

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

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| Product Name: Carbon dioxide, refrigerated liquid (MSDS No. P-4573-D) | Trade Names: <i>Liquiflow</i> [™] Liquid Carbon Dioxide, <i>Medipure</i> [®] Liquid Carbon Dioxide |
| Chemical Name: Carbon dioxide | Synonyms: Carbon dioxide (cryogenic liquid), LCO ₂ , liquefied CO ₂ |
| Chemical Family: Acid anhydride | Product Grades: Industrial, USP |
| Telephone: Emergencies: 1-800-645-4633* CHEMTREC: 1-800-424-9300* Routine: 1-800-PRAXAIR | Company Name: Praxair, Inc. 39 Old Ridgebury Road Danbury, CT 06810-5113 |

*Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier, Praxair sales representative, or call 1-800-PRAXAIR (1-800-772-9247).

2. Hazards Identification

EMERGENCY OVERVIEW

WARNING! Cold liquid and gas under pressure.

Can cause rapid suffocation.

Can increase respiration and heart rate.

May cause nervous system damage.

May cause frostbite.

May cause dizziness and drowsiness.

Self-contained breathing apparatus and protective clothing may be required by rescue workers.

This product is a colorless, odorless liquid that transforms to white crystalline particles when discharged from its container. The gas is slightly acidic and may be felt to have a slight, pungent odor and biting taste.

OSHA REGULATORY STATUS: This material is considered hazardous by the OSHA Hazard Communications Standard (29 CFR 1910.1200).

POTENTIAL HEALTH EFFECTS:

Effects of a Single (Acute) Overexposure

Inhalation. Carbon dioxide gas is an asphyxiant with effects due to lack of oxygen. It is also physiologically active, affecting circulation and breathing. Moderate concentrations may cause headache, drowsiness, dizziness, stinging of the nose and throat, excitation, rapid breathing and heart rate, excess salivation, vomiting, and unconsciousness. Lack of oxygen can kill.

Skin Contact. No harm expected from vapor. Prolonged contact with carbon dioxide crystals (snow) could cause frostbite. Cold gas, or liquid or solid carbon dioxide may cause severe frostbite.

Swallowing. An unlikely route of exposure. This product is a gas at normal temperature and pressure. But severe frostbite of the lips and mouth may result from contact with the liquid or solid.

Eye Contact. No harm expected from vapor. Cold gas, or liquid or solid carbon dioxide may cause severe frostbite.

Effects of Repeated (Chronic) Overexposure. No harm expected to healthy individuals. Where competent medical authority deems that such illness would be aggravated by exposure to carbon dioxide, persons in ill health should be restricted from working with or handling this product.

Other Effects of Overexposure. Damage to retinal or ganglion cells and central nervous system may occur.

Medical Conditions Aggravated by Overexposure. The toxicology and the physical and chemical properties of carbon dioxide suggest that overexposure is unlikely to aggravate existing medical conditions.

CARCINOGENICITY: Carbon dioxide is not listed by NTP, OSHA, or IARC.

POTENTIAL ENVIRONMENTAL EFFECTS: None known. For further information, see section 12, Ecological Information.

3. Composition/Information on Ingredients

See section 16 for important information about mixtures.

| COMPONENT | CAS NUMBER | CONCENTRATION |
|---|------------|---------------|
| Carbon dioxide <i>*The symbol > means "greater than."</i> | 124-38-9 | >99%* |

4. First Aid Measures

INHALATION: Immediately remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician.

SKIN CONTACT: For exposure to cold liquid, vapor, or solid, immediately warm frostbite area with warm water not to exceed 105°F (41°C). In case of massive exposure, remove contaminated clothing while showering with warm water. Call a physician.

SWALLOWING: An unlikely route of exposure. This product is a gas at normal temperature and pressure.

EYE CONTACT: For exposure to cold liquid, vapor, or solid, immediately flush eyes thoroughly with warm water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. See a physician, preferably an ophthalmologist, immediately.

NOTES TO PHYSICIAN: *There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.*

5. Fire Fighting Measures

FLAMMABLE PROPERTIES: Carbon dioxide cannot catch fire.

SUITABLE EXTINGUISHING MEDIA: Nonflammable—use media appropriate for surrounding fire.

PRODUCTS OF COMBUSTION: Not applicable.

PROTECTION OF FIREFIGHTERS: WARNING! Cold liquid and gas under pressure.

Evacuate all personnel from danger area. Immediately spray containers with water from maximum distance until cool, taking care not to direct spray onto vents on top of container. Do not discharge sprays into liquid carbon dioxide, which will freeze water rapidly. When containers have cooled, move them away from fire area if without risk. Self-contained breathing apparatus and protective clothing may be required by rescue workers. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

Specific Physical and Chemical Hazards. Heat of fire can build pressure in cylinder and cause it to rupture. No part of container should be subjected to a temperature higher than 125°F (52°C). Liquid carbon dioxide containers are equipped with pressure relief devices.

Protective Equipment and Precautions for Firefighters. Firefighters should wear appropriate gear for surrounding fire.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

WARNING! Cold liquid and gas under pressure.

Personal Precautions. Carbon dioxide is an asphyxiant. Lack of oxygen can kill. Evacuate all personnel from danger area. Use self-contained breathing apparatus and protective clothing where needed. Liquid carbon dioxide will not “spill.” Flakes of solid carbon dioxide will form at pressures below 67 psig (461.95 kPa) and fall as snow. Shut off leak if you can do so without risk. Ventilate area or move container to a well-ventilated area. Test for sufficient oxygen, especially in confined spaces, before allowing reentry.

