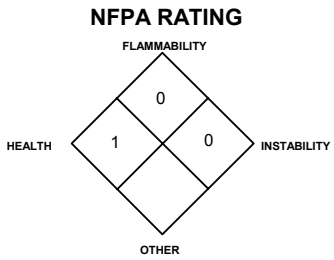
Airgas



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:	**CHLORODIFLUOROMETHANE(R-22) and CHLOROPENTAFLUOROETHANE (R-115) MIX HALOCARBON R 502**
	Document Number: 001058
PRODUCT USE:	For General Analytical/Synthetic Chemical Uses/Refrigerant
SUPPLIER/MANUFACTURER'S NAME:	AIRGAS INC.
ADDRESS:	259 N. Radnor-Chester Road Suite 100 Radnor, PA 19087-5283
BUSINESS PHONE:	1-610-687-5253
EMERGENCY PHONE:	1-800-949-7937 International: 423-479-0293
DATE OF PREPARATION:	November 16, 1996
REVISION DATE:	February 13, 2004

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH-TLV		OSHA-PEL		NIOSH	OTHER
			TWA ppm	STEL ppm	TWA ppm	STEL ppm	IDLH ppm	ppm
Chlorodifluoromethane (R-22)	75-45-6	48.8%	1000	NE	1000 (Vacated 1989 PEL)	NE	NE	NIOSH RELs: TWA V = 1000 STEL = 1250 DFG MAKs: TWA = 500 PEAK = 8•MAK 15 min. average value, 1-hr interval DFG MAK Pregnancy Risk Classification: C Carcinogen: IARC-3, TLV-A4
Chloropentafluoroethane (R-115)	76-15-3	51.2%	1000	NE	1000 (Vacated 1989 PEL)	NE	NE	NIOSH REL: TWA = 1000

NE = Not Established. 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 gas mixture 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: This gas mixture is a colorless non-flammable, liquefied gas with a slightly ethereal odor, due to the presence of Chlorodifluoromethane. Inhalation of this gas mixture can cause central nervous system depression, producing symptoms which can include headaches, nausea, dizziness, drowsiness, confusion, and unconsciousness. At high concentrations, this gas mixture can act as an asphyxiant, by displacing oxygen; therefore, exposure to high concentrations of this gas can be fatal. Frostbite can be caused by contact with rapidly expanding gases or the liquefied gas. This gas is not flammable or reactive in normal emergency response situations. However, if involved in a fire, this gas mixture can decompose to produce toxic gases (e.g., hydrogen fluoride, phosgene). Emergency responders must wear personal protective equipment appropriate for the situation to which they are responding

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: The most significant route of overexposure for this gas mixture is by inhalation. The following paragraphs describe symptoms of exposure by route of exposure.

INHALATION: Exposures to high concentrations of this gas (above 50,000 ppm) may cause central nervous system depression. Effects of such overexposure can include light-headedness, giddiness, shortness of breath and in extreme cases, irregular heartbeats, cardiac arrest, and death. Repeated or prolonged overexposures to this gas mixture, especially at high concentrations, can cause cardiac arrest due to sensitization of the heart to adrenaline and nor-adrenaline and liver damage.

Additionally, high concentrations of this gas mixture can cause an oxygen-deficient environment. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. The skin of a victim of overexposure may have a blue color. Under some circumstances of overexposure, death may occur. The effects associated with various levels of oxygen are as follows:

CONCENTRATION	**SYMPTOMS OF EXPOSURE**
12-16% Oxygen:	Breathing and pulse rate increased, muscular coordination slightly disturbed.
10-14% Oxygen:	Emotional upset, abnormal fatigue, disturbed respiration.
6-10% Oxygen:	Nausea and vomiting, collapse or loss of consciousness.
Below 6%:	Convulsive movements, possible respiratory collapse, and death.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH HAZARD	(BLUE)	1
FLAMMABILITY HAZARD	(RED)	0
PHYSICAL HAZARD	(YELLOW)	0

PROTECTIVE EQUIPMENT

EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8

For Routine Industrial Use and Handling Applications

See Section 16 for Definition of Ratings

OTHER POTENTIAL HEALTH EFFECTS: Contact with liquid or 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 this gas mixture may cause the following health effects:

ACUTE: The most significant hazard associated with this gas mixture is inhalation of high concentrations of this gas mixture. Such overexposure can cause symptoms of central nervous system depression and oxygen deficiency. Symptoms of such exposures include respiratory difficulty, ringing in ears, headaches, dizziness, indigestion, nausea, and possible death. Contact with liquid or rapidly expanding gases (which are released under high pressure) may cause frostbite.

CHRONIC: Prolonged contact with the skin may cause defatting or dryness of the skin. There are currently no confirmed adverse health effects on humans associated with chronic exposure to this compressed gas. However, this gas mixture may cause cardiac sensitization, permanent neurological abnormalities, damage to the lungs, liver, kidney, blood. Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may affect the heart and nervous system. See Section 11 (Toxicological Information) for additional information.

TARGET ORGANS: ACUTE: Respiratory system, central nervous system, skin. ACUTE: Skin, cardiovascular system, central nervous system, liver, kidney, blood.

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 GAS MIXTURE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus and Personal Protective equipment should be worn. Remove victim(s) to a safe location. Trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. 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).

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.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Conditions relating to the target organs may be aggravated by overexposures to this gas mixture. See Section 3 (Hazard Identification) for information on these conditions.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, if necessary. Treat symptoms and eliminate exposure. Epinephrine or other sympathomimetic amines and adrenergic activators should not be used, since they may sensitize the heart for development of arrhythmias. Patients must be removed from the exposure environment, and high-flow supplemental oxygen should be utilized. The respiratory system should be evaluated for injury, aspiration, or pulmonary edema and treated appropriately. If necessary, administer liver, and kidney function tests, and Holter monitor (special 24 hour EKG to look for irregular heartbeat). Central nervous system findings should be treated supportively. A calm environment with no physical exertion is imperative to avoid increasing endogenous adrenegic levels. Exogenous adrenergic drugs must not be used to avoid inducing sensitized myocardial dysrhythmias. Atropine is ineffective in treating bradyarrhythmias. For ventricular dysrhythmias, diphenylhydantoin and countershock may be effective.

Cryogenic dermal injuries should be treated by water bath re-warming at 40 to 42°C until vasodilatory flush has returned. Elevation of the limb and standard frostbite management with late surgical debridement should be utilized. Ocular exposure requires irrigation and slit-lamp evaluation for injury.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): Not applicable.

Upper (UEL): Not applicable.

FIRE EXTINGUISHING MATERIALS: Non-flammable gas. Use extinguishing media appropriate for surrounding fire.

Water Spray: YES

Carbon Dioxide: YES

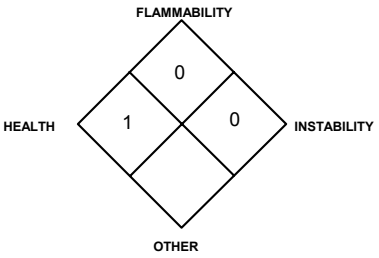
Dry Chemical: YES

Halon: YES

Foam: YES

Other: Any "ABC" Class.

NFPA RATING



See Section 16 for Definition of Ratings

UNUSUAL FIRE AND EXPLOSION HAZARDS: Although this gas mixture is a non-flammable gas, it can present some health hazards to firefighters. When involved in a fire, this material may decompose and produce toxic gases (e.g., phosgene, hydrogen fluoride, hydrogen chloride, and carbonyl fluoride). This gas mixture does not burn; however, containers, when involved in fire, may rupture or burst in the heat of the fire.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. In the event of fire, cool containers of this gas mixture with water to prevent failure. Use a water spray or fog to reduce or direct vapors. If cylinders are exposed to heat, the cylinder may rupture or burst and release the contents. It may be prudent to remove potentially heat-exposed cylinders from the area surrounding a fire, if it is safe for firefighters to do so.

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. In case of an accidental release, evacuate all personnel upwind and away from affected area, protect people, and respond with trained personnel. In the event of a non-incidental release, minimum Personal Protective Equipment should be **Level B: mechanically-resistant gloves and Self-Contained Breathing Apparatus**. Allow the gas to dissipate.

6. ACCIDENTAL RELEASE MEASURES (Continued)

SPILL AND LEAK RESPONSE (continued): Monitor the surrounding area for Chlorodifluoromethane, Chloropentafluoroethane, and oxygen. Chlorodifluoromethane and Chloropentafluoroethane are below levels indicated in Section 2 (Composition and Information on Ingredients) and the atmosphere must 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.

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

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting this gas mixture IN YOU. Do not eat or drink while handling chemicals. Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this gas mixture 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. Do not use this gas mixture with or near incompatible chemicals (see Section 10, Stability and Reactivity). Acceptable materials for construction for equipment used in the handling of this gas mixture include most commonly used metals (steel, cast iron, brass, copper, tin, lead, and aluminum).

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Protect cylinders against physical damage. Store in cool, dry, well-ventilated area, away from sources of heat, ignition and direct sunlight. Use a check valve or trap in the discharge line to prevent hazardous backflow. Post "No Smoking or Open Flame" signs in storage and use areas. 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 work 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 (where provided) 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 gas mixture 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 (where provided). Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers. 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. Purge gas handling equipment with inert gas (e.g., nitrogen) before attempting repairs.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation to ensure exposures of Chlorodifluoromethane and Chloropentafluoroethane are below limits in Section 2 (Composition and Information on Ingredients). Local exhaust ventilation is preferred, because it prevents dispersion into the work place by eliminating the gas at its source. If necessary, the work area should be monitored for the level of 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).

EYE PROTECTION: Splash goggles or safety glasses, for protection from rapidly expanding. Face-shields should be worn if contact with the liquefied gas is anticipated. If necessary, refer to U.S. OSHA 29 CFR 1910.133, or Canadian Standards.

HAND PROTECTION: Wear mechanically-resistant gloves when handling cylinders of this gas mixture. Wear Viton or rubber gloves when using this gas mixture. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

BODY PROTECTION: Use body protection appropriate for task. Transfer of large quantities under pressure may require protective equipment appropriate to protect employees from splashes of liquefied product. 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.

