

## MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

### PART I *What is the material and what do I need to know in an emergency?*

#### 1. PRODUCT IDENTIFICATION

**CHEMICAL NAME; CLASS:** **PROPYLENE OXIDE**  
**SYNONYMS:** 1,2-Epoxypropane, 1,2-Propylene Oxide, Epoxypropane, Methyl Ethylene Oxide, Methyloxirane  
 Document Number: 001089  
**PRODUCT USE:** For General Analytical/Synthetic Chemical Uses  
**SUPPLIER/MANUFACTURER'S NAME:** AIRGAS INC.  
**ADDRESS:** 259 North Radnor-Chester Road  
 Suite 100  
 Radnor, PA 19087-5283  
**BUSINESS PHONE:** 1-610-687-5253  
**EMERGENCY PHONE:** 1-800-949-7937  
 International: 1-423-479-0293  
**DATE OF PREPARATION:** January 14, 2002

#### 2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA		NIOSH IDLH ppm	OTHER ppm
			TLV ppm	STEL ppm	PEL ppm	STEL ppm		
Propylene Oxide	75-56-9	100	2 (sensitizer)	NE	100 20 (Vacated 1989 PEL)	NE	400	NIOSH REL: Reduce to Lowest Feasible Concentration (LOQ = 8.4 ppm) Carcinogen: EPA-B2, IARC-2B, MAK-2, NIOSH-Ca, NTP-R, TLV-A3

NE = Not Established.      LOQ = Limit of Quantitation      See Section 16 for Definitions of Terms Used.  
 NOTE (1): ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

#### 3. HAZARD IDENTIFICATION

**EMERGENCY OVERVIEW:** Propylene Oxide is a flammable, colorless liquid that is shipped under its own vapor pressure and which has an ethereal, or benzene-like odor. Propylene Oxide is a possible human carcinogen. Inhalation over-exposures to Propylene Oxide irritate the respiratory system and can damage the lungs. Severe inhalation over-exposure may be fatal. Propylene Oxide is corrosive to skin, eyes, and contaminated tissues. Releases of Propylene Oxide present a serious fire hazard. The vapors of Propylene Oxide are heavier than air and may spread long distances; distant ignition and flash-back are possible. Propylene Oxide can react with water and a runaway reaction may occur. Propylene Oxide can undergo hazardous polymerization when in contact with highly active catalysts, acids, and bases. Emergency responders must wear the proper personal protective equipment (and have appropriate fire suppression equipment) suitable for the situation to which they are responding.

### 3. HAZARD IDENTIFICATION (Continued)

**SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE:** The most significant routes of occupational over-exposure are by inhalation and skin and eye contact. Propylene Oxide is classified toxicologically as a primary irritant, a mild antagonist of protoplasmic protein and a mild depressant of central nervous system activity. The symptoms of over-exposure to the Propylene Oxide, via route of exposure, are as follows:

**INHALATION:** Inhalation of Propylene Oxide vapors irritate the mucous membranes and upper respiratory tract. Inhalation of Propylene Oxide vapors may cause headache, dizziness, lightheadedness, incoordination, and unconsciousness. Central nervous system effects consist of incoordination, ataxia and general depression. Inhalation of very high concentrations of the vapors, as may occur if Propylene Oxide is used or released in a poorly ventilated area or confined space (or during a release of large volumes of Propylene Oxide), may cause lung damage and reduce resistance to pneumonia. Repeated inhalation over-exposures may cause lung damage.

There is confirmed potential for worker sensitization as a result of inhalation exposure, based on the weight of scientific evidence. In susceptible individuals, repeated exposure may result in allergic reaction. Severe inhalation over-exposure may be fatal.

**CONTACT WITH SKIN or EYES:** Depending on the duration and concentration of over-exposure, contact of the liquid or vapor of Propylene Oxide with the eyes may cause irritation, tearing, burns, and permanent injury. Corneal burns have been reported. Depending on the duration and concentration of over-exposure, skin contact may cause redness, severe irritation, and burns. Contact with skin, even with dilute solutions of Propylene Oxide may result in irritation and necrosis of skin. There is confirmed potential for worker sensitization as a result of dermal contact and/or inhalation exposure, based on the weight of scientific evidence. Repeated skin over-exposure may cause dermatitis and allergic skin reaction in susceptible individuals.

**SKIN ABSORPTION:** Skin absorption is not known to be a significant route of entry for Propylene Oxide.

**INGESTION:** Ingestion is not anticipated to be a significant route of over-exposure for Propylene Oxide. If Propylene Oxide is swallowed, it can cause nausea, vomiting, and diarrhea. Symptoms can include those described in "Inhalation". Ingested Propylene Oxide may be aspirated into the lungs and cause severe lung damage (edema) and pneumonitis.



**OTHER POTENTIAL HEALTH EFFECTS:** Contact with rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after such contact can quickly subside.

**HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms.** Overexposure to Propylene Oxide may cause the following health effects:

**ACUTE:** Inhalation and ingestion over-exposure to Propylene Oxide may cause headache, dizziness, lightheadedness, incoordination, unconsciousness, lung damage, and reduced resistance to pneumonia. Severe inhalation over-exposure may be fatal. Contamination of skin may cause severe irritation or burns. Contamination of eyes may cause burns or permanent injury.

**CHRONIC:** Repeated skin over-exposure may cause allergic skin reaction. Repeated inhalation over-exposures may cause lung damage. There is confirmed potential for worker sensitization as a result of dermal contact and/or inhalation exposure, based on the weight of scientific evidence. Chronic over-exposure may cause liver damage. Propylene Oxide is a confirmed animal carcinogen and probable human carcinogen and possible reproductive toxin. See Section 11 (Toxicological Information) for additional information.

**TARGET ORGANS:** ACUTE: Respiratory system, skin, eyes. CHRONIC: Skin, respiratory system, liver (based on animal test data), central nervous system, eyes.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM			
HEALTH		(BLUE)	3
FLAMMABILITY		(RED)	4
REACTIVITY		(YELLOW)	2
PROTECTIVE EQUIPMENT			X
EYES	RESPIRATORY	HANDS	BODY
	SEE SECTION 8		SEE SECTION 8
For Routine Industrial Use and Handling Applications			

**See Section 16 for Definition of Ratings**

## **PART II** *What should I do if a hazardous situation occurs?*

### **4. FIRST-AID MEASURES**

**RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS PRODUCT WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus and Fire-Retardant Personal Protective equipment should be worn. Adequate fire protection must be provided during rescue situations.**

Victim(s) must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to physician or other health professional with victim(s). Remove victim(s) to fresh air, as quickly as possible. In case of eye contact which leads to irritation, immediately flush eyes with copious amounts of water for at least 15 minutes. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Only trained personnel should administer supplemental oxygen.

In case of frostbite, place the frostbitten part in warm water. **DO NOT USE HOT WATER.** If warm water is not available, or is impractical to use, wrap the affected parts gently in blankets. Alternatively, if the fingers or hands are frostbitten, place the affected area in the armpit. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention.

**SKIN EXPOSURE:** If this gas contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate the eyes. Victim must seek immediate medical attention.

**EYE EXPOSURE:** If this gas gets into the eyes, or if irritation of the eye develops after exposure to gas, open victim's eyes while under gently running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Seek medical assistance immediately, preferably an ophthalmologist.

**MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:** Acute or chronic respiratory system, skin, or eye conditions, as well as disorders involving the "Target Organs", as listed in Section 3 (Hazard Information), may be aggravated by overexposure to Propylene Oxide.

**RECOMMENDATIONS TO PHYSICIANS:** Administer oxygen if necessary, treat symptoms, and eliminate exposure. Be observant for initial signs of pulmonary edema.

### **5. FIRE-FIGHTING MEASURES**

**FLASH POINT (closed cup):** -35 to -37°C (-31 to -34.6°F)

**AUTOIGNITION TEMPERATURE:** 429°C - 465°C (804°F - 869°F);  
570°C (1058°F) [in absence of air]

**FLAMMABLE LIMITS (in air by volume, %):**

Lower (LEL): 2.1 %

Upper (UEL): 37.0 %

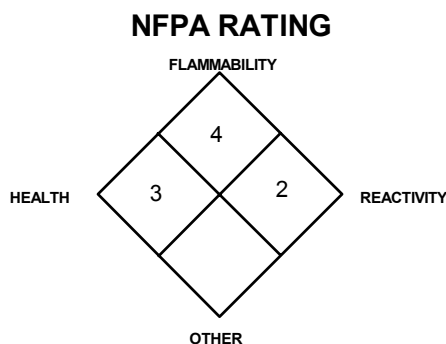
**FIRE EXTINGUISHING MATERIALS:** Extremely flammable material. Extinguish fires by shutting off the source of the leak. Do NOT direct water onto the Propylene Oxide release. Use water spray or a foam agent to cool fire-exposed containers, structures, and equipment.

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** Propylene Oxide is corrosive and presents a serious contact hazard to firefighters. Propylene Oxide is a Class IA flammable liquid; it will rapidly or completely vaporize or readily disperse in air and burn. Propylene Oxide can react with water resulting in a runaway reaction. Water should not be applied directly onto a fire that involves Propylene Oxide. Propylene Oxide can undergo hazardous polymerization when in contact with highly active catalysts, acids, and bases. When involved in a fire, Propylene Oxide may decompose and produce toxic gases (carbon monoxide and carbon dioxide). The vapors of Propylene Oxide are heavier than air and may spread long distances; distant ignition and flash-back are possible.

**DANGER!** Fires impinging (direct flame) on the outside surface of cylinders or storage vessels can be very dangerous. Direct flame exposure on the cylinder wall can cause an explosion. The resulting fire and explosion can result in severe equipment damage and personnel injury or death over a large area around the vessel. For massive fires in large areas, use unmanned hose holder or monitor nozzles; if this is not possible, withdraw from area and allow fire to burn.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Static discharge may cause Propylene Oxide to ignite explosively.



**See Section 16 for  
Definition of Ratings**

## 5. FIRE-FIGHTING MEASURES (Continued)

**SPECIAL FIRE-FIGHTING PROCEDURES:** In the event of fire, cool containers of Propylene Oxide with water to prevent failure. Use a water spray or fog to reduce or direct vapors. Do NOT direct water onto the Propylene Oxide release. Move containers from fire area if it can be done without risk to personnel. Stop leaks or discharges if possible. For small releases, if it is not possible to stop the leak and it does not endanger personnel, let the fire burn itself out. Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. If Propylene Oxide is involved in a fire, fire runoff water should be contained to prevent possible environmental damage.

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## 6. ACCIDENTAL RELEASE MEASURES

**SPILL AND LEAK RESPONSE:** Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. Eliminate all sources of ignition prior to entering the area. In case of a release, clear the affected area and protect people. Adequate fire protection must be provided. Minimum Personal Protective Equipment should be **Level B: fire-retardant protective clothing and a chemically resistant suit, mechanically-resistant gloves and Self-Contained Breathing Apparatus**. Use only non-sparking tools and equipment. Locate and seal the source of the leaking gas. Protect personnel attempting the shut-off with water-spray. Allow the gas to dissipate. Monitor the surrounding area for the level of Propylene Oxide, and oxygen. If in liquid form, absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material. Large spills: Dike far ahead of liquid spill for later disposal. Water spray may reduce vapor; but may not prevent ignition in closed spaces.

Combustible vapor concentration must be below 10% of the LEL (LEL = 2.1% - see Section 5, Fire-Fighting Measures) prior to entry of response personnel. The atmosphere must contain Propylene Oxide below levels listed in Section 2 (Composition and Information on Ingredients) and have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus. Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in-place or remove it to a safe area and allow the gas to be released there.

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## **PART III** *How can I prevent hazardous situations from occurring?*

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### 7. HANDLING and STORAGE

**WORK PRACTICES AND HYGIENE PRACTICES:** As with all chemicals, avoid getting this gas IN YOU. Do not eat or drink while handling chemicals. Be aware of any signs of overexposure [See Section 3 (Hazard Identification)], because overexposure to fatal concentrations of this product could occur without any significant warning symptoms.

**STORAGE AND HANDLING PRACTICES:** Cylinders should be stored in dry, well-ventilated areas away from sources of heat. Compressed gases can present significant safety hazards. Store containers away from heavily trafficked areas and emergency exits. Post "No Smoking or Open Flames" signs in storage or use areas. Cylinders should be separated from oxygen cylinders, or other oxidizers, by a minimum distance of 20 ft., or by a barrier of non-combustible material at least 5 ft. high, having a fire-resistance rating of at least 0.5 hours. Isolate from other incompatible chemicals (refer to Section 10, Stability and Reactivity). Storage areas must meet national electrical codes for Class 1 Hazardous Areas. Post "No Smoking or Open Flames" signs in storage or use areas. Consider installation of leak detection and alarm for storage and use areas. Have appropriate extinguishing equipment in the storage area (i.e. sprinkler system, portable fire extinguishers).

**SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS:** Protect cylinders against physical damage. Store in cool, dry, well-ventilated, fireproof area, away from flammable materials and corrosive atmospheres. Store away from heat and ignition sources and out of direct sunlight. Do not store near elevators, corridors or loading docks. Do not allow area where cylinders are stored to exceed 52°C (125°F). Avoid storing products by incompatible chemicals. Do not store containers where they can come into contact with moisture. Cylinders should be stored upright and be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. The following rules are applicable to situations in which cylinders are being used:

**Before Use:** Move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap in-place until cylinder is ready for use.

**During Use:** Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

**After Use:** Close main cylinder valve. Replace valve protection cap. Mark empty cylinders "EMPTY".

## 7. HANDLING and STORAGE (Continued)

### SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS (continued):

**NOTE:** Use only DOT or ASME Code containers. Earth-ground and bond all lines and equipment associated with this product. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Pamphlet P-1, *Safe Handling of Compressed Gases in Containers*. Additionally, refer to CGA Bulletin SB-2 "Oxygen Deficient Atmospheres".

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

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## 8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation to ensure compliance with exposure limits described in Section 2 (Composition and Information on Ingredients). Local exhaust ventilation is preferred, because it prevents dispersion of this gas into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the Propylene Oxide, and oxygen.

RESPIRATORY PROTECTION: Maintain Oxygen levels above 19.5% in the workplace. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93 and applicable standards of Canadian Provinces. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998). The following are NIOSH respiratory protection equipment recommendations for Propylene Oxide concentrations in air:

### PROPYLENE OXIDE

#### CONCENTRATION      RESPIRATORY PROTECTION

At Concentrations Above the NIOSH REL, or Where There is no REL, at any Detectable Concentration: Any Self-Contained Breathing Apparatus (SCBA) that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode, or any Supplied-Air Respirator (SAR) that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive-pressure mode.

Escape:            Any Air-Purifying, Full-Facepiece Respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection Propylene Oxide, or any appropriate escape-type, SCBA.

EYE PROTECTION: Splash goggles, face-shields or safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133, or Canadian Standards.

HAND PROTECTION: Wear chemically-resistant gloves when handling Propylene Oxide. Wear mechanically-resistant gloves when handling cylinders of this product. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: Use body protection appropriate for task. Cotton clothing is recommended to prevent static electric build up. Under certain circumstances of use and handling, the use of chemically resistant clothing may be appropriate. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR.

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## 9. PHYSICAL and CHEMICAL PROPERTIES

VAPOR DENSITY (air = 1): 2.00

SPECIFIC GRAVITY (water = 1): 0.8304

BOILING POINT(@ 1 atm.): 33.9°C (93°F)

EVAPORATION RATE (nBuAc = 1): Not available.

ODOR THRESHOLD: 35 ppm (recognition)

MELTING/FREEZING POINT: -112°C (-170°F)

CRITICAL PRESSURE: 4900 kPa (48.6 atm)

VISCOSITY-DYNAMIC @ 25°C: 0.28 mPa.s (0.28 centipoises)

SOLUBILITY IN WATER @ 20°C: Very soluble: 41 g/100 mL

SOLUBLE IN OTHER LIQUIDS: Soluble in ethanol, diethyl ether.

SATURATION VAPOR CONCENTRATION @ 20°C: 5.9 x 10 ppm (59%) [calculated]

COEFFICIENT WATER/OIL DISTRIBUTION: Log P(oct) = 0.03

APPEARANCE, ODOR AND COLOR: Propylene Oxide is a flammable, colorless liquid with an ethereal, or benzene-like odor.

HOW TO DETECT THIS SUBSTANCE (warning properties): The odor of Propylene Oxide is not a reliable warning of a release.

pH: Not applicable.

MOLECULAR WEIGHT: 58.08

CRITICAL TEMPERATURE: 209.1°C (408°F)

EXPANSION RATIO: Not available.

VAPOR PRESSURE @ 20°C: 59 kPa (445 mmHg)

SURFACE TENSION: 24.5 Newtons/metre (N/m)

## 10. STABILITY and REACTIVITY

**STABILITY:** Stable at standard temperatures and pressures.

**DECOMPOSITION PRODUCTS:** If ignited in air, or in the presence of water, Propylene Oxide will generate carbon monoxide, carbon dioxide.

**MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE:** Propylene Oxide is incompatible with water, acids, bases, oxidizing agents, metal chlorides, copper, and copper alloys.

**HAZARDOUS POLYMERIZATION:** Will occur on contact with highly active catalysts, acids, and bases.

**CONDITIONS TO AVOID:** Avoid exposing cylinders to extremely high temperatures, which could cause the cylinders to rupture. Avoiding exposing this Propylene Oxide to incompatible chemicals.

## PART IV *Is there any other useful information about this material?*

### 11. TOXICOLOGICAL INFORMATION

**TOXICITY DATA:** The following are toxicity data currently available for Propylene Oxide:

Open Irritation Test (Skin-Rabbit) 415 mg: Moderate	TCLo (Inhalation-Rat) 1433 ppm/6 hours/12 days-intermittent: Lungs, Thorax, or Respiration: dyspnea; Gastrointestinal: hypermotility, diarrhea; Related to Chronic Data: death	TCLo (Inhalation-Mouse) 400 ppm/6 hours/2 years-intermittent: Tumorigenic: Carcinogenic by RTECS criteria; Sense Organs and Special Senses (Olfaction): tumors
Standard Draize Test (Skin-Rabbit) 50 mg/6 minutes: Severe	TCLo (Inhalation-Rat) 25 mg/m <sup>3</sup> /4 hours/26 weeks-intermittent: Brain and Coverings: changes in surface EEG, other degenerative changes; Vascular: BP lowering not characterized in autonomic section	TCLo (Inhalation-Guinea Pig) 457 ppm/7 hours/22 weeks-intermittent: Sense Organs and Special Senses (Eye): effect, not otherwise specified; Lungs, Thorax, or Respiration: changes in lung weight; Nutritional and Gross Metabolic: weight loss or decreased weight gain
Standard Draize Test (Eye-Rabbit) 20 mg: Severe	TCLo (Inhalation-Rat) 529 ppm/6 hours/4 weeks-intermittent: Sense Organs and Special Senses (Olfaction): effect, not otherwise specified	TCLo (Inhalation-Monkey) 100 ppm/7 hours: male 2 year(s) pre-mating: Reproductive: Paternal Effects: spermatogenesis (incl. genetic material, sperm morphology, motility, and count)
Standard Draize Test (Eye-Rabbit) 20 mg/24 hours: Moderate	TCLo (Inhalation-Rat) 997 ppm/6 hours/2 weeks-intermittent: Cardiac: changes in heart weight; Lungs, Thorax, or Respiration: structural or functional change in trachea or bronchi; Nutritional and Gross Metabolic: weight loss or decreased weight gain	TDLo (Oral-Rat) 10,798 mg/kg/2 years-intermittent: Tumorigenic: Carcinogenic by RTECS criteria; Gastrointestinal: tumors
TCLo (Inhalation-Man)1400 gm/m <sup>3</sup> /10 minutes: Behavioral: somnolence (general depressed activity), headache; Gastrointestinal: nausea or vomiting	TCLo (Inhalation-Rat) 100 ppm/7 hours/2 years-intermittent: Tumorigenic: neoplastic by RTECS criteria; Endocrine: tumors	TDLo (Subcutaneous-Rat) 1500 mg/kg/46 weeks-intermittent: Tumorigenic: equivocal tumorigenic agent by RTECS criteria, facilitates action of known carcinogen
LC <sub>50</sub> (Inhalation-Rat) 4000 ppm/4 hours: Sense Organs and Special Senses (Olfaction): effect, not otherwise specified, lacrimation; Lungs, Thorax, or Respiration: dyspnea	TCLo (Inhalation-Rat) 500 ppm/7 hours: female 7-16 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus); Specific Developmental Abnormalities: musculoskeletal system	TDLo (Intraperitoneal-Rat) 47 mg/kg: male 1 day(s) pre-mating: Reproductive: Paternal Effects: spermatogenesis (incl. genetic material, sperm morphology, motility, and count)
LC <sub>50</sub> (Inhalation-Mouse) 1740 ppm/4 hours: Sense Organs and Special Senses (Olfaction): effect, not otherwise specified; Lungs, Thorax, or Respiration: dyspnea; Gastrointestinal: changes in structure or function of salivary glands	TCLo (Inhalation-Rat) 500 ppm/7 hours: female 7-16 day(s) after conception: Reproductive: Specific Developmental Abnormalities: craniofacial (including nose and tongue)	TDLo (Intraperitoneal-Rat) 1860 mg/kg: male 6 week(s) pre-mating: Reproductive: Paternal Effects: spermatogenesis (incl. genetic material, sperm morphology, motility, and count), testes, epididymis, sperm duct
LD <sub>50</sub> (Oral-Rat) 380 mg/kg: Behavioral: excitement, ataxia; Lungs, Thorax, or Respiration: respiratory stimulation	TCLo (Inhalation-Rat) 500 ppm/7 hours: female 15 day(s) pre-mating female 1-16 day(s) after conception: Reproductive: Fertility: pre-implantation mortality (e.g. reduction in number of implants per female; total number of implants per corpora lutea, litter size (e.g. # fetuses per litter; measured before birth), other measures of fertility	TDLo (Subcutaneous-Mouse) 272 mg/kg/95 weeks-intermittent: Tumorigenic: Carcinogenic by RTECS criteria; Blood: lymphoma, including Hodgkin's disease; Tumorigenic: tumors at site of application
LD <sub>50</sub> (Intraperitoneal-Rat) 150 mg/kg	TCLo (Inhalation-Mouse) 487 ppm/6 hours/2 weeks-intermittent: Behavioral: somnolence (general depressed activity); Lungs, Thorax, or Respiration: dyspnea	TD (Subcutaneous-Mouse) 3640 mg/kg/91 weeks-intermittent: Tumorigenic: neoplastic by RTECS criteria; Blood: lymphoma, including Hodgkin's disease, tumors at site of application
LD <sub>50</sub> (Intraperitoneal-Mouse) 175 mg/kg	TCLo (Inhalation-Mouse) 125 ppm/6 hours/13 weeks-intermittent: Related to Chronic Data: death	TD (Subcutaneous-Mouse) 868 mg/kg/95 weeks-intermittent: Tumorigenic: Carcinogenic by RTECS criteria; Blood: lymphoma, including Hodgkin's disease, tumors at site of application
LD <sub>50</sub> (Oral-Mouse) 440 mg/kg: Behavioral: excitement, ataxia; Lungs, Thorax, or Respiration: respiratory stimulation	TCLo (Inhalation-Mouse) 400 ppm/6 hours/2 years-intermittent: Tumorigenic: Carcinogenic by RTECS criteria; Sense Organs and Special Senses (Olfaction): tumors	TD (Subcutaneous-Mouse) 2912 mg/kg/95 weeks-intermittent: Tumorigenic: Carcinogenic by RTECS criteria; Blood: lymphoma, including Hodgkin's disease, tumors at site of application
LD <sub>50</sub> (Oral-Mammal-species unspecified) 440 mg/kg		
LD <sub>50</sub> (Oral-Guinea Pig) 660 mg/kg: Behavioral: somnolence (general depressed activity); Liver: other changes; Kidney, Ureter, Bladder: other changes		
LD <sub>50</sub> (Skin-Rabbit) 1500 µL/kg		
LCLo (Inhalation-Dog) 2005 ppm/4 hours: Sense Organs and Special Senses (Olfaction): effect, not otherwise specified, lacrimation; Gastrointestinal: nausea or vomiting		
LCLo (Inhalation-Guinea Pig) 4000 ppm/4 hours: Sense Organs and Special Senses (Eye): iritis; Behavioral: muscle weakness; Lungs, Thorax, or Respiration: dyspnea		
LCLo (Inhalation-Rat) 457 ppm/7 hours/28 weeks-intermittent: Sense Organs and Special Senses (Eye): effect, not otherwise specified; Lungs, Thorax, or Respiration: fibrosis, focal (pneumoconiosis); Related to Chronic Data: death		
TDLo (Oral-Rat) 1170 mg/kg/45 days-intermittent: Brain and Coverings: other degenerative changes; Liver: other changes; Blood: other changes		

## 11. TOXICOLOGICAL INFORMATION (Continued)

### TOXICITY DATA (continued):

TD (Subcutaneous-Mouse) 6616 mg/kg/95 weeks-intermittent: Tumorigenic: Carcinogenic by RTECS criteria; Blood: lymphoma, including Hodgkin's disease, tumors at site of application	Specific Locus Test (Mouse-Lymphocyte) 160 ppm/48 hours-continuous	Heritable Translocation Test (Parenteral- <i>Drosophila melanogaster</i> ) 10 ppb
TD (Oral-Rat) 2714 mg/kg/2 years-intermittent: Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Gastrointestinal: tumors	Mutation in Microorganisms (Bacteria- <i>Salmonella typhimurium</i> ) 350 µg/plate	Gene Conversion and Mitotic Recombination (Yeast- <i>Saccharomyces cerevisiae</i> ) 25 mmol/L
TC (Inhalation-Rat) 400 ppm/6 hours/2 years-intermittent: Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Sense Organs and Special Senses (Olfaction): tumors	Mutation in Microorganisms (Bacteria- <i>Salmonella typhimurium</i> ) 700 µg/plate	Sister Chromatid Exchange (Yeast- <i>Saccharomyces cerevisiae</i> ) 100 mmol/L
TC (Inhalation-Rat) 300 ppm/6 hours/2.3 years-intermittent: Tumorigenic: neoplastic by RTECS criteria; Skin and Appendages: tumors	Mutation in Microorganisms (Bacteria- <i>Salmonella typhimurium</i> ) 1 pph	Sister Chromatid Exchange (Human-Lymphocyte) 25,000 ppm
DNA Damage (Bacteria- <i>Escherichia coli</i> ) 1 µmol/L	Mutation in Microorganisms (Bacteria- <i>Escherichia coli</i> ) 700 µg/plate	Sister Chromatid Exchange (Intraperitoneal-Mouse) 232 mg/kg
DNA Damage (Microorganism-not otherwise specified) 1 mmol/L	Mutation in Microorganisms (Bacteria-Klebsiella pneumoniae) 500 µmol/L	Sister Chromatid Exchange (Hamster-Ovary) 5 mg/L
DNA Damage (Salmon-Sperm) 5 minutes	Mutation in Microorganisms (Microorganism-not otherwise specified) 25 mmol/L	Sister Chromatid Exchange (Hamster-Lung) 2500 µmol/L
DNA Damage (Fish-not otherwise specified Testis) 5 gm	Mutation in Microorganisms (Microorganism-not otherwise specified): 5 mmol/plate	Cytogenetic Analysis (Human-Lymphocyte) 1850 µg/L
DNA Damage (Rat-Liver) 30 µmol/L	Mutation in Microorganisms (Mold- <i>Neurospora crassa</i> ) 500 mmol/L	Cytogenetic Analysis (Rat-Liver) 25 µg/L
DNA Damage (Intraperitoneal-Mouse) 200 mg/kg	Mutation in Microorganisms (Yeast- <i>Saccharomyces cerevisiae</i> ) 50 mmol/L	Cytogenetic Analysis (Intraperitoneal-Mouse) 349 mg/kg
DNA Damage (Mammal-species unspecified-Lymphocyte) 75 mmol/L	Mutation in Microorganisms (Yeast- <i>Schizosaccharomyces pombe</i> ) 183 mmol/L	Cytogenetic Analysis (Hamster-Ovary) 160 mg/L
Specific Locus Test (Inhalation- <i>Drosophila melanogaster</i> ) 1500 ppm	Sex Chromosome Loss and Nondisjunction (Inhalation- <i>Drosophila melanogaster</i> ) 645 ppm/24 hours-continuous	Dominant Lethal Test (Inhalation-Rat) 300 ppm/5 days-intermittent
	Sex Chromosome Loss and Nondisjunction (Oral- <i>Drosophila melanogaster</i> ) 1 ppb	Micronucleus Test (Intraperitoneal-Mouse) 600 mg/kg/24 hours
	Sex Chromosome Loss and Nondisjunction (Parenteral- <i>Drosophila melanogaster</i> ) 10 ppb	Mutation in Mammalian Somatic Cells (Mouse-Lymphocyte) 400 µg/L
		DNA Adduct (Mammal-species unspecified-Lymphocyte) 100 mmol/tube

### SUSPECTED CANCER AGENT: Propylene Oxide is listed as follows:

ACGIH TLV-A3 (Confirmed Animal Carcinogen); EPA-B2 (Probable Human Carcinogen: Sufficient Evidence from Animal Studies, Inadequate Evidence or No Data from Epidemiologic Studies); IARC-2B (Probably Carcinogenic to Humans), MAK-2 (Substances That Are Considered to be Carcinogenic for Man Because Sufficient Data From Long-Term Animal Studies or Limited Evidence From Animal Studies Substantiated by Evidence From Epidemiological Studies Indicate that They Can Make a Significant Contribution to Cancer Risk.), NIOSH-Ca (Potential Occupational Carcinogen, With No Further Categorization); NTP-R (Reasonably Anticipated to Be a Human Carcinogen)

**IRRITANCY OF PRODUCT:** Propylene Oxide can be irritating and corrosive to contaminated tissue and eyes.

**SENSITIZATION OF PRODUCT:** There are confirmed data of possible sensitization effects after dermal contact or inhalation of Propylene Oxide.

**REPRODUCTIVE TOXICITY INFORMATION:** Listed below is information concerning the effects of Propylene Oxide on the human reproductive system.

**Mutagenicity:** Human mutation data are available Propylene Oxide; these data were obtained during clinical studies on specific human tissues exposed to high doses of this compound.

**Embryotoxicity:** Currently, there are no human embryotoxic data for Propylene Oxide.

**Teratogenicity:** Currently, there are no human teratogenic data for Propylene Oxide. Clinical studies on test animals exposed to relatively high doses of Propylene Oxide indicate teratogenic effects.

**Reproductive Toxicity:** Currently, there are no human reproductive data for Propylene Oxide. Clinical studies on test animals exposed to relatively high doses of Propylene Oxide indicate adverse reproductive effects.

*A **mutagen** is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An **embryotoxin** is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A **teratogen** is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A **reproductive toxin** is any substance which interferes in any way with the reproductive process.*

**ACGIH BIOLOGICAL EXPOSURE INDICES:** Currently, there are no Biological Exposure Indices determined for Propylene Oxide.

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## 12. ECOLOGICAL INFORMATION

**ENVIRONMENTAL STABILITY:** Propylene Oxide readily hydrolyzes. Additional environmental data is available as follows:

**Terrestrial Fate:** The aqueous hydrolysis of Propylene Oxide occurs at an environmentally important rate, therefore, hydrolysis in moist soil conditions is likely to be important. The estimated Koc values of 3.6 and 30 indicate that propylene oxide is expected to be very mobile in soil. The relatively high vapor pressure of Propylene Oxide, 439 mm Hg at 20°C, suggest that it should evaporate rapidly from dry soil surfaces. Propylene Oxide is predicted to be moderately volatile from water; therefore, evaporation from wet soils may also be possible, however, the rate of evaporation may be diminished by leaching. (continued on following page)

## 12. ECOLOGICAL INFORMATION (Continued)

### ENVIRONMENTAL STABILITY (continued):

Aquatic Fate: In freshwater, Propylene Oxide will hydrolyze with estimated half-lives of 11.6 days (pH's 7-9) and 6.6 days (pH 5) at 25°C. The presence of chloride ion accelerates the degradation as the chemical degradation half-lives in seawater are estimated to be 4.1 days (pH's 7-9) and 1.5 days (pH 5) at 25°C. Reaction of Propylene Oxide with Cl ion in water yields approximately 90% 1-chloro-2-propanol and 10% 2-chloro-1-propanol as products under neutral pH conditions. Reaction with photochemically produced hydroxyl radicals in natural water has no environmental significance as the estimated half-life at room temperature is 9.15 years. The estimated Koc values of 3.6 and 30 suggest that partitioning of propylene oxide from the water column to sediments and particulate matter will not be important. Volatilization of Propylene Oxide from the aquatic environment may be an important transport mechanism as the calculated half-life from a model river 1 m deep flowing at 1 m/sec with a wind velocity of 3 m/sec is 10 hr at 20°C and the calculated half-life from a representative oligotrophic lake is 18 days at 20°C. Calculated log BCF's of -0.20 and -0.40 suggest that bioconcentration in aquatic organisms will not be environmentally significant.

Atmospheric Fate: When released to the atmosphere, vapor phase Propylene Oxide will react with photochemically produced hydroxyl radicals with a calculated half-life of 30 days. It is not expected to react significantly with ozone in the atmosphere. Physical removal of Propylene Oxide from the ambient atmosphere is not expected to be generally important, although localized wash-out due to rainfall may occur.

Biodegradation: Using the standard dilution method, a 5 day BODT of 8% was measured for Propylene Oxide using a filtered effluent seed from a biological sanitary waste treatment plant while a 5 day BODT of 9% was measured using an adapted seed.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Exposure to animals may result in burns or may be fatal. Additionally, frost produced in the presence of rapidly expanding gases may adversely affect plant life.

EFFECT OF CHEMICAL ON AQUATIC LIFE: Propylene Oxide may have an adverse effect on aquatic life if released into an aquatic environment.

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## 13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Product removed from cylinder must be disposed of in accordance with appropriate U.S. Federal, State and local regulations or with regulations of Canada and its Provinces. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.

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## 14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Propylene Oxide  
HAZARD CLASS NUMBER and DESCRIPTION: 3 (Flammable)  
UN IDENTIFICATION NUMBER: UN 1280  
PACKING GROUP: I  
DOT LABEL(S) REQUIRED: Class 3 (Flammable)  
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 127P  
MARINE POLLUTANT: Propylene Oxide is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: Propylene Oxide is considered as dangerous goods, per regulations of Transport Canada. Use the above U.S. DOT shipping information for the preparation of Canadian Shipments.

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## 15. REGULATORY INFORMATION

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

U.S. SARA REPORTING REQUIREMENTS: Propylene Oxide is subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

CHEMICAL NAME	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Propylene Oxide	Yes	Yes	Yes

U.S. SARA THRESHOLD PLANNING QUANTITY: Propylene Oxide = 10,000 lb (4540 kg); Extremely Hazardous RQ (Section 304) = 100 lb (45.4 kg)

U.S. CERCLA REPORTABLE QUANTITY (RQ): Propylene Oxide = 100 lb (45.4 kg)

U.S. TSCA INVENTORY STATUS: Propylene Oxide is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Propylene Oxide is subject to the reporting requirements of Section 112(r) of the Clean Air Act. Threshold Quantity = 10,000 lbs (4540 kg). Propylene Oxide is listed as a Regulated Substance (Toxic Substance) per 40 CFR, Part 68 of the Risk Management for Chemical Release Prevention. Threshold Quantity = 10,000 lb (4540 kg). Depending on specific operations involving the use of Propylene Oxide, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Under this regulation, Propylene Oxide is not listed in Appendix A; however, any process that involves a flammable liquid on site in one location in quantities of 10,000 lbs (4,553 kg) or greater is covered under this regulation unless it is used as a fuel. Propylene Oxide is listed as a hazardous air pollutant (HAP) generally known or suspected to cause serious health problems under the Clean Air Act.

## 15. REGULATORY INFORMATION (Continued)

### ADDITIONAL U.S. REGULATIONS (continued):

U.S. STATE REGULATORY INFORMATION: Propylene Oxide is covered under specific State regulations, as denoted below:

**Alaska - Designated Toxic and Hazardous Substances:** Propylene Oxide.

**California - Permissible Exposure Limits for Chemical Contaminants:** Propylene Oxide.

**Florida - Substance List:** Propylene Oxide.

**Illinois - Toxic Substance List:** Propylene Oxide.

**Kansas - Section 302/313 List:** Propylene Oxide.

**Massachusetts - Substance List:** Propylene Oxide.

**Michigan - Critical Materials Register:** No.

**Minnesota - List of Hazardous Substances:** Propylene Oxide.

**Missouri - Employer Information/Toxic Substance List:** Propylene Oxide.

**New Jersey - Right to Know Hazardous Substance List:** Propylene Oxide.

**North Dakota - List of Hazardous Chemicals, Reportable Quantities:** Propylene Oxide.

**Pennsylvania - Hazardous Substance List:** Propylene Oxide.

**Rhode Island - Hazardous Substance List:** Propylene Oxide.

**Texas - Hazardous Substance List:** Propylene Oxide.

**West Virginia - Hazardous Substance List:** Propylene Oxide.

**Wisconsin - Toxic and Hazardous Substances:** Propylene Oxide.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Propylene Oxide is on the California Proposition 65 lists. **WARNING!** This product contains a chemical known to the state of California to cause cancer.

CGA LABELING (For Compressed Gas):

#### DANGER:

HARMFUL, FLAMMABLE LIQUID OR GAS UNDER PRESSURE.  
MAY BE FATAL IF INHALED.  
CAN CAUSE EYE IRRITATION OR BURNS.  
CAN CAUSE SENSITIZATION BY DERMAL CONTACT OR INHALATION.  
CAN FORM EXPLOSIVE MIXTURES WITH AIR.  
CAN POLYMERIZE UPON EXPOSURE TO WATER, INCOMPATIBLE MATERIALS.

#### ODOR:

ETHEREAL OR BENZENE-LIKE.  
Do not breath gas.  
Store and use with adequate ventilation, and use in closed systems.  
Keep away from heat, flames, and sparks.  
Avoid contact with eyes.  
Cylinder temperature should not exceed 52°C (125°F).  
Close valve after each use and when empty.  
Use in accordance with the Material Safety Data Sheet.

#### FIRST AID:

**IF INHALED**, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician, even if no symptoms are present. Keep under medical observation. Symptoms may be delayed.  
**IN CASE OF CONTACT**, immediately flush eyes or skin with water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician.  
**DO NOT REMOVE THIS PRODUCT LABEL.**

#### ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL INVENTORY: Propylene Oxide is listed on the DSL Inventory.

OTHER CANADIAN REGULATIONS: Not applicable.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: Propylene Oxide is not on the CEPA Priorities Substances Lists.

CANADIAN WHMIS CLASSIFICATION AND SYMBOLS:

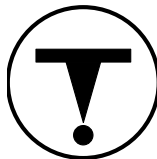
**Class B2:** Flammable Liquid

**Class C:** Corrosive

**Class D1A:** Acute Lethality

**Class D2B:** Other Toxic Effects-Chronic Toxic Effects – Sensitization

**Class F:** Dangerously Reactive Material



## 16. OTHER INFORMATION

### PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.  
PO Box 3519, La Mesa, CA 91944-3519  
858/670-0609

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. AirGas, Inc. assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, AirGas, Inc. assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

## DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

**CAS #:** This is the Chemical Abstract Service Number which uniquely identifies each constituent.

### EXPOSURE LIMITS IN AIR:

**ACGIH** - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (**TWA**), the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (**C**). Skin absorption effects must also be considered.

**OSHA** - U.S. Occupational Safety and Health Administration.

**PEL** - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.

**IDLH** - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury.

**The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). NIOSH issues exposure guidelines called **Recommended Exposure Levels (RELs)**. When no exposure guidelines are established, an entry of **NE** is made for reference.

### HAZARD RATINGS:

**HAZARDOUS MATERIALS IDENTIFICATION SYSTEM:** Health Hazard: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]. Reactivity Hazard: **0** (normally stable); **1** (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures). **PERSONAL PROTECTIVE EQUIPMENT CODES:** **B:** Gloves and goggles; **C:** Gloves, goggles, rubber apron (appropriate body protection); **D:** Gloves, goggles, faceshield; rubber apron (appropriate body protection); **X:** Special attention should be given to PPE Selection.

**NATIONAL FIRE PROTECTION ASSOCIATION:** Health Hazard: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury);

**NATIONAL FIRE PROTECTION ASSOCIATION (continued): 2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure could cause death or major residual injury). Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

### FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (**NFPA**). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

### TOXICOLOGICAL INFORMATION:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD<sub>50</sub>** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC<sub>50</sub>** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m<sup>3</sup>** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: EC is the effect concentration in water.

### REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (**SARA**); the Canadian Domestic/Non-Domestic Substances List (**DSL/NDL**); the U.S. Toxic Substance Control Act (**TSCA**); Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA** or **Superfund**); and various state regulations.