Environmental Precautions. Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN HANDLING: Never allow any unprotected part of your body to touch uninsulated pipes or vessels containing refrigerated liquids. Flesh will stick to the extremely cold metal and tears when you try to pull free. Use a suitable hand truck to move containers. Containers must be handled and stored in an upright position. Do not drop or tip containers, or roll them on their sides. If valve is hard to open, discontinue use and contact your supplier. For other precautions in using carbon dioxide, see section 16.

PRECAUTIONS TO BE TAKEN IN STORAGE: Gas can cause rapid suffocation due to oxygen deficiency. Store and use with adequate ventilation. Do not store in a confined space. Carbon dioxide is heavier than air. It tends to accumulate near the floor of an enclosed space, displacing air and pushing it upward. This creates an oxygen-deficient atmosphere near the

floor. Ventilate space before entry. Verify sufficient oxygen concentration. Close container valve after each use; keep closed even when empty. Storage areas should be clean and dry, free of oils and dust. These collect on condensing coils and impair their efficiency.

Temperatures should not exceed 125°F (51.1°C). Cryogenic containers are equipped with a pressure relief device and a pressure-controlling valve. Under normal conditions, these containers periodically vent product to control internal pressure. Use adequate pressure relief devices in systems and piping to prevent pressure buildup; entrapped liquid can generate extremely high pressures.

RECOMMENDED PUBLICATIONS: For further information on storage, handling, and use, see Praxair publications P-14-153, *Guidelines for Handling Gas Cylinders and Containers*; P-15-073, *Safety Precautions for Carbon Dioxide*; and P-3499, *Safety Precautions and Emergency Response Planning*. Obtain from your local supplier.

8. Exposure Controls/Personal Protection

See section 16 for important information on by-products generated during use in welding and cutting.

| COMPONENT | OSHA PEL | ACGIH TLV-TWA (2009) |
|----------------|-----------|------------------------------------|
| Carbon dioxide | 5,000 ppm | 5,000 ppm; 30,000 ppm, 15 min STEL |

TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

IDLH = 40,000 ppm

ENGINEERING CONTROLS:

Local Exhaust. Use a local exhaust system, if necessary, to keep the concentration of carbon dioxide below all applicable exposure limits in the worker's breathing zone.

Mechanical (General). Under certain conditions, general exhaust ventilation may be acceptable to keep carbon dioxide below the exposure limit.

Special. None

Other. None

PERSONAL PROTECTIVE EQUIPMENT:

Skin Protection. Wear insulated neoprene gloves and metatarsal shoes for cylinder handling. Protective clothing where needed. Cuffless trousers should be worn outside shoes. Select in accordance with OSHA 29 CFR 1910.132 and 1910.133. When using carbon dioxide or carbon dioxide mixtures in welding and cutting, see Praxair MSDS P-4574, gaseous carbon dioxide, for requirements. Regardless of protective equipment, never touch live electrical parts.

Eye/Face Protection. Select in accordance with OSHA 29 CFR 1910.133.

Respiratory Protection. A respiratory protection program that meet OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable) requirements must be followed whenever workplace conditions warrant respirator use. Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure (e.g., an organic vapor cartridge). For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus.

9. Physical and Chemical Properties

| | | |
|---|--|-------------------------------|
| APPEARANCE: | Colorless liquid | |
| ODOR: | Slight, pungent | |
| ODOR THRESHOLD: | Not available. | |
| PHYSICAL STATE: | Refrigerated liquid | |
| pH: | 3.7 (for carbonic acid) | |
| SUBLIMATION POINT at 1 atm: | -109.3°F (-78.5°C) | |
| FLASH POINT (test method): | Not applicable. | |
| EVAPORATION RATE (Butyl Acetate = 1): | High | |
| FLAMMABILITY: | Nonflammable | |
| FLAMMABLE LIMITS IN AIR , % by volume: | LOWER: Not applicable. | UPPER: Not applicable. |
| VAPOR PRESSURE at 70°F (21.1°C): | 838 psig (5778 kPa) | |
| LIQUID DENSITY (saturated) at 70°F (21.1°C) and 1 atm: | 47.6 lb/ft ³ (762 kg/m ³) | |
| SPECIFIC GRAVITY (H ₂ O = 1): | Not available. | |
| SPECIFIC GRAVITY (Air = 1) at 70°F (21.1°C) and 1 atm: | 1.52 | |
| SOLUBILITY IN WATER vol/vol at 68°F (20°C) and 1 atm: | 0.90 | |
| PARTITION COEFFICIENT: n-octanol/water: | Not available. | |
| AUTOIGNITION TEMPERATURE: | Not applicable. | |
| DECOMPOSITION TEMPERATURE: | None | |
| PERCENT VOLATILES BY VOLUME: | 100 | |
| MOLECULAR WEIGHT: | 44.01 | |
| MOLECULAR FORMULA: | CO ₂ | |

10. Stability and Reactivity

CHEMICAL STABILITY: Unstable Stable

CONDITIONS TO AVOID: Contact with incompatible materials, exposure to electrical discharges, and/or high temperatures as stated below.

INCOMPATIBLