBON MONOXIDE, CARBON DIOXIDE

7 - SPILL AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTE STOP LEAK IF YOU CAN DO SO WITHOUT RISK. USE WATER SPRAY T

TAKE UP WITH SAND OR OTHER NON-COMBUSTIBLE ABSORBENT INTO CONTAINER FOR LATER DISPOSAL. FLUSH SPILL AREA WITH

DISPOSAL PROCEDURE

DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER: U080 (TOXIC WASTE)

A DRAWE WILLIAM COLUMN

8 - PROTECTIVE EQUIPMENT

VENTILATION: USE GENERAL OR LOCAL EXHAUST VENTILATION TO TLV REQUIREMENTS.

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS ABOVE 100 PPM, A SELF-CONTAINED BREATHING APPARATUS IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GOGGLES AND FACE SHIELD, UNII PROTECTIVE SUIT, POLYVINYL ALCOHOL GLOVES ARE RECOMMENDED.

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9 - STORAGE AND HANDLING PRECAUTIONS

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SAF-T-DATA(TM) STORAGE COLOR CODE: BLUE (HEALTH)

SPECIAL PRECAUTIONS

KEEP CONTAINER TIGHTLY CLOSED. STORE IN SECURE POISON AR KEEP CONTAINERS OUT OF SUN AND AWAY FROM HEAT.

\_\_\_\_\_

10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME DICHLOROMETHANE (AIR ONLY) HAZARD CLASS ORM-A

UN/NA UN1593 LABELS NONE REPORTABLE QUANTITY 1000 LBS.

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME DICHLOROMETHANE HAZARD CLASS 6.1 UN/NA UN1593 LABELS HARMFUL - STOW AWAY FROM FOOD STUFFS

```
EXXON CHEMICAL AMERICAS -- TOLUENE - TOLUENE, TECHNICAL
MATERIAL SAFETY DATA SHEET
  N: 6810005798431
 manufacturer's CAGE: 72190
Part No. Indicator: A
Part Number/Trade Name: TOLUENE
______
                      General Information
Item Name: TOLUENE, TECHNICAL
Company's Name: EXXON CHEMICAL AMERICAS
Company's P. O. Box: 3272
Company's City: HOUSTON
Company's State: TX
Company's Country: US
Company's Zip Code: 77001
Company's Emerg Ph #: 713-870-6000/800-424-9300(CHEMTREC)
Company's Info Ph #: 713-870-6885
Distributor/Vendor # 1: CSD, INC (409-756-1065)
Distributor/Vendor # 1 Cage: 4N760
Record No. For Safety Entry: 009
Tot Safety Entries This Stk#: 011
Status: SE
Date MSDS Prepared: 08MAY92
Safety Data Review Date: 27AUG97
Supply Item Manager: CX
MSDS Serial Number: BTKRC
Specification Number: TT-T-548
Spec Type, Grade, Class: NONE
  zard Characteristic Code: F3
onit Of Issue: QT
Unit Of Issue Container Qty: 32.000 OZ
Type Of Container: CAN
Net Unit Weight: 1.81 LB/QT
NRC/State License Number: NONE
Net Propellant Weight-Ammo: NONE
Ingredients/Identity Information
Proprietary: NO
Ingredient: TOLUENE (SARA 313) (CERCLA)
Ingredient Sequence Number: 01
Percent: 100
NIOSH (RTECS) Number: XS5250000
CAS Number: 108-88-3
OSHA PEL: 200 PPM; Z-2
ACGIH TLV: S, 50 PPM; 9596
Other Recommended Limit: NONE RECOMMENDED
Physical/Chemical Characteristics
Appearance And Odor: CLEAR COLORLESS LIQUID, AROMATIC (HYDROCARBON) ODOR
Boiling Point: 230F,110C
Melting Point: <-76F,<-60C
Vapor Pressure (MM Hg/70 F): 47 MM
Vapor Density (Air=1): 3.20
 ecific Gravity: 0.87
Decomposition Temperature: UNKNOWN
Evaporation Rate And Ref: 2.4 (N-BUTYL ACETATE = 1)
Solubility In Water: 0.05%
```

Percent Volatiles By Volume: 100 Corrosion Rate (IPY): UNKNOWN

Fire and Explosion Hazard Data

Flash Point: 45.0F,7.2C Flash Point Method: TCC Lower Explosive Limit: 1.4 Upper Explosive Limit: 7.4

Extinguishing Media: USE WATER SPRAY TO COOL FIRE EXPOSED SURFACES AND TO PROTECT PERSONNEL. USE WATER SPRAY TO DISCHARGE VAPORS.

Special Fire Fighting Proc: EITHER ALLOW FIRE TO BURN UNDER CONTROLLED CONDITIONS OR EXTINGUISH WITH FOAM OR DRY CHEMICAL. TRY TO COVER LIQUID SPILLS WITH FOAM.

Unusual Fire And Expl Hazrds: EITHER THE LIQUID OR VAPOR MAY SETTLE IN LOW AREAS OR TRAVEL SOME DISTANCE ALONG THE GROUND OR SURFACE TO IGNITION SOURCES WHERE THEY MAY IGNITE OR EXPLODE.

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#### Reactivity Data

Stability: YES

Cond To Avoid (Stability): NOT APPLICABLE.

Materials To Avoid: STRONG OXIDIZING AGENTS, CONCENTRATED NITRIC OR

SULFURIC ACID, HALOGENS OR MOLTEN SULPHUR.

Hazardous Decomp Products: NONE.

Hazardous Poly Occur: NO

Conditions To Avoid (Poly): WILL NOT OCCUR

#### Health Hazard Data

LD50-LC50 Mixture: LD50 (ORAL RAT) IS UNKNOWN

Route Of Entry - Inhalation: YES

Route Of Entry - Skin: YES

Route Of Entry - Ingestion: YES

VAPOR/AEROSOL CONCENTRATIONS >1000 PPM IRRITATE EYES & RESPIRATORY TRACT. INGESTED:SMALL AMTS ASPIRATED INTO LUNGS MAY CAUSE MILD TO SEVERE PULMONARY INJURY.

Carcinogenicity - NTP: NO Carcinogenicity - IARC: NO Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: MFR LISTED NO INFORMATION ABOUT THE CARCINOGENICITY OF THIS MATERIAL.

Signs/Symptoms Of Overexp: INHALATION: HEADACHE, DIZZINESS, ANESTHESIA, DROWSINESS, UNCONSCIOUSNESS, BRAIN DAMAGE & POSSIBLY DEATH.

Med Cond Aggravated By Exp: EXISTING DERMATITIS.

Emergency/First Aid Proc: EYE:FLUSH WITH LARGE AMOUNTS OF WATER UNTIL IRRITATION SUBSIDES. SKIN:FLUSH WITH LARGE AMOUNTS OF WATER; USE SOAP IF AVAILABLE. REMOVE GROSSLY CONTAMINATED CLOTHING AND LAUNDER BEFORE REUSE. INHALED:REMOVE THE EFFECTED VICTIM FROM EXPOSURE. ADMINISTER ARTIFICIAL RESPIRATION IF BREATHING IS STOPPED. INGESTED: DO NOT INDUCE VOMITING. KEEP AT REST. GET PROMPT MEDICAL ATTENTION.

#### Precautions for Safe Handling and Use

Steps If Matl Released/Spill: ELIMINATE SOURCES OF IGNITION. PREVENT

ADDITIONAL DISCHARGE IF W/O HAZARD. SMALL SPILL:IMPLEMENT CLEAN-UP CEDURES. LARGE SPILL:IMPLEMENT CLEANUP PROCEDURES. ISOLATE AREA 7 ADVISE ACTHORITIES. PREVENT FROM ENTERING SEWER, WATERWWAYS. RECOVER.

Waste Disposal Method: RECOVER BY PUMPING OR WITH A SUITABLE ABSORBENT.

CONSULT AN EXPERT ON DISPOSAL OF RECOVERED MATERIAL AND ENSURE CONFORMITY

TO LOCAL DISPOSAL REGULATIONS.

Precautions-Handling/Storing: STORE AT AMBIENT TEMPERATURE & ATMOSPHERIC ESSURE. USE PROPER GROUNDING PROCEDURES.

Other Precautions: HEALTH STUDIES HAVE SHOWN THAT HYDROCARBONS POSE POTENTIAL HUMAN HEALTH RISKS WHICH VARY FROM PERSON TO PERSON.

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#### Control Measures

Respiratory Protection: WHERE AIRBORN CONCENTRATIONS EXCEED LIMITS AND VENTILATION & WORK PRACTICE DOES NOT REDUCE EXPOSURE TO BELOW LIMITS, USE A NIOSH/MSHA APPROVED RESPIRATIOR TO PREVENT OVEREXPOSURE.

Ventilation: USE LOCAL EXHAUST TO CONTROL EMISSIONS NEAR SOURCE. USE MECHANICAL VENTILATION FOR ECNLOSED SPACES.

Protective Gloves: CHEMICAL RESISTANT

Eye Protection: SAFETY GLASSES W/SIDE SHIELDS

Other Protective Equipment: LONG SLEEVES. HMIS RECOMMENDS GOGGLES REPLACE RHE ABOVE RECOMMENDATION FOR EYE PROTECTION.

Work Hygienic Practices: MINIMIZE EXPOSURE TO LIQUIDS, VAPORS, MISTS OR FUMES.

Suppl. Safety & Health Data: FLAMMABLE LIQUID.

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#### Transportation Data

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Trans Data Review Date: 97253

DOT PSN Code: OJY

DOT Proper Shipping Name: TOLUENE

DOT Class: 3

DOT ID Number: UN1294 DOT Pack Group: II

T Label: FLAMMABLE LIQUID

IMO PSN Code: OSR

IMO Proper Shipping Name: TOLUENE IMO Regulations Page Number: 3285

IMO UN Number: 1294 IMO UN Class: 3.2

IMO Subsidiary Risk Label: -

IATA PSN Code: YEL
IATA UN ID Number: 1294

IATA Proper Shipping Name: TOLUENE

IATA UN Class: 3

IATA Label: FLAMMABLE LIQUID

AFI PSN Code: YEL

AFI Prop. Shipping Name: TOLUENE

AFI Class: 3

AFI ID Number: UN1294 AFI Pack Group: II AFI Special Prov: P5 AFI Basic Pac Ref: A7.3

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# Disposal Data

Label Data

Label Required: YES

Technical Review Date: 27AUG97

bel Status: F

mmon Name: TOLUENE
Chronic Hazard: YES
Signal Word: WARNING!

Acute Health Hazard-Moderate: X

Contact Hazard-Slight: X re Hazard-Moderate: X Reactivity Hazard-None: X

VAPOR/AEROSOL CONCENTRATIONS >1000 PPM IRRITATE EYES & RESPIRATORY TRACT. INGESTED:SMALL AMTS ASPIRATED INTO LUNGS MAY CAUSE MILD TO SEVERE PULMONARY INJURY. STORE AT AMBIENT TEMPERATURE. FIRST AID:EYE:FLUSH WITH WATER UNTIL IRRITATION SUBSIDES. SKIN:WASH WITH SOAP AND WATER. REMOVE CONTAMINATED CLOTHING AND LAUNDER BEFORE REUSE. INHALED:REMOVE THE VICTIM FROM EXPOSURE.

ADMINISTER ARTIFICIAL RESPIRATION IF BREATHING IS DIFFICULT/STOPPED.

INGESTION: DO NOT INDUCE VOMITING. GET PROMPT MEDICAL ATTENTION.

Protect Skin: Y

Protect Respiratory: Y

Label Name: EXXON CHEMICAL AMERICAS

Label P.O. Box: 3272 Label City: HOUSTON Label State: TX Label Zip Code: 7700

Label Zip Code: 77001 Label Country: US

Label Emergency Number: 713-870-6000/800-424-9300(CHEMTREC)

Back to chemicals



Temarry Products & Services

ALL CHEMICAL PRODUCTS MAY BE HAZARDOUS IF IMPROPERLY USED, HANDLED OR STORED. ALWAYS ENSURE THAT YOU HAVE CONSULTED THE ATEST MATERIAL SAFETY DATA SHEET (MSDS) FOR ANY CHEMICAL PRODUCT BEFORE USING, HANDLING OR STORING A CHEMICAL PRODUCT, AND THAT YOU ARE WEARING AND USING ALL APPROPRIATE SAFETY EQUIPMENT.

THE INFORMATION PRESENTED HEREIN, WHILE NOT GUARANTEED, WAS PREPARED BY TECHNICAL PERSONNEL AND IS TRUE AND ACCURATE TO THE BEST OF OUR KNOWLEDGE. NO WARRANTY OR GUARANTEE, EXPRESSED OR IMPLIED, IS MADE REGARDING PERFORMANCE, STABILITY OR OTHERWISE.

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PERFORMANCE CONSIDERATIONS. WHILE OUR TECHNICAL PERSONNEL WILL BE HAPPY TO RESPOND TO QUESTIONS REGARDING SAFE HANDLING AND USE PROCEDURES, SAFE HANDLING AND USE REMAINS THE RESPONSIBILITY OF THE CUSTOMER. NO SUGGESTIONS FOR USE ARE INTENDED AS, AND NOTHING HEREIN SHALL BE CONSTRUED AS, A RECOMMENDATION TO INFRINGE ANY EXISTING PATENTS OR TO VIOLATE ANY FEDERAL, STATE OR LOCAL LAWS.

\*\text{\text{ISDS Number: T4914 \* \* \* \* \* Effective Date: 05/08/03 \* \* \* \* \* Supercedes: 09/14/00



# Material Safety Data Sheet

From: Mallinckrodt Baker, inc. 222 Red School Lane Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151 CHEMTREC: 1-800-424-9300

National Response in Canada CANUTEC: 613-996-6666

Outside U.S. And Canada Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

# 1,1,1-TRICHLOROETHANE

# 1. Product Identification

Synonyms: Methyl chloroform; trichloroethane; chloroetene

**CAS No.:** 71-55-6

Molecular Weight: 133.40 Chemical Formula: CH3CCl3

Product Codes: 9435, 9437, W509, W510

# 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous	
Methyl Chloroform	71-55-6	96 ~ 100%	Yes	
Dioxane	123-91-1	< 3%	Yes	
1,2-Epoxybutane	106-88-7	< 0.5%	Yes	
Actual concentrations proprietary				

# **Hazards Identification**

**Emergency Overview** 

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, KIDNEYS, AND CARDIOVASCULAR SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. POSSIBLE CANCER HAZARD. CONTAINS DIOXANE WHICH MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.

# J.T. Baker SAF-T-DATA<sup>(tm)</sup> Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)

Flammability Rating: 1 - Slight Reactivity Rating: 1 - Slight Contact Rating: 2 - Moderate

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES

Storage Color Code: Blue (Health)

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# **Potential Health Effects**

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#### Inhalation:

Inhalation of vapors will irritate the respiratory tract. Affects the central nervous system. Symptoms include headache, dizziness, weakness, nausea. Higher levels of exposure (> 5000 ppm) can cause irregular heart beat, kidney and liver damage, fall in blood pressure, unconsciousness and even death.

# **Ingestion:**

Harmful if swallowed. Symptoms similar to inhalation will occur along with nausea, vomiting. Aspiration of material into the lungs can cause chemical pneumonitis which can be fatal. If aspirated, may be rapidly absorbed through the lungs and result in injury to other body systems.

#### **Skin Contact:**

Causes mild irritation and redness, especially on prolonged contact. Repeated contact may cause drying or flaking of the skin.

# **Eve Contact:**

Liquids and vapors cause irritation. Symptoms include tearing, redness, stinging, swelling.

# **Chronic Exposure:**

Prolonged or repeated skin contact may cause dermatitis. Chronic exposure may affect the kidneys and liver. Dioxane is a suspected human carcinogen based on animal data.

# **Aggravation of Pre-existing Conditions:**

Personnel with CNS, kidney, liver or heart disease may be more susceptible to the effects of this substance. Use of alcoholic beverages may aggravate symptoms.

# 4. First Aid Measures

#### **Inhalation:**

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

# Ingestion:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

#### **Skin Contact:**

In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician.

# **Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

# 5. Fire Fighting Measures

#### Fire:

Autoignition temperature: 500C (932F) Flammable limits in air % by volume:

lel: 7.0; uel: 16.0

Vapors in containers can explode if subjected to high energy source.

Dioxane has a flash point below 16C (60F).

# **Explosion:**

Can react with strong caustic, such as potash to form a flammable or explosive material. Air/vapor mixtures may explode when heated. Vapors can flow along surfaces to distant ignition source and flash back. Sealed containers may rupture when heated.

# Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire.

# **Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Combustion by-products include phosgene and hydrogen chloride gases. Structural firefighters' clothing provides only limited protection to the combustion products of this material.

# 6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! Do not use aluminum, magnesium or zinc metal for storage container. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

# 7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Containers of this material may be hazardous when empty since

they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. Do not use aluminum equipment or storage containers. Contact with aluminum parts in a pressurized fluid system may cause violent reactions.

# 8. Exposure Controls/Personal Protection

# Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):

350 ppm (TWA) for trichloroethane

100 ppm (TWA) skin for dioxane

-ACGIH Threshold Limit Value (TLV):

350 ppm (TWA), 450 ppm (STEL) for trichloroethane

20 ppm (TWA) skin, A3 - Animal Carcinogen for dioxane

# **Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

# Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). This substance has questionable warning properties. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.

#### **Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Viton is a recommended material for personal protective equipment.

# **Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

# 9. Physical and Chemical Properties

#### Appearance:

Clear, colorless liquid.

Odor:

Mild chloroform-like odor.

**Solubility:** 

4,400 ppm in water @ 20C (68F)

**Specific Gravity:** 

1.34 @ 20C/4C

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

**Boiling Point:** 

74C (165F)

**Melting Point:** 

-32C (-26F)

Vapor Density (Air=1):

4.63

Vapor Pressure (mm Hg):

100 @ 20C (68F)

**Evaporation Rate (BuAc=1):** 

12.8

# 10. Stability and Reactivity

# Stability:

Requires inhibitor content to prevent corrosion of metals. Slowly hydrolyzes in water to form hydrochloric and acetic acid.

# **Hazardous Decomposition Products:**

May produce carbon monoxide, carbon dioxide, hydrogen chloride and phosgene when heated to decomposition. Carbon dioxide and carbon monoxide may form when heated to decomposition.

# **Hazardous Polymerization:**

Hazardous polymerization can occur in contact with aluminum trichloride.

# **Incompatibilities:**

Open flames, welding arcs, nitrogen tetroxide, oxygen, liquid oxygen, sodium, sodium hydroxide, and sodium-potassium alloy, strong alkalis, oxidizers, aluminum and other reactive metals.

#### **Conditions to Avoid:**

Insufficient inhibitor, incompatibles, heat, flame and ignition sources

# 11. Toxicological Information

Oral rat LD50: 9600 mg/kg; inhalation rat LC50: 18000 ppm/4H; investigated as a mutagen, tumorigen, reproductive effector; irritation eye rabbit, Standard Draize, 2mg/24H severe.

\Cancer Lists\						
	NTP Carcinogen					
Ingredient	Known	Anticipated	IARC Category			
Methyl Chloroform (71-55-6)	No	No	3			
Dioxane (123-91-1)	No	Yes	2B			
1,2-Epoxybutane (106-88-7)	No	No	2B			

# 12. Ecological Information

### **Environmental Fate:**

When released into the soil, this material is not expected to biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released to water, this material is expected to quickly evaporate. This material is not expected to significantly bioaccumulate. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition. When released to the atmosphere, this material has an average global half-life of 6.0 - 6.9 years. When released into the air, this material may adversely affect the ozone layer.

# **Environmental Toxicity:**

This material is expected to be slightly toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/l.

# 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

# **५**4. Transport Information

Domestic (Land, D.O.T.)

**Proper Shipping Name:** 1,1,1-TRICHLOROETHANE

Hazard Class: 6.1 UN/NA: UN2831 Packing Group: III

Information reported for product/size: 20L

# 15. Regulatory Information

\Chemical Inventory Status - Part 1\					_
Ingredient		EC		Australia	
Methyl Chloroform (71-55-6)	Yes	Yes	Yes	Yes	
Dioxane (123-91-1)	Yes	Yes	Yes	Yes	
1,2-Epoxybutane (106-88-7)	Yes	Yes	Yes	Yes	
\Chemical Inventory Status - Part 2\	<b></b>	<b></b>	<b></b>		_
(4.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1			anada		
Ingredient	Korea	DSL	NDSL	Phil.	
<b>/</b>					
Methyl Chloroform (71-55-6)	Yes	Yes	No	Yes	
Dioxane (123-91-1)	Yes	Yes	No	Yes	

1,2-Epoxybutane (106-88-7)		Yes	Yes	No Ye	es
\Federal, State & International					
Ingredient	RQ			Chemical	
Methyl Chloroform (71-55-6)	No		Yes		
Dioxane (123-91-1)	No	No	Yes	No	
1,2-Epoxybutane (106-88-7)	No	No	Yes	No	
\Federal, State & International	Regulatio	ons -		 -TSCA-	
' Ingredient	CERCL	A		8 (d)	
Methyl Chloroform (71-55-6)	1000	-	U226		
Dioxane (123-91-1)	100		U108	No	
1,2-Epoxybutane (106-88-7)	100		No	No	
Chemical Weapons Convention: No TSCA	12(b): 1	Yes	CDTA:	No	
SARA 311/312: Acute: Yes Chronic: Y Reactivity: No (Mixture / Liquid		No P	ressure	No.	

#### **WARNING:**

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2[Z]

**Poison Schedule:** S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

# 16. Other Information

**NFPA Ratings:** Health: 2 Flammability: 1 Reactivity: 0

**Label Hazard Warning:** 

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, KIDNEYS, AND CARDIOVASCULAR SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. POSSIBLE CANCER HAZARD. CONTAINS DIOXANE WHICH MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.

# **Label Precautions:**

Avoid breathing vapor.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Avoid contact with eyes, skin and clothing.

#### Label First Aid:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of

water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician.

\*

**Product Use:** 

Laboratory Reagent.

**Revision Information:** 

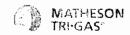
No Changes.

Disclaimer:

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**Prepared by:** Environmental Health & Safety Phone Number: (314) 654-1600 (U.S.A.)



# MATERIAL SAFETY DATA SHEET

# 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC. 959 ROUTE 46 EAST PARSIPPANY, NEW JERSEY 07054-0624 EMERGENCY CONTACT: CHEMTREC 1-800-424-9300 INFORMATION CONTACT:

973-257-1100

SUBSTANCE: TRICHLOROETHYLENE

# TRADE NAMES/SYNONYMS:

MTG MSDS 199; ACETYLENE TRICHLORIDE; ETHYLENE TRICHLORIDE; 1-CHLORO-2,2-DICHLOROETHYLENE; 1,1-DICHLORO-2-CHLOROETHYLENE; TCE; ETHINYL TRICHLORIDE; TRICHLOROETHENE; 1,1,2-TRICHLOROETHYLENE; 1,1,2-TRICHLOROETHENE; UN 1710; RCRA U228; C2HCl3; MAT23850; RTECS KX4550000

CHEMICAL FAMILY: halogenated, alkenes

CREATION DATE: Jan 24 1989 REVISION DATE: Sep 18 2003

# 2. COMPOSITION, INFORMATION ON INGREDIENTS

**COMPONENT: TRICHLOROETHYLENE** 

CAS NUMBER: 79-01-6 PERCENTAGE: >99

COMPONENT: INHIBITORS CAS NUMBER: Not assigned.

PERCENTAGE: <0.1

COMPONENT: AMINES CAS NUMBER: Not assigned.

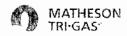
PERCENTAGE: <0.1

# 3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=1 REACTIVITY=0

**EMERGENCY OVERVIEW:** 





**COLOR:** colorless

PHYSICAL FORM: liquid

**ODOR:** sweet odor

MAJOR HEALTH HAZARDS: respiratory tract irritation, skin irritation, eye irritation, central nervous system depression, allergic reactions, cancer hazard (in humans)

PHYSICAL HAZARDS: May polymerize. Containers may rupture or explode. May decompose on contact with air, light, moisture, heat or storage and use above room temperature. Releases toxic, corrosive, flammable or explosive gases.

# POTENTIAL HEALTH EFFECTS:

### INHALATION:

SHORT TERM EXPOSURE: irritation, changes in blood pressure, nausea, vomiting, stomach pain, difficulty breathing, irregular heartbeat, headache, drowsiness, dizziness, disorientation, mood swings, tremors, loss of coordination, visual disturbances, bluish skin color, lung congestion, kidney damage, liver damage, unconsciousness, coma

LONG TERM EXPOSURE: same as effects reported in short term exposure, loss of appetite, weight loss, blood disorders, brain damage, cancer

SKIN CONTACT:

SHORT TERM EXPOSURE: irritation, allergic reactions

LONG TERM EXPOSURE: irritation, allergic reactions, nausea, loss of appetite, weight loss, difficulty breathing, headache, drowsiness, dizziness, joint pain, loss of coordination, visual disturbances, paralysis EYE CONTACT:

SHORT TERM EXPOSURE: irritation (possibly severe), blurred vision LONG TERM EXPOSURE: irritation (possibly severe), eye damage

**INGESTION:** 

SHORT TERM EXPOSURE: same as effects reported in short term inhalation LONG TERM EXPOSURE: same as effects reported in long term inhalation

# 4. FIRST AID MEASURES

**INHALATION:** If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

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

**EYE CONTACT:** Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

**INGESTION:** If vomiting occurs, keep head lower than hips to help prevent aspiration. If person is unconscious, turn head to side. Get medical attention immediately.