9. PHYSICAL and CHEMICAL PROPERTIES

VAPOR DENSITY: 3.92 kg/m^3 (0.245 lb/ft^3)
SPECIFIC GRAVITY(air = 1): 3.97
SOLUBILITY IN WATER: Slightly.
EVAPORATION RATE (nBuAc = 1): >1
VAPOR PRESSURE (psia): 169
SPECIFIC VOLUME (ft^3/lb): Not determined.
pH: Not applicable.
FREEZING POINT: Not determined.
BOILING POINT @ 1 atm: -45°C (-49.7°F)
EXPANSION RATIO: Not applicable.
ODOR THRESHOLD: Not determined.
COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.
APPEARANCE, ODOR AND COLOR: Colorless, non-flammable gas with a slightly ethereal odor.
HOW TO DETECT THIS SUBSTANCE (warning properties): There are no distinct warning properties for this gas mixture. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.

10. STABILITY and REACTIVITY

STABILITY: Stable at normal temperature and pressure.
DECOMPOSITION PRODUCTS: If this gas is exposed to fire, thermal decomposition can include toxic products such as hydrogen fluoride, phosgene, hydrogen chloride, carbonyl fluoride.
MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: The following materials are not compatible with this gas: sodium, potassium, calcium, zinc, and magnesium, powdered aluminum and strong oxidizers.
HAZARDOUS POLYMERIZATION: Will not occur.
CONDITIONS TO AVOID: Avoid contact with incompatible materials. Avoid exposing cylinders to extremely high temperatures, which could cause the cylinders to rupture or burst.

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

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following data are available for components of this gas mixture:

CHLORODIFLUOROMETHANE:

LD (Oral-Rat) > 43,200 μg/kg

LC_{50} (Inhalation-Rat) 35 pph/15 minutes: Behavioral: altered sleep time (including change in righting reflex), ataxia; Lungs, Thorax, or Respiration: respiratory depression

LC_{50} (Inhalation-Mouse) 1380 gm/m^3/2 hours: Behavioral: somnolence (general depressed activity), ataxia; Lungs, Thorax, or Respiration: cyanosis

LCLo (Inhalation-Dog) 70 pph: Lungs, Thorax, or Respiration: other changes

LCLo (Inhalation-Guinea Pig) 30 pph/2 hours: Behavioral: general anesthetic, somnolence (general depressed activity), convulsions or effect on seizure threshold

TDLo (Oral-Rat) 2457 mg/kg/26 weeks-intermittent: Brain and Coverings: other degenerative changes; Blood: changes in other cell count (unspecified); Nutritional and Gross Metabolic: weight loss or decreased weight gain

TCLo (Inhalation-Mouse) 50 gm/m^3/6 hours/43 weeks-intermittent: Brain and Coverings: other degenerative changes; Spinal Cord: other degenerative changes; Behavioral: alteration of classical conditioning

TCLo (Inhalation-Rat) 50,000 ppm/5 hours: male 56 day(s) pre-mating: Reproductive: Paternal Effects: prostate, seminal vesicle, Cowper's gland, accessory glands

TCLo (Inhalation-Rat) 5 ppm: female 6-15 day(s) after conception: Reproductive: Specific Developmental Abnormalities: eye/ear

TDLo (Inhalation-Rat) 50,000 ppm/6 hours: female 6-15 day(s) after conception: Reproductive: Specific Developmental Abnormalities: eye/ear

Mutation in Microorganisms (Bacteria-*Salmonella typhimurium*) 33 pph/24 hours-continuous

CHLORODIFLUOROMETHANE (continued):

SHORT-TERM INHALATION: High concentrations of Chlorodifluoromethane produced stimulation, then depression of the central nervous system; this was followed by asphyxiation. In a 2-hour study, it was found that exposures of 7.5-10% of Chlorodifluoromethane produced excitation and/or changes in the equilibrium of rats and guinea pigs. Unconsciousness occurred at 20% exposures, and death was observed at exposures of 30-40% Chlorodifluoromethane Concentrations of less than 20% were not lethal in rats, mice, guinea pigs and dogs. A no-effect level has been established at 1% Chlorodifluoromethane for rats and mice.

LUNGS AND HEART: Effects such as respiratory depression, bronchio-constriction, rapid heart beat, myocardial depression, and low blood pressure occurred in animals breathing 5-25% Chlorodifluoromethane.

LONG-TERM INHALATION: Rats, mice, and rabbits which were exposed to 14% Chlorodifluoromethane over a 10-month period showed the following effects: changes in body weight, physiological endurance, and blood characteristics; pathological changes in the lungs, central nervous system, heart, liver kidneys, and spleen. Test animals similarly exposed to 0.2% Chlorodifluoromethane did not show any adverse health effect.

LIVER: Fat accumulation was observed in animals exposed to relative high doses (mice exposed to 25% Chlorodifluoromethane for 60 minutes and rabbits exposed to 30-40 for 10 minutes). Mild liver changes were observed in rabbits exposed to 6% 5 hours/day for 5 days/week for 8-12 weeks.

CHLOROPENTAFLUOROETHANE:

LC_{50} (Inhalation-Rat) 4880 gm/m^3/4 hours

11. TOXICOLOGICAL INFORMATION (Continued)

SUSPECTED CANCER AGENT: Components of this gas mixture are listed by agencies tracking the carcinogenic potential of chemical compounds, as follows:

CHLORODIFLUOROMETHANE: ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen); IARC-3 (Unclassifiable as to Carcinogenicity in Humans)

The remaining component of this product is not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, IARC; and therefore are not considered to be, nor suspected to be cancer-causing agents by these agencies.

IRRITANCY OF PRODUCT: This gas is not irritating; however, contact with rapidly expanding gases can cause frostbite to exposed tissue.

SENSITIZATION TO THE PRODUCT: This gas may cause weak cardiac sensitization, based on animal tests.

REPRODUCTIVE TOXICITY INFORMATION: The following is information concerning the effects of this gas and its components on the human reproductive system.

Mutagenicity: The components of this gas are not reported to produce mutagenic effects in humans. The following information has been obtained during clinical animal and other studies: The Chlorodifluoromethane component of this gas mixture was mutagenic in one bacterial test. The gas does not induce mutation or gene conversion in yeast, or DNA damage or mutation in cultured, mammalian cells. It does not induce chromosomal damage or dominant lethal mutations in mice or rats treated in vivo. This gas mixture is not reported to produce mutagenic effects in humans.

Embryotoxicity: The components of this gas are not reported to produce embryotoxic effects in humans.

Teratogenicity: The components of this gas are not reported to cause teratogenic effects in humans. Clinical studies on test animals exposed to relatively high doses of the Chlorodifluoromethane component of this gas mixture indicate teratogenic effects.

Reproductive Toxicity: The components of this gas are not reported to cause reproductive effects in humans.

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.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) have not been determined for the components of this gas.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: This gas will be dissipated rapidly in well-ventilated areas. The components of this gas mixture are chlorofluorocarbon (CFC) compounds. Chlorofluorocarbon compounds have been implicated in the possible depletion of the stratospheric ozone, via a series of complex chemical reactions which occur in the upper atmosphere. Atmospheric ozone is essential in protecting plants and animals from potentially harmful ultraviolet-light exposures. All work practice must be directed at eliminating environmental contamination. Additionally, environmental toxicity data are available for the components of this gas as follows:

CHLORODIFLUOROMETHANE:

Terrestrial Fate: Since Chlorodifluoromethane is a gas under ambient conditions, most of the chemical released on land will volatilize rapidly. Any Chlorodifluoromethane which remains on soil will have a high potential for leaching based on its estimated Koc of 35. Based on Chlorodifluoromethane's low biodegradability under both aerobic and anaerobic conditions, it is not expected to biodegrade in soils.

Aquatic Fate: Based on a classification scheme, an estimated Koc value of 35, using a structure estimation method based on molecular connectivity indices, indicates that Chlorodifluoromethane is not expected to adsorb to suspended solids and sediment. Volatilization from water surfaces is expected based upon a Henry's Law constant of 4.06X10-2 atm-cu m/mole. Using this Henry's Law constant and an estimation method, volatilization half-lives for a model river and model lake are 58 minutes and 3.7 days, respectively. Based on Chlorodifluoromethane's low biodegradability under both aerobic and anaerobic conditions, it is not expected to biodegrade in aqueous systems. According to a classification scheme, an estimated BCF of 1, from its log Kow of 1.08 and a regression-derived equation, suggests the potential for bioconcentration in aquatic organisms is low. Hydrolysis in water is not expected to be important due to Chlorodifluoromethane's low rate of hydrolysis (< 0.01 g/L-yr).

Atmospheric Fate: According to a model of gas/particle partitioning of semi-volatile organic compounds in the atmosphere, Chlorodifluoromethane, which has a vapor pressure of 7,250 mm Hg at 25°C, is expected to exist in the gas phase in the ambient atmosphere. Gas-phase Chlorodifluoromethane is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 9.4 years, calculated from its rate constant of 4.68X10-15 cu cm/molecule-sec at 25°C. As a result of its long half-life, a substantial fraction of the Chlorodifluoromethane will slowly diffuse to the upper stratosphere. Once in the upper stratosphere, it is dissociated through photolysis, reaction with hydroxyl radical and excited atomic oxygen resulting in the release of chlorine at high altitudes. These chlorine atoms then become part of a catalytic process that contributes to the destruction of the ozone layer. In the troposphere, however, Chlorodifluoromethane is not expected to undergo photolysis since it does not absorb light > 290nm.

Bioconcentration: An estimated BCF of 1 was calculated for Chlorodifluoromethane, using a log Kow of 1.08 and a regression-derived equation. According to a classification scheme, this BCF suggests the potential for bioconcentration in aquatic organisms is low.

