



AIR LIQUIDE

MATERIAL SAFETY DATA SHEET

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

1. PRODUCT AND COMPANY INFORMATION

CHEMICAL NAME; CLASS: CARBON DIOXIDE

SYNONYMS: Carbon Anhydride; Carbonic Acid Gas; Carbonic Anhydride; Carbon Dioxide USP; Carbon Dioxide, Refrigerated Liquid; Dry Ice

CHEMICAL FAMILY NAME: Acid Anhydride

FORMULA: CO₂

PRODUCT USE:

Document Number: 10040

For carbonation, chilling and freezing, medical, inerting, pH control, fire protection, and general analytical/synthetic chemical uses.

MANUFACTURED/SUPPLIED FOR:

ADDRESS:

EMERGENCY PHONE:

BUSINESS PHONE:

General MSDS Information 1-713/896-2896

Fax on Demand: 1-800/231-1366



AIR LIQUIDE

2700 Post Oak Drive

Houston, TX 77056-8229

CHEMTREC: 1-800-424-9300

2. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Carbon Dioxide is a colorless, odorless gas, or a colorless, odorless liquid in a high-pressure container. Over-exposure to Carbon Dioxide can increase respiration and heart rate, possibly resulting in circulatory insufficiency, which may lead to coma and death. At concentrations between 2 and 10%, Carbon Dioxide can cause nausea, dizziness, headache, mental confusion, increased blood pressure and respiratory rate. Exposure to Carbon Dioxide can also cause asphyxiation, through displacement of oxygen. If the gas concentration reaches 10% or more, suffocation can occur within minutes. The liquid will rapidly boil to the gas at standard temperatures and pressures. Contact with the cold gas can cause freezing of exposed tissue. Moisture in the air could lead to the formation of carbonic acid which can be irritating to the eyes. All forms of Carbon Dioxide are non-combustible.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant routes of over-exposure for this gas are by inhalation, and skin or eye contact. Symptoms of such exposure are as follows:

INHALATION: Carbon Dioxide is an asphyxiant and a powerful cerebral vasodilator. If the concentration of Carbon Dioxide reaches 10% or more, suffocation can occur within minutes. At concentrations between 2 and 10%, Carbon Dioxide can cause nausea, dizziness, headache, mental confusion, increased blood pressure and respiratory rate. Carbon Dioxide initially stimulates respiration and then causes respiratory depression. High concentrations result in narcosis. Repeated inhalation of low concentrations (3-5%) have no known permanent harmful effects. Symptoms in humans are as follows:

<u>CONCENTRATION</u>	<u>EFFECT</u>
1%	Slight increase in breathing rate.
2%	Breathing rate increases to 50% above normal level. Prolonged exposure can cause headache, tiredness.
3%	Breathing increases to twice normal rate and becomes labored. Weak narcotic effect. Impaired hearing, headache, increase in blood pressure and pulse rate.
4-5%	Breathing increases to approximately four times normal rate, symptoms of intoxication become evident and slight choking may be felt.
5-10%	Characteristic sharp odor noticeable. Very labored breathing, headache, visual impairment and ringing in the ears. Judgment may be impaired, followed within minutes by loss of consciousness.
50-100%	Unconsciousness occurs more rapidly above 10% level. Prolonged exposure to high concentrations may eventually result in death from asphyxiation.

High concentrations of this gas can also cause an oxygen-deficient environment. However, the asphyxiating properties of Carbon Dioxide will be reached before oxygen-deficiency is a factor.

CONTACT WITH SKIN or EYES: Contact of the cold gas with the skin can lead to frostbite or dermatitis (red, cracked, irritated skin), depending upon concentration and duration of exposure. Contact of the cold gas, or solid dry ice with the eyes can cause pain, redness, burns, and severe exposure could cause blindness.

OTHER POTENTIAL HEALTH EFFECTS: Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after contact with cold gas can quickly subside. Moisture in the air could lead to the formation of carbonic acid, which can be irritating to the eyes.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Over-exposure to Carbon Dioxide may cause the following health effects:

ACUTE: Carbon Dioxide is an asphyxiant and a powerful cerebral vasodilator. Inhaling large quantities causes rapid circulatory insufficiency, which can lead to coma or death. At low concentrations, inhalation of Carbon Dioxide can cause nausea, dizziness, visual disturbances, shaking, headache, mental confusion, sweating, increased heartbeat, and elevated blood pressure and respiratory rate. High concentrations of the gas in air may cause eye irritation. Contact with the eyes can cause damage to the retinal ganglion cells.

CHRONIC: There are currently no known adverse health effects associated with chronic exposure to this gas.

TARGET ORGANS: ACUTE: Respiratory system, central nervous system, eyes. CHRONIC: None known.

3. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH-TLV		OSHA-PEL		NIOSH IDLH ppm	OTHER ppm
			TWA ppm	STEL ppm	TWA ppm	STEL ppm		
Carbon Dioxide	124-38-9	> 99.5%	5000	30,000	5000 10,000 (Vacated 1989 PEL)	30,000 (Vacated 1989 PEL)	40,000	NIOSH REL: TWA = 5000 STEL = 30,000 (ceiling) DFG-MAK: TWA = 5000 PEAK = 2•MAK, 60 min. momentary value
Maximum Impurities		< 0.5%	None of the trace impurities in this product contribute significantly to the hazards associated with the product. All pertinent hazard information has been provided in this document, per the requirements of the Federal Occupational Safety and Health Administration Standard (29 CFR 1910.1200), U.S. State equivalent Standards and Canadian Workplace Hazardous Materials Identification System Standards (CPR 4).					

This material is classified as hazardous under OSHA regulations in the United States and the WHMIS in Canada.

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 Z400.1-2004 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.

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 equipment should be worn.

Remove victim(s) to fresh air, as quickly as possible. 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).

SKIN EXPOSURE: Remove any clothing that may restrict circulation to any frozen area. Do not rub frozen parts as tissue damage may occur. As soon as practicable, place any affected area in warm water bath which has a temperature that does not exceed 105°F (40°C). NEVER USE HOT WATER. NEVER USE DRY HEAT. If area of frostbite is extensive, remove clothing while showering with warm 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 of the body in the armpit. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention.

Frozen tissue is painless and appears waxy, with a possible yellow color. Frozen tissue will become swollen, painful and prone to infection when thawed. If the frozen part of the body has been thawed by the time medical attention has been obtained, cover the area with a dry sterile dressing and a large bulky protective covering.

EYE EXPOSURE: If irritation of the eye develops after exposure to gas, open victim's eyes while under gentle 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: Pre-existing respiratory conditions may be aggravated by over-exposure to this product.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and reduce over-exposure.

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: Carbon Dioxide is commonly used as an extinguishing agent for Class B and Class C fires. Use extinguishing media appropriate for the surrounding fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Carbon Dioxide does not burn; however, containers, when involved in fire, may rupture or burst in the heat of the fire. Dusts of various reactive metals (e.g., magnesium, zircon, titanium alloys), are readily ignited and explode in the presence of Carbon Dioxide. In the presence of moisture, cesium oxide ignites on contact with Carbon Dioxide. Metal acetylides or hydrides will also ignite or explode.

Liquid Carbon Dioxide will vaporize rapidly when accidentally released, forming an oxygen-deficient vapor cloud. Additionally, if large concentrations of Carbon Dioxide gas are present, the water vapor in the surrounding air will condense, creating a dense fog. Evacuate the surrounding area; visibility may be obscured in such a vapor cloud making it difficult to find fire exits or equipment. Pressure in a high pressure container can build-up due to heat and it may rupture if pressure relief devices should fail to function. Contact with cold, gaseous or solid Carbon Dioxide may cause frostbite.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural fire-fighters must wear Self-Contained Breathing Apparatus and full protective equipment.

6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel.

Minimum Personal Protective Equipment should be **Level B: protective clothing, leather or thermally insulating gloves and Self-Contained Breathing Apparatus**. Locate and seal the source of the leaking gas. Allow the gas to dissipate. Monitor the surrounding area for Carbon Dioxide and oxygen levels. The level of Carbon Dioxide must be below 3%, and the atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus.

RESPONSE TO PRESSURIZED-LIQUID RELEASE: Clear the affected area. After the gas is formed, follow the instructions provided above. If the area must be entered by emergency personnel, SCBA, leather or insulated gloves, an safety shoes must be worn.

7. HANDLING AND STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this product could occur without any significant warning symptoms.

STORAGE AND HANDLING PRACTICES: 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. Cylinders should be stored in dry, well-ventilated areas away from sources of heat, ignition and direct sunlight. Keep storage area clear of materials which can burn. Do not allow area where cylinders are stored to exceed 52°C (125°F). Store containers away from heavily trafficked areas and emergency exits. Store away from process and production areas, away from elevators, building and room exits or main aisles leading to exits. Protect cylinders against physical damage. Isolate from other non-compatible chemicals (refer to Section 10, Stability and Reactivity).

Storage containers and equipment should not be located in sub-surface or enclosed areas, unless engineered to maintain a concentration of Carbon Dioxide below the TLV (TLV = 5000 ppm) in the event of a release. Relief valves should be vented to a well-ventilated external location. 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).

Use a check valve in the discharge line to prevent hazardous backflow. Never tamper with pressure relief valves and cylinders. (continued on following page)

Full and empty cylinders should be segregated. Use a first-in, first-out inventory systems to prevent full containers from being stored for long periods of time.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Compressed gases can present significant safety hazards. The following rules are applicable to work situations in which cylinders are being used.

7. HANDLING AND STORAGE (Continued)

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 (where provided) 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. Do not use oils or grease on gas-handling fittings or equipment. Leak-check system with leak detection solution. Immediately contact the supplier if there are any difficulties associated with operating cylinder valve. Never insert an object (e.g., wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage the valve, causing a leak to occur. Use an adjustable strap wrench to remove over-tight or rusted caps. Never strike an arc, on a compressed gas cylinder or make a cylinder part of an electric circuit.

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

SPECIAL PRECAUTIONS FOR HANDLING PRESSURIZED CONTAINERS OF LIQUID CARBON DIOXIDE:

Cold liquids can present significant safety hazards. Never allow any unprotected part of the body to touch uninsulated pipes or vessels which contain cold fluids. The extremely cold metal of the container will cause moist flesh to stick fast and tear when one attempts to withdraw from it. The following rules are applicable to work situations in which liquid containers are being used. Check all hoses and transfer equipment before filling them with the liquid. Replace any worn or cut hoses prior to use. Liquid Carbon Dioxide is extremely cold and is under pressure. A leak will result in the formation of "Dry Ice" particles which will be forcibly ejected from the system, possibly injuring the operator. A complete hose failure can result in a large release of Carbon Dioxide and violent movement of the hose and associated equipment, which may cause severe injury or death. Special care must be taken when depressurizing and disconnecting hoses. Releasing the contents of a liquid-filled line to atmospheric pressure may result in the formation of a solid dry ice plug in the line. This plug will prevent further removal of the liquid behind the plug, resulting in either an unexpected, rapid release of Carbon Dioxide as the line warms, or the catastrophic failure of the line as the liquid warms behind the plug. Sufficient vapor pressure must be applied and maintained behind the liquid before opening a discharge valve. This action will prevent the depressurization of the liquid to the point of solid formation before it exits the line.

High-pressure containers for liquid product are equipped with pressure relief devices to control internal pressure. Under normal conditions, these containers will periodically vent small amounts of product. Some metals such as carbon steel may become brittle at low temperatures and will easily fracture. Prevent entrapment of liquid in closed systems or piping without pressure relief devices.

NOTE: Use only DOT or ASME-approved code containers. Close valve after each use and when empty.

STANDARD CYLINDER VALVE CONNECTIONS FOR U.S. AND CANADA: Use the proper CGA connections, **DO NOT USE ADAPTERS:**

<u>THREADED:</u>	CGA 320
<u>PIN-INDEXED YOKE:</u>	CGA 940 (Medical Use)
<u>ULTRA HIGH INTEGRITY:</u>	716

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 (i.e. nitrogen) before attempting repairs. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Carbon Dioxide accumulates in low-lying areas with limited air movement. Natural or mechanical ventilation should be available in the worker's breathing zone to prevent levels of Carbon Dioxide above exposure limits (see 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. Areas of Carbon Dioxide use should be engineered to remove vapor from the lowest possible level and exhaust vapor to a well-ventilated area or to the outside. Carbon Dioxide levels should be monitored to assure levels are maintained below the TLV. If appropriate, install automatic monitoring equipment to detect the levels of Carbon Dioxide and of oxygen.

RESPIRATORY PROTECTION: Maintain Carbon Dioxide levels below those listed in Section 2 (Composition and Information on Ingredients) and oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if Carbon Dioxide levels are above the IDLH (40,000 ppm) or during emergency response to a release of this product. 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. 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

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

Protection Standard (1910.134-1998). Respiratory selection guidelines from NIOSH for Carbon Dioxide are provided below for information.

CONCENTRATION

Up to 40,000 ppm:

RESPIRATORY EQUIPMENT

Supplied Air Respirator (SAR); or full-facepiece Self-Contained Breathing Apparatus (SCBA).

Emergency or Planned Entry Into Unknown Concentrations or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

Escape: Escape-type SCBA.

NOTE: The IDLH concentration for Carbon Dioxide is 40,000 ppm.

EYE PROTECTION: Safety glasses. Use faceshields when handling Liquid Carbon Dioxide in high pressure containers. If necessary, refer to U.S. OSHA 29 CFR 1910.133, or Canadian Standards.

HAND PROTECTION: Wear leather or thermally insulated gloves when handling cylinders of this product. Otherwise, wear glove protection appropriate to the specific operation for which this product is used. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: Use body protection appropriate for task. Safety shoes are recommended when handling cylinders. When handling the liquid in high pressure containers, long sleeve shirts and trousers are recommended. 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.

HEARING PROTECTION: Discharges of Liquid Carbon Dioxide and of the vapor can produce noise levels requiring hearing protection.

9. PHYSICAL and CHEMICAL PROPERTIES

GAS DENSITY @ 21.1°C (70°F) and 1 atm: 0.1144 lb/ft³ (1.833 kg/m³)

LIQUID DENSITY @ 21.1°C (70°F) and 838 psig (5778 kPa): 47.35 lb/ft³ (761.3 kg/m³)

FREEZING/MELTING POINT: (sublimation temperature) -78.5°C (-109.3°F)

TRIPLE POINT: -55.6°C (-69.9°F) @ 60.4 psig (416 kPa)

SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 1.522

ODOR THRESHOLD: Odorless.

EVAPORATION RATE (nBuAc = 1): Not applicable.

VAPOR PRESSURE @ 21.1°C (70°F) psig: 838 psig (5778 kPa)

SOLUBILITY IN WATER vol/vol 20°C (68°F) and 1 atm: 0.90

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

APPEARANCE AND COLOR: This product is a colorless, odorless gas, or colorless, odorless, volatile liquid stored under high pressure. As this gas is slightly acidic, some individuals may notice a slightly pungent odor and biting taste.

HOW TO DETECT THIS SUBSTANCE (warning properties): There are no unusual warning properties associated with a release of this product, except the potential of a vapor cloud in the event of a large release.

10. STABILITY and REACTIVITY

STABILITY: Normally stable.

DECOMPOSITION PRODUCTS: Carbon Dioxide will produce Carbon Monoxide and Oxygen when heated to temperatures above 3000°F (1648°C).

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Carbon Dioxide will ignite and explode when heated with powdered aluminum, beryllium, cerium alloys, chromium, magnesium-aluminum alloys, manganese, thorium, titanium, and zirconium. In the presence of moisture, Carbon Dioxide will ignite with cesium oxide. Metal acetylides will also ignite and explode on contact with Carbon Dioxide. Carbon Dioxide will react with alkaline materials to form carbonates and bicarbonates.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Avoid exposing cylinders or bulk storage containers of Carbon Dioxide to extremely high temperatures, which could cause the cylinders or storage containers to rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: Carbon Dioxide gas is an asphyxiant gas, which has physiological effects at high concentrations. High concentrations can also result in narcosis. The following toxicological information is available for Carbon Dioxide.