**NOTE TO PHYSICIAN:** For ingestion, consider gastric lavage. Consider oxygen.



# 5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Slight fire hazard.

EXTINGUISHING MEDIA: carbon dioxide, regular dry chemical

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: Cool containers with water spray until well after the fire is out. Stay away from the ends

of tanks. For tank, rail car or tank truck, evacuation radius: 800 meters (1/2 mile).

FLASH POINT: No data available.

**LOWER FLAMMABLE LIMIT:** 7.8% @ 100 C **UPPER FLAMMABLE LIMIT:** 52% @ 100 C

AUTOIGNITION: 770 F (410 C)

#### 6. ACCIDENTAL RELEASE MEASURES

#### AIR RELEASE:

Reduce vapors with water spray. Collect runoff for disposal as potential hazardous waste.

### **SOIL RELEASE:**

Dig holding area such as lagoon, pond or pit for containment. Dike for later disposal. Absorb with sand or other non-combustible material.

#### **WATER RELEASE:**

Absorb with activated carbon. Remove trapped material with suction hoses. Collect spilled material using mechanical equipment. Subject to California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). Keep out of water supplies and sewers.

# **OCCUPATIONAL RELEASE:**

Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. Small liquid spills: Absorb with sand or other non-combustible material. Large spills: Dike for later disposal. Remove sources of ignition. Keep unnecessary people away, isolate hazard area and deny entry. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

# 7. HANDLING AND STORAGE

**STORAGE:** Store and handle in accordance with all current regulations and standards. Store in a cool, dry place. Store in a well-ventilated area. Avoid heat, flames, sparks and other sources of ignition. Keep separated from incompatible substances.



# 8. EXPOSURE CONTROLS, PERSONAL PROTECTION

# **EXPOSURE LIMITS:**

# TRICHLOROETHYLENE:

100 ppm OSHA TWA

200 ppm OSHA ceiling

300 ppm OSHA peak (5 minutes in any 2 hours)

50 ppm (269 mg/m3) OSHA TWA (vacated by 58 FR 35338, June 30, 1993)

200 ppm (1070 mg/m3) OSHA STEL (vacated by 58 FR 35338, June 30, 1993)

50 ppm ACGIH TWA

100 ppm ACGIH STEL

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

**EYE PROTECTION:** Wear splash resistant safety goggles. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

**CLOTHING:** Wear appropriate chemical resistant clothing.

**GLOVES:** Wear appropriate chemical resistant gloves.

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

# At any detectable concentration -

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 full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

# Escape -

Any air-purifying respirator with a full facepiece and an organic vapor canister.

Any appropriate escape-type, self-contained breathing apparatus.

# For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Any self-contained breathing apparatus with a full facepiece.

# 9. PHYSICAL AND CHEMICAL PROPERTIES

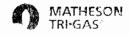
PHYSICAL STATE: liquid

COLOR: colorless ODOR: sweet odor

**MOLECULAR WEIGHT: 131.39** 

MOLECULAR FORMULA: CI-C-H-C-C12





**BOILING POINT:** 189 F (87 C) **FREEZING POINT:** -99 F (-73 C)

VAPOR PRESSURE: 58 mmHg @ 20 C

VAPOR DENSITY (air=1): 4.53

SPECIFIC GRAVITY (water=1): 1.4642

**WATER SOLUBILITY: 0.1%** 

PH: Not available

VOLATILITY: Not available ODOR THRESHOLD: 21 ppm

**EVAPORATION RATE:** 0.69 (carbon tetrachloride=1)

**COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available** 

**SOLVENT SOLUBILITY:** 

Soluble: alcohol, ether, acetone, chloroform, benzene, vegetable oils

# 10. STABILITY AND REACTIVITY

**REACTIVITY:** May decompose on contact with air, light, moisture, heat or storage and use above room temperature. Releases toxic, corrosive, flammable or explosive gases.

**CONDITIONS TO AVOID:** Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat.

INCOMPATIBILITIES: bases, metals, combustible materials, oxidizing materials

# **HAZARDOUS DECOMPOSITION:**

Thermal decomposition products: phosgene, halogenated compounds, oxides of carbon

**POLYMERIZATION:** May polymerize. Avoid contact with heat or light and monitor inhibitor content.

# 11. TOXICOLOGICAL INFORMATION

### TRICHLOROETHYLENE:

# **IRRITATION DATA:**

2 mg/24 hour(s) skin-rabbit severe; 20 mg/24 hour(s) eyes-rabbit moderate

#### **TOXICITY DATA:**

8450 ppm/4 hour(s) inhalation-mouse LC50; >20 gm/kg skin-rabbit LD50; 4920 mg/kg oral-rat LD50 **CARCINOGEN STATUS:** NTP: Anticipated Human Carcinogen; IARC: Human Limited Evidence, Animal Sufficient Evidence, Group 2A; ACGIH: A5 -Not Suspected as a Human Carcinogen

**LOCAL EFFECTS:** 

Irritant: inhalation, skin, eye
ACUTE TOXICITY LEVEL:
Moderately Toxic: ingestion
Slightly Toxic: inhalation

TARGET ORGANS: immune system (sensitizer), central nervous system MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: heart problems



TUMORIGENIC DATA: Available. MUTAGENIC DATA: Available.

REPRODUCTIVE EFFECTS DATA: Available.

ADDITIONAL DATA: May cross the placenta. Stimulants such as epinephrine may induce ventricular

fibrillation.

# 12. ECOLOGICAL INFORMATION

### **ECOTOXICITY DATA:**

FISH TOXICITY: 3100 ug/L 96 hour(s) LC50 (Mortality) Flagfish (Jordanella floridae)

**INVERTEBRATE TOXICITY:** 1700 ug/L 7 hour(s) EC50 (Regeneration) Flatworm (Dugesia japonica)

OTHER TOXICITY: 45000 ug/L 48 week(s) LC50 (Mortality) Clawed toad (Xenopus laevis)

# **FATE AND TRANSPORT:**

BIOCONCENTRATION: 17 ug/L 1-14 hour(s) BCF (Residue) Bluegill (Lepomis macrochirus) 8.23 ug/L

# 13. DISPOSAL CONSIDERATIONS

Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): U228. Hazardous Waste Number(s): D040. Dispose of in accordance with U.S. EPA 40 CFR 262 for concentrations at or above the Regulatory level. Regulatory level- 0.5 mg/L. Dispose in accordance with all applicable regulations.

#### 14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:

PROPER SHIPPING NAME: Trichloroethylene

ID NUMBER: UN1710

HAZARD CLASS OR DIVISION: 6.1

PACKING GROUP: III

**LABELING REQUIREMENTS: 6.1** 

# CANADIAN TRANSPORTATION OF DANGEROUS GOODS:

SHIPPING NAME: Trichloroethylene

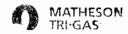
**UN NUMBER: UN1710** 

**CLASS: 6.1** 

PACKING GROUP/RISK GROUP: III

# 15. REGULATORY INFORMATION





# **U.S. REGULATIONS:**

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4): TRICHLOROETHYLENE: 100 LBS RQ

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30): Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.40): Not regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370.21):

ACUTE: Yes CHRONIC: Yes FIRE: No

REACTIVE: No

SUDDEN RELEASE: No

SARA TITLE III SECTION 313 (40 CFR 372.65): TRICHLOROETHYLENE

OSHA PROCESS SAFETY (29CFR1910.119): Not regulated.

# **STATE REGULATIONS:**

California Proposition 65:

Known to the state of California to cause the following:

TRICHLOROETHYLENE

Cancer (Apr 01, 1988)

# CANADIAN REGULATIONS:

WHMIS CLASSIFICATION: D2

# **NATIONAL INVENTORY STATUS:**

U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CANADA INVENTORY (DSL/NDSL): Not determined.

### 16. OTHER INFORMATION

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# MATERIAL SAFETY DATA SHEET

# 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC.

**959 ROUTE 46 EAST** 

PARSIPPANY, NEW JERSEY 07054-0624

**EMERGENCY CONTACT:** 

CHEMTREC 1-800-424-9300

**INFORMATION CONTACT:** 

973-257-1100

SUBSTANCE: VINYL CHLORIDE

#### TRADE NAMES/SYNONYMS:

MTG MSDS 97; 1-CHLOROETHYLENE; 1-CHLOROETHENE; CHLOROETHYLENE; CHLOROETHENE; CHLORETHENE; CHLORETHYLENE; ETHYLENE MONOCHLORIDE; MONOCHLOROETHYLENE; MONOCHLOROETHENE; WINYL CHLORIDE MONOMER; VINYL CHLORIDE, INHIBITED; VINYL C MONOMER; RCRA U043; UN 1086; C2H3CI; MAT24940; RTECS KU9625000

CHEMICAL FAMILY: halogenated, aliphatic

**CREATION DATE:** Jan 24 1989 **REVISION DATE:** Dec 15 2003

# 2. COMPOSITION, INFORMATION ON INGREDIENTS

**COMPONENT:** VINYL CHLORIDE

CAS NUMBER: 75-01-4 PERCENTAGE: >99.9

COMPONENT: PHENOL CAS NUMBER: 108-95-2 PERCENTAGE: <0.1

**COMPONENT:** INHIBITORS **CAS NUMBER:** Not assigned.

PERCENTAGE: <0.1

# 3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=4 REACTIVITY=1





# **EMERGENCY OVERVIEW:**

COLOR: colorless PHYSICAL FORM: gas

ODOR: faint odor, sweet odor

MAJOR HEALTH HAZARDS: harmful if swallowed, skin irritation, eye irritation, central nervous system

depression, cancer hazard (in humans)

PHYSICAL HAZARDS: Flammable gas. May cause flash fire. May polymerize. Containers may rupture or

explode.

#### POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EXPOSURE: irritation, nausea, difficulty breathing, irregular heartbeat, headache, drowsiness, discrientation, joint pain, loss of coordination, hearing loss, lung congestion LONG TERM EXPOSURE: impotence, bluish skin color, blood disorders, liver damage, cancer

**SKIN CONTACT:** 

SHORT TERM EXPOSURE: irritation, blisters LONG TERM EXPOSURE: irritation, blisters

**EYE CONTACT:** 

SHORT TERM EXPOSURE: irritation, eye damage LONG TERM EXPOSURE: irritation, eye damage

**INGESTION:** 

SHORT TERM EXPOSURE: frostbite LONG TERM EXPOSURE: cancer

# 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 CONTACT:** If frostbite or freezing occur, immediately flush with plenty of lukewarm water (105-115 F; 41-46 C). DO NOT USE HOT WATER. If warm water is not available, gently wrap affected parts in blankets. Get immediate medical attention.

**EYE CONTACT:** Wash eyes immediately with large amounts of water, occasionally lifting upper and lower lids, until no evidence of chemical remains. Get medical attention immediately.

**INGESTION:** If a large amount is swallowed, get medical attention.

NOTE TO PHYSICIAN: For inhalation, consider oxygen.

### 5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Severe fire hazard. Severe explosion hazard. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back. Vapor/air mixtures are



explosive. Electrostatic discharges may be generated by flow or agitation resulting in ignition or explosion.

**EXTINGUISHING MEDIA:** carbon dioxide, regular dry chemical

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk. 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: Stop leak if possible without personal risk. Let burn unless leak can be stopped immediately. For smaller tanks or cylinders, extinguish and isolate from other flammables. 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. Cool containers with water spray until well after the fire is out. 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. Evacuate if fire gets out of control or containers are directly exposed to fire. Evacuation radius: 500 meters (1/3 mile). Consider downwind evacuation if material is leaking.

FLASH POINT: -108 F (-78 C) (CC) LOWER FLAMMABLE LIMIT: 3.6% UPPER FLAMMABLE LIMIT: 33% AUTOIGNITION: 882 F (472 C)

# 6. ACCIDENTAL RELEASE MEASURES

### **WATER RELEASE:**

Subject to California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). Keep out of water supplies and sewers.

#### **OCCUPATIONAL RELEASE:**

Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Keep unnecessary people away, isolate hazard area and deny entry. Remove sources of ignition. Ventilate closed spaces before entering. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

#### 7. HANDLING AND STORAGE

**STORAGE:** Store and handle in accordance with all current regulations and standards. Protect from physical damage. Store outside or in a detached building. Inside storage: Store in a cool, dry place. Store in a well-ventilated area. Avoid heat, flames, sparks and other sources of ignition. Grounding and bonding required. Subject to storage regulations: U.S. OSHA 29 CFR 1910.101. See original container for storage recommendations. Keep separated from incompatible substances.



# 8. EXPOSURE CONTROLS, PERSONAL PROTECTION

# EXPOSURE LIMITS: VINYL CHLORIDE:

1.0 ppm OSHA TWA 5 ppm OSHA ceiling 15 minute(s) 0.5 ppm OSHA action level 1 ppm ACGIH TWA

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

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

**CLOTHING:** Wear appropriate chemical resistant clothing.

**GLOVES:** For the gas: Wear appropriate chemical resistant gloves. For the liquid: Wear insulated gloves. OSHA REGULATED SUBSTANCES: U.S. OSHA 29 CFR 1910.1017.

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

# 10 p/m

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode.

Any chemical cartridge respirator with cartridge(s) providing protection against this substance.

# 25 p/m

Any powered, air-purifying respirator with a tight-fitting facepiece and cartridge(s) providing protection against this substance.

Any air-purifying respirator with a full facepiece, a canister providing protection against this substance, and a high-efficiency particulate filter.

### 100 p/m

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

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.

#### 1000 p/m

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Any supplied-air respirator operated in a continuous-flow mode.

Any supplied-air respirator with a full facepiece.



Any supplied-air respirator operated in a continuous-flow mode.

### 3600 p/m

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

# For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

# 9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: gas

**COLOR:** colorless

ODOR: faint odor, sweet odor MOLECULAR WEIGHT: 62.50

**MOLECULAR FORMULA: C-H2-C-H-C1** 

**BOILING POINT:** 9 F (-13 C) **FREEZING POINT:** -245 F (-154 C)

VAPOR PRESSURE: 2515.6 mmHg @ 21.1 C

VAPOR DENSITY (air=1): 2.2

SPECIFIC GRAVITY (water=1): 0.9106

**WATER SOLUBILITY: 0.25%** 

PH: Not applicable

**VOLATILITY:** Not applicable **ODOR THRESHOLD:** 260 ppm

**EVAPORATION RATE:** Not applicable

VISCOSITY: 0.01072 cP @ 20 C

**COEFFICIENT OF WATER/OIL DISTRIBUTION:** Not applicable

SOLVENT SOLUBILITY:

Soluble: alcohol, ether, carbon tetrachloride, benzene

# 10. STABILITY AND REACTIVITY

**REACTIVITY:** May polymerize. Avoid contact with light or storage and use above room temperature.

**CONDITIONS TO AVOID:** Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat.

**INCOMPATIBILITIES:** metal carbide, metals, oxidizing materials, peroxides

#### HAZARDOUS DECOMPOSITION:

Thermal decomposition products: halogenated compounds, oxides of carbon, phosgene

**POLYMERIZATION:** May polymerize. Avoid contact with heat, light, air, water or incompatible materials. Closed containers may rupture violently.



# 11. TOXICOLOGICAL INFORMATION

### VINYL CHLORIDE:

# **TOXICITY DATA:**

18 pph/15 minute(s) inhalation-rat LC50; 500 mg/kg oral-rat LD50

CARCINOGEN STATUS: OSHA: Carcinogen; NTP: Known Human Carcinogen; IARC: Human Sufficient Evidence, Animal Sufficient Evidence, Group 1; ACGIH: A1 -Confirmed Human Carcinogen;

EC: Category 1
LOCAL EFFECTS:

Irritant: skin, eye

**ACUTE TOXICITY LEVEL:** 

Toxic: ingestion

Relatively Non-toxic: inhalation

TARGET ORGANS: central nervous system

TUMORIGENIC DATA: Available. MUTAGENIC DATA: Available.

**REPRODUCTIVE EFFECTS DATA:** Available.

ADDITIONAL DATA: Stimulants such as epinephrine may induce ventricular fibrillation. May cause birth

defects.

# 12. ECOLOGICAL INFORMATION

#### **ECOTOXICITY DATA:**

FISH TOXICITY: 388000 ug/L 10 month(s) LETH (Mortality) Northern pike (Esox lucius)

INVERTEBRATE TOXICITY: 41.74 ug/L 72 day(s) (Residue) Mosquito (Culex pipiens quinquefasciata)

ALGAL TOXICITY: 41.74 ug/L 72 day(s) (Residue) Green algae (Oedogonium cardiacum)

# 13. DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations. Hazardous Waste Number(s): D043. Dispose of in accordance with U.S. EPA 40 CFR 262 for concentrations at or above the Regulatory level. Regulatory level- 0.2 mg/L. U043.

# 14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:

PROPER SHIPPING NAME: Vinyl chloride, stabilized

**ID NUMBER: UN1086** 

HAZARD CLASS OR DIVISION: 2.1 LABELING REQUIREMENTS: 2.1





**QUANTITY LIMITATIONS:** 

PASSENGER AIRCRAFT OR RAILCAR: Forbidden

CARGO AIRCRAFT ONLY: 150 kg

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:

SHIPPING NAME: Vinyl chloride, stabilized

**UN NUMBER: UN1086** 

**CLASS: 2.1** 

# 15. REGULATORY INFORMATION

# **U.S. REGULATIONS:**

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):

Vinyl chloride: 1 LBS RQ PHENOL: 1000 LBS RQ

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.30): Not

regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355.40): Not

regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370.21):

ACUTE: Yes CHRONIC: Yes FIRE: Yes

**REACTIVE: Yes** 

SUDDEN RELEASE: Yes

# SARA TITLE III SECTION 313 (40 CFR 372.65):

Vinyl chloride

OSHA PROCESS SAFETY (29CFR1910.119): Not regulated.

# **STATE REGULATIONS:**

**California Proposition 65:** 

Known to the state of California to cause the following:

Vinyl chloride

Cancer (Feb 27, 1987)

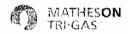
# **CANADIAN REGULATIONS:**

WHMIS CLASSIFICATION: ABD2

# NATIONAL INVENTORY STATUS:

U.S. INVENTORY (TSCA): Listed on inventory.





TSCA 12(b) EXPORT NOTIFICATION:

**PHENOL** 

CAS NUMBER: 108-95-2

**SECTION 4** 

CANADA INVENTORY (DSL/NDSL): Not determined.

16. OTHER INFORMATION

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MSDS Number: **T4940** \* \* \* \* \* \* Effective Date: 05/08/03 \* \* \* \* \* \* Supercedes: 09/14/00



#### Material Safety Data Sheet

From: Mailinckrodt Baker, Inc. 222 Red School Lane Phillipsburg, NJ 08865





24 Hour Emergency Telephone: 908-859-2151 CHEMTREC: 1-800-424-9300

National Response in Canada CANUTEC: 613-896-6666

Outside U.S. and Canada Chemtree: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill leak, fire, exposure or adolders involving greenicals.

All non-emergency cuestions should be directed to Customer Service (1 800-582-2537) for assistance.

# **TRICHLOROETHYLENE**

### 1. Product Identification

Synonyms: Trichloroethene; TCE; acetylene trichloride; Ethinyl trichloride

CAS No.: 79-01-6

Molecular Weight: 131.39 Chemical Formula: C2HCl3

**Product Codes:** 

J.T. Baker: 5376, 9454, 9458, 9464, 9473, 9474

Mallinckrodt: 8598, 8600, 8633

# 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Trichloroethylene	79-01-6	100%	Yes

# 3. Hazards Identification

**Emergency Overview** 

WARNING! HARMFUL IF SWALLOWED OR INHALED. AFFECTS HEART, CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. CAUSES SEVERE SKIN IRRITATION. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

# J.T. Baker SAF-T-DATA<sup>(tm)</sup> Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)

Flammability Rating: 1 - Slight Reactivity Rating: 1 - Slight Contact Rating: 2 - Moderate

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER

GLOVES

Storage Color Code: Blue (Health)

-----

#### **Potential Health Effects**

#### Inhalation:

Vapors can irritate the respiratory tract. Causes depression of the central nervous system with symptoms of visual disturbances and mental confusion, incoordination, headache, nausea, euphoria, and dizziness. Inhalation of high concentrations could cause unconsciousness, heart effects, liver effects, kidney effects, and death.

#### **Ingestion:**

Cases irritation to gastrointestinal tract. May also cause effects similar to inhalation. May cause coughing, abdominal pain, diarrhea, dizziness, pulmonary edema, unconsciousness. Kidney failure can result in severe cases. Estimated fatal dose is 3-5 ml/kg.

#### **Skin Contact:**

Cause irritation, redness and pain. Can cause blistering. Continued skin contact has a defatting action and can produce rough, dry, red skin resulting in secondary infection.

#### **Eve Contact:**

Vapors may cause severe irritation with redness and pain. Splashes may cause eye damage.

#### **Chronic Exposure:**

Chronic exposures may cause liver, kidney, central nervous system, and peripheral nervous system effects. Workers chronically exposed may exhibit central nervous system depression, intolerance to alcohol, and increased cardiac output. This material is linked to mutagenic effects in humans. This material is also a suspect carcinogen.

#### **Aggravation of Pre-existing Conditions:**

Persons with pre-existing skin disorders, cardiovascular disorders, impaired liver or kidney or respiratory function, or central or peripheral nervous system disorders may be more susceptible to the effects of the substance.

### 4. First Aid Measures

#### Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

#### **Ingestion:**

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Call a physician.

#### **Skin Contact:**

Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

#### **Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

#### Note to Physician:

Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.

# 5. Fire Fighting Measures

#### Fire:

Autoignition temperature: 420C (788F) Flammable limits in air % by volume:

lel: 8; uel: 12.5 **Explosion:** 

A strong ignition source, e. g., a welding torch, can produce ignition. Sealed containers may rupture when heated

#### Fire Extinguishing Media:

Use water spray to keep fire exposed containers cool. If substance does ignite, use CO2, dry chemical or foam.

#### **Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Combustion by-products include phosgene and hydrogen chloride gases. Structural firefighters' clothing provides only limited protection to the combustion products of this material.

# 6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

# 7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Isolate from incompatible substances. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

# 8. Exposure Controls/Personal Protection

#### **Airborne Exposure Limits:**

Trichloroethylene:

-OSHA Permissible Exposure Limit (PEL):

100 ppm (TWA), 200 ppm (Ceiling),

300 ppm/5min/2hr (Max)

-ACGIH Threshold Limit Value (TLV):

50 ppm (TWA) 100 ppm (STEL);

listed as A5, not suspected as a human carcinogen.

#### Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation*, *A Manual of Recommended Practices*, most recent edition, for details.

#### Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). This substance has poor warning properties. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.

#### **Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Neoprene is a recommended material for personal protective equipment.

#### **Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

# 9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Chloroform-like odor.

**Solubility:** 

Practically insoluble in water. Readily miscible in organic solvents.

#### **Specific Gravity:**

1.47 @ 20C/4C

#### pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

#### **Boiling Point:**

87C (189F)

#### **Melting Point:**

-73C (-99F)

#### Vapor Density (Air=1):

4.5

#### Vapor Pressure (mm Hg):

57.8 @ 20C (68F)

#### Evaporation Rate (BuAc=1):

No information found.

# 10. Stability and Reactivity

#### Stability:

Stable under ordinary conditions of use and storage. Will slowly decompose to hydrochloric acid when exposed to light and moisture.

#### **Hazardous Decomposition Products:**

May produce carbon monoxide, carbon dioxide, hydrogen chloride and phosgene when heated to decomposition.

#### **Hazardous Polymerization:**

Will not occur.

#### **Incompatibilities:**

Strong caustics and alkalis, strong oxidizers, chemically active metals, such as barium, lithium, sodium, magnesium, titanium and beryllium, liquid oxygen.

#### **Conditions to Avoid:**

Heat, flame, ignition sources, light, moisture, incompatibles

# 11. Toxicological Information

#### **Toxicological Data:**

Trichloroethylene: Oral rat LD50: 5650 mg/kg; investigated as a tumorigen, mutagen, reproductive effector.

#### Reproductive Toxicity:

This material has been linked to mutagenic effects in humans.

-	\Cancer	Lists\			
			<b>NT</b> P	Carcinogen	
	Ingredient		Known	Anticipated	IARC Category
,	'				

Trichloroethylene (79-01-6)

No

Yes

2A

# 12. Ecological Information

#### **Environmental Fate:**

When released into the soil, this material may leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released to water, this material is expected to quickly evaporate. This material has an experimentally-determined bioconcentration factor (BCF) of less than 100. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days.

#### **Environmental Toxicity:**

The LC50/96-hour values for fish are between 10 and 100 mg/l. This material is expected to be slightly toxic to aquatic life.

# 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

# 14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: TRICHLOROETHYLENE

Hazard Class: 6.1 UN/NA: UN1710 Packing Group: III

Information reported for product/size: 4L

International (Water, I.M.O.)