12. ECOLOGICAL INFORMATION (Continued)

ENVIRONMENTAL STABILITY (continued):

CHLOROPENTAFLUOROETHANE:

Terrestrial Fate: Based on a recommended classification scheme, an estimated Koc value of 212, determined from a measured water solubility of 250 mg/L at 25°C, and a recommended regression derived equation indicates that Chloropentafluoroethane is expected to have moderate mobility in soil. Volatilization of Chloropentafluoroethane is expected from moist soil surfaces based on an estimated Henry's Law constant of 5.58 atm-cu m/mole determined from a measured vapor pressure of 6,860 mm Hg at 25°C and water solubility of 250 mg/l at 25°C. Chloropentafluoroethane is expected to volatilize rapidly from dry soil surfaces based on the measured vapor pressure of this compound. Highly chlorinated/fluorinated compounds are not expected to biodegrade rapidly.

Aquatic Fate: Based on a recommended classification scheme, an estimated Koc value of 212, determined from a measured water solubility of 250 mg/L at 25°C, and a recommended regression derived equation, indicates that Chloropentafluoroethane is not expected to adsorb to suspended solids and sediment in water. Chloropentafluoroethane is expected to volatilize rapidly from water surfaces based on an estimated Henry's Law constant of 5.58 atm-cu m/mole determined from a measured vapor pressure of 6,860 mm Hg at 25°C and water solubility of 250 mg/L at 25°C. Estimated half-lives for a model river and model lake are 4 and 118 hours, respectively. According to a classification scheme, an estimated BCF value of 28, from the measured water solubility, suggests that bioconcentration in aquatic organisms is low. Highly chlorinated/fluorinated compounds are not expected to biodegrade rapidly.

Atmospheric Fate: According to a model of gas/particle partitioning of semi-volatile organic compounds in the atmosphere, Chloropentafluoroethane, which has a measured vapor pressure of 6,860 mm Hg at 25°C, is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase Chloropentafluoroethane is essentially inert in the troposphere. This compound is expected to diffuse into the stratosphere above the ozone layer where it will slowly degrade due to direct photolysis from UV-C radiation and contribute to the catalytic removal of stratospheric ozone. The atmospheric lifetime of this compound has been estimated to range from 230 to 550 years.

Bioconcentration: An estimated BCF value of 28 was calculated for Chloropentafluoroethane, using a measured water solubility of 250 mg/L and a recommended regression-derived equation. According to a classification scheme, this BCF value suggests that bioconcentration in aquatic organisms is low.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Any adverse effect on animals would be related to adverse effects on the central nervous system and to exposure to oxygen-deficient environments. The symptoms experienced by over-exposed animals would be similar to those described for exposed humans. No adverse effect is anticipated to occur to plant-life, except for frost produced in the presence of rapidly expanding gases.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on the effects of this gas on aquatic life.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Product removed from the 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.

14. TRANSPORTATION INFORMATION

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

PROPER SHIPPING NAME:	Chlorodifluoromethane and chloropentafluoroethane mixture
ALTERNATE SHIPPING NAME:	Refrigerant gas R 502
HAZARD CLASS NUMBER and DESCRIPTION:	Class 2.2 (Non-flammable Gas)
UN IDENTIFICATION NUMBER:	UN 1973
PACKING GROUP:	Not Applicable.
DOT LABEL(S) REQUIRED:	Class 2.2 (Non-flammable Gas)

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126

MARINE POLLUTANT: No component of this gas mixture is classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This gas mixture is considered as Dangerous Goods, per regulations of Transport Canada. The use of the above U.S. DOT information from the U.S. 49 CFR regulations is allowed for shipments that originate in the U.S. For shipments via ground vehicle or rail that originate in Canada, the following information is applicable.

PROPER SHIPPING NAME:	Chlorodifluoromethane and chloropentafluoroethane mixture
ALTERNATE SHIPPING NAME:	Refrigerant gas R 502
HAZARD CLASS NUMBER and DESCRIPTION:	2.2 (Non-Flammable Gas)
UN IDENTIFICATION NUMBER:	UN 1973
PACKING GROUP:	Not Applicable
HAZARD LABEL(S) REQUIRED:	Class 2.2 (Non-Flammable Gas)
SPECIAL PROVISIONS:	None
EXPLOSIVE LIMIT & LIMITED QUANTITY INDEX:	0.12
ERAP INDEX:	None
PASSENGER CARRYING SHIP INDEX:	None

PASSENGER CARRYING ROAD OR RAIL VEHICLE INDEX: 75

MARINE POLLUTANT: Components of this gas mixture are not Marine Pollutants

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The components of this gas are subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

COMPOUND	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Chlorodifluoromethane	No	No	Yes
Chloropentafluoroethane	No	No	Yes

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for this material. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

U.S. CERCLA REPORTABLE QUANTITY (RQ): The both components of this gas mixture are CERCLA Hazardous Substances, although they have not been assigned a specific CERCLA RQ.

U.S. TSCA INVENTORY STATUS: The components of this gas are listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Chlorodifluoromethane and Chloropentafluoroethane are subject to the requirements under Title VI of the Clean Air Act Amendments of 1990: "Stratospheric Ozone Protection". Chlorodifluoromethane and Chloropentafluoroethane are listed as Class I and II ozone-depleting chemicals. Containers of this gas may be required to bear the following label:

Warning: Contains Chlorodifluoromethane and Chloropentafluoroethane, substances which harm public health and environment by destroying ozone in the upper atmosphere.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): No component of this gas mixture is on the California Proposition 65 lists.

CGA LABELING (For Compressed Gas):

CAUTION: LIQUID AND GAS UNDER PRESSURE.
CAN CAUSE RAPID SUFFOCATION.
MAY CAUSE FROSTBITE.
Store and use with adequate ventilation.
Do not get liquid in eyes, on skin or clothing.
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.

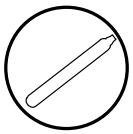
FIRST-AID: **IF INHALED**, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
IN CASE OF FROSTBITE, obtain immediate medial attention.
DO NOT REMOVE THIS PRODUCT LABEL.

ADDITIONAL CANADIAN REGULATIONS:

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: Components of this gas mixture are not on the CEPA Priorities Substances Lists.

CANADIAN DSL/NDSL INVENTORY STATUS: Chlorodifluoromethane and Chloropentafluoroethane are listed on the DSL Inventory.

CANADIAN WHMIS CLASSIFICATION AND SYMBOLS: **Class A:** Compressed Gases



16. OTHER INFORMATION

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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 that uniquely identifies each constituent.

EXPOSURE LIMITS IN AIR:

CEILING LEVEL: The concentration that shall not be exceeded during any part of the working exposure.

LOQ: Limit of Quantitation.

MAK: Federal Republic of Germany Maximum Concentration Values in the workplace.

NE: Not Established. When no exposure guidelines are established, an entry of NE is made for reference.

NIC: Notice of Intended Change.

NIOSH CEILING: The exposure that shall not be exceeded during any part of the workday. If instantaneous monitoring is not feasible, the ceiling shall be assumed as a 15-minute TWA exposure (unless otherwise specified) that shall not be exceeded at any time during a workday.

NIOSH RELs: NIOSH's Recommended Exposure Limits.

PEL-Permissible Exposure Limit: OSHA's Permissible Exposure Limits. 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 that was vacated by Court Order.

SKIN: Used when a there is a danger of cutaneous absorption.

STEL-Short Term Exposure Limit: Short Term Exposure Limit, usually a 15-minute time-weighted average (TWA) exposure that should not be exceeded at any time during a workday, even if the 8-hr TWA is within the TLV-TWA, PEL-TWA or REL-TWA.

TLV-Threshold Limit Value: An airborne concentration of a substance that 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.

TWA-Time Weighted Average: Time Weighted Average exposure concentration for a conventional 8-hr (TLV, PEL) or up to a 10-hr (REL) workday and a 40-hr workweek.

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.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS: This rating system was developed by the National Paint and Coating Association and has been adopted by industry to identify the degree of chemical hazards.

HEALTH HAZARD:

0 (Minimal Hazard: No significant health risk, irritation of skin or eyes not anticipated. *Skin Irritation*: Essentially non-irritating. PII or Draize = "0". *Eye Irritation*: Essentially non-irritating, or minimal effects which clear in < 24 hours [e.g. mechanical irritation]. Draize = "0". *Oral Toxicity LD_{50} Rat*: < 5000 mg/kg. *Dermal Toxicity LD_{50}Rat or Rabbit*: < 2000 mg/kg. *Inhalation Toxicity 4-hrs LC_{50} Rat*: < 20 mg/L.); **1** (Slight Hazard: Minor reversible Injury may occur; slightly or mildly irritating. *Skin Irritation*: Slightly or mildly irritating. *Eye Irritation*: Slightly or mildly irritating. *Oral Toxicity LD_{50} Rat*: > 500-5000 mg/kg. *Dermal Toxicity LD_{50}Rat or Rabbit*: > 1000-2000 mg/kg. *Inhalation Toxicity LC_{50}* 4-hrs *Rat*: > 2-20 mg/L); **2** (Moderate Hazard: Temporary or transitory injury may occur. *Skin Irritation*: Moderately irritating; primary irritant; sensitizer. PII or Draize > 0, < 5. *Eye Irritation*: Moderately to severely irritating and/or corrosive; reversible corneal opacity; corneal involvement or irritation clearing in 8-21 days. Draize > 0, ≤ 25. *Oral Toxicity LD_{50} Rat*: > 50-500 mg/kg. *Dermal Toxicity LD_{50}Rat or Rabbit*: > 200-1000 mg/kg. *Inhalation Toxicity LC_{50} 4-hrs Rat*: > 0.5-2 mg/L.); **2** (Moderate Hazard: Temporary or transitory injury may occur. *Skin Irritation*: Moderately irritating; primary irritant; sensitizer. PII or Draize > 0, < 5. *Eye Irritation*: Moderately to severely irritating and/or corrosive; reversible corneal opacity; corneal involvement or irritation clearing in 8-21 days. Draize > 0, ≤ 25. *Oral Toxicity LD_{50} Rat*: > 50-500 mg/kg. *Dermal Toxicity LD_{50}Rat or Rabbit*: > 200-1000 mg/kg. *Inhalation Toxicity LC_{50} 4-hrs Rat*: > 0.5-2 mg/L.); **3** (Serious Hazard: Major injury likely unless prompt action is taken and medical treatment is given; high level of toxicity; corrosive. *Skin Irritation*: Severely irritating and/or corrosive; may destroy dermal tissue, cause skin burns, dermal necrosis.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