LCLo (Inhalation-Human) 9 pph/5 minutes
LCLo (Inhalation-Mammal-species unspecified) 90000 ppm/5 minutes

TCLo (Inhalation-Rat) 10000 ppm/24 hours/days-continuous: Blood: other changes

TCLo (Inhalation-Rat) 6 pph/24 hours: female 10 day(s) after conception: Reproductive: Specific Developmental Abnormalities: musculoskeletal system, cardiovascular (circulatory) system, respiratory system

TCLo (Inhalation-Rabbit) 27,000 ppm/24 hours/30 days-continuous : Behavioral: somnolence (general depressed activity)

TCLo (Inhalation-Rat) 6 pph/24 hours: female 10 day(s) after conception: Reproductive: Effects on Newborn: growth statistics (e.g.%, reduced weight gain)

TCLo (Inhalation-Rabbit) 13 pph/4 hours: female 9-12 day(s) after conception: Reproductive: Specific Developmental Abnormalities: musculoskeletal system

TCLo (Inhalation-Mouse) 55 pph/2 hours: male 3 day(s) pre-mating: Reproductive: Paternal Effects: spermatogenesis (incl. genetic material, sperm morphology, motility, and count)

TCLo (Inhalation-Mouse) 55 pph/4 hours: male 6 day(s) pre-mating: Reproductive: Fertility: male fertility index (e.g. # males impregnating females per # males exposed to fertile nonpregnant females)

TCLo (Inhalation-Mouse) 2 pph/8 hours: female 10 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants); Specific Developmental Abnormalities: musculoskeletal system

SUSPECTED CANCER AGENT: Carbon Dioxide is not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, IARC, and therefore is not considered to be, nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Contact with rapidly expanding gases can cause frostbite and damage to exposed skin and eyes.

SENSITIZATION OF PRODUCT: Carbon Dioxide is not a skin or respiratory sensitizer.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Carbon Dioxide on the human reproductive system.

Mutagenicity: This product is not expected to cause mutagenic effects in humans.

Embryotoxicity: This product has not been reported to cause embryotoxic effects.

Teratogenicity: This product is not expected to cause teratogenic effects in humans. Clinical studies involving test animals exposed to high concentrations of Carbon Dioxide indicate teratogenic effects.

Reproductive Toxicity: This product is not expected to cause adverse reproductive effects in humans. Clinical studies involving test animals exposed to high concentrations of Carbon Dioxide indicate 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.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) have not been determined for this compound.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: Carbon Dioxide occurs naturally in the atmosphere. The gas will be dissipated rapidly in well-ventilated areas.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: No adverse effect is anticipated to occur to animal or 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 this product's effects on aquatic life.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual product to Air Liquide. Do not dispose of locally.

For emergency disposal, secure the cylinder and slowly discharge the gas to the atmosphere in a well-ventilated area or outdoors.

14. TRANSPORTATION INFORMATION

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

	<u>FOR GAS</u>	<u>FOR LIQUID</u>
PROPER SHIPPING NAME:	Carbon dioxide	Carbon Dioxide, refrigerated liquid
HAZARD CLASS NUMBER and DESCRIPTION:	2.2 (Non-Flammable Gas)	2.2 (Non-Flammable Gas)
UN IDENTIFICATION NUMBER:	UN 1013	UN 2187
PACKING GROUP:	Not applicable.	Not applicable.
DOT LABEL(S) REQUIRED:	Non-Flammable Gas	Non-Flammable Gas
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2006):	120	

MARINE POLLUTANT: Carbon Dioxide is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles present serious safety hazards and should be discouraged.

NOTE: Shipment of compressed gas cylinders which have not been filled with the owners consent is a violation of Federal law (49 CFR, Part 173.301 (b)).

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

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: Carbon Dioxide is not subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act.

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

U.S. TSCA INVENTORY STATUS: Carbon Dioxide is listed on the TSCA Inventory.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

OTHER U.S. FEDERAL REGULATIONS:

- Generally recognized as safe (GRAS) as a direct human food ingredient when used as a leavening agent, processing aid, propellant, aerating agent and gas.
- Carbon Dioxide USP is regulated by the FDA as a prescription drug.
- Carbon Dioxide is subject to the reporting requirements of CFR 29 1910.1000. Carbon Dioxide is listed on Table Z.1.
- Depending on specific operations involving the use of this product, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Under this regulation Carbon Dioxide is not listed in Appendix A.
- Carbon Dioxide does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
- Carbon Dioxide is not listed as a Regulated Substance, per 40 CFR, Part 68, of the Risk Management for Chemical.

U.S. STATE REGULATORY INFORMATION: Carbon Dioxide is covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: Carbon Dioxide.

California - Permissible Exposure Limits for Chemical Contaminants: Carbon Dioxide.

Florida - Substance List: Carbon Dioxide.

Illinois - Toxic Substance List: Carbon Dioxide.

Kansas - Section 302/313 List: No.

Massachusetts - Substance List: Carbon Dioxide.

Michigan - Critical Materials List: No.

Minnesota - List of Hazardous Substances: Carbon Dioxide.

Missouri - Employer Information/Toxic Substance List: Carbon Dioxide.

New Jersey - Right to Know Hazardous Substance List: Carbon Dioxide.

North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.

Pennsylvania - Hazardous Substance List: Carbon Dioxide.

Rhode Island - Hazardous Substance List: Carbon Dioxide.

Texas - Hazardous Substance List: No.

West Virginia - Hazardous Substance List: Carbon Dioxide.

Wisconsin - Toxic and Hazardous Substances: Carbon Dioxide.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Carbon Dioxide is not on the California Proposition 65 lists.

OTHER CANADIAN REGULATIONS:

CANADIAN DSL/NDL INVENTORY STATUS: Carbon Dioxide is listed on the DSL Inventory.

15. REGULATORY INFORMATION (Continued)

CANADIAN WHMIS REGULATIONS: Carbon Dioxide is categorized as a Controlled Product, Hazard Class A as per the Controlled Product Regulations.

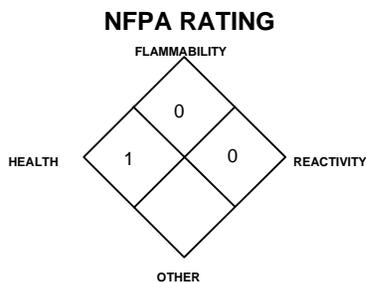
CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: Carbon Dioxide is not on the CEPA Priorities Substances Lists.

16. OTHER INFORMATION

CARBON DIOXIDE GAS

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM			
HEALTH	(BLUE)	1	
FLAMMABILITY	(RED)	0	
REACTIVITY	(YELLOW)	0	
PROTECTIVE EQUIPMENT		B	
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See- Section 8
For routine industrial applications			

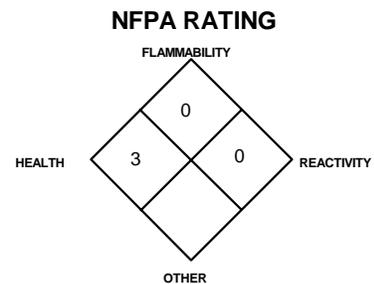
CARBON DIOXIDE GAS



CARBON DIOXIDE, LIQUEFIED

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM			
HEALTH	(BLUE)	3	
FLAMMABILITY	(RED)	0	
REACTIVITY	(YELLOW)	0	
PROTECTIVE EQUIPMENT		X	
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See- Section 8
For routine industrial applications			

CARBON DIOXIDE, LIQUEFIED



MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

16. OTHER INFORMATION (Continued)

Further information about Carbon Dioxide can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 4221 Walney Road 5th floor, Chantilly, VA 20151-2923. Telephone: (703) 788-2700.

G-6	<i>"Carbon Dioxide"</i>
G-6.1	<i>"Standard for Low Pressure Carbon Dioxide Systems at Customer Sites"</i>
G-6.2	<i>"Commodity Specification for Carbon Dioxide "</i>
G-6.3	<i>"Carbon Dioxide Cylinder Filling and Handling Procedures"</i>
G-6.5	<i>"Standard for Small Stationary Carbon Dioxide Systems"</i>
G-6.6	<i>"Standard for Elastomer-Type Bulk Transfer Hose"</i>
P-1	<i>"Safe Handling of Compressed Gases in Containers"</i>
P-7	<i>"Standard for the Re-Qualification of Cargo Tank Hose"</i>
P-14	<i>"Accident Prevention in Oxygen-Rich and Oxygen Deficient Atmospheres"</i>
SB-2	<i>"Oxygen Deficient Atmospheres"</i>
AV-1	<i>"Safe Handling and Storage of Compressed Gases"</i>
AV-7	<i>"Characteristics and Safe Handling of Carbon Dioxide"</i>

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This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this product. To the best of Air Liquide's knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this product is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.