**Proper Shipping Name:** TRICHLOROETHYLENE

Hazard Class: 6.1 UN/NA: UN1710 Packing Group: III

Information reported for product/size: 4L

# 15. Regulatory Information

_	\Chemical	Inventory S	status - Pa	rt 1\					
	Ingredient	_			TSCA	EC	Japan	Austral	ia
	Trichloroethylene							Yes	
	\Chemical	Inventory S	tatus - Pa	rt 2\					<del>-</del>
	Ingredient					DSL		Phil.	
	Trichloroethylene						No		
	\Federal,	State & Int	ernational	-				A 313	
	Ingredient			RQ	TPQ	Lis	st Che	nical Cat	tg.
	Trichloroethylene						8		
	\Federal,	State & Int	ernational	Regulation			2\		
	Ingredient			CERCL	A 2	261.33	8	(d)	
	Trichloroethylene						No		
SA	emical Weapons Con RA 311/312: Acute activity: No	e: Yes	Chronic: Ye						

#### **WARNING:**

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: None allocated.

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

## 16. Other Information

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

Label Hazard Warning:

WARNING! HARMFUL IF SWALLOWED OR INHALED. AFFECTS HEART, CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. CAUSES SEVERE SKIN IRRITATION. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

**Label Precautions:** 

Do not get in eyes, on skin, or on clothing.

Do not breathe vapor.

Keep container closed.

Use only with adequate ventilation. Wash thoroughly after handling. Keep away from heat and flame.

#### Label First Aid:

If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician. Note to physician: Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.

**Product Use:** 

Laboratory Reagent.

**Revision Information:** 

No Changes.

Disclaimer:

\*\*\*\*\*

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**Prepared by:** Environmental Health & Safety Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: T0767 \* \* \* \* \* Effective Date: 05/08/03 \* \* \* \* \* Supercedes: 08/02/00



### Material Safety Data Sheet

From: Mailinckrodt Baker, Inc. 222 Red School Lane Philipsburg, NJ 08865





24 Hour Emergency Telephone: 908-859-2151 CHEMTREC 1-800-424-9300

National Response in Canada CANUTEC: 613-896-6666

Outside U.S. and Canada Chemtree: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Cerner emergency numbers to be used only in the event of chemical emergencies involving a spit, leak, the, exposure or secrets involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

# **TETRACHLOROETHYLENE**

# 1. Product Identification

Synonyms: ethylene tetrachloride; tetrachloroethene; perchloroethylene; carbon bichloride; carbon

dichloride

CAS No.: 127-18-4

Molecular Weight: 165.83 Chemical Formula: Cl2C:CCl2

**Product Codes:** 

J.T. Baker: 9218, 9360, 9453, 9465, 9469

Mallinckrodt: 1933, 8058

# 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Tetrachloroethylene	127-18-4	99 - 100%	Yes

# 3. Hazards Identification

**Emergency Overview** 

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

# J.T. Baker SAF-T-DATA<sup>(tm)</sup> Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)

Flammability Rating: 0 - None Reactivity Rating: 1 - Slight Contact Rating: 2 - Moderate

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER

**GLOVES** 

Storage Color Code: Blue (Health)

\_\_\_\_\_\_

#### **Potential Health Effects**

#### Inhalation:

Irritating to the upper respiratory tract. Giddiness, headache, intoxication, nausea and vomiting may follow the inhalation of large amounts while massive amounts can cause breathing arrest, liver and kidney damage, and death. Concentrations of 600 ppm and more can affect the central nervous system after a few minutes.

#### **Ingestion:**

Not highly toxic by this route because of low water solubility. Used as an oral dosage for hookworm (1 to 4 ml). Causes abdominal pain, nausea, diarrhea, headache, and dizziness.

#### **Skin Contact:**

Causes irritation to skin. Symptoms include redness, itching, and pain. May be absorbed through the skin with possible systemic effects.

#### **Eve Contact:**

Causes irritation, redness, and pain.

#### **Chronic Exposure:**

May cause liver, kidney or central nervous system damage after repeated or prolonged exposures.

Suspected cancer risk from animal studies.

#### **Aggravation of Pre-existing Conditions:**

Persons with pre-existing skin disorders or eye problems or impaired liver or kidney function may be more susceptible to the effects of the substance. The use of alcoholic beverages enhances the toxic effects.

# 4. First Aid Measures

#### Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

#### **Ingestion:**

Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

#### **Skin Contact:**

Wash skin with soap or mild detergent and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician.

#### **Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

#### Note to Physician:

Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.

# 5. Fire Fighting Measures

#### Fire:

Not considered to be a fire hazard but becomes hazardous in a fire situation because of vapor generation and possible degradation to phosgene (highly toxic) and hydrogen chloride (corrosive). Vapors are heavier than air and collect in low-lying areas.

#### **Explosion:**

Not considered to be an explosion hazard. Containers may explode when involved in a fire.

#### Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire. Water spray may be used to keep fire exposed containers cool.

#### **Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

# 6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

# 7. Handling and Storage

Store in a cool, dry, ventilated area away from sources of heat or ignition. Isolate from flammable materials. Protect from direct sunlight. Wear special protective equipment (Sec. 8) for maintenance breakin or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in

workplace. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

# 8. Exposure Controls/Personal Protection

#### **Airborne Exposure Limits:**

-OSHA Permissible Exposure Limit (PEL):

100 ppm (TWA), 200 ppm (ceiling),

300 ppm/5min/3-hour (max)

-ACGIH Threshold Limit Value (TLV):

25 ppm (TWA), 100 ppm (STEL); listed as A3, animal carcinogen

#### **Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation*, *A Manual of Recommended Practices*, most recent edition, for details.

#### Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus.

#### **Skin Protection:**

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

#### **Eye Protection:**

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

# 9. Physical and Chemical Properties

#### Appearance:

Clear, colorless liquid.

Odor:

Ethereal odor.

**Solubility:** 

0.015 g in 100 g of water.

**Specific Gravity:** 

1.62 @ 20C/4C

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

**Boiling Point:** 

121C (250F)

**Melting Point:** 

-19C (-2F)

Vapor Density (Air=1): 5.7 Vapor Pressure (mm Hg): 18 @ 25C (77F) Evaporation Rate (BuAc=1): 0.33 (trichloroethylene = 1)

# 10. Stability and Reactivity

#### **Stability:**

Stable under ordinary conditions of use and storage. Slowly decomposed by light. Deteriorates rapidly in warm, moist climates.

#### **Hazardous Decomposition Products:**

Carbon dioxide and carbon monoxide may form when heated to decomposition. Hydrogen chloride gas and phosgene gas may be formed upon heating. Decomposes with moisture to yield trichloroacetic acid and hydrochloric acid.

#### **Hazardous Polymerization:**

Will not occur.

#### **Incompatibilities:**

Strong acids, strong oxidizers, strong alkalis, especially NaOH, KOH; finely divided metals, especially zinc, barium, lithium. Slowly corrodes aluminum, iron and zinc.

#### **Conditions to Avoid:**

Moisture, light, heat and incompatibles.

# 11. Toxicological Information

Oral rat LD50: 2629 mg/kg; inhalation rat LC50: 34.2 g/m3/8H; investigated as a tumorigen, mutagen, reproductive effector.

\Cancer Lists\			
	<b>-NT</b> P	Carcinogen	
Ingredient	Known	Anticipated	IARC Category
Tetrachloroethylene (127-18-4)	No	Yes	2A

# 12. Ecological Information

#### **Environmental Fate:**

When released into the soil, this material is expected to quickly evaporate. When released into the soil, this material may leach into groundwater. When released into the soil, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. When released into water, this material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with

photochemically produced hydroxyl radicals.

#### **Environmental Toxicity:**

The LC50/96-hour values for fish are between 1 and 10 mg/l. The LC50/96-hour values for fish are between 10 and 100 mg/l. This material is expected to be toxic to aquatic life.

# 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

# 14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: TETRACHLOROETHYLENE

Hazard Class: 6.1 UN/NA: UN1897 Packing Group: III

Information reported for product/size: 20L

International (Water, I.M.O.)

**Proper Shipping Name:** TETRACHLOROETHYLENE

Hazard Class: 6.1 UN/NA: UN1897 Packing Group: III

Information reported for product/size: 20L

# 15. Regulatory Information

\Chemical Inventory Status - Part 1\ Ingredient	TSCA	EC	Japan	
Tetrachloroethylene (127-18-4)	Yes	Yes	Yes	Yes
\Chemical Inventory Status - Part 2\			anada	
Ingredient	Korea	_		Phil.
Tetrachloroethylene (127-18-4)	Yes	Yes	No	Yes
\Federal, State & International Regulation	ions - :	Part	1\	

	Ingredient	-SARA RQ	302- TPQ		SARA 313 Chemical Catg.
	Tetrachloroethylene (127-18-4)	No	No	Yes	No
	\Federal, State & International Reg	gulatio		Part 2\	
	Ingredient	CERCL	A 2	261.33	8 (d)
	Tetrachloroethylene (127-18-4)	100	τ	J210	No
S	nemical Weapons Convention: No TSCA 12( ARA 311/312: Acute: Yes Chronic: Yes eactivity: No (Pure / Liquid)			CDTA: N	=

#### **WARNING:**

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2[Z] Poison Schedule: None allocated.

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

# 16. Other Information

NFPA Ratings: Health: 2 Flammability: 0 Reactivity: 0

Label Hazard Warning:

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

#### **Label Precautions:**

Do not get in eyes, on skin, or on clothing.

Do not breathe vapor or mist.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

#### Label First Aid:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician.

#### **Product Use:**

Laboratory Reagent.

#### **Revision Information:**

No Changes.

Disclaimer:

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Prepared by: Environmental Health & Safety Phone Number: (314) 654-1600 (U.S.A.)

# APPENDIX B RELEVANT JOB SAFETY ANALYSIS FORMS

ACTIVITY HAZARD	ACTIVITY HAZARD ANALYSIS FOR GROUNDY	UNDWATER SAMPLING		
AIR MONITORING: MINIMUM PPE REQ	Ambient air monitoring UIREMENTS: LEVEL	AIR MONITORING: Ambient air monitoring should be conducted during activities MINIMUM PPE REQUIREMENTS: LEVEL D (Safety Glasses, Gloves, Steel-toe Boots)		
Task Breakdown	Potential Hazards	Hazard Control Measures	Personal Protective Equipment	Air Monitoring Devices
Groundwater Sampling	Inhalation & Contact with Hazardous Substances	Provide workers proper skin, eye, respiratory & splash protection based on the exposure hazards present	Nitrile gloves	PID
		<ul> <li>Review hazardous properties of site contaminants</li> <li>Avoid contact with contaminated groundwater</li> </ul>		
	Electrical Shock	De-energize or shut off utility lines at their source before work begins, if necessary		
		Use double insulated or properly grounded electric power-operated tools     Maintain fools in a sefe condition		
		Provide an equipment-grounding conductor program     or emolov ground-fault circuit interrupters		
		<ul> <li>Inspect all extension cords daily for structural integrity, ground continuity, and damaged insulation</li> </ul>		
		<ul> <li>Cover or elevate electric wire or flexible cord passing through work areas to protect from damage</li> </ul>		
		<ul> <li>Keep all plugs and receptacles out of water</li> <li>Use approved water-proof, weather-proof type if</li> </ul>		
	_	exposure to moisture is likely		
		<ul> <li>Inspect all electrical power circuits prior to commencing work</li> </ul>		
		Follow Lockout-Tagout procedures in accordance with Apex's Health and Safety Procedures		_

ACTIVITY HAZARD	ANALYSIS FOR GROU	ACTIVITY HAZARD ANALYSIS FOR GROUNDWATER SAMPLING		
AIR MONITORING:	Ambient air monitoring	AIR MONITORING: Ambient air monitoring should be conducted during activities MINIMUM PPE REQUIREMENTS: LEVEL D (Safety Glasses, Gloves, Steel-toe Boots)		
Task Breakdown	Potential Hazards	Hazard Control Measures	Personal Protective Equipment	Air Monitoring Devices
	Slips, Trips, Falls	<ul> <li>Clear walkways, work areas of equipment, ground debris, tools, and other materials</li> <li>Mark, identify, or barricade other obstructions</li> <li>Clean up spills immediately</li> </ul>		
Groundwater	Fires	<ul> <li>Eliminate sources of ignition from the work area</li> <li>Prohibit smoking</li> <li>Provide ABC (or equivalent) fire extinguishers for all work and flammable storage areas, fuel powered</li> </ul>		
		<ul> <li>Store flammable liquids in well ventilated areas</li> <li>Store flammable liquids in well ventilated areas</li> <li>Prohibit storage, transfer of flammable liquids in plastic containers</li> <li>Post "NO SMOKING" signs</li> <li>Store combustible materials away from flammables</li> </ul>		
	Struck By/ Against Vehicles & Equipment	<ul> <li>Make eye contact with operators before approaching equipment</li> <li>Understand and review hand signals</li> <li>Wear reflective vests when working in areas with traffic.</li> </ul>	Hard hat, Safety glasses	
	High Noise Levels	<ul> <li>Use hearing protection when exposed to excessive noise levels (greater than 85 dBA over an 8-hour work period</li> </ul>	Ear plugs	Noise dosimeter
	High/Low Ambient Temperature	<ul> <li>Monitor for heat/cold stress</li> <li>Provide fluids to prevent worker dehydration</li> </ul>	Proper clothing for temperature	

ACTIVITY HAZARD	ACTIVITY HAZARD ANALYSIS FOR GROUNDWATER SAMPLING	NDWATER SAMPLING		
AIR MONITORING: MINIMUM PPE REG	Ambient air monitoring	AIR MONITORING: Ambient air monitoring should be conducted during activities MINIMUM PPE REQUIREMENTS: LEVEL D (Safety Glasses, Gloves, Steel-toe Boots)		
Task Breakdown	Potential Hazards	Hazard Control Measures	Personal Protective Equipment	Air Monitoring Devices
	Preserved Glassware	<ul> <li>Wear gloves when handling sample containers.</li> <li>Identify containers containing preservatives; avoid contact with preservatives.</li> <li>Discard any leaking or broken glassware appropriately.</li> </ul>	Nitrile gloves	
	Sharp Objects	<ul> <li>Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp</li> </ul>	Cut resistant gloves	
		edges or objects  Maintain all hand and power tools in a safe condition  Keep guards in place during use		

AIR MONITORING: PID/FID; O <sub>2</sub> /LEL; PART	FID; O <sub>2</sub> /L	EL; PARTICULATE – SEE ACTION LEVELS IN HASP		
Potential Hazards	Hazard	Hazard Control Measures	Personal Protective Equipment	Air Monitoring Instrumentation
Chemical Exposure	••••	Review HASP. Understand and comply with PPE requirements. Avoid contact with soil and other contaminated materials. Review hazardous properties of site contaminants prior to starting work. Use proper hygiene practices. Store all materials in proper containers designed for peroxide, ferrous sulfate and acid storage as applicable.	Hard Hat, Safety Glasses, Gloves, Tyvek, Respirator	
Chemical Reaction Monitoring	• • • •	Review HASP.  Monitor Temperature and Pressure of subsurface and coordinate action levels with chemical vendors.  Maintain neutralization solution on-site and follow vendor recommendations to stop unwanted reactions.  Do not inject peroxide at concentrations exceeding 10% for any free product sites. Free product injections require additional H&S reviews.  Monitor off-gassing during and following injection events and compare to applicable OSHA and NIOSH levels.	Hard Hat, Safety Glasses, Gloves, Tyvek, Respirator	
Dust	• • •	Avoid working in dusty conditions; use caution when mixing ferrous sulfate solutions (if applicable) with water. Maintain adequate dust suppression. Upgrade respiratory protection if warranted.	Safety Glasses, Hard Hat, Tyvek, Gloves, Respirator	
Back Strain	•	Use caution when carrying buckets up ladder; get assistance if needed. Lift buckets properly when unloading from the truck and		

JOB SAFETY ANALYSIS FOR FENTON'S	FOR FENTON'S REAGENT INJECTION		
AIR MONITORING: PID/FID; O <sub>2</sub> /LEL; PART	ID; O <sub>2</sub> /LEL; PARTICULATE – SEE ACTION LEVELS IN HASP		
	emptying into the tank.		
Confined Spaces	Do NOT enter any tanks or other confined spaces.		
Heat/Cold Stress	<ul> <li>Dress appropriately for the weather.</li> <li>Avoid dehydration; drink plenty of fluids.</li> <li>Monitor for symptoms of heat/cold stress.</li> </ul>	Proper clothing	Monitor temperature (WBGIT)
High Noise Levels	<ul> <li>Use hearing protection when exposed to excessive noise levels</li> </ul>	Hearing protection	Sound Level Meter
Sharp Objects	<ul> <li>Wear cut resistant gloves when sharp edges or object may cause lacerations.</li> <li>Maintain all tools in a safe condition.</li> </ul>	Leather gloves	
Slip, Trip, Fall	<ul> <li>Keep work areas cleared and organized.</li> <li>Use caution when walking in wet, muddy, or icy conditions.</li> <li>Use caution when climbing the ladder to access the tanks; ensure that ladder is set up correctly. Use three points of contact.</li> </ul>	Safety Glasses, Hard Hat, Tyvek, Gloves	
Sun Exposure	<ul> <li>Wear sunscreen when working outdoors.</li> <li>Wear long-sleeve, light colored clothing.</li> <li>Wear a hat and shaded safety glasses.</li> </ul>	Safety Glasses, Hard Hat, Sunscreen.	
Traffic/Heavy Equipment	<ul> <li>Wear high visibility safety vests.</li> <li>Be award of potential blind spots on machinery/cars</li> <li>Mark/cone off work area; use police to direct traffic if necessary.</li> <li>Wear hearing protection if necessary while working near heavy equipment.</li> </ul>	Hard Hat, Safety Glasses, Gloves, Safety Vest, Hearing Protection	Sound Level Meter

JOB SAFETY ANALYSIS FOR FENTON'	SIS FOF	R FENTON'S REAGENT INJECTION		
AIR MONITORING: PID/FID; O <sub>2</sub> /LEL; PA	J/FID; (	0 <sub>2</sub> /LEL; PARTICULATE – SEE ACTION LEVELS IN HASP	HASP	
Potential Hazards	Hazarı	Hazard Control Measures	Personal Protective Equipment	Air Monitoring Instrumentation
Chemical Exposure	••••	Review HASP.  Understand and comply with PPE requirements. Avoid contact with soil and other contaminated materials. Review hazardous properties of site contaminants prior to starting work. Use proper hygiene practices. Store all materials in proper containers designed for peroxide, ferrous sulfate and acid storage as applicable.	Hard Hat, Safety Glasses, Gloves, Tyvek, Respirator	
Chemical Reaction Monitoring	• • • •	Review HASP.  Monitor Temperature and Pressure of subsurface and coordinate action levels with chemical vendors.  Maintain neutralization solution on-site and follow vendor recommendations to stop unwanted reactions.  Do not inject peroxide at concentrations exceeding 10% for any free product sites. Free product injections require additional H&S reviews.  Monitor off-gassing during and following injection events and compare to applicable OSHA and NIOSH levels.	Hard Hat, Safety Glasses, Gloves, Tyvek, Respirator	
Dust	• • •	Avoid working in dusty conditions; use caution when mixing ferrous sulfate solutions (if applicable) with water. Maintain adequate dust suppression. Upgrade respiratory protection if warranted.	Safety Glasses, Hard Hat, Tyvek, Gloves, Respirator	
Back Strain	•	Use caution when carrying buckets up ladder; get assistance if needed.		

operly when unloading from the truck and the tank.  any tanks or other confined spaces. iately for the weather. Indication when exposed to excessive noise hearing protection stant gloves when sharp edges or object may condition. Indication is as as cleared and organized. Indication is as as condition. Indication is as as a cleared and organized. Indication is as a condition. Indication is a	JOB SAFETY ANALYSIS FOR FENTON'S	IS FO	R FENTON'S REAGENT INJECTION		
<ul> <li>Lift buckets properly when unloading from the truck and emptying into the tank.</li> <li>Do NOT enter any tanks or other confined spaces.</li> <li>Do NoT enter any tanks or other confined spaces.</li> <li>Avoid dehydration; drink plenty of fluids.</li> <li>Avoid dehydration; drink plenty of fluids.</li> <li>Monitor for symptoms of heat/cold stress.</li> <li>Wear cut resistant gloves when sharp edges or object may cause lacerations.</li> <li>Maintain all tools in a safe condition.</li> <li>Keep work areas cleared and organized.</li> <li>Wear caution when valking in wet, muddy, or icy conditions.</li> <li>Use caution when climbing the ladder to access the tanks; ensure that ladder is set up correctly. Use three points of contact.</li> <li>Wear sunscreen when working outdoors.</li> <li>Wear a hat and shaded safety glasses.</li> <li>Wear high visibility safety wests.</li> <li>Be award of potential blind spots on machinery/cars Glasses, Gloves, Mark/cone off work area; use police to direct traffic if necessary.</li> <li>Wear hearing protection if necessary while working near</li> </ul>	AIR MONITORING: PID	/FID;	O <sub>2</sub> /LEL; PARTICULATE – SEE ACTION LEVELS IN	N HASP	
Do NOT enter any tanks or other confined spaces.  Dress appropriately for the weather. Avoid dehydration; drink plenty of fluids. Monitor for symptoms of heat/cold stress.  Use hearing protection when exposed to excessive noise learning protection when sharp edges or object may cause lacerations.  Maintain all tools in a safe condition.  Keep work areas cleared and organized. Use caution when walking in wet, muddy, or icy conditions. Use caution when walking in ladder to access the tanks; ensure that ladder is set up correctly. Use three points of contact.  Wear ungreen when working outdoors. Wear long-sleeve, light colored clothing. Wear nigh visibility safety vests.  Warkcone off work area; use police to direct traffic if necessary.  Hard Hat, Safety Glasses, Safety Glasses, Sunscreen.  Hard Hat, Safety Glasses, Safety Glasses, Safety Vest, Safety Vest, necessary.  Hard Hat, Safety Glasses, Gloves Safety Vest, Safety Vest, necessary.		•	Lift buckets properly when unloading from the truck and emptying into the tank.		
<ul> <li>Dress appropriately for the weather.</li> <li>Avoid dehydration; drink plenty of fluids.</li> <li>Monitor for symptoms of heat/cold stress.</li> <li>Monitor for symptoms of heat/cold stress.</li> <li>Use hearing protection when exposed to excessive noise levels</li> <li>Wear cut resistant gloves when sharp edges or object may cause lacerations.</li> <li>Maintain all tools in a safe condition.</li> <li>Keep work areas cleared and organized.</li> <li>Use caution when walking in wet, muddy, or icy conditions.</li> <li>Use caution when walking in wet, muddy, or icy conditions.</li> <li>Use caution when walking in wet, muddy, or icy conditions.</li> <li>Use caution when walking outdoors.</li> <li>Wear ladder is set up correctly. Use three points of contact.</li> <li>Wear long-sleeve, light colored clothing.</li> <li>Wear a hat and shaded safety glasses.</li> <li>Wear high visibility safety vests.</li> <li>Be award of potential blind spots on machinery/cars.</li> <li>Mark/cone off work area; use police to direct traffic if necessary.</li> <li>Wear hearing protection if necessary while working near</li> <li>Wear hearing protection if necessary while working near</li> </ul>	Confined Spaces	•	Do NOT enter any tanks or other confined spaces.		
<ul> <li>Monitor for symptoms of heat/cold stress.</li> <li>Use hearing protection when exposed to excessive noise levels</li> <li>Wear cut resistant gloves when sharp edges or object may cause lacerations.</li> <li>Maintain all tools in a safe condition.</li> <li>Keep work areas cleared and organized.</li> <li>Use caution when walking in wet, muddy, or icy conditions.</li> <li>Use caution when climbing the ladder to access the tanks; ensure that ladder is set up correctly. Use three points of contact.</li> <li>Wear sunscreen when working outdoors.</li> <li>Wear long-sleeve, light colored clothing.</li> <li>Wear a hat and shaded safety glasses.</li> <li>Wear high visibility safety vests.</li> <li>Be award of potential blind spots on machinery/cars Mark/cone off work area; use police to direct traffic if necessary.</li> <li>Wear hearing protection if necessary while working near</li> </ul>	Heat/Cold Stress	• •	Dress appropriately for the weather. Avoid dehydration: drink plenty of fluids.	Proper clothing	Monitor temperature
<ul> <li>Use hearing protection when exposed to excessive noise levels</li> <li>Wear cut resistant gloves when sharp edges or object may cause lacerations.</li> <li>Maintain all tools in a safe condition.</li> <li>Keep work areas cleared and organized.</li> <li>Wear caution when walking in wet, muddy, or icy conditions.</li> <li>Use caution when valking in wet, muddy, or icy conditions.</li> <li>Use caution when climbing the ladder to access the tanks; ensure that ladder is set up correctly. Use three points of contact.</li> <li>Wear sunscreen when working outdoors.</li> <li>Wear long-sleeve, light colored clothing.</li> <li>Wear high visibility safety vests.</li> <li>Be award of potential blind spots on machinery/cars.</li> <li>Markcone off work area; use police to direct traffic if necessary.</li> <li>Wear hearing protection if necessary while working near</li> </ul>		•	Monitor for symptoms of heat/cold stress.		
<ul> <li>Wear cut resistant gloves when sharp edges or object may cause lacerations.</li> <li>Maintain all tools in a safe condition.</li> <li>Keep work areas cleared and organized.</li> <li>Use caution when walking in wet, muddy, or icy conditions.</li> <li>Use caution when climbing the ladder to access the tanks; ensure that ladder is set up correctly. Use three points of contact.</li> <li>Wear sunscreen when working outdoors.</li> <li>Wear long-sleeve, light colored clothing.</li> <li>Wear long-sleeve, light colored clothing.</li> <li>Wear a hat and shaded safety glasses.</li> <li>Wear high visibility safety vests.</li> <li>Be award of potential blind spots on machinery/cars Glasses, Gloves, nark/cone off work area; use police to direct traffic if necessary.</li> <li>Wear hearing protection if necessary while working near</li> </ul>	High Noise Levels	•	Use hearing protection when exposed to excessive noise levels	Hearing protection	Sound Level Meter
<ul> <li>Maintain all tools in a safe condition.</li> <li>Keep work areas cleared and organized.</li> <li>Use caution when walking in wet, muddy, or icy conditions.</li> <li>Use caution when climbing the ladder to access the tanks; ensure that ladder is set up correctly. Use three points of contact.</li> <li>Wear sunscreen when working outdoors.</li> <li>Wear long-sleeve, light colored clothing.</li> <li>Wear land shaded safety glasses.</li> <li>Be award of potential blind spots on machinery/cars</li> <li>Mark/cone off work area; use police to direct traffic if necessary.</li> <li>Wear hearing protection if necessary while working near</li> </ul>	Sharp Objects	•	Wear cut resistant gloves when sharp edges or object may cause lacerations.	Leather gloves	
<ul> <li>Keep work areas cleared and organized.</li> <li>Use caution when walking in wet, muddy, or icy conditions.</li> <li>Use caution when climbing the ladder to access the tanks; ensure that ladder is set up correctly. Use three points of contact.</li> <li>Wear sunscreen when working outdoors.</li> <li>Wear long-sleeve, light colored clothing.</li> <li>Wear a hat and shaded safety glasses.</li> <li>Wear high visibility safety vests.</li> <li>Be award of potential blind spots on machinery/cars Mark/cone off work area; use police to direct traffic if necessary.</li> <li>Wear hearing protection if necessary while working near</li> </ul>		•	Maintain all tools in a safe condition.		
<ul> <li>Use caution when walking in wet, muddy, or icy conditions.</li> <li>Use caution when climbing the ladder to access the tanks; ensure that ladder is set up correctly. Use three points of contact.</li> <li>Wear sunscreen when working outdoors.</li> <li>Wear long-sleeve, light colored clothing.</li> <li>Wear long-sleeve, light colored clothing.</li> <li>Wear long-sleeve, light colored clothing.</li> <li>Wear high visibility safety vests.</li> <li>Be award of potential blind spots on machinery/cars</li> <li>Mark/cone off work area; use police to direct traffic if necessary.</li> <li>Wear hearing protection if necessary while working near</li> </ul>	Slip, Trip, Fall	•	Keep work areas cleared and organized.	Safety Glasses,	
<ul> <li>Use caution when climbing the ladder to access the tanks; ensure that ladder is set up correctly. Use three points of contact.</li> <li>Wear sunscreen when working outdoors.</li> <li>Wear long-sleeve, light colored clothing.</li> <li>Wear a hat and shaded safety glasses.</li> <li>Wear high visibility safety vests.</li> <li>Be award of potential blind spots on machinery/cars award of work area; use police to direct traffic if necessary.</li> <li>Wear hearing protection if necessary while working near</li> </ul>		•	Use caution when walking in wet, muddy, or icy conditions.	Hard Hat, Tyvek,	
ensure that ladder is set up correctly. Use three points of contact.  • Wear sunscreen when working outdoors. • Wear long-sleeve, light colored clothing. • Wear a hat and shaded safety glasses. • Wear high visibility safety vests. • Be award of potential blind spots on machinery/cars Glasses, Gloves, necessary. • Mark/cone off work area; use police to direct traffic if necessary. • Wear hearing protection if necessary while working near		•	Use caution when climbing the ladder to access the tanks;	Gloves	
<ul> <li>Wear sunscreen when working outdoors.</li> <li>Wear long-sleeve, light colored clothing.</li> <li>Wear a hat and shaded safety glasses.</li> <li>Equipment</li> <li>Wear high visibility safety vests.</li> <li>Be award of potential blind spots on machinery/cars</li> <li>Mark/cone off work area; use police to direct traffic if necessary.</li> <li>Wear hearing protection if necessary while working near</li> </ul>			ensure that ladder is set up correctly. Use three points of contact.		
<ul> <li>Wear long-sleeve, light colored clothing.</li> <li>Wear a hat and shaded safety glasses.</li> <li>Wear high visibility safety vests.</li> <li>Be award of potential blind spots on machinery/cars</li> <li>Mark/cone off work area; use police to direct traffic if necessary.</li> <li>Wear hearing protection if necessary while working near</li> </ul>	Sun Exposure	•	Wear sunscreen when working outdoors.	Safety Glasses,	
<ul> <li>Wear a hat and shaded safety glasses.</li> <li>Wear high visibility safety vests.</li> <li>Be award of potential blind spots on machinery/cars</li> <li>Mark/cone off work area; use police to direct traffic if necessary.</li> <li>Wear hearing protection if necessary while working near</li> </ul>		•	Wear long-sleeve, light colored clothing.	Hard Hat,	
<ul> <li>Wear high visibility safety vests.</li> <li>Be award of potential blind spots on machinery/cars</li> <li>Mark/cone off work area; use police to direct traffic if necessary.</li> <li>Wear hearing protection if necessary while working near</li> </ul>		•	Wear a hat and shaded safety glasses.	Sunscreen.	
near	Traffic/Heavy Equipment	•	Wear high visibility safety vests.	Hard Hat, Safety	Sound Level Meter
lear		•	Be award of potential blind spots on machinery/cars	Glasses, Gloves,	_
protection if necessary while working near		•	Mark/cone off work area; use police to direct traffic if	Safety Vest,	
protection it necessary while working near			necessary.	Hearing Protection	
		•	Wear hearing protection it necessary while working near	0	

# ACTIVITY HAZARD ANALYSIS FOR EQUIPMENT DECONTAMINATION

AIR MONITORING: <u>ACTION LEVELS</u> - SEE HASP MINIMUM PPE REQUIREMENTS: LEVEL D (Safety Glasses/Faceshield, Rain Suit/Tyvek, Gloves, Steel-Toe Boots)

Task Breakdown	Potential Hazards	Hazard Control Measures	Personal Protective Equipment	Air Monitoring Devices
Decon of Heavv	Slips, Trips, Falls	Clear walkways, work areas of equipment, vegetation, tools and debris		
Equipment & Vehicles		Mark, identify, or barricade other obstructions Use caution when using water in cold weather – icy conditions		
	Struck by/Against	Use reflective vests when exposed to vehicular traffic	Safety vests, hard hat	
	Protruding Objects, & Solashes	Isolate equipment swing areas	goggles and face	
		Make eye contact with operators before approaching equipment	Tyvek	
		Wear hard hats, safety glasses with side shields, or goggles with splash shields and steel-toe safety boots		
		Understand and review hand signals		

# ACTIVITY HAZARD ANALYSIS FOR EQUIPMENT DECONTAMINATION

AIR MONITORING: <u>ACTION LEVELS</u> - SEE HASP MINIMUM PPE REQUIREMENTS: LEVEL D (Safety Glasses/Faceshield, Rain Suit/Tyvek, Gloves, Steel-Toe Boots)

Task Breakdown	Potential Hazards	Hazard Control Measures	Personal Protective Equipment	Air Monitoring Devices
	Inhalation and Contact with Hazardous Substances	Provide workers proper skin, eye and respiratory protection based on the exposure hazards present Review hazardous properties of site contaminants with workers before operations begin Avoid contact with contaminated materials (soil and water) Use wet methods to remove dirt and debris from equipment	PVC rain suit or Tyvek coveralls, Nitrile or latex gloves	
	Bums	Use proper gloves, face shield/safety goggles, shin and toe guards, and splash suits to protect workers from skin burns and injury when operating laser (high pressure washers)	Goggles and face shield, shin and toe guards	
	Handling Heavy Objects	Observe proper lifting techniques Obey sensible lifting limits (60 lb. maximum per person manual lifting) Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads		

# ACTIVITY HAZARD ANALYSIS FOR EQUIPMENT DECONTAMINATION

AIR MONITORING: <u>ACTION LEVELS</u> - SEE HASP MINIMUM PPE REQUIREMENTS: LEVEL D (Safety Glasses/Faceshield, Rain Suit/Tyvek, Gloves, Steel-Toe Boots)

Task Breakdown	Potential Hazards	Hazard Control Measures	Personal Protective Equipment	Air Monitoring Devices
	Sharp Objects	Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects	Leather gloves	
		Maintain all hand and power tools in a safe condition Keep guards in place during use		
	High Noise Levels	Use hearing protection when exposed to excessive noise levels (greater than 85 dBA over an 8-hour work period)	Ear plugs	
Decon of Heavy Equipment & Vehicles	Decon Materials	Ensure that decon material is compatible with chemicals of concern and does not create a great exposure. Review MSDS for decon solution.	Use PPE as specified by type of decon material used.	
	High/Low Ambient Temperature	Monitor for Heat/Cold stress Provide fluids to prevent worker dehydration	Clothing appropriate for temperatures	

# APPENDIX C TAILGATE SAFETY MEETING FORMS



#### **DAILY TAILGATE SAFETY MEETING FORM**

#### Instructions:

- Conduct a Daily Tailgate Safety Meeting with site personnel prior to commencing daily activities. Safety topics can be selected from the attached table.
- Address potential hazards and controls for tasks that will be conducted.
- Discuss air monitoring, training, PPE and other appropriate requirements.
- Follow-up on noted items and document the resolution of any action items.

Date:
Meeting conducted by:
Project/Site:
Safety topics/information reviewed:
Follow-up action items/comments:

## Attendance:

NAME	<b>SIGNATURE</b>	COMPANY/AGENCY/OTHER ORG



#### DAILY TAILGATE SAFETY MEETING TOPICS GUIDE

1	ACC	IDENT	REPO	RTING
1.	ALL	IDENI	REPU	RING

- 2. AIR MONITORING
- 3. AIR MONITORING AND ACTION LEVELS
- 4. ALCOHOL CONSUMPTION AND WORKSITE SAFETY
- 5. COLD STRESS
- 6. CONFINE SPACE ENTRY
- 7. CRANE SAFETY
- 8. DAILY WORK TASK HAZARDS
- 9. DECONTAMINATION
- 10. DISCIPLINARY POLICY FOR NOT FOLLOWING SAFETY RULES/SAFE WORK PRACTICES
- 11. DRILL RIG SAFETY
- 12. ELECTRICAL SAFETY
- 13. EMERGENCY RESPONSE
- 14. ERGONOMICS
- 15. EXCAVATION/TRENCHING HAZARDS
- 16. EYE WASH STATION LOCATION (S)
- 17. FALL PROTECTION
- 18. FIRE SAFETY/BONDING-GROUNDING TECHNIQUES
- 19. FIRST AID/CPR
- 20. FUGITIVE DUST CONTROL
- 21. GENERAL SITE SAFETY RULES
- 22. HAND TOOL HAZARDS
- 23. HAZARD COMMUNICATION/LOCATION OF MSDS/REVIEW OF HAZMAT PROPERTIES
- 24. HEALTH AND SAFETY PLAN
- 25. HEARING PROTECTION
- 26. HEAT STRESS
- 27. HEAVY MACHINERY
- 28. HOSPITAL DIRECTIONS
- 29. HOUSEKEEPING
- 30. MATERIAL HANDLING
- 31. MECHANICAL HAZARDS/GUARDING/LOTO
- 32. OVERHEAD HAZARDS
- 33. PERSONAL PROTECTIVE EQUIPMENT
- 34. RESPIRATORY PROTECTION AND FILTER CHANGE-OUT SCHEDULE
- 35. ROLES AND RESPONSIBILITIES
- 36. SITE SECURITY
- 37. SMOKING AND BREAK AREAS
- 38. TANK REMOVAL SAFETY
- 39. UNDERGROUND UTILITIES
- 40. USE OF "BUDDY SYSTEM"

- 41. VAPOR CONTROL
- 42. WATER HAZARDS
- 43. WELDING SAFETY
- 44. WORK STOPPAGE

# APPENDIX D

**Environmental Monitoring & Calibration Forms** 

						APEX ENVI	APEX ENVIRONMENTAL, INC. AIR MONITORING FORM	Č.			
Project Name:	ë										
Project Number: Task to be Monitored:	fonitored:										
Contaminants or Physical Hazards:	ts or Phys	ical									
Date	Time	Ionization Detector Reading	ation ctor ding	Explosimeter Reading	imeter Jing	Detector Tube or Participate Readings	Other Parameters	Location	Wind Speed and Direction	Work Task	Initials
		FID	PID	%LEL	%O <sub>2</sub>	ppm or mg/m3					
											·



# APPENDIX E ACCIDENT REPORT FORM

#### **APEX INCIDENT REPORT FORM**

Incident ID No. (Assigned by Corporate)

Instructions: this Apex Incident Report (AIR) Form is to be completed by the Apex employee experiencing any of the incident types listed below. The AIR Form can also be completed with support from the employee's Supervisor, or Office Central Safety Committee. This form is to be completed for motor vehicle accidents/incidents involving personal or rented/leased vehicles, near miss incidents, environmental incidents, first aid/minor injury incidents, fires, property damage, thefts, community complaints and other incidents deemed important for review by Apex management. The AIR Form must be answered completely and submitted to your Division Manager, Apex's Corporate Human Resources Office in Rockville, Maryland and the Director, Corporate Health and Safety in Reading, Pennsylvania within 72 hours of the incident.

Type of Incident:	Motor Vehicle Environmental		Serious Injury/Illness First Aid/Minor Injury
	Fire		Property Damage
	Theft		Community Complaint
	Near Miss		Other
Date and time of incident:		_	
Report prepared by		Job title	e
Address			Phone
Employee ID No	Home	e office	
Description of Incident:			
		_	
Witness(es)	Phone	e	

Witness(es) Statement(s) Attached?_ information provided by witness(es):_					_		the
Work task at time of incident							
Description of incident							
Describe the unsafe act or condition c	ontributing to t	he incide	nt				
Corrective measures taken or recomm	nended to prev	ent a sim	lar incide	nt			
Employee Printed Name:				,			
Signature:	Date	Superviso	r Printed	Name	e:		
Signature:	Date						
Witness Printed Name:							
Signature:	Date						
I certify that the information submitted providing false information is grounds to		action up					ı of
Any person who knowingly, and wing statement of claim containing any misleading, information concerning and acceptable acceptable.	false informat	ion, or co thereto, c	nceals, fo	r the	purpose	<u>of</u>	<u>ce</u>
If similar incidents have occurred in the	office or on p	rojects, pl	ease disc	uss_			

### Corporate Health and Safety and Human Resources Representatives Review:

Agree with action taken?	Human Resources	s: Yes	No	
	Health & Safety:	Yes	No	
Human Resources comme				
Health and Safety commen				
Human Resources Represe	entative: Dire	ector, Corpora	te Health and Safety:	
Signature	Sig	nature		
Printed	Prir	nted		
Date	Dat	e		

# APPENDIX F RESPIRATORY PROTECTION PROGRAM

#### PURPOSE AND GOALS OF THE RESPIRATORY PROTECTION PROGRAM

#### Overview

To control the incidence of occupational diseases, the Occupational Safety and Health Administration (OSHA) requires that hazardous air contaminant levels in the work place be reduced to the lowest possible levels by instituting engineering controls and work practices designed to prevent atmospheric contamination. However, when such controls are not feasible or while they are in the process of being instituted, OSHA permits the use of respirators as a means of controlling employee exposure to hazardous air contaminants. Since the nature of the work performed by Apex Environmental, Inc. (Apex) employees does not always allow such controls, appropriate respirators are made available to employees to ensure that they are adequately protected against potentially harmful airborne contaminants. The policies and procedures found in this plan are generic in nature and are to be followed whenever respirators are used to control personal exposures to hazardous airborne substances. This Respiratory Protection Program is a supplement to the Corporate Safety, Health and Environmental Control Plan's Section 11.0, Respiratory Protection.

#### Scope

Apex anticipates the need for employees to utilize respirators for protection from a variety of hazardous airborne contaminants. Such exposures may result from activities taking place in any area where hazardous substances have the potential to become airborne, either through a chemical, biological or physical activity.

The type of respirator worn most often by Apex employees consists of a tight-fitting, half or full face-piece, negative pressure, or battery powered air-purifying respirator (PAPR) designed to remove asbestos fibers, particulates, fumes, mists, organic vapors or gases. Apex's Respiratory Protection Program (RPP) focuses on the use of these types of respirators. If an Apex employee is required to work in an Immediately Dangerous to Life or Health (IDLH) atmosphere, and/or wear a self-contained breathing apparatus (SCBA) or supplied air respirator (SAR), he/she will have additional job-specific training in the use of these types of respiratory protection, prior to wearing the respirator.

OSHA requires that respirators will be provided to employees by the employer and must be worn in the following situations:

 When engineering controls, work practices or administrative controls are not feasible for assuring safe and healthful conditions;

- While engineering controls are in the process of being instituted;
- Where protection against occasional and/or relatively brief exposure is needed (most of Apex's services would likely fall under this situation);
- When the oxygen concentration in the air is insufficient to support life (less than 19.5%), or when entering a confined space or any other area with unknown concentrations air of contaminants; and
- When required by applicable laws and regulations.

Apex is also requiring respiratory protection for employees working in areas, which have potential for exposure to excessive levels of microbiological contaminants. For example, microbiological contaminants might be encountered during indoor air quality investigations in situations where mold or other microbial growth is obvious on the building structures and inside heating and air conditioning systems. Certain microbiological organisms have been associated with severe respiratory illnesses. These types of contaminants generally do not have established exposure limits. Apex employees may encounter the need for wearing respiratory protection in areas inside a building, in confined spaces or crawl spaces, which show water intrusion, staining, musty odors or obvious microbial growth, or areas where bird or bat droppings may be encountered (e.g., Histoplasmosis). As a precautionary measure, Apex is requiring employees to wear respiratory protection when such environments are encountered during the course of our services.

Apex also is requiring that its employees bring respiratory protection to job sites for use in emergency situations, even though respiratory protection may not be required for the services being provided to our clients. Emergency situations may develop during soil or tank excavation or other activities, which produce atmospheric contamination due to the accidental rupturing of a tank, drum, gas line, excavation into contaminated soils, etc.

#### Regulatory Authority

Federal and state regulations mandate that employers instituting the use of respirators must comply with certain standards, including, but not limited to:

- 29 CFR 1910.134, the Respiratory Protection Standard;
- 29 CFR 1910 Subpart Z, Permissible Exposure Limits for Toxic Substances;
- 29 CFR 1926.1101, the Asbestos Standard for the Construction Industry;
- 29 CFR 1910.1020, Access to Employee Exposure and Medical Records;
- 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response; and,

- 29 CFR 1926.62, Lead in Construction
- In addition, OSHA has promulgated various other standards specific to certain contaminants that require use of respirators (e.g., arsenic, benzene, tuberculosis).

It is the policy of Apex Environmental, Inc. to comply with all applicable federal and state requirements, whether or not specifically referenced in this Respiratory Protection Program.

#### **Program Description**

A description of Apex's Respiratory Protection Program requirements, information on the responsibilities of the Program Administrator, Employees and employees Supervisors are discussed in the following sections.

#### **Program Requirements**

The key requirements of an acceptable respiratory protection program are set forth in OSHA's Respiratory Protection Standard (29 CFR 1910.134) and are summarized below:

- The program must be in writing;
- Written standard operating procedures must be established for the safe and proper use of respirators;
- A medical surveillance program must be established;
- Selection of respiratory protection must be based on the hazards to which an employee is exposed. Only NIOSH-certified respirators shall be used;
- Training covering the proper use and limitations of respirators must be offered;
- Provisions shall be established for the regular cleaning and disinfecting of all respirators. Respirators shall be inspected during cleaning. Worn or deteriorated parts shall be replaced by a competent person;
- Respirators will be assigned to individual workers for their exclusive use;
- Fit-testing must be performed at least annually;
- A monitoring program for the evaluation and documentation of work area conditions must be established and relate actual personal exposure to appropriate respiratory protection (usually established in a project Health and Safety Plan (HASP)); and
- The respiratory protection program must be evaluated for effectiveness on an annual basis.

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#### **Program Administrator Responsibilities**

Apex has designated one person to be responsible for the proper implementation of the Respiratory Protection Program. The Respiratory Protection Program Administrator will, with the support of other Apex personnel, administer all aspects of the program and maintain required documentation. The RPP Administrator will be John Reinemann, CIH. Mr. Reinemann is located in Apex's Averill Park, New York office.

The Program Administrator is responsible for ensuring the following:

- Administration of the respiratory protection program is properly carried out;
- Appropriate medical surveillance of each employee issued a respirator occurs;
- Appropriate respirators are issued and maintained;
- Selecting proper respirators based on the nature of the specific hazard and conditions of use:
- Qualitative fit testing or quantitative fit testing is performed at least annually for tightfitting air purifying respirators;
- Training is provided in the use, care, cleaning, storage and limitations of respirators and allows employees the opporturity to become accustomed to, and gain confidence in, the use of respirators while in a safe environment;
- All necessary records and documentation for this respiratory protection program are maintained;
- Obtaining the same training as the employees required to wear respirators and training will occur on an annual basis.
- Ensuring that the effectiveness of the respiratory protection program is evaluated on an annual basis, updating it as necessary to assure continued safety of employees and compliance with the OSHA Respiratory Protection Standards.

#### **Employee Responsibilities**

Employees of Apex performing tasks for which respirators are required shall:

- Be clean shaven in the area of the respirator face-piece to face seal;
- Inspect his/her respirator before and after each use. Replace, or have replaced, worn or damaged parts, as needed;
- Clean his/her respirator after each use and ensure that it is properly stored in a plastic bag or other suitable clean container;
- Perform required positive/negative pressure fit checks prior to each use;

- Utilize the respirator properly during designated tasks;
- Routinely replace respirator cartridges according to established change out schedules and when breakthrough is noted. Obtain proper cartridge replacements;
- Be familiar with the HASP and requirements for respiratory protection for projects being worked on and be familiar with the known or potential contaminants expected at the job site and associated hazards:
- Be familiar with their respirator's product information particularly regarding selection, use, maintenance and care; and,
- Be trained on an annual basis on the requirements of the OSHA Respirator Standard and on the contents and requirements of this Apex Respiratory Protection Program.

#### Supervisor Responsibilities

Supervisors of employees performing tasks for which respirators are assigned shall:

- Prohibit any worker from working in a contaminated, or potentially contaminated, atmosphere if the worker is not clean shaven or does not pass user fit-checks on the respirator;
- Ensure that employees utilize the proper cartridge or filter for the contaminants of concern;
- Ensure that workers inspect their respirators adequately before and after use and perform positive and negative pressure fit checks prior to each use;
- Ensure that cleaning facilities are provided and utilized;
- Require proper use of respirators during designated tasks;
- Periodically inspect storage of respirators to make certain respirators are stored in a plastic bag or other suitable storage container in an uncontaminated atmosphere and in a proper manner;
- Ensure that workers have had appropriate training and are medically qualified to wear respirators prior to employees using a respirator;
- Review potential job hazards with employee(s) prior to commencing work on projects that require, or may require, the use of respiratory protection. This review must be documented;
- Conduct period project safety audits, when appropriate, to verify that respirators and other personal protective equipment are being appropriately used, and verify that the requirements of the Respiratory Protection Plan are being followed; and,
- Receive the same training as employees who may be wearing respiratory protection.

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#### **Program Coordinator Responsibilities**

When possible, Each Apex branch office will have a designated Program Coordinator. The Program Coordinator will be responsible for:

- Maintaining respirator fit test and other respiratory protection records of office employees;
- Coordinating medical exams for respirator users;
- Maintaining files on medical approvals for respirator users; and,
- Providing general oversight of the Respiratory Protection Program for the office.

#### **Respirator Selection**

As required by OSHA, only National Institute for Occupational Safety and Health (NIOSH) approved respirators and replacement parts will be purchased for use by Apex employees. If for some reason an employee is unable to wear a certain type or brand of respirator, a different respirator may be chosen by the employee, providing it is NIOSH-approved. By regulation, Apex may provide a powered air-purifying respirator in lieu of any negative-pressure respirator whenever an employee chooses to use this type of respirator.

It is the policy of Apex that no employee with a beard, or excessively thick sideburns, will be fittested or allowed to wear any respirator.

Respirators will be chosen on the basis of the type of hazard the employees are exposed to, e.g. gas, vapors, dust, or fumes, the concentration of the hazard in the air, and the protection factor of the respirator. Protection factors (PF) are assigned to respirators by NIOSH. Tables 11.3-1 and 11.7-1 provide guidance on the types of respirators that could be used with various concentrations of air contaminants and respirators associated with typical consulting services that Apex provides.

The protection factor of a respirator is multiplied by the current OSHA Permissible Exposure Limit (PEL) of the contaminant to determine the maximum concentration of contaminant in air acceptable for a respirator. OSHA is currently reviewing assigned protection factors and maximum use concentrations (MUC) permitted for various respirators. The table below provides tentative guidance for selection of various types of respirators. For example, maximum use concentrations for exposure to asbestos fibers wearing various respirator types are shown in the table below.

Table F-1
Maximum Use Concentration for Selected Respirator Types

RESPIRATOR TYPE	PROTECTION FACTOR	CURRENT PEL*	MAXIMUM USE CONC.		
½ facepiece, negative pressure, P- 100 filters	10x	0.1f/cc	1f/cc		
Full-facepiece, negative pressure, P-100 filters	50x	0.1f/cc	5f/cc		
Powered air-purifying with P-100 filters (papr)	100x	0.1f/cc	10f/cc		
Continuous flow airline (Supplied air)	100x	0.1f/cc	10f/cc		
Full-facepiece, positive pressure, self-contained breathing apparatus (scba)	>1000x	0.1f/cc	>100 f/cc or unknown		
*OSHA PEL for asbestos in fibers per cubic centimeter (F/CC) of air					

#### **Medical Evaluation**

All Apex employees assigned to jobs requiring the use of negative pressure respirators must first receive a medical evaluation by a Physician or other Licensed Health Care Professional (PLHCP) knowledgeable in pulmonary diseases and respiratory protection practice. The examining PLHCP shall be given information about the equipment to be used. He/she should know whether the personal protective equipment would produce additional aspiratory and expiratory stress, whether it represents an additional weight, and whether it may cause an increase in the metabolic heat load.

Employees shall not be assigned to tasks requiring the use of respirators unless it has been determined by the PLCHP that they are both psychologically and physically able to perform their duties while wearing the prescribed respirator.

The examining PLHCP shall provide a written opinion, which describes the individual's ability to wear the respirator and the opinion shall be forwarded to the Program Coordinator of each office. The Program Coordinator from each office will be a designated representative of the Central Safety Committee who has been assigned responsibilities for overseeing the Respiratory Protection Program in that office. Each Apex office will have a Program Coordinator.

The medical status of the respirator user shall be part of the yearly evaluation of the program. The medical evaluation will include the use of the OSHA medical questionnaire or an initial medical examination that obtains the same information as the medical questionnaire. A written opinion by the PLHCP is to be forwarded to the Program Coordinator for each office. Written opinions will be maintained in the employee's personnel file at the branch office and at the Corporate Human Resources office in Rockville, Maryland.

Apex shall ensure that a follow-up medical examination is provided for an employee who gives a positive response to any question among questions 1 through 8 in Section 2, Part A of the OSHA medical questionnaire located in **Appendix F-1** of this Respiratory Protection Program.

Apex shall provide a copy of the RPP to the PLHCP for review prior to having medical evaluations conducted. Once the PLHCP determines that the employee is physically able to wear a respirator, he/she will be allowed to perform any duties in areas requiring respirator use. A review of the employee's health status will be conducted annually provided that the employee's job description continues to require respirator use. Records of medical surveillance will be maintained for the duration of employment plus thirty years.

#### Recordkeeping

Documentation is an important part of the Respiratory Protection Program and is essential in tracking exposure information and employee training. The Respiratory Protection Standard, as well as other OSHA regulation specifies record keeping requirements including records of all environmental, biological and exposure monitoring and training. OSHA 29 CFR 1910.1020 requires that these records be made available to employees, upon request.

It shall be the responsibility of the Respiratory Protection Program Coordinator at each office, or a designated representative, to maintain the employee respiratory protection records for the office. All respiratory protection records shall be kept by Apex for at least 30 years plus the length of employment for each employee covered by the RPP. Records will be provided to the employee or the employee's designee upon written request.

#### Medical

Medical record keeping shall be performed in accordance with all applicable OSHA regulations and **Section 11.4** of this Program. A copy of the record must be provided to the employee (or designee) at his/her written request.

#### **Training**

A course roster and/or training form will be completed for each course and be made part of the permanent record. Training records will be kept at least as long as medical records. The following information shall be kept as part of the permanent training record:

- Employee's name and signature;
- Employee identification number or Social Security Number;
- Work areas/type of work conducted;
- Training course name, syllabus, date and location; and
- Instructor signature.

#### Fit - Testing

Fit testing of persons required to wear a respirator must be performed every year and according to the procedures outlined in 29 CFR 1910.134. Other OSHA Standards covering specific hazardous air contaminants such as asbestos and lead, should be reviewed when working with specific air contaminants, which may have their own unique requirements. A fit-test record form will be completed for each employee fit-tested. A copy of this form can be found in Appendix F-Fit test records shall be maintained for at least one year beyond the last date of employment.

#### Exposure Monitoring

Exposure monitoring is a requirement of several OSHA regulations including 29 CFR 1910.1000, Air Contaminants, Subpart Z and 29 CFR 1910.134, Respiratory Protection. Monitoring the workplace air is required to ensure that respiratory protection measures being taken are adequate. The following items must be made part of the permanent record of any Apex employee exposure monitoring conducted:

- Name and social security number of employee monitored;
- Date monitored;
- Analyte monitored;
- Sampling method (OSHA or NIOSH) used;
- Sampling results;
- AIHA-accredited laboratory used;
- Type of respiratory protection used (e.g., ½ face, PAPR, etc.);
- Current PEL or TLV, or other helpful information such as REL;
- Current regulations governing exposure to, or work with, the analyte; and
- The action taken as a result of any monitoring program report recommendations.

June 24, 2002 Apex Environmental, Inc. Chapter 11: Respiratory Protection Program Page 9 of 48 Exposure monitoring records should be maintained in project files.

#### Respiratory Protection Program Evaluation

This Respiratory Protection Program will be reviewed and evaluated on an ongoing basis (at least annually) to ensure the program's continued effectiveness and compliance with all applicable regulations. The review includes updating standard operating procedures and policies such as respirator selection guidance and adopting current permissible exposure limits where applicable. The evaluation will be initiated by the Program Administrator and coordinated with each Apex office through the Apex RPP Coordinators and the Central Safety Committee, and will include a review of employee exposure information, medical surveillance records, training documentation, respirator assignment and fit-testing records, and the results of ongoing program compliance inspections.

This Respiratory Protection Program must be evaluated for compliance and effectiveness. New operations may develop over the year, or existing operating procedures or work areas modified, such that workers may be required to wear respiratory protection. Air monitoring will need to be periodically conducted to determine employee exposure in these work areas. In areas where hazardous materials are used or generated, verification must be made that engineering or administrative controls are being used to minimize the need for respirators. Employees must be identified that fall under the Respirator Protection Program and medical evaluations must be Employees must be fit tested on tight-fitting respirators worn. It must also be confirmed that employees are receiving necessary training on respiratory protection and hazards associated with the hazardous materials used.

A written evaluation of the Respiratory Protection Program is to be prepared by the Program Administrator and submitted and discussed with Apex's Chief Operating Officer. The written evaluation will be incorporated in a report that evaluates the Program's effectiveness. The written evaluation will assess whether:

- The proper types of respirators are selected and issued based upon workplace hazards, routine air monitoring results and NIOSH selection guidelines;
- Respirator users have been identified, properly trained, and medical evaluations are completed;
- 3. The respirators are worn properly, as verified from an inspection;
- 4. The respirators are properly maintained, cleaned and stored;
- Fit testing is documented and follows OSHA Respirator Fit Test protocol;

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- 6. All pertinent records are kept, including annual medical evaluations, fit testing and training records;
- The report shall include results of the inspection, the effectiveness of the program administration, wearer acceptance, inadequacies and action to correct deficiencies with target dates;
- Consultation with respirator users included: resistance to breathing, fatigue, interference with vision and communication, restriction of movement, job performance and confidence in the Respiratory Protection Program;
- Follow-up medical evaluations and written opinions have been updated in employees personnel files;
- Evaluation made of new or modified operations have been completed which require respiratory protection; and,
- 11. Whether verification has been made that engineering or administrative controls are used to minimize the need for respiratory protection.

A checklist entitled the Respirator Program Evaluation Checklist for the Annual Report, will be used for guidance with program evaluations.

Tasks Requiring The Use Of A Respirator

Table F-2 contains a list of possible tasks, which require the use of a respirator by Apex employees.

Table F-2
Tasks Requiring Respiratory Protection

TASK	MINIMUM RESPIRATORY PROTECTION
Working in any asbestos, lead or other "regulated area"	'Half-face piece, negative pressure, air- purifying respirator with P-100 cartridges
When bulk sampling suspect asbestos-containing materials	'Half-face piece, negative pressure, air- purifying respirator with P-100 cartridges
Working around fumes, oil mist or dusts containing heavy metals or sampling for bacteria or fungi in buildings known to have water damage and indoor air quality problems	'Half-face piece, negative pressure, air- purifying respirator with P-100 cartridges
Working around fuel oil, gasoline or PAH contaminated soils	'Half-face piece, negative pressure, air- purifying respirator with P-100 and organic vapor cartridges
	Positive pressure, SCBA or supplied-air, full-face piece respirator, with escape SCBA.

Working around particulate projectiles or suspended particulates	Full-face piece, negative pressure, air- purifying respirator with P-100 cartridges
Working in areas that contain gaseous or vapor contaminants	Half or full-face piece, air-purifying respirator with organic vapor or other appropriate chemical cartridges
Working at an uncharacterized hazardous waste site	Self-contained breathing apparatus; full or half-face, negative pressure, air purifying respirator with organic vapor or other appropriate chemical cartridges, if approved by the SSHO.

NOTE: The adequacy of respiratory protection utilized will be assessed for each application and modified as conditions warrant.

NOTE: The air purifying respirators listed above cannot be used in environments immediately dangerous to life or health (IDLH). Such environments require the use of full face piece pressure demand SCBA or combination full face piece supplied air respirator (SAR) with auxiliary self contained air supply.

#### **Eye Protection**

Wherever eye protection (goggles or safety glasses) is required and an employee must wear eyeglasses, the fit of the respirator must not be compromised. Half-face piece respirator straps should go underneath glasses or goggles, or a respirator worn, which has prescription lens, inserted into the respirator (full-face piece). Although OSHA allows contact lenses to be worn under full-face piece respirators, Apex prohibits the wearing of contact lenses in any contaminated atmosphere regardless of the respiratory protection utilized. Apex believes that a worker would try to remove the respirator or rub the eyes in a hazardous work area, should the eyes become irritated for any reason. This maneuver could subject the employee to injury.

#### **Air Purifying Respirators**

Air-purifying respirators (APR) consist of a face-piece and an air-purifying device, which is either a removable component of the face-piece, or an air-purifying apparatus worn on a body harness and attached to the face-piece by a hose. An APR selectively removes specific airborne contaminants from ambient air by filtration, absorption, adsorption or chemical reactions. They are approved for use in atmospheres containing specific contaminants up to designated concentrations and *NOT for Immediately Dangerous* to *Life and Health (IDLH)* atmospheres. IDLH means an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

The primary benefits of utilizing air-purifying respirators include enhanced mobility of the wearer and relatively low cost. The limitations of air-purifying respirators include:

- Cannot be used in IDLH or oxygen-deficient atmospheres (less than 19.5% oxygen);
- Limited duration of protection;
- Only protects against specific chemicals and concentrations; and,
- Requires monitoring of air contaminants and oxygen levels.

#### **Respirator Selection**

Air-purifying respirators can be half and full-face piece, or powered air purifying (PAPR). Each type is selected based on the type of contaminant, whether the contaminant is readily absorbed through the skin or eye, and the protection factor assigned to the respirator. Other considerations include the ability of the employee to be fitted with the respirator, the use of eyeglasses by the employee or personal preference of the employee. The following conditions exclude, or may exclude the use of air-purifying respirators:

- Oxygen deficiency;
- IDLH concentrations of specific substances;
- Entry into an unventilated or confined area where the exposure conditions are not known;
- Identified gases or vapors with inadequate warning properties, such as odor or taste;
   and
- High relative humidity, which may reduce the protection offered by the sorbent. If the air
  contaminant can be readily absorbed through the skin or eyes, a full-face air purifying
  respirator or supplied air respirator that covers the entire face will be required.

If the air contaminant can be readily absorbed through the skin or eyes, a full-face piece air purifying respirator, or supplied air respirator that covers that entire face, is required.

The selection of respirators for routine services provided by Apex is addressed in this plan. Selection of respirators for non-routine tasks should be performed in accordance with 29 CFR 1910.134 and all the requirements of this plan.

#### Respirator Cartridge Replacement

When Apex employees wear respirators in atmospheres that are not Immediately Dangerous to Life or Health (IDLH), Apex will provide a NIOSH-approved respirator that is adequate to protect the health of the employees. For protection against gases and vapors, Apex will provide an air-

purifying respirator, provided that the respirator is equipped with an End-of-Service-Life Indicator (ESLI) certified by NIOSH for the contaminant. If there is no ESLI appropriate for conditions in the employee's workplace, Apex will implement a change schedule for canisters and cartridges that is based on objective information or data, including air monitoring data, that will ensure that canisters and cartridges are changed before the end of their service life. Apex will rely upon the respirator manufacturer's recommendations for Change-Out Schedule and atmospheric concentrations at the job site.

When no ESLI is available for a gas or vapor, employees should must change filters or cartridges at least once every eight-hours for exposure to atmospheric concentrations at, or below, two times the OSHA Permissible Exposure Limit (PEL) of the contaminant.

When the gas or vapor is a carcinogen, Apex employees are not permitted to wear any airpurifying respirator unless concentrations are being monitored continuous and concentrations are determined to be below any established OSHA PEL. (Note that there are not many carcinogens with established PELs). Otherwise, supplied air respirators will be worn when working in atmospheres containing carcinogens.

For protection against particulate concentrations that are not considered IDLH, Apex will provide:

- An atmosphere-supplying respirator; or,
- An air-purifying respirator equipped with a filter certified by NIOSH under 30 CFR Part
   11, as a high efficiency particulate air (HEPA) filter, or an air-purifying respirator equipped with a filter certified for particulates by NIOSH under 42 CFR Part 84; or,
- For contaminants consisting primarily of particles with mass median aerodynamic diameters of at least two micrometers, an air-purifying respirator equipped with any filter certified for particulates by NIOSH.

#### **Employee Respiratory Protection Training**

Any Apex employee issued a respirator must be medically qualified and receive proper training prior to being fit tested, or using the respirator. The training must be comprehensive, understandable and recur annually, and more often, if necessary. The training will include the following:

An explanation of the respirator and its parts;

- A demonstration of how to properly put on, adjust, wear and check the seals of the respirator;
- An opportunity to wear the respirator in a normal environment;
- A review of the requirements of the OSHA Respiratory Protection Standard and Apex's Respiratory Protection Program;
- Qualitative fit-testing of the employee, at least annually, with the respirator he/she will
  use (for half or full-face piece respirators); quantitative fit-testing for all other respirator
  types;
- An explanation of the nature of the respiratory hazards for which protection is sought and the health effects which can occur from exposure to the contaminant(s),
- How to use a respirator effectively in emergency situations, including malfunctioning situations;
- A discussion of how improper fit, usage or maintenance can compromise the protective effect of a respirator;
- How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators;
- A discussion of the respirator's protection capabilities, limitations and factors that impact proper fit;
- A discussion of Apex' policy regarding the use of respirators; and,
- Instructions for proper cleaning, maintenance, storage, inspection, care, and cartridge replacement.

All Apex employees must be fit-tested according to the procedures outlined in 29 CFR 1910.134 prior to using a tight-fitting, air-purifying respirator. Fit-testing procedures, including those for negative and positive pressure checks and irritant smoke, banana oil and other qualitative fit test methods, are provided. The positive and negative pressure tests described must be performed by the employee whenever the respirator is donned as well as periodically throughout the day. The banana oil or irritant smoke tests are performed when the employee is assigned a half-face, or full face piece respirator and at least once every year, or upon request.

Respirator fit-testing must be repeated if an employee experiences any changes in facial features such as significant weight loss or weight gain, facial scarring or dental work.

Fit-testing records will be retained for respirator users until the next fit test is administered.

#### Respirator Assignment, Inspection, Cleaning And Storage

#### **Respirator Assignment**

Apex employees will be issued tight-fitting, half-face-piece, or a full-face-piece respirator. Each employee should become familiar with the manufacturer's instructions regarding his/her respirator. Respirators will be individually assigned to employees and should be marked to ensure easy identification by the user. All employees required to wear a respirator must adhere to the following:

- Use only the respirator assigned to him/her in accordance with the training received and do not give or lend his/her respirator to any other person;
- Shave the areas of the face where the face piece seals no more than eight (8) hours prior to wearing the respirator and trim any facial hair, which may interfere with the operation of the respirator, including long sideburns, bushy mustaches and long hair inside the respirator, which may interfere with the exhalation valve;
- Inspect the respirator for functional operations, missing parts, and damage prior to each use. Replace missing and/or damaged parts immediately upon detection with manufacturer parts only;
- Conduct routine user seal checks each time the respirator is put on to ensure proper placement on the face using the positive or negative pressure tests;
- Clean the respirator on a regular basis;
- Store the respirator in a clean air-tight bag, or other suitable sealable container, in such a way that the face piece is not distorted and is not exposed to excessive moisture, heat or cold:
- Obtain new cartridges whenever the End of Service Life Indicator (ESLI) signals the need, breathing through the cartridges becomes difficult, as soon as odor is detected, the change out schedule dictates, or as recommended by the manufacturer; and,
- Report any problems with the respirator to the Respiratory Protection Program Coordinator for the office, the RPP Administrator, or your Supervisor. Defective respirators should be immediately replaced.

#### **Respirator Inspection**

Once an Apex employee is issued an air-purifying respirator, there are general rules, which he/she must follow:

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• Inspect respirators before each use, and during cleaning. If there are any parts, which are worn or need replacing, do so before using again. Inspect routinely for the following:

Excessive dirt or residue on the face piece;

Inflexibility of the pliable face piece;

Cracks, tears, holes or physical distortions of shape;

Incorrectly mounted or scratched full-face piece lens;

Broken/missing mounting clips (full-face piece);

Cracked or broken air-purifying element holder(s);

Badly worn threads or missing gasket(s); and

Cracks, tears, distortions or debris in the valves seats.

Head straps or head harness should be examined for:

Breaks;

Loss of elasticity;

Broken or malfunctioning buckles, corrosion of buckles and other metal components and attachments; and

Excessively worn serrations on head harness, which may permit slippage.

Exhalation valve should be examined for the following (after removing its cover):

Foreign material, such as detergent residue, dust particles or human hair under the valve seat;

Cracks, tears or distortions in the valve;

Improper insertion of the valve body in the face-piece;

Cracks, breaks or chips in the valve body, particularly in the sealing surface;

Missing or defective valve cover; and

Improper installation of the valve in the valve body.

Air-purifying element should be examined for:

Incorrect cartridge, canister or filter for the hazard;

Incorrect installation, loose connections, missing or worn gasket or cross threading in the holder;

Expired shelf-life date/end of service life indicator on the cartridge or canister; and

Cracks or dents in the outside case of the filter, cartridge or canister, indicated by the absence of sealing material, tape, foil, etc. over the inlet.

- All respirators maintained for use in emergency situations shall be inspected at least monthly and in accordance with the manufacturers recommendations, and shall be checked for proper function before and after each use.
- Emergency escape-only respirators (5 to 10 minute air supply) shall be inspected before being carried into the workplace for use.
- Self-contained breathing apparatus (SCBA) shall be inspected monthly. Breathing air in cylinders shall be maintained in a fully charged state and recharged when the pressure drops below 90% of the manufacturers recommended pressure level. The employee shall determine that regulator and warning devices function properly.
- For any respirator used for emergency purposes, the employer must certify on a tag or label, the inspection date, the name of the inspector, the findings, required remedial action and a serial number or other means of identifying the inspected respirator.
- Emergency respirators must have an inspection tag or label, attached to the respirator storage compartment, or have inspection information included in reports as paper or electronic file. This information shall be maintained until replaced following a subsequent certification.
- Emergency respirators shall be kept accessible to the work area; stored in compartments or in covers that are clearly marked as containing emergency respirators; and stored in accordance with any applicable manufacturers instructions.

Inspection records must be maintained with project files.

#### **Respirator Cleaning**

Employees will be responsible for the inspection, cleaning and maintenance of their own respirators. The cleaning procedures located in **Appendix F-3** should be performed on a regular basis. These procedures are general in nature, and Apex will permit cleaning procedures recommended by the manufacturer of the respirator, as an alternative, provided such procedures are as effective as those listed in **Appendix F-3**.

#### **Respirator Storage**

Respirators must be stored in an appropriate storage location when not in use. This storage area must protect the respirators from dust, sunlight, heat, extreme cold, excessive moisture, and damaging chemicals such as solvents or corrosive gases. If stored near an area containing hazardous materials, such as a hazardous waste storage room, the respirator should be stored outside the room near the entranceway.

Respirators shall be placed in plastic bags, or other sealable containers, and stored so that face-pieces and valves will rest in a normal position to prevent deformation. Failure to properly store a respirator may result in face piece seal failure or valve malfunction.

#### **Supplied Air Respirators**

Supplied-air respirators (SAR) include airline (Type C) respirators and Self-Contained Breathing Apparatus (SCBA). SARs are utilized when air-purifying respirators cannot adequately control exposure to respiratory hazards. Selection will be performed according to the guidance of ANSI Standard ZB8.2-1980. John Reinemann will obtain a copy of ANSI Standard ZB8.2-1980.

#### Air-Line Respirators (Type C)

Airline respirators are the most commonly used type of supplied-air respirator for physically demanding, long term, or confined space work. Type C supplied air systems normally consist of a compressor providing Grade D air, a NIOSH-approved face-piece and air delivery line, an air cleaning system, and a reserve air supply, such as a 5 or 10-minute escape cylinder. Every component of air-line respirator units must be approved by NIOSH. In addition, OSHA requires that the airlines not exceed 300 feet in length and the inlet pressure not exceed 125 psi. The greater the length of the airline in Type C respiratory protective equipment, the greater the potential for a significant safety hazard. Therefore, escape maneuvers in an emergency can become difficult if the airline becomes pinched and caught, tangled or twisted. Operation of the system requires several persons. Users must be aware that the air supply can become contaminated and must also be decontaminated, as appropriate.

Airline respirators will usually consist of the following:

- A face-piece with a breathing valve;
- An air supply hose and manifold assembly;
- A harness assembly;
- · A grade "D" air supply; and
- An escape cylinder and regulator.

The following must be considered and evaluated prior to the use of air-line respirators:

- Is the atmosphere IDLH or likely to become IDLH?
- Will the air hose impair the mobility of the user?
- Is there a danger of the airline becoming damaged by equipment or chemicals?
- · Will airborne contaminants interfere with the breathing air source?

Is the breathing air quality monitored?

#### **Self-Contained Breathing Apparatus (SCBA)**

SCBA usually consists of a face-piece connected by a hose and a regulator to an air source carried by the wearer. Only positive-pressure SCBAs will be used by Apex employees for entry into atmospheres that are IDLH. SCBAs provide the greatest degree of protection against contaminants but are bulky, weighing anywhere from 30 to 50 pounds and can increase the user's risk of heat stress and potential for injury when working in confined spaces and other areas. In addition, SCBAs contain a limited air supply (30-60 minutes), which may vary depending upon the oxygen needs (physical exertion) of the user. SCBAs are utilized during routine and emergency operations for unknown or extremely dangerous concentrations of hazardous substances.

All compressed breathing air cylinders must meet minimum U.S. Department of Transportation (DOT) requirements for interstate shipment (49 CFR Parts 173 and 178). All compressed air must meet all requirements of OSHA 29 CFR 1910.134 (d). In addition, breathing air must meet or exceed the requirements of Grade D breathing air as specified in the Compressed Gas Association pamphlet G-7.1.

Compressed breathing air shall meet the following specifications:

- 1. Oxygen content (v/v) of 19.5% 23.5%;
- 2. Condensed hydrocarbon content of 5 milligrams per cubic meter of air or less;
- 3. Carbon monoxide (CO) content of 10 ppm or less;
- 4. Carbon dioxide (CO<sub>2</sub>) content of 1000 ppm or less; and,
- 5. Lack of noticeable odor.

When considering the selection of SCBA for a job, all of the following should be addressed:

- Is the atmosphere IDLH or is it likely to become IDLH?
- Is the duration of air supply sufficient for accomplishing the necessary tasks?
- Will the bulk and weight of the SCBA interfere with performance of the task or cause excessive stress to the wearer?
- How will temperature effect the equipment and the worker?

#### **Employee Information and Training**

Prior to the use of supplied-air respirators, Apex employees must complete training on SCBA, such as that provided during the 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, 24 or 40-hour initial training courses. Training includes the following:

- An explanation of the respirator and its parts;
- A demonstration of the proper donning, adjusting, wearing and doffing of the respirator;
- The opportunity for the employee to wear the respirator in a normal, non-hazardous environment;
- An explanation of the nature of the respiratory hazards for which protection is sought and the health effects which can occur from exposure to the contaminant; and
- A discussion of the respirator's protection capabilities, limitations and factors that affect proper fit.

Apex employees shall follow the manufacturers instructions provided with the respirators for inspection, maintenance, and storage directions.

#### **Respirator Fit-Testing Procedures**

Once an employee is issued a respirator, he/she must first be fit-tested to determine if it fits properly. Fit checking and fit testing should be performed on a routine basis.

Before an employee may be required to use any respirator with a negative or positive pressure tight-fitting face piece, the employee must be fit tested with the same make, model, style, and size of respirator that will be used. Apex requires that employees using a tight-fitting face piece respirator pass an appropriate qualitative fit test (QLFT) or quantitative fit test (QNFT). If a QLFT is conducted, the assigned protection factor can not exceed 50 for full face piece, or 10 for ½ face piece respirators. When a QNFT protocol is used, if the fit factor is equal to or greater than 100 for tight fitting, half-face piece respirator, or equal to or greater than 500 for tight fitting, full-face piece respirator, the QNFT has been passed with that respirator. A QLFT is passed when the wearer is unable to detect the testing agent. Additional fit testing is required whenever the employee reports, or the employer, PLHCP, supervisor, or program administrator(s) makes visual observations of changes in the employee's physical condition that could affect respirator fit. Such conditions include, but are not limited to facial scarring, facial swelling, dental changes, cosmetic surgery, or an obvious change in body weight.

Employees that voluntarily wear respirators must be provided with OSHA's information for voluntary use of a respirator. A copy of this voluntary use information is included in the Program guide as **Appendix F-4**. A list of employees that voluntarily wear respirators must be maintained and must include the following information:

- 1. Employee name;
- 2. Department that employee is assigned to;
- 3. Tasks performed; and,
- 4. Type of respirator.

If after passing a QLFT or QNFT, the employee subsequently notifies the program administrator, supervisor, or PLHCP that the fit of the respirator is unacceptable, the employee shall be given a reasonable opportunity to select a different respirator face piece and to be retested. Any fit test shall be administered using an OSHA-accepted QLFT or QNFT protocol.

#### Qualitative Fit-Testing (QLFT)

QLFT is required for all Apex employees under the Respirator Protection Program. QLFT may only be used to fit test tight-fitting negative or positive pressure air purifying respirators that must achieve a fit factor of 100 or less. The fit factor for ½ mask APR is 10; the fit factor for a full-face APR is 50. The fit factor means a quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn. The QLFT will be performed at least annually. The QLFT requirement applies to all tight-fitting negative or positive pressure respirators used in toxic environments.

#### **Testing Procedure**

- 1. Respirators in a full range of sizes will be available for the employee to select from. The respirator selected will be equipped with organic-vapor cartridges. Assessment of comfort shall include reviewing the following points with the test subject: chin properly placed; positioning of mask on nose; strap tension; fit across nose bridge; interference from safety glasses; tendency to slip; room to talk; distance from nose to chin; cheeks filled out; and self observation in mirror. Allow adequate time for this assessment. Before moving to the next step, the employee shall be told to "seat" the mask by rapidly moving the head side-to-side and up-and-down while taking a few deep breaths.
- After a comfort assessment, the test subject shall conduct the conventional negative and positive fit checks.

- a. <u>Positive Pressure Test</u>: Close off the exhalation valve with your hand. Breathe air into the mask. The face fit is satisfactory if some pressure can be built up inside the mask without air leaking out between the mask and the face of the wearer.
- b. <u>Negative Pressure Test</u>: Close the inlet openings of cartridge with the palm of your hand. Some masks may require that the filter holder be removed to seal off the intake valve. Inhale gently so that a vacuum occurs within the face piece. Hold your breath for ten seconds. If the vacuum remains, and no inward leakage is detected, the respirator is properly fitted.

NOTE: The negative and positive fit tests are required every time the respirator is donned, unlike the QLFT, which is required annually.

- 3. Isoamyl Acetate (banana oil) will be the agent used for the QLFT on tight-fitting respirators equipped with organic vapor cartridges. Individuals must be screened (respirator off) to ensure they can detect the sweet odor. If an individual cannot detect the banana-like odor, then irritant smoke will be used and high-efficiency particulate air (HEPA) cartridges must be substituted for the organic vapor cartridges. If irritant smoke is used, the plastic test enclosure used for conducting the isoamyl acetate QLFT must not be used. The RPPA shall be notified before proceeding with irritant smoke as the testing agent.
- 4. The fitting process now shall be conducted in a separate room to prevent odor fatigue. The subject will don his/her respirator and slip the plastic test enclosure (tent) over his/her head. While the test agent is released into the subject's breathing zone, he/she must go through the following exercise regiment:
  - a. Breathe normally for at least one minute.
  - b. Breathe deep for one minute, pausing between breaths so as not to hyperventilate.
  - c. Turn head side to side and up and down for one minute.
  - d. Read the "Rainbow Passage" slowly out loud:

"When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow."

- e. Bend over and attempt to touch toes for one minute.
- f. Jog in place for one minute.
- g. Breathe normally for one minute.

- 5. If the entire test is completed without the test subject detecting the odor of the testing agent, the test is passed and the respirator selected is judged adequate.
  - If anytime during the test, the subject detects the odor of the testing agent, she/he shall quickly exit the room and the fitting process shall start again at step 4.
  - b. If the test subject exhibits difficulty in breathing during the tests, the test will stop and he/she will be referred to a physician trained in pulmonary medicine.
  - c. If the respirator proves to be unsatisfactory after actual use, the employee may request another test.
  - d. If the test subject has any significant physical changes such as weight loss or gain, scarring, dental work, cosmetic surgery, etc. that may alter the face piece sealing, another QLFT shall be conducted.

#### Records

A summary of all fit test results shall be maintained in the employee's work area and copies kept by the RPPA for a minimum of the duration of employment. The Respirator Fit Test Record Form is located in this plan. The records shall include the following:

- 1. Types of respirator, fitting test used (QLFT);
- Specific make and model of respirator tested and cartridges used;
- 3. Name of person tested;
- 4. Name of test operator;
- 5. Date of test; and
- 6. Results (success or failure).

#### 11.1 **Voluntary Use Of Respirators**

Employees that voluntarily wear respirators must be provided with OSHA's information for voluntary use of a respirator. A copy of this voluntary use information is included in this Program. A list of employees that voluntarily wear respirators must be maintained in each office and must include the following information:

- 1. Employee name;
- 2. Department that employee is assigned to:
- 3. Tasks performed; and,
- 4. Type of respirator

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## APPENDIX F-1 OSHA RESPIRATOR MEDICAL EVALUATION QUESTIONNAIRE

Part Number: 1910 • Part Title: Occupational Safety and Health Standards Subpart: · Subpart Title: Personal Protective Equipment Standard Number: 1910.134 App C OSHA Respirator Medical Evaluation Questionnaire (Mandatory). Title: Appendix C to Sec. 1910.134: OSHA Respirator Medical Evaluation Questionnaire (Mandatory) To the employer: Answers to questions in Section 1, and to question 9 in Section 2 of Part A, do not require a medical examination. To the employee: Can you read (circle one): Yes/No Your employer must allow you to answer this questionnaire during normal working hours, or at a time and place that is convenient to you. To maintain your confidentiality, your employer or supervisor must not look at or review your answers, and your employer must tell you how to deliver or send this guestionnaire to the health care professional who will review it. Part A. Section 1. (Mandatory) The following information must be provided by every employee who has been selected to use any type of respirator (please print). 1. Today's date: 2. Your name: 3. Your age (to nearest year):\_\_\_ 4. Sex (circle one): Male/Female 5. Your height: \_\_\_\_\_ ft. \_ 6. Your weight: \_ 7. Your job title: 8. A phone number where you can be reached by the health care professional who reviews this questionnaire (include the Area Code): 9. The best time to phone you at this number: 10. Has your employer told you how to contact the health care professional who will review this questionnaire (circle one): Yes/No 11. Check the type of respirator you will use (you can check more than one category): a. N, R, or P disposable respirator (filter-mask, non- cartridge type only). Other type (for example, half- or full-facepiece type, powered-air purifying, supplied-air, self-contained breathing apparatus). 12. Have you worn a respirator (circle one): Yes/No If "yes," what type(s): Part A. Section 2. (Mandatory) Questions 1 through 9 below must be answered by every employee who has been selected to use any type of respirator (please circle "yes" or "no"). 1. Do you currently smoke tobacco, or have you smoked tobacco in the last month: Yes/No 2. Have you ever had any of the following conditions? a. Seizures (fits): Yes/No b. Diabetes (sugar disease): Yes/No Allergic reactions that interfere with your breathing: Yes/No C. Claustrophobia (fear of closed-in places): Yes/No e. Trouble smelling odors: Yes/No 3. Have you ever had any of the following pulmonary or lung problems? a. Asbestosis: Yes/No b. Asthma: Yes/No Chronic bronchitis: Yes/No C. d. Emphysema: Yes/No e. Pneumonia: Yes/No Tuberculosis: Yes/No f. Silicosis: Yes/No g. h. Pneumothorax (collapsed lung): Yes/No Lung cancer: Yes/No i. Broken ribs: Yes/No j. k. Any chest injuries or surgeries: Yes/No Any other lung problem that you've been told about: Yes/No 4. Do you currently have any of the following symptoms of pulmonary or lung illness?

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a. Shortness of breath: Yes/No

- b. Shortness of breath when walking fast on level ground or walking up a slight hill or incline: Yes/No
- Shortness of breath when walking with other people at an ordinary pace on level ground: Yes/No
- Have to stop for breath when walking at your own pace on level ground: Yes/No
- Shortness of breath when washing or dressing yourself: Yes/No
- Shortness of breath that interferes with your job: Yes/No f.
- Coughing that produces phlegm (thick sputum): Yes/No
- Coughing that wakes you early in the morning: Yes/No
- Coughing that occurs mostly when you are lying down: Yes/No i.
- Coughing up blood in the last month: Yes/No
- Wheezing: Yes/No
- 1. Wheezing that interferes with your job: Yes/No
- m. Chest pain when you breathe deeply: Yes/No
- Any other symptoms that you think may be related to lung problems: Yes/No
- 5. Have you ever had any of the following cardiovascular or heart problems?
  - a. Heart attack: Yes/No
  - b. Stroke: Yes/No
  - Angina: Yes/No
  - d. Heart failure: Yes/No
  - e. Swelling in your legs or feet (not caused by walking): Yes/No
  - Heart arrhythmia (heart beating irregularly): Yes/No
  - High blood pressure: Yes/No
  - Any other heart problem that you've been told about: Yes/No
- 6. Have you ever had any of the following cardiovascular or heart symptoms?
  - a. Frequent pain or tightness in your chest: Yes/No
  - b. Pain or tightness in your chest during physical activity: Yes/No
  - c. Pain or tightness in your chest that interferes with your job: Yes/No
  - d. In the past two years, have you noticed your heart skipping or missing a beat: Yes/No
  - e. Heartburn or indigestion that is not related to eating: Yes/ No
  - Any other symptoms that you think may be related to heart or circulation problems: Yes/No
- 7. Do you currently take medication for any of the following problems?
  - a. Breathing or lung problems: Yes/No
  - Heart trouble: Yes/No
  - Blood pressure: Yes/No C.
  - Seizures (fits): Yes/No
- 8. If you've used a respirator, have you ever had any of the following problems? (If you've never used a respirator, check the following space and go to question 9:)

  - a. Eye irritation: Yes/Nob. Skin allergies or rashes: Yes/No
  - c. Anxiety: Yes/No
  - d. General weakness or fatigue: Yes/No
  - e. Any other problem that interferes with your use of a respirator: Yes/No
- 9. Would you like to talk to the health care professional who will review this questionnaire about your answers to this questionnaire: Yes/No

Questions 10 to 15 below must be answered by every employee who has been selected to use either a fullfacepiece respirator or a self-contained breathing apparatus (SCBA). For employees who have been selected to use other types of respirators, answering these questions is voluntary.

- 10. Have you ever lost vision in either eye (temporarily or permanently): Yes/No
- 11. Do you currently have any of the following vision problems?
  - a. Wear contact lenses: Yes/Nob. Wear glasses: Yes/No

  - Color blind: Yes/No
  - d. Any other eye or vision problem: Yes/No
- 12. Have you ever had an injury to your ears, including a broken ear drum: Yes/No
- 13. Do you currently have any of the following hearing problems?
  - a. Difficulty hearing: Yes/No
  - b. Wear a hearing aid: Yes/No
  - c. Any other hearing or ear problem: Yes/No
- 14. Have you ever had a back injury: Yes/No
- 15. Do you currently have any of the following musculoskeletal problems?
  - a. Weakness in any of your arms, hands, legs, or feet: Yes/No
  - b. Back pain: Yes/No

c. Difficulty fully moving your arms and legs: Yes/No d. Pain or stiffness when you lean forward or backward at the waist: Yes/No Difficulty fully moving your head up or down: Yes/No Difficulty fully moving your head side to side: Yes/No Difficulty bending at your knees: Yes/No Difficulty squatting to the ground: Yes/No Climbing a flight of stairs or a ladder carrying more than 25 lbs: Yes/No Any other muscle or skeletal problem that interferes with using a respirator: Yes/No Part B Any of the following questions, and other questions not listed, may be added to the questionnaire at the discretion of the health care professional who will review the questionnaire. 1. In your present job, are you working at high altitudes (over 5,000 feet) or in a place that has lower than normal amounts of oxygen: Yes/No If "yes," do you have feelings of dizziness, shortness of breath, pounding in your chest, or other symptoms when you're working under these conditions: Yes/No 2. At work or at home, have you ever been exposed to hazardous solvents, hazardous airborne chemicals (e.g., gases, fumes, or dust), or have you come into skin contact with hazardous chemicals: Yes/No If "yes," name the chemicals if you know them: 3. Have you ever worked with any of the materials, or under any of the conditions, listed below: a. Asbestos: Yes/No b. Silica (e.g., in sandblasting): Yes/No c. Tungsten/cobalt (e.g., grinding or welding this material): Yes/No d. Beryllium: Yes/No e. Aluminum: Yes/No f. Coal (for example, mining): Yes/No g. Iron: Yes/No h. Tin: Yes/No Dusty environments: Yes/No Any other hazardous exposures: Yes/No j. Any other hazardous exposite "yes," describe these exposures: 4. List any second jobs or side businesses you have: 5. List your previous occupations: 6. List your current and previous hobbies: 7. Have you been in the military services? Yes/No If "yes," were you exposed to biological or chemical agents (either in training or combat): Yes/No 8. Have you ever worked on a HAZMAT team? Yes/No 9. Other than medications for breathing and lung problems, heart trouble, blood pressure, and seizures mentioned earlier in this questionnaire, are you taking any other medications for any reason (including over-thecounter medications): Yes/No If "yes," name the medications if you know them: 10. Will you be using any of the following items with your respirator(s)?

- a. HEPA Filters: Yes/No
  - b. Canisters (for example, gas masks): Yes/No
  - c. Cartridges: Yes/No
- 11. How often are you expected to use the respirator(s) (circle "yes" or "no" for all answers that apply to you)?:
  - a. Escape only (no rescue): Yes/No
  - b. Emergency rescue only: Yes/No
  - c. Less than 5 hours per week: Yes/No
  - d. Less than 2 hours per day: Yes/No
  - e. 2 to 4 hours per day: Yes/No
  - Over 4 hours per day: Yes/No
- 12. During the period you are using the respirator(s), is your work effort:
  - a. Light (less than 200 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift:\_\_\_ hrs. Examples of a light work effort are sitting while writing, typing, drafting, or performing light assembly work; or standing while operating a drill press (1-3 lbs.) or controlling machines.

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b. Moderate (200 to 350 kcal per hour): Yes/No	
If "yes," how long does this period last during the average shift: hrs.	mins.
Examples of moderate work effort are sitting while nailing or filing; driving a truck or be	
standing while drilling, nailing, performing assembly work, or transferring a moderate lo	ad (about 35 lbs.) at
trunk level; walking on a level surface about 2 mph or down a 5-degree grade about 3	mph: or pushing a
wheelbarrow with a heavy load (about 100 lbs.) on a level surface.	mpin, or publishing a
c. <b>Heavy</b> (above 350 kcal per hour): Yes/No	
	mins
If "yes," how long does this period last during the average shift: hrs. Examples of heavy work are <b>lifting</b> a heavy load (about 50 lbs.) from the floor to your w	aist or shoulder: working
on a loading dock; <b>shoveling</b> ; <b>standing</b> while bricklaying or chipping castings; <b>walking</b>	un an 8-degree grade
about 2 mph; climbing stairs with a heavy load (about 50 lbs.).	ap an e degree grade
13. Will you be wearing protective clothing and/or equipment (other than the respirator)	when you're using your
respirator: Yes/No	e yeare asing year
If "yes," describe this protective clothing and/or equipment:	
11 you, assorbe the protocare distantly arrayor equipment.	
14. Will you be working under hot conditions (temperature exceeding 77 deg. F): Yes/N	<u> </u>
15. Will you be working under humid conditions: Yes/No	
16. Describe the work you'll be doing while you're using your respirator(s):	
10. Doonbo the work you'll be doing will by you'll doing you reapplicately.	
	_
17. Describe any special or hazardous conditions you might encounter when you're usir	 ng vour respirator(s) (for
example, confined spaces, life-threatening gases):	.3 ,
3 g	
18. Provide the following information, if you know it, for each toxic substance that you'll	be exposed to when
you're using your respirator(s):	
Name of the first toxic substance:	
Estimated maximum exposure level per shift:	
Duration of exposure per shift:	
Name of the second toxic substance:  Estimated maximum exposure level per shift:	
Estimated maximum exposure level per shift:	
Duration of exposure per shift:	
Name of the third toxic substance:	-
Estimated maximum exposure level per shift:	
Duration of exposure per shift:	<u>.</u>
The name of any other toxic substances that you'll be exposed to	
while using your respirator:	
19. Describe any special responsibilities you'll have while using your respirator(s) that m	ay affect the safety and
well-being of others (for example, rescue, security):	
[63 FR 1152, Jan. 8, 1998; 63 FR 20098, April 23, 1998]	

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## APPENDIX F-2 RESPIRATOR USER SEAL CHECK AND FIT TEST PROCEDURES RECORD

Part Number: 1910

Part Title: Occupational Safety and Health Standards

Subpart:

Subpart Title: Personal Protective Equipment

• Standard Number: 1910.134 App A

• Title: Fit Testing Procedures (Mandatory).

Appendix A to § 1910.134: Fit Testing Procedures (Mandatory)

#### Part I. OSHA-Accepted Fit Test Protocols

A. Fit Testing Procedures -- General Requirements

The employer shall conduct fit testing using the following procedures. The requirements in this appendix apply to all OSHA-accepted fit test methods, both QLFT and QNFT.

- 1. The test subject shall be allowed to pick the most acceptable respirator from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.
- 2. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, because it is only a review.
- 3. The test subject shall be informed that he/she is being asked to select the respirator that provides the most acceptable fit. Each respirator represents a different size and shape, and if fitted and used properly, will provide adequate protection.
- 4. The test subject shall be instructed to hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit.
- 5. The more acceptable facepieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in the following item A.6. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.
- 6. Assessment of comfort shall include a review of the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:
- (a) Position of the mask on the nose
- (b) Room for eye protection
- (c) Room to talk
- (d) Position of mask on face and cheeks
- 7. The following criteria shall be used to help determine the adequacy of the respirator fit:
- (a) Chin properly placed;
- (b) Adequate strap tension, not overly tightened;
- (c) Fit across nose bridge;
- (d) Respirator of proper size to span distance from nose to chin;
- (e) Tendency of respirator to slip;
- (f) Self-observation in mirror to evaluate fit and respirator position.
- 8. The test subject shall conduct a user seal check, either the negative and positive pressure seal checks described in Appendix B-1 of this section or those recommended by the respirator manufacturer which provide equivalent protection to the procedures in Appendix B-1. Before conducting the negative and positive pressure checks, the subject shall be told to seat the mask on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the user seal check tests.
- 9. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, mustache or sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.
- 10. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician or other licensed health care professional, as appropriate, to determine whether the test subject can wear a respirator while performing her or his duties.
- 11. If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.
- 12. Exercise regimen. Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall

include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.

- 13. The fit test shall be performed while the test subject is wearing any applicable safety equipment that may be worn during actual respirator use which could interfere with respirator fit.
- 14. Test Exercises. (a) The following test exercises are to be performed for all fit testing methods prescribed in this appendix, except for the CNP method. A separate fit testing exercise regimen is contained in the CNP protocol. The test subject shall perform exercises, in the test environment, in the following manner:
- (1) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally.
- (2) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as not to hyperventilate.
- (3) Turning head side to side. Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.
- (4) Moving head up and down. Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).
- (5) Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song.

#### Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

- (6) Grimace. The test subject shall grimace by smiling or frowning. (This applies only to QNFT testing; it is not performed for QLFT)
- (7) Bending over. The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT or QLFT units that do not permit bending over at the waist. (8) Normal breathing. Same as exercise (1).
- (b) Each test exercise shall be performed for one minute except for the grimace exercise which shall be performed for 15 seconds. The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried. The respirator shall not be adjusted once the fit test exercises begin. Any adjustment voids the test, and the fit test must be repeated.

#### B. Qualitative Fit Test (QLFT) Protocols

- 1. General
- (a) The employer shall ensure that persons administering QLFT are able to prepare test solutions, calibrate equipment and perform tests properly, recognize invalid tests, and ensure that test equipment is in proper working order.
- (b) The employer shall ensure that QLFT equipment is kept clean and well maintained so as to operate within the parameters for which it was designed.
- 2. Isoamyl Acetate Protocol

**Note:** This protocol is not appropriate to use for the fit testing of particulate respirators. If used to fit test particulate respirators, the respirator must be equipped with an organic vapor filter.

(a) Odor Threshold Screening

Odor threshold screening, performed without wearing a respirator, is intended to determine if the individual tested can detect the odor of isoamyl acetate at low levels.

- (1) Three 1 liter glass jars with metal lids are required.
- (2) Odor-free water (e.g., distilled or spring water) at approximately 25 deg. C (77 deg. F) shall be used for the solutions.
- (3) The isoamyl acetate (IAA) (also known at isopentyl acetate) stock solution is prepared by adding 1 ml of pure IAA to 800 ml of odor-free water in a 1 liter jar, closing the lid and shaking for 30 seconds. A new solution shall be prepared at least weekly.
- (4) The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well-ventilated to prevent the odor of IAA from becoming evident in the general room air where testing takes place.
- (5) The odor test solution is prepared in a second jar by placing 0.4 ml of the stock solution into 500 ml of odor-free water using a clean dropper or pipette. The solution shall be shaken for 30 seconds and allowed to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution shall be used for only one day.
- (6) A test blank shall be prepared in a third jar by adding 500 cc of odor-free water.

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- (7) The odor test and test blank jar lids shall be labeled (e.g., 1 and 2) for jar identification. Labels shall be placed on the lids so that they can be peeled off periodically and switched to maintain the integrity of the test.
- (8) The following instruction shall be typed on a card and placed on the table in front of the two test jars (i.e., 1 and 2): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."
- (9) The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.
- (10) If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test shall not be performed.
- (11) If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.
- (b) Isoamyl Acetate Fit Test
- (1) The fit test chamber shall be a clear 55-gallon drum liner suspended inverted over a 2-foot diameter frame so that the top of the chamber is about 6 inches above the test subject's head. If no drum liner is available, a similar chamber shall be constructed using plastic sheeting. The inside top center of the chamber shall have a small hook attached.
- (2) Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors.
- (3) After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well-ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.
- (4) A copy of the test exercises and any prepared text from which the subject is to read shall be taped to the inside of the test chamber.
- (5) Upon entering the test chamber, the test subject shall be given a 6-inch by 5-inch piece of paper towel, or other porous, absorbent, single-ply material, folded in half and wetted with 0.75 ml of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber. An IAA test swab or ampule may be substituted for the IAA wetted paper towel provided it has been demonstrated that the alternative IAA source will generate an IAA test atmosphere with a concentration equivalent to that generated by the paper towel method.
- (6) Allow two minutes for the IAA test concentration to stabilize before starting the fit test exercises. This would be an appropriate time to talk with the test subject; to explain the fit test, the importance of his/her cooperation, and the purpose for the test exercises; or to demonstrate some of the exercises.
- (7) If at any time during the test, the subject detects the banana-like odor of IAA, the test is failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.
- (8) If the test is failed, the subject shall return to the selection room and remove the respirator. The test subject shall repeat the odor sensitivity test, select and put on another respirator, return to the test area and again begin the fit test procedure described in (b) (1) through (7) above. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait at least 5 minutes before retesting. Odor sensitivity will usually have returned by this time.
- (9) If the subject passes the test, the efficiency of the test procedure shall be demonstrated by having the subject break the respirator face seal and take a breath before exiting the chamber.
- (10) When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test, so that there is no significant IAA concentration buildup in the chamber during subsequent tests. The used towels shall be kept in a self-sealing plastic bag to keep the test area from being contaminated.
- 3. Saccharin Solution Aerosol Protocol
- The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the
- (a) Taste threshold screening. The saccharin taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of saccharin.
- (1) During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches in diameter by 14 inches tall with at least the front portion clear and that allows free movements of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.
- (2) The test enclosure shall have a 3/4-inch (1.9 cm) hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.
- (3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his/her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a sweet taste.
- (4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. The nozzle is directed away from the nose and mouth of the person.

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- (5) The threshold check solution is prepared by dissolving 0.83 gram of sodium saccharin USP in 100 ml of warm water. It can be prepared by putting 1 ml of the fit test solution (see (b)(5) below) in 100 ml of distilled
- (6) To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then released and allowed to fully expand.
- (7) Ten squeezes are repeated rapidly and then the test subject is asked whether the saccharin can be tasted. If the test subject reports tasting the sweet taste during the ten squeezes, the screening test is completed. The taste threshold is noted as ten regardless of the number of squeezes actually completed.
- (8) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted. If the test subject reports tasting the sweet taste during the second ten squeezes, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.
- (9) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted. If the test subject reports tasting the sweet taste during the third set of ten squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.
- (10) The test conductor will take note of the number of squeezes required to solicit a taste response.
- (11) If the saccharin is not tasted after 30 squeezes (step 10), the test subject is unable to taste saccharin and may not perform the saccharin fit test.

Note to paragraph 3. (a): If the test subject eats or drinks something sweet before the screening test, he/she may be unable to taste the weak saccharin solution.

- (12) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.
- (13) Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.
- (14) The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least each morning and afternoon or at least every four hours.
- (b) Saccharin solution aerosol fit test procedure.
- (1) The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.
- (2) The fit test uses the same enclosure described in 3. (a) above.
- (3) The test subject shall don the enclosure while wearing the respirator selected in section I. A. of this appendix. The respirator shall be properly adjusted and equipped with a particulate filter(s).
- (4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution
- (5) The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 ml of warm water.
- (6) As before, the test subject shall breathe through the slightly open mouth with tongue extended, and report if he/she tastes the sweet taste of saccharin.
- (7) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of saccharin fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test. A minimum of 10 squeezes is required.
- (8) After generating the aerosol, the test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.
- (9) Every 30 seconds the aerosol concentration shall be replenished using one half the original number of squeezes used initially (e.g., 5, 10 or 15).
- (10) The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected. If the test subject does not report tasting the saccharin, the test is passed.
- (11) If the taste of saccharin is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried and the entire test procedure is repeated (taste threshold screening and fit testing).
- (12) Since the nebulizer has a tendency to clog during use, the test operator must make periodic checks of the nebulizer to ensure that it is not clogged. If clogging is found at the end of the test session, the test is invalid.
- 4. Bitrex<sup>TM</sup> (Denatonium Benzoate) Solution Aerosol Qualitative Fit Test Protocol
  The Bitrex<sup>TM</sup> (Denatonium benzoate) solution aerosol QLFT protocol uses the published saccharin test protocol because that protocol is widely accepted. Bitrex is routinely used as a taste aversion agent in household liquids which children should not be drinking and is endorsed by the American Medical Association, the National Safety Council, and the American Association of Poison Control Centers. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.
- (a) Taste Threshold Screening.

The Bitrex taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of Bitrex.

(1) During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and

Apex Environmental, Inc. June 24, 2002 Chapter 11: Respiratory Protection Program Page 34 of 48 shoulders that is approximately 12 inches (30.5 cm) in diameter by 14 inches (35.6 cm) tall. The front portion of the enclosure shall be clear from the respirator and allow free movement of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.

- (2) The test enclosure shall have a \3/4\ inch (1.9 cm) hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.
- (3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his or her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a bitter taste
- (4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the Threshold Check Solution into the enclosure. This Nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.
- (5) The Threshold Check Solution is prepared by adding 13.5 milligrams of Bitrex to 100 ml of 5% salt (NaCl) solution in distilled water.
- (6) To produce the aerosol, the nebulizer bulb is firmly squeezed so that the bulb collapses completely, and is then released and allowed to fully expand.
- (7) An initial ten squeezes are repeated rapidly and then the test subject is asked whether the Bitrex can be tasted. If the test subject reports tasting the bitter taste during the ten squeezes, the screening test is completed. The taste threshold is noted as ten regardless of the number of squeezes actually completed.
- (8) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the Bitrex is tasted. If the test subject reports tasting the bitter taste during the second ten squeezes, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.
- (9) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the Bitrex is tasted. If the test subject reports tasting the bitter taste during the third set of ten squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.
- (10) The test conductor will take note of the number of squeezes required to solicit a taste response.
- (11) If the Bitrex is not tasted after 30 squeezes (step 10), the test subject is unable to taste Bitrex and may not perform the Bitrex fit test.
- (12) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.
- (13) Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.
- (14) The nebulizer shall be thoroughly rinsed in water, shaken to dry, and refilled at least each morning and afternoon or at least every four hours.
- (b) Bitrex Solution Aerosol Fit Test Procedure.
- (1) The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.
- (2) The fit test uses the same enclosure as that described in 4. (a) above.
- (3) The test subject shall don the enclosure while wearing the respirator selected according to section I. A. of this appendix. The respirator shall be properly adjusted and equipped with any type particulate filter(s).
- (4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.
- (5) The fit test solution is prepared by adding 337.5 mg of Bitrex to 200 ml of a 5% salt (NaCl) solution in warm water
- (6) As before, the test subject shall breathe through his or her slightly open mouth with tongue extended, and be instructed to report if he/she tastes the bitter taste of Bitrex.
- (7) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of the fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test.
- (8) After generating the aerosol, the test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.
- (9) Every 30 seconds the aerosol concentration shall be replenished using one half the number of squeezes used initially (e.g., 5, 10 or 15).
- (10) The test subject shall indicate to the test conductor if at any time during the fit test the taste of Bitrex is detected. If the test subject does not report tasting the Bitrex, the test is passed.
- (11) If the taste of Bitrex is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried and the entire test procedure is repeated (taste threshold screening and fit testing).
  5. Irritant Smoke (Stannic Chloride) Protocol
- This qualitative fit test uses a person's response to the irritating chemicals released in the "smoke" produced by a stannic chloride ventilation smoke tube to detect leakage into the respirator.
- (a) General Requirements and Precautions
- (1) The respirator to be tested shall be equipped with high efficiency particulate air (HEPA) or P100 series

filter(s).

- (2) Only stannic chloride smoke tubes shall be used for this protocol.
- (3) No form of test enclosure or hood for the test subject shall be used.
- (4) The smoke can be irritating to the eyes, lungs, and nasal passages. The test conductor shall take precautions to minimize the test subject's exposure to irritant smoke. Sensitivity varies, and certain individuals may respond to a greater degree to irritant smoke. Care shall be taken when performing the sensitivity screening checks that determine whether the test subject can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the test subject.
- (5) The fit test shall be performed in an area with adequate ventilation to prevent exposure of the person conducting the fit test or the build-up of irritant smoke in the general atmosphere.

(b) Sensitivity Screening Check

- The person to be tested must demonstrate his or her ability to detect a weak concentration of the irritant smoke.
- (1) The test operator shall break both ends of a ventilation smoke tube containing stannic chloride, and attach one end of the smoke tube to a low flow air pump set to deliver 200 milliliters per minute, or an aspirator squeeze bulb. The test operator shall cover the other end of the smoke tube with a short piece of tubing to prevent potential injury from the jagged end of the smoke tube.
- (2) The test operator shall advise the test subject that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the subject to keep his/her eyes closed while the test is performed.
- (3) The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties and to determine if he/she can detect the irritating properties of the smoke. The test operator shall carefully direct a small amount of the irritant smoke in the test subject's direction to determine that he/she can detect it.
- (c) Irritant Smoke Fit Test Procedure
- (1) The person being fit tested shall don the respirator without assistance, and perform the required user seal check(s).
- (2) The test subject shall be instructed to keep his/her eyes closed.
- (3) The test operator shall direct the stream of irritant smoke from the smoke tube toward the faceseal area of the test subject, using the low flow pump or the squeeze bulb. The test operator shall begin at least 12 inches from the facepiece and move the smoke stream around the whole perimeter of the mask. The operator shall gradually make two more passes around the perimeter of the mask, moving to within six inches of the respirator.
- (4) If the person being tested has not had an involuntary response and/or detected the irritant smoke, proceed with the test exercises.
- (5) The exercises identified in section I.A. 14. of this appendix shall be performed by the test subject while the respirator seal is being continually challenged by the smoke, directed around the perimeter of the respirator at a distance of six inches.
- (6) If the person being fit tested reports detecting the irritant smoke at any time, the test is failed. The person being retested must repeat the entire sensitivity check and fit test procedure.
- (7) Each test subject passing the irritant smoke test without evidence of a response (involuntary cough, irritation) shall be given a second sensitivity screening check, with the smoke from the same smoke tube used during the fit test, once the respirator has been removed, to determine whether he/she still reacts to the smoke. Failure to evoke a response shall void the fit test.
- (8) If a response is produced during this second sensitivity check, then the fit test is passed.
- C. Quantitative Fit Test (QNFT) Protocols

The following quantitative fit testing procedures have been demonstrated to be acceptable: Quantitative fit testing using a non-hazardous test aerosol (such as corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS], or sodium chloride) generated in a test chamber, and employing instrumentation to quantify the fit of the respirator; Quantitative fit testing using ambient aerosol as the test agent and appropriate instrumentation (condensation nuclei counter) to quantify the respirator fit; Quantitative fit testing using controlled negative pressure and appropriate instrumentation to measure the volumetric leak rate of a facepiece to quantify the respirator fit.

- 1. General
- (a) The employer shall ensure that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly and ensure that test equipment is in proper working order.
- (b) The employer shall ensure that QNFT equipment is kept clean, and is maintained and calibrated according to the manufacturer's instructions so as to operate at the parameters for which it was designed.
- 2. Generated Aerosol Quantitative Fit Testing Protocol
- (a) Apparatus.
- (1) Instrumentation. Aerosol generation, dilution, and measurement systems using particulates (com oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS] or sodium chloride) as test aerosols shall be used for quantitative fit testing.
- (2) Test chamber. The test chamber shall be large enough to permit all test subjects to perform freely all

required exercises without disturbing the test agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the test agent is effectively isolated from the ambient air, yet uniform in concentration throughout the chamber.

- (3) When testing air-punifying respirators, the normal filter or cartridge element shall be replaced with a high efficiency particulate air (HEPA) or P100 series filter supplied by the same manufacturer.
- (4) The sampling instrument shall be selected so that a computer record or strip chart record may be made of the test showing the rise and fall of the test agent concentration with each inspiration and expiration at fit factors of at least 2,000. Integrators or computers that integrate the amount of test agent penetration leakage into the respirator for each exercise may be used provided a record of the readings is made.
- (5) The combination of substitute air-purifying elements, test agent and test agent concentration shall be such that the test subject is not exposed in excess of an established exposure limit for the test agent at any time during the testing process, based upon the length of the exposure and the exposure limit duration.
- (6) The sampling port on the test specimen respirator shall be placed and constructed so that no leakage occurs around the port (e.g., where the respirator is probed), a free air flow is allowed into the sampling line at all times, and there is no interference with the fit or performance of the respirator. The in-mask sampling device (probe) shall be designed and used so that the air sample is drawn from the breathing zone of the test subject, midway between the nose and mouth and with the probe extending into the facepiece cavity at least 1/4 inch.
- (7) The test setup shall permit the person administering the test to observe the test subject inside the chamber during the test.
- (8) The equipment generating the test atmosphere shall maintain the concentration of test agent constant to within a 10 percent variation for the duration of the test.
- (9) The time lag (interval between an event and the recording of the event on the strip chart or computer or integrator) shall be kept to a minimum. There shall be a clear association between the occurrence of an event and its being recorded.
- (10) The sampling line tubing for the test chamber atmosphere and for the respirator sampling port shall be of equal diameter and of the same material. The length of the two lines shall be equal.
- (11) The exhaust flow from the test chamber shall pass through an appropriate filter (i.e., high efficiency particulate filter) before release.
- (12) When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed 50 percent.
- (13) The limitations of instrument detection shall be taken into account when determining the fit factor.
- (14) Test respirators shall be maintained in proper working order and be inspected regularly for deficiencies such as cracks or missing valves and gaskets.
- (b) Procedural Requirements.
- (1) When performing the initial user seal check using a positive or negative pressure check, the sampling line shall be crimped closed in order to avoid air pressure leakage during either of these pressure checks.
- (2) The use of an abbreviated screening QLFT test is optional. Such a test may be utilized in order to quickly identify poor fitting respirators that passed the positive and/or negative pressure test and reduce the amount of QNFT time. The use of the CNC QNFT instrument in the count mode is another optional method to obtain a quick estimate of fit and eliminate poor fitting respirators before going on to perform a full QNFT.
- (3) A reasonably stable test agent concentration shall be measured in the test chamber prior to testing. For canopy or shower curtain types of test units, the determination of the test agent's stability may be established after the test subject has entered the test environment.
- (4) Immediately after the subject enters the test chamber, the test agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed 5 percent for a half mask or 1 percent for a full facepiece respirator.
- (5) A stable test agent concentration shall be obtained prior to the actual start of testing.
- (6) Respirator restraining straps shall not be over-tightened for testing. The straps shall be adjusted by the wearer without assistance from other persons to give a reasonably comfortable fit typical of normal use. The respirator shall not be adjusted once the fit test exercises begin.
- (7) The test shall be terminated whenever any single peak penetration exceeds 5 percent for half masks and 1 percent for full facepiece respirators. The test subject shall be refitted and retested.
- (8) Calculation of fit factors.
- (i) The fit factor shall be determined for the quantitative fit test by taking the ratio of the average chamber concentration to the concentration measured inside the respirator for each test exercise except the grimace exercise.
- (ii) The average test chamber concentration shall be calculated as the arithmetic average of the concentration measured before and after each test (i.e., 7 exercises) or the arithmetic average of the concentration measured before and after each exercise or the true average measured continuously during the respirator sample.

Overall Fit Factor 
$$\frac{\text{Number of exercises}}{\frac{1}{111} + \frac{1}{111} + \frac{1}{11$$

- (iii) The concentration of the challenge agent inside the respirator shall be determined by one of the following methods:
- (A) Average peak penetration method means the method of determining test agent penetration into the respirator utilizing a strip chart recorder, integrator, or computer. The agent penetration is determined by an average of the peak heights on the graph or by computer integration, for each exercise except the grimace exercise. Integrators or computers that calculate the actual test agent penetration into the respirator for each exercise will also be considered to meet the requirements of the average peak penetration method.
- (B) Maximum peak penetration method means the method of determining test agent penetration in the respirator as determined by strip chart recordings of the test. The highest peak penetration for a given exercise is taken to be representative of average penetration into the respirator for that exercise.
- (C) Integration by calculation of the area under the individual peak for each exercise except the grimace exercise. This includes computerized integration.
- (D) The calculation of the overall fit factor using individual exercise fit factors involves first converting the exercise fit factors to penetration values, determining the average, and then converting that result back to a fit factor. This procedure is described in the following equation:

Where ff<sub>1</sub>, ff<sub>2</sub>, ff<sub>3</sub>, etc. are the fit factors for exercises 1, 2, 3, etc.

- (9) The test subject shall not be permitted to wear a half mask or quarter facepiece respirator unless a minimum fit factor of 100 is obtained, or a full facepiece respirator unless a minimum fit factor of 500 is obtained.
- (10) Filters used for quantitative fit testing shall be replaced whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media.
- 3. Ambient aerosol condensation nuclei counter (CNC) quantitative fit testing protocol. The ambient aerosol condensation nuclei counter (CNC) quantitative fit testing (Portacount TM) protocol quantitatively fit tests respirators with the use of a probe. The probed respirator is only used for quantitative fit tests. A probed respirator has a special sampling device, installed on the respirator, that allows the probe to sample the air from inside the mask. A probed respirator is required for each make, style, model, and size that the employer uses and can be obtained from the respirator manufacturer or distributor. The CNC instrument manufacturer, TSI Inc., also provides probe attachments (TSI sampling adapters) that permit fit testing in an employee's own respirator. A minimum fit factor pass level of at least 100 is necessary for a half-mask respirator and a minimum fit factor pass level of at least 500 is required for a full facepiece negative pressure respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.
- (a) Portacount Fit Test Requirements.
- (1) Check the respirator to make sure the sampling probe and line are properly attached to the facepiece and that the respirator is fitted with a particulate filter capable of preventing significant penetration by the ambient particles used for the fit test (e.g., NIOSH 42 CFR 84 series 100, series 99, or series 95 particulate filter) per manufacturer's instruction.
- (2) Instruct the person to be tested to don the respirator for five minutes before the fit test starts. This purges the ambient particles trapped inside the respirator and permits the wearer to make certain the respirator is comfortable. This individual shall already have been trained on how to wear the respirator properly.
- (3) Check the following conditions for the adequacy of the respirator fit: Chin properly placed; Adequate strap tension, not overly tightened; Fit across nose bridge; Respirator of proper size to span distance from nose to chin; Tendency of the respirator to slip; Self-observation in a mirror to evaluate fit and respirator position.
- (4) Have the person wearing the respirator do a user seal check. If leakage is detected, determine the cause. If leakage is from a poorly fitting facepiece, try another size of the same model respirator, or another model of respirator.
- (5) Follow the manufacturer's instructions for operating the Portacount and proceed with the test.
- (6) The test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.
- (7) After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried.
- (b) Portacount Test Instrument.
- (1) The Portacount will automatically stop and calculate the overall fit factor for the entire set of exercises. The overall fit factor is what counts. The Pass or Fail message will indicate whether or not the test was successful. If the test was a Pass, the fit test is over.
- (2) Since the pass or fail criterion of the Portacount is user programmable, the test operator shall ensure that the pass or fail criterion meet the requirements for minimum respirator performance in this Appendix.
- (3) A record of the test needs to be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style, and size of respirator used; and date tested.
- 4. Controlled negative pressure (CNP) quantitative fit testing protocol.

The CNP protocol provides an alternative to aerosol fit test methods. The CNP fit test method technology is

based on exhausting air from a temporarily sealed respirator facepiece to generate and then maintain a constant negative pressure inside the facepiece. The rate of air exhaust is controlled so that a constant negative pressure is maintained in the respirator during the fit test. The level of pressure is selected to replicate the mean inspiratory pressure that causes leakage into the respirator under normal use conditions. With pressure held constant, air flow out of the respirator is equal to air flow into the respirator. Therefore, measurement of the exhaust stream that is required to hold the pressure in the temporarily sealed respirator constant yields a direct measure of leakage air flow into the respirator. The CNP fit test method measures leak rates through the facepiece as a method for determining the facepiece fit for negative pressure respirators. The CNP instrument manufacturer Dynatech Nevada also provides attachments (sampling manifolds) that replace the filter cartridges to permit fit testing in an employee's own respirator. To perform the test, the test subject closes his or her mouth and holds his/her breath, after which an air pump removes air from the respirator facepiece at a pre-selected constant pressure. The facepiece fit is expressed as the leak rate through the facepiece, expressed as milliliters per minute. The quality and validity of the CNP fit tests are determined by the degree to which the in-mask pressure tracks the test pressure during the system measurement time of approximately five seconds. Instantaneous feedback in the form of a real-time pressure trace of the in-mask pressure is provided and used to determine test validity and quality. A minimum fit factor pass level of 100 is necessary for a half-mask respirator and a minimum fit factor of at least 500 is required for a full facepiece respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test. (a) CNP Fit Test Requirements.

- (1) The instrument shall have a non-adjustable test pressure of 15.0 mm water pressure.
- (2) The CNP system defaults selected for test pressure shall be set at -- 15 mm of water (-0.58 inches of water) and the modeled inspiratory flow rate shall be 53.8 liters per minute for performing fit tests.
- (Note: CNP systems have built-in capability to conduct fit testing that is specific to unique work rate, mask, and gender situations that might apply in a specific workplace. Use of system default values, which were selected to represent respirator wear with medium cartridge resistance at a low-moderate work rate, will allow inter-test comparison of the respirator fit.)
- (3) The individual who conducts the CNP fit testing shall be thoroughly trained to perform the test.
- (4) The respirator filter or cartridge needs to be replaced with the CNP test manifold. The inhalation valve downstream from the manifold either needs to be temporarily removed or propped open.
- (5) The test subject shall be trained to hold his or her breath for at least 20 seconds.
- (6) The test subject shall don the test respirator without any assistance from the individual who conducts the CNP fit test.
- (7) The QNFT protocol shall be followed according to section I.
- C. 1. of this appendix with an exception for the CNP test exercises.
- (b) CNP Test Exercises.
- (1) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject needs to hold head straight ahead and hold his or her breath for 10 seconds during the test measurement.
- (2) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply for 1 minute, being careful not to hyperventilate. After the deep breathing exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during test measurement.
- (3) Turning head side to side. Standing in place, the subject shall slowly turn his or her head from side to side between the extreme positions on each side for 1 minute. The head shall be held at each extreme momentarily so the subject can inhale at each side. After the turning head side to side exercise, the subject needs to hold head full left and hold his or her breath for 10 seconds during test measurement. Next, the subject needs to hold head full right and hold his or her breath for 10 seconds during test measurement.
- (4) Moving head up and down. Standing in place, the subject shall slowly move his or her head up and down for 1 minute. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling). After the moving head up and down exercise, the subject shall hold his or her head full up and hold his or her breath for 10 seconds during test measurement. Next, the subject shall hold his or her head full down and hold his or her breath for 10 seconds during test measurement.
- (5) Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song for 1 minute. After the talking exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement.
- (6) Grimace. The test subject shall grimace by smiling or frowning for 15 seconds.
- (7) Bending Over. The test subject shall bend at the waist as if he or she were to touch his or her toes for 1 minute. Jogging in place shall be substituted for this exercise in those test environments such as shroud-type QNFT units that prohibit bending at the waist. After the bending over exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement.
- (8) Normal Breathing. The test subject shall remove and re-don the respirator within a one-minute period. Then, in a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal

breathing exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement. After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of a respirator shall be tried.

(c) CNP Test Instrument.

- (1) The test instrument shall have an effective audio warning device when the test subject fails to hold his or her breath during the test. The test shall be terminated whenever the test subject failed to hold his or her breath. The test subject may be refitted and retested.
- (2) A record of the test shall be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style and size of respirator used; and date tested.

#### Part II. New Fit Test Protocols

- A. Any person may submit to OSHA an application for approval of a new fit test protocol. If the application meets the following criteria, OSHA will initiate a rulemaking proceeding under section 6(b)(7) of the OSH Act to determine whether to list the new protocol as an approved protocol in this Appendix A.
- B. The application must include a detailed description of the proposed new fit test protocol. This application must be supported by either:
- A test report prepared by an independent government research laboratory (e.g., Lawrence Livermore National Laboratory, Los Alamos National Laboratory, the National Institute for Standards and Technology) stating that the laboratory has tested the protocol and had found it to be accurate and reliable; or
- 2. An article that has been published in a peer-reviewed industrial hygiene journal describing the protocol and explaining how test data support the protocol's accuracy and reliability.
- C. If OSHA determines that additional information is required before the Agency commences a rulemaking proceeding under this section, OSHA will so notify the applicant and afford the applicant the opportunity to submit the supplemental information. Initiation of a rulemaking proceeding will be deferred until OSHA has received and evaluated the supplemental information.

[63 FR 20098, April 23, 1998]

Part Number:

1910

• Part Title:

Occupational Safety and Health Standards

· Subpart:

- 1

Subpart Title:

Personal Protective Equipment

· Standard Number:

1910.134 App B-1

• Title:

User Seal Check Procedures (Mandatory).

Appendix B-1 to § 1910.134: User Seal Check Procedures (Mandatory)

The individual who uses a tight-fitting respirator is to perform a user seal check to ensure that an adequate seal is achieved each time the respirator is put on. Either the positive and negative pressure checks listed in this appendix, or the respirator manufacturer's recommended user seal check method shall be used. User seal checks are not substitutes for qualitative or quantitative fit tests.

I. Facepiece Positive and/or Negative Pressure Checks

A. Positive pressure check. Close off the exhalation valve and exhale gently into the facepiece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. For most respirators this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.

B. Negative pressure check. Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s), inhale gently so that the facepiece collapses slightly, and hold the breath for ten seconds. The design of the inlet opening of some cartridges cannot be effectively covered with the palm of the hand. The test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

II. Manufacturer's Recommended User Seal Check Procedures

The respirator manufacturer's recommended procedures for performing a user seal check may be used instead of the positive and/or negative pressure check procedures provided that the employer demonstrates that the manufacturer's procedures are equally effective.

[63 FR 1152, Jan. 8, 1998]

### APPENDIX F-3 RESPIRATOR CLEANING PROCEDURES AND RECORDS

Part Number:

1910

· Part Title:

Occupational Safety and Health Standards

· Subpart:

Subpart Title:

Personal Protective Equipment

Standard Number:

1910.134 App B-2

· Title:

Respirator Cleaning Procedures (Mandatory).

#### Appendix B-2 to § 1910.134: Respirator Cleaning Procedures (Mandatory)

These procedures are provided for employer use when cleaning respirators. They are general in nature, and the employer as an alternative may use the cleaning recommendations provided by the manufacturer of the respirators used by their employees, provided such procedures are as effective as those listed here in Appendix B- 2. Equivalent effectiveness simply means that the procedures used must accomplish the objectives set forth in Appendix B-2, i.e., must ensure that the respirator is properly cleaned and disinfected in a manner that prevents damage to the respirator and does not cause harm to the user.

I. Procedures for Cleaning Respirators

- A. Remove filters, cartridges, or canisters. Disassemble facepieces by removing speaking diaphragms, demand and pressure- demand valve assemblies, hoses, or any components recommended by the manufacturer. Discard or repair any defective parts.
- B. Wash components in warm (43 deg. C [110 deg. F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.
- C. Rinse components thoroughly in clean, warm (43 deg. C [110 deg. F] maximum), preferably running water. Drain.
- D. When the cleaner used does not contain a disinfecting agent, respirator components should be immersed for two minutes in one of the following:
- 1. Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 43 deg. C (110 deg. F); or,
- 2. Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine (6-8 grams ammonium and/or potassium iodide/100 cc of 45% alcohol) to one liter of water at 43 deg. C (110 deg. F); or,
- 3. Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.
- E. Rinse components thoroughly in clean, warm (43 deg. C [110 deg. F] maximum), preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.
- F. Components should be hand-dried with a clean lint-free cloth or air-dried.
- G. Reassemble facepiece, replacing filters, cartridges, and canisters where necessary.
- H. Test the respirator to ensure that all components work properly.

[63 FR 1152, Jan. 8, 1998]

#### RESPIRATOR CLEANING RECORD

EMPLOYEE NAME	RESPIRATOR TYPE/ID NO.	DATE CLEANED	COMMENTS
		_	
		_	

#### **RESPIRATOR CLEANING RECORD**

EMPLOYEE NAME	RESPIRATOR TYPE/ID NO.	DATE CLEANED	COMMENTS

#### **RESPIRATOR CLEANING RECORD**

EMPLOYEE NAME	RESPIRATOR TYPE/ID NO.	DATE CLEANED	COMMENTS
	_	_	
		_	_
		_	
			_
		_	

### APPENDIX F-4 GUIDANCE FOR VOLUNTARY RESPIRATOR USAGE

Part Number: 1910

· Part Title: Occupational Safety and Health Standards

· Subpart:

 Subpart Title: Personal Protective Equipment

 Standard Number: 1910.134 App D

· Title: (Mandatory) Information for Employees Using Respirators When not

Required Under Standard.

#### Appendix D to Sec. 1910.134 (Mandatory) Information for Employees Using Respirators When Not Required Under the Standard

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards. If your employer provides respirators for your voluntary use, of if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not present a hazard. You should do the following:

- 1. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.
- 2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.
- 3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes or smoke.
- 4. Keep track of your respirator so that you do not mistakenly use someone else's respirator. [63 FR 1152, Jan. 8, 1998; 63 FR 20098, April 23, 1998]

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## APPENDIX G CONFINED SPACE ENTRY PROGRAM & FORMS

#### **CONFINED SPACES**

Many common tasks, such as cleaning, renovating, welding, painting, electrical equipment maintenance, etc., take on an added hazardous dimension when performed in confined or enclosed spaces. To ensure that entry and/or work in confined spaces is performed safely, it is essential that safe procedures are established and followed for entry,



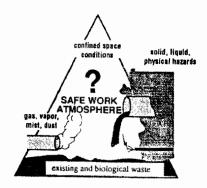
work, egress, and/or rescue. Among the numerous potential hazards associated with working in confined spaces are:

- Oxygen deficiency (asphyxiation),
- Fire or explosion (due to the presence of flammable concentrations of vapors or gases),
- High concentrations of toxic air contaminants (due to limited ventilation),
- High noise levels, and
- Heat stress and various physical hazards.

All potential hazards must be considered, evaluated and to the extent possible controlled for every confined space entry. Examples of confined spaces include, but are not limited to: fixed and mobile storage tanks including baker tanks, process vessels, pits, storage compartments, silos, vats, certain types of excavations, reaction vessels, boilers, ventilation ducts, sewers, tunnels, underground utility vaults, and pipelines.

Frequently, industrial workplaces and locations contain areas of the type described in the paragraph above, which incorporate one or more of the elements defining a confined space. However, it is anticipated that as set out in OSHA 1910.146, Permit Required Confined Space Entry, many confined spaces do not include hazard characteristics sufficient to be designated as Entry Permit-Required Confined Spaces. As such, entry into these non-permit required (low hazard) confined spaces will require less stringent procedures including the following general precautions:

 Prior to work in an area, which could be classified as a confined space, a qualified individual such as the Safety and Health Specialist or trained Project Manager, will conduct a review and determine that the space does not require an entry permit. Only work in non-permit (low hazard) confined spaces is authorized for Apex project personnel. In the event that entry into a permit-required confined space is necessary, affected personnel will receive adequate training and the OSHA



requirements for a full entry permit system will be initiated;

- If a potentially hazardous atmosphere exists inside the confined space, continuous forced air ventilation must be used to ensure safe entry conditions are maintained:
- Continuous air quality monitoring is maintained to demonstrate that acceptable air quality is present;
- An attendant will be stationed outside the entry point. The attendant will
  maintain communication with the entrant(s) and summon assistance in case of
  an emergency; and
- The attendant will ensure that all workers exit the workspace safely.

When Apex employees are required to enter permit-required confined spaces to perform work, the following Confined Space Entry Program will be followed.

#### **CONFINED SPACE ENTRY PROGRAM**

Responsible person for this program is the Health & Safety Coordinator.

#### INTRODUCTION

The entry into a confined space is potentially one of the most dangerous activities that **Apex Environmental** employees may face. Due to the unique conditions that can exist, great care must be taken both before and during this type of work procedure. This program is written to be in compliance with **OSHA Regulation 29 CFR 1910.146**, and designed to assist the employees of **Apex Environmental** when they performing entry operations.

Asphyxiation is the leading cause of death in confined spaces due to situations involving IDLH (immediately dangerous to life and health) atmospheres that are poorly ventilated as compared to more open areas that generally have natural ventilation. All efforts will be devised to control oxygen deficient/combustible/toxic environments that may be encountered prior to, or during work activities. **Total energy isolation is required before any entry will be allowed.** 

#### **DEFINITIONS:**

An enclosed area/object meets the OSHA definition of a **confined space** when its particular design features display all of the following characteristics:

- The space is large enough and so configured that an employee can bodily enter and perform assigned work;
- There are limited or restricted means for entry and exit; and,

It is not designed for continuous employee occupancy.

An enclosed area/object can also meet the definition of a **permit confined space** when its particular design characteristics meet one or more of the following guidelines:

- It contains or has the potential to contain a hazardous atmosphere;
- It contains a material that has the potential for entrant engulfment;
- It has an internal configuration such that an entrant could be trapped or asphyxiated (such as sloping walls and floors that converge to a point of constriction); or
- Contains any other recognized serious safety or health hazard.

**Acceptable entry conditions** refer to conditions that must exist in a permit space to allow employees to enter and to ensure they can safely complete their work while in that confined space.

**Attendant** refers to a person stationed outside the permit space who monitors the authorized entrants, and performs the duties assigned to them by this written program. (Also called locally the "lookout", "man watch", or "hole watch".)

**Authorized Entrant** refers to an employee who is authorized under this written program to enter a permit space.

**Emergency** refers to an event that could endanger an authorized entrant whether it occurs inside or outside the permit space.

**Entry** refers to the entrance of a person into a permit-required confined space. Entry is considered to begin when the feet or head breaks the plane of entry into the space.

**Entry Permit** refers to the written document that controls entry into a permit confined space, and contains all pertinent information required by the OSHA Standard.

**Entry Supervisor** refers to the person designated with the responsibility to determine acceptable entry conditions, and to authorize, supervise, or terminate any entry.

**Hazardous Atmosphere** refers to an atmosphere which may expose a person to the risk of death, incapacitation, injury, acute illness, or impaired ability to escape unaided from an emergency. An atmosphere is considered hazardous if it contains one or more of the following:

- Atmospheric oxygen concentration below 19.5% or above 23.5%;
- Flammable gas, vapor, or mist in excess of 10% of its lower explosive limit (LEL);

- Airborne combustible dust at a concentration that meets or exceeds its LFL, lower flammability limit, e.g. (if the dust obscures vision at a distance of < 5 feet);
- Atmospheric concentration of any substance where employee exposure would exceed any listed toxic dose or permissible exposure limit; or
- Any other atmospheric condition that is immediately dangerous to life and health.

**IDLH** (immediately dangerous to life and health) refers to a condition that threatens loss of life, adverse health effects, or impaired ability to escape unaided from an emergency.

Oxygen Deficient Atmosphere refers to an atmosphere that contains less than 19.5% oxygen.

**Oxygen Enriched Atmosphere** refers to an atmosphere that contains more than 23.5% oxygen.

**Retrieval System** refers to equipment which non-entry personnel can use to retrieve persons from a permit space in case of emergency.

**Testing** refers to a process used to identify and evaluate a potentially hazardous atmosphere with monitoring instruments.

#### MANAGEMENT/EMPLOYEE RESPONSIBILITIES

The Health & Safety Coordinator is responsible for the overall implementation of this program or the requirements of any host-facility program, while working on contracted projects at host facilities. Due to the extremely severe consequences possible if improper confined space entries are made, all employees will comply with the provisions of this program.

#### **IDENTIFICATION**

The identified confined space will be revealed to all employees by the use of a red/white hazard-warning sign with black letters stating:

### DANGER PERMIT-REQUIRED CONFINED SPACE DO NOT ENTER

Currently we have no known confined spaces for Apex Environmental offices, only at host facility job sites.

#### **HAZARD EVALUATION**

Testing or monitoring conditions prior to entry and during entry operations will be conducted by the **host-facility unit operator**, **designated safety or environmental personnel**, or **other qualified personnel**, by the use of a calibrated, direct-reading, gas monitor. The tests shall be performed in this order:

- 1. Oxygen concentration (19.5% 23.5% range);
- 2. Flammable gases/vapors (less than 10% of LEL);
- 3. Potential toxic concentrations (less than listed PEL's)

The results shall be recorded on the host-facility entry permit, and entry into the confined space will not be allowed unless the defined acceptable entry conditions are met. Continuous or intermittent monitoring of the permitted space may be implemented depending on the potential atmospheric conditions that may be experienced during operations. Employees or their representatives are entitled and encouraged to request additional air monitoring at any time that work is underway.

Initially, the air monitoring instrument probe or line must extend into the confined space at least several feet. The person performing the air monitoring should not break the plane of the confined space with their body. Since particular gases can stratify in layers in a confined space, testing will be performed at multiple levels of the space to be entered.

If an instrument reading ever indicates an unusual, unexpected, or unacceptable atmospheric condition, it is never to be ignored, or assumed to be due to instrument error. If a bad reading is recorded, all necessary measures will be taken to correct the situation (recalibrate instrument, ventilate space, etc). **Apex Environmental** employees will not be expected to enter confined spaces until it is deemed safe to do so, and the acceptable entry conditions are recorded on the entry permit.

Lighting sources (drop cords) to be used in the permit confined space shall be explosiveproof and specifically approved by a recognized agency such as **Underwriter Laboratory** or the **Mine Safety and Health Administration** for use in potentially explosive atmospheres. Any electrically operated tool taken inside the permit space shall be double insulated, inspected for defects, and connected to an approved ground fault circuit interrupter (**GFCI**) that has been inspected and tested before use.

All ladders used for entry/exit into the permit confined space must meet all applicable codes and standards as outlined in

29 CFR 1910.25 or .26, and inspected prior to use. They must not interfere with rescue or retrieval systems, ventilation methods, and work operations.

The confined space to be entered should be cleaned of hazardous material surface residue prior to entry.

#### VENTILATION

If the atmospheric entry conditions cannot be met as defined in this written program, continuous forced-air ventilation methods will be utilized at all times to eliminate the encountered hazardous atmosphere. An oxygen source with a concentration greater than 23.5% is not allowed as a ventilation or air dilution method.

If ventilation is unsuccessful, as demonstrated by unacceptable retesting results, or even if acceptable conditions are unable to be consistently maintained during actual entry operations, authorized entrants will be required to wear appropriate respiratory protective equipment in compliance with OSHA Regulation 29 CFR 1910.134, the Respiratory Protection Standard.

This equipment selection will be based on the atmospheric test results that will indicate the proper level of respiratory protection to be worn (see **Respiratory Program Section**).

#### **ENTRY PERMITS**

The authorized entry Supervisor shall prepare the entry permit, recording all testing results on the permit. This system will provide the best assurance that confined space entry takes place only after all actions and conditions necessary for the protection of authorized entrants have been performed. When entry operations have been completed, the entry Supervisor shall write "canceled" across the permit. The entry permit will identify the following information:

- Permit space (name/location of space to be entered);
- Purpose (specify job/type of work to be performed in that space);
- Date/duration of entry (current date and length of time allowed);

- Entrant names (roster of authorized personnel for space entry);
- Attendant name(s) (at least one, but may rotate with entrants);
- Entry Supervisor (authorized for entry also);
- List of hazards (observed or present);
- Hazards control/isolation (methods of elimination);
- Acceptable entry conditions (oxygen, combustible, toxins);
- Test results (initial/periodic monitoring & initials of tester);
- Rescue provisions (services to call, emergency #'s);
- Communication methods (phone, 2-way radio, voice, signals);
- Tools/Equipment needed (PPE, harnesses, retrieval lines, alarms);
- Space specific information (special precautions unique to the space);
- Additional permits (hot work, lockout/tagout); and,
- Authorization for permit (proper signatures of authority).

**Apex Environmental** employees will have the opportunity to participate in the permit review and signing of this document prior to the commencement of permit authorized work activities.

#### **TRAINING**

Whether you are an entrant, attendant, entry Supervisor, or part of the support personnel, training is mandatory.` Most confined space accidents and fatalities are the result of the wide range of possible hazards to be encountered, as well as the lack of training, so this will be an important part of the **Apex Environmental Confined Space Program**. Training will be provided:

- Before any employee is assigned any duties;
- Before any assigned duties are changed;
- Whenever there is a change in operations affecting the space; and,
- Whenever an employee demonstrates deficiencies or deviations from the initial training provided.

Written certification to include employee's name, trainer signature/initials, and dates of training will be provided upon completion of required levels of training as provided by outside

contract training resources, or **Apex Environmental** Management, and maintained in the **Employee Personnel Files** at the **Branch or Project** office. Certification must be made available to employees and their authorized representatives.

#### **DUTIES OF AUTHORIZED ENTRANTS**

The Employer shall ensure that all authorized entrants:

- Know the hazards that may be faced during entry, including information on the mode, signs, or symptoms of these hazards, and consequences of any exposure;
- Properly use all tools and safety equipment as required; and,
- Communicate with the attendant as necessary to enable the attendant to monitor the entrant(s) status and to alert entrant(s) of the need to evacuate the space as required.

#### Authorized Entrants must alert the attendant when:

- They recognize any warning sign or symptoms of exposure to a dangerous situation; and,
- They detect a prohibited condition.

Authorized Entrants must exit from the permit space as quickly as possible when:

- An order to evacuate is given by the attendant or the entry supervisor;
- They recognize any warning sign or symptom of exposure to a dangerous situation;
- They detect a prohibited condition; and,
- An evacuation alarm is activated.

#### **DUTIES OF ATTENDANTS**

The employer shall ensure that all attendants:

- Know the hazards that may be faced during entry, including information on the mode, signs, symptoms, and consequences of the exposure;
- Are aware of possible behavior effects of hazard exposure in authorized entrants;

- Continuously maintain an accurate count of authorized entrants in the permit space and ensure that the means used to identify authorized entrants accurately identifies who is in the permit space;
- Remain outside of the permit space during entry operations until relieved by another attendant. If an attendant is trained and equipped for rescue, they may attempt non-entry rescue provided that they have been relieved by a properly outfitted and trained attendant. Any unauthorized personnel will be prohibited from attempting any type of rescue;
- Communicate with authorized entrants as necessary to monitor entrant status and alert entrants of the need to evacuate the space as required;
- Monitor activities inside and outside the space to determine if it is safe for entrants to remain in the space and order the authorized entrants to evacuate the permit space *immediately* under any of the following conditions:
  - 1. If they detect a prohibited condition;
  - 2. If they detect the behavioral effects of hazard exposure in an **authorized entrant**;
  - 3. If they detect a situation outside the space that could endanger the authorized entrants; and,
  - 4. If they cannot, for any reason, effectively and safely perform all the duties required.
- Summon rescue and other emergency services as soon as they determine
  that authorized entrants may need assistance to escape from permit space
  hazards. By whatever means are available (voice, radio, phone), the
  attendant shall notify their immediate Apex Environmental supervisor or
  host-facility operator for emergencies.
- Take the following actions when unauthorized persons approach or enter a permit space while entry is underway:
  - 1. Warn the unauthorized persons that they must stay away from the permit space;
  - 2. Advise the unauthorized persons that they must exit immediately if they have entered the permit space;
  - 3. Inform the authorized entrants and the **Entry Supervisor** if unauthorized persons have entered the permit space;
  - 4. Perform non-entry rescue as specified by the employer's rescue procedure; and,
  - 5. Perform no duties that might interfere with their primary duty to monitor and protect the **authorized entrants**.

**Apex Environmental** Management does not allow more than one confined space to be monitored by the attendant at any one time, and if an emergency arises, that person will contact the **Entry Supervisor** by voice, radio, or messenger for assistance.

#### **DUTIES OF ENTRY SUPERVISORS**

The employer must ensure that all **Entry Supervisors**:

- Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;
- Verify that all tests specified by the permit have been conducted and all
  procedures and equipment specified by the permit are in place before signing
  the permit and allowing entry to begin;
- Terminate the entry and cancel the permit as required;
- Verify that rescue services are available and the means to summon them are operable;
- Remove unauthorized individuals who enter or attempt to enter the permit space during entry operation;
- Determine whenever responsibility for permit space entry operation is transferred, and at intervals dictated by the hazards and operations performed within the space, that entry operations remain consistent with terms of the entry permit and acceptable entry conditions are maintained; and,
- Coordinate entry operations for multi-employers' so that employees of one employer do not endanger the employees of any other employer.

#### **ENTRY PROCEDURES**

No employee of **Apex Environmental** will be allowed to enter a permit-confined space unless the following procedures are adhered to:

- 1. The confined space must be properly tested for acceptable ranges of oxygen content, flammable atmosphere, and toxic concentrations present, using a calibrated, direct-reading, gas-monitoring instrument, operated by a trained Supervisor. (There can be no longer than a **2-hour time gap** between tests performed and any space entry.)
- 2. The permit space shall be identified by appropriate signs, and the external area barricaded to ensure that no unauthorized persons, equipment, or vehicles present a danger to **authorized entrants**.
- 3. No smoking or flammable, combustible material s are allowed within this barricaded area. A properly inspected, charged ABC dry chemical fire extinguisher is required to be outside the permit space, ready to use. No

welding gas tanks are allowed inside the permit space, and all hoses, regulators, leads, electrode holders or other welding/cutting equipment will be inspected before entry into the permit space. Equipment found to be defective will not be allowed for use.

- 4. Communication methods will be by voice, visual contact, or two -way radios that are required to be intrinsically safe in design.
- 5. Properly inspected, approved entry/exit means will be secured into position, following all established safe ladder-use guidelines.
- Ventilation equipment will be activated and provide continuous forced air from clean air sources, so that proper air exchanges for the enclosed space is maintained at all times for permit space occupancy.
- 7. Approved, properly rated (12V explosion-proof) light sources, or intrinsically safe flashlights will be provided for safe illumin ation while working inside a permit space.
- 8. Appropriately selected personal protective equipment will be donned prior to vessel entry, and worn at all times while inside the permit space. (Examples are hard hats, splash/impact goggles, face-shields, safety glasses, respirators, protective clothing, steel-toed shoes, earplugs, & gloves.) Defective equipment shall not be used, but instead discarded and replaced.
- After the space has been tested and declared safe for entry, the entry permit shall be completed, conditions explained to all authorized personnel, signed by all authorized personnel, and posted at a conspicuous location outside/on the vessel.
- 10. The attendants shall be assigned to their appropriate duties. The entrants may then enter inside the confined space, and the Entry Supervisor is accountable for maintaining safe operations.
- 11. Permits will be canceled upon completion of work, or for emergency evacuation due to dangers occurring inside or outside the space that could directly affect the life or health of an entrant.
- 12. If an emergency occurs and evacuation of the space is required, the space will be re-evaluated to determine the cause, extent, and nature of the hazard encountered. The hazard will be eliminated before entry is again permitted, after inspection and testing is satisfactory.
- 13. Upon job completion or evacuation, the word "CANCELLED" shall be written across the permit, noting date and time. (Cancellation reason to be listed **only if** a dangerous incident, injury, or hazard occurred.)
- 14. Permits or copies will be retained for a period of at least one year by the **host** facility. The written program must be reviewed annually (unless no entries were made during the prior 12 month period) and revised as necessary to protect

employees from confined space hazards when injuries, near-misses, employee complaints, or unauthorized entry occurs.

#### **RESCUE AND EMERGENCY SERVICES**

Apex Environmental employees will totally rely upon the rescue efforts of the host-facility's rescue personnel, or outside rescue service response when they are contacted. The authorized Entry Supervisor will be notified by the attendant that emergency rescue operations are required.

The respective "*identified*" host-facility in-house trained rescue team or outside rescue services will be notified to respond to the permit space to assist in retrieving an injured entrant. (**Note**: This language must be specifically stated in the contract agreement between the designated responder, host-facility operator and **Apex Environmental** Management.)

A documented, simulated rescue attempt will be performed by this crew as part of their established training regiment and at least annually thereafter if confined spaces are still required to be entered. This would enable the host-facility operator to evaluate and verify the prospective service(s)' ability to respond in a timely manner based on the specific hazard(s) associated with each particular type of entry. A "qualified party" will conduct a performance evaluation of the simulated rescue attempt and critique this action to identify any deficiencies in equipment, training, or personnel.

A quick survey of the rescued entrant will determine if first aid is required or professional medical assistance will be contacted. The trained rescue team members, **Authorized Attendant(s)** and **Entry Supervisor(s)** will be trained and certified to perform CPR and emergency first aid treatment before rendering assistance to rescued personnel. The **Entry Supervisor** will direct **Apex Environmental** Management or the host-facility Company representative to dial **911** emergency medical services if the need so arises.

#### CONCLUSION

By reading, understanding, and practicing the safety guidelines that have been outlined in this written program, you will be able to appreciate the benefits of complying with this regulation. They have been designed to protect your health and safety while performing confined space entry job tasks. Follow these written procedures, never take short cuts, and be aware of the hazards that can be encountered in confined spaces.

Non-compliance by any **Apex Environmental** employee with any part of this described program will result in disciplinary action as outlined in the Company's **Corrective Action/Disciplinary Program**.

#### **CONFINED SPACE ENTRY PERMIT**

This permit is valid only for the times and dates stated below. It becomes void if conditions or description of work changes or at the end of the shift (not to exceed 12 hours). The permit may be extended for additional shifts by re-certification of acceptable conditions. New personnel entering the confined space during the shift and new supervisor must sign this permit.

Location of or Name of	Date:
Confined Space:	Time Permit Issued:
	Time Permit Expires:
This is a Class A Confined Space (required an attendant)  Class B - Confined Space	
Work to be done:	

#### Supervisor's Check List

		<u>Yes</u>	<u>No</u>	<u>Not</u> <u>Applicable</u>
1.	Is this entry necessary?		_	
2.	Space empty, cleaned, flushed, cooled, purged?		_	
3.	Pipelines blanked or blocked and bled?			
4.	All pumps servicing the space locked/tagged out?			
5.	Mechanical equipment inside space locked/tagged out?			
6.	Electrical equipment locked/tagged out?			
7	Mechanical ventilation provided?			
8.	Atmosphere tested and within parameters?			
9.	Personal atmospheric monitors available and tested?			
10	Periodic testing for toxic materials required?			
11	Safe means provided for entry/exit into/from space?			
12	Rescue team available at plant or from outside?			
13	Communication equipment and/or alarms available and checked?			
14	Trained attendant assigned and stationed outside space?			
15	Personal entry log established?			
16	Welding/flame permit issued?			
17	Portable electrical equipment of low voltage or double insulated type; or			

	ground fault circuit used?		
18	Adequate lighting provided?		
19	Entrants trained on hazards of confined spa	aces?	
20	Personal protective equipment required: (c	heck)	
	Respiratory Protective clothing Hard hat Safety harness/belts Other	goggles boots lifelines chemical resistance suit	face shield gloves hearing protection
If N	o is checked on any of the above, an explar	nation of the reason for the excep	otion must be given.
	ature of Personnel Entering Space:ature of Attendant:		

#### **CONFINED SPACE ENTRY PERMIT (cont'd)**

Atmospheric Tests

Date/Time	Oxygen (Range: 19.5 to 23%)	Flammability (<10% LEL)	Toxicity ( <osha pel)<="" th=""><th>Qualified Per Making Te</th></osha>	Qualified Per Making Te
	-			
				_
-				
		-		

I have personally chec space.	cked the conditions ne	ecessary and specified,	and approve entry int	o this confined
Supervisor(s):			Date:	Time:

### APPENDIX H SITE SPECIFIC HASP AMENDMENT FORM

#### HASP CHANGE REQUEST FORM

The purpose of this Health and Safety Plan (HASP) Change Request Form (CRF) is to formerly request a change to the existing approved HASP. Examples of when submission of a CRF is required include but are not limited to:

- Major additions, deletions, or change changes to project field activities;
- Any changes to the scope of work, which introduce new, significant hazards;
- Discovery of new chemical or physical hazards which require a change in personal protective equipment (PPE), air monitoring procedures, engineering controls; training and inspection requirements, etc.;
- Changes to existing policies, SOPs, or government regulations or requirements that affect implementation of the HASP; and
- Changes in roles and responsibilities of project personnel. The CRF must be reviewed and approved by the personnel listed below.
- Upon approval, a copy of this CRF must be attached to all existing copies on the HASP and placed in the project files.

Project name/location:	
Date HASP created/last revised	
CRF completed by:	
Today's date:	
Describe in detail all proposed changes to the necessary)	e HASP (attached additional sheets as
Approvals:	
Site Safety and Health Officer	Date:
Project Manager	Date:

## <u>APPENDIX I</u> <u>DAILY SIGN IN/OUT LOG</u>

# Former Pall Corporation Facility 30 Sea Cliff Avenue Glen Cove, New York Site Safety Daily Sign In/ Sign Out Sheet

Note: All persons coming on site to perform services are required to sign in and sign out prior to entering the site. If person is to enter into an area where hazards are anticipated, this person shall also review and sign off on the Site Specific Health and Safety Plan for the Site prior to entering the Property.

Name	Company	Services Performed	Time In	Time Out
	<del>-</del>			