HEALTH HAZARD (continued):

3 (continued): PII or Draize > 5-8 with destruction of tissue. *Eye Irritation*: Corrosive, irreversible destruction of ocular tissue; corneal involvement or irritation persisting for more than 21 days. Draize > 80 with effects irreversible in 21 days. *Oral Toxicity LD_{50} Rat*: > 1-50 mg/kg. *Dermal Toxicity LD_{50}Rat or Rabbit*: > 20-200 mg/kg. *Inhalation Toxicity LC_{50} 4-hrs Rat*: > 0.05-0.5 mg/L.); **4** (Severe Hazard: Life-threatening; major or permanent damage may result from single or repeated exposure. *Skin Irritation*: Not appropriate. Do not rate as a "4", based on skin irritation alone. *Eye Irritation*: Not appropriate. Do not rate as a "4", based on eye irritation alone. *Oral Toxicity LD_{50} Rat*: ≤ 1 mg/kg. *Dermal Toxicity LD_{50}Rat or Rabbit*: ≤ 20 mg/kg. *Inhalation Toxicity LC_{50} 4-hrs Rat*: ≤ 0.05 mg/L).

FLAMMABILITY HAZARD:

0 (Minimal Hazard-Materials that will not burn in air when exposure to a temperature of 815.5°C [1500°F] for a period of 5 minutes.); **1** (Slight Hazard-Materials that must be pre-heated before ignition can occur. Material require considerable pre-heating, under all ambient temperature conditions before ignition and combustion can occur, Including: Materials that will burn in air when exposed to a temperature of 815.5°C (1500°F) for a period of 5 minutes or less; Liquids, solids and semisolids having a flash point at or above 93.3°C [200°F] (e.g. OSHA Class IIIB, or; Most ordinary combustible materials [e.g. wood, paper, etc.]; **2** (Moderate Hazard-Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not, under normal conditions, form hazardous atmospheres in air, but under high ambient temperatures or moderate heating may release vapor in sufficient quantities to produce hazardous atmospheres in air, Including: Liquids having a flash-point at or above 37.8°C [100°F] Solid materials in the form of course dusts that may burn rapidly but that generally do not form explosive atmospheres; Solid materials in a fibrous or shredded form that may burn rapidly and create flash fire hazards (e.g. cotton, sisal, hemp; Solids and semisolids that readily give off flammable vapors.); **3** (Serious Hazard- Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures, or, unaffected by ambient temperature, are readily ignited under almost all conditions, including: Liquids having a flash point below 22.8°C [73°F] and having a boiling point at or above 38°C [100°F] and below 37.8°C [100°F] [e.g. OSHA Class IB and IC]; Materials that on account of their physical form or environmental conditions can form explosive mixtures with air and are readily dispersed in air [e.g., dusts of combustible solids, mists or droplets of flammable liquids]; Materials that burn extremely rapidly, usually by reason of self-contained oxygen [e.g. dry nitrocellulose and many organic peroxides]); **4** (Severe Hazard-Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air, and which will burn readily, including: Flammable gases; Flammable cryogenic materials; Any liquid or gaseous material that is liquid while under pressure and has a flash point below 22.8°C [73°F] and a boiling point below 37.8°C [100°F] [e.g. OSHA Class IA; Material that ignite spontaneously when exposed to air at a temperature of 54.4°C [130°F] or below [e.g. pyrophoric]).

PHYSICAL HAZARD:

0 (*Water Reactivity*: Materials that do not react with water. *Organic Peroxides*: Materials that are normally stable, even under fire conditions and will not react with water. *Explosives*: Substances that are Non-Explosive. Unstable *Compressed Gases*: No Rating. *Pyrophorics*: No Rating. *Oxidizers*: No "0" rating allowed. *Unstable Reactives*: Substances that will not polymerize, decompose, condense or self-react.); **1** (*Water Reactivity*: Materials that change or decompose upon exposure to moisture. *Organic Peroxides*: Materials that are normally stable, but can become unstable at high temperatures and pressures. These materials may react with water, but will not release energy. *Explosives*: Division 1.5 & 1.6 substances that are very insensitive explosives or that do not have a mass explosion hazard.

DEFINITIONS OF TERMS (Continued)

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

PHYSICAL HAZARD (continued):

1 (continued): *Compressed Gases*: Pressure below OSHA definition. *Pyrophorics*: No Rating. *Oxidizers*: Packaging Group III; Solids: any material that in either concentration tested, exhibits a mean burning time less than or equal to the mean burning time of a 3:7 potassium bromate/cellulose mixture and the criteria for Packing Group I and II are not met. Liquids: any material that exhibits a mean pressure rise time less than or equal to the pressure rise time of a 1:1 nitric acid (65%)/cellulose mixture and the criteria for Packing Group I and II are not met. *Unstable Reactives*: Substances that may decompose, condense or self-react, but only under conditions of high temperature and/or pressure and have little or no potential to cause significant heat generation or explosive hazard. Substances that readily undergo hazardous polymerization in the absence of inhibitors.); **2** (*Water Reactivity*: Materials that may react violently with water. *Organic Peroxides*: Materials that, in themselves, are normally unstable and will readily undergo violent chemical change, but will not detonate. These materials may also react violently with water. *Explosives*: Division 1.4 – Explosive substances where the explosive effect are largely confined to the package and no projection of fragments of appreciable size or range are expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package. *Compressed Gases*: Pressurized and meet OSHA definition but < 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics*: No Rating. *Oxidizers*: Packing Group II Solids: any material that, either in concentration tested, exhibits a mean burning time of less than or equal to the mean burning time of a 2:3 potassium bromate/cellulose mixture and the criteria for Packing Group I are not met. Liquids: any material that exhibits a mean pressure rise time less than or equal to the pressure rise of a 1:1 aqueous sodium chlorate solution (40%)/cellulose mixture and the criteria for Packing Group I are not met. *Unstable Reactives*: Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure, but have a low potential for significant heat generation or explosion. Substances that readily form peroxides upon exposure to air or oxygen at room temperature); **3** (*Water Reactivity*: Materials that may form explosive reactions with water. *Organic Peroxides*: Materials that are capable of detonation or explosive reaction, but require a strong initiating source, or must be heated under confinement before initiation; or materials that react explosively with water. *Explosives*: Division 1.2 – Explosive substances that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but do not have a mass explosion hazard. *Compressed Gases*: Pressure ≥ 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics*: No Rating. *Oxidizers*: Packing Group I Solids: any material that, in either concentration tested, exhibits a mean burning time less than the mean burning time of a 3.:2 potassium bromate/cellulose mixture. Liquids: Any material that spontaneously ignites when mixed with cellulose in a 1:1 ratio, or which exhibits a mean pressure rise time less than the pressure rise time of a 1:1 perchloric acid (50%)/cellulose mixture. *Unstable Reactives*: Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a moderate potential to cause significant heat generation or explosion.); **4** (*Water Reactivity*: Materials that react explosively with water without requiring heat or confinement. *Organic Peroxides*: Materials that are readily capable of detonation or explosive decomposition at normal temperature and pressures. *Explosives*: Division 1.1 & 1.2-explosive substances that have a mass explosion hazard or have a projection hazard. A mass explosion is one that affects almost the entire load instantaneously. *Compressed Gases*: No Rating. *Pyrophorics*: Add to the definition of Flammability "4". *Oxidizers*: No "4" rating. *Unstable Reactives*: Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a high potential to cause significant heat generation or explosion.).

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS:

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 HAZARD RATINGS (continued):

HEALTH HAZARD (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: **0** Materials that will not burn under typical fire conditions, including intrinsically noncombustible materials such as concrete, stone, and sand. **1** Materials that must be preheated before ignition can occur. Materials in this degree require considerable preheating, under all ambient temperature conditions, before ignition and combustion can occur **2** Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not under normal conditions form hazardous atmospheres with air, but under high ambient temperatures or under moderate heating could release vapor in sufficient quantities to produce hazardous atmospheres with air. **3** Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures or, though unaffected by ambient temperatures, are readily ignited under almost all conditions. **4** Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air and will burn readily.

INSTABILITY HAZARD: **0** Materials that in themselves are normally stable, even under fire conditions. **1** Materials that in themselves are normally stable, but that can become unstable at elevated temperatures and pressures. **2** Materials that readily undergo violent chemical change at elevated temperatures and pressures. **3** Materials that in themselves are capable of detonation or explosive decomposition or explosive reaction, but that require a strong initiating source or that must be heated under confinement before initiation. **4** Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures.

FLAMMABILITY LIMITS IN AIR: Much of the information related to fire and explosion is derived from the **N**ational **F**ire **P**rotection **A**ssociation (**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:

Human and Animal Toxicology: 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_{50}** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC_{50}** - 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^3** 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. 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. **Cancer Information:** 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 Information: BEI** - ACGIH 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.

DEFINITIONS OF TERMS (Continued)

ECOLOGICAL INFORMATION:

EC is the effect concentration in water. **BCF** = Bioconcentration Factor, which is used to determine if a substance will concentrate in lifeforms which consume contaminated plant or animal matter. **TL_m** = median threshold limit; Coefficient of Oil/Water Distribution is represented by **log K_{ow}** or **log K_{oc}** and is used to assess a substance's behavior in the environment.

REGULATORY INFORMATION:

U.S. and CANADA:

This section explains the impact of various laws and regulations on the material. **ACGIH:** American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **EPA** is the U.S. Environmental Protection Agency. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. **O**ccupational **S**afety and **H**ealth **A**dministration (**OSHA**). **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/NDSL)**; 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. This section also includes information on the precautionary warnings which appear on the material's package label. **OSHA** - U.S. Occupational Safety and Health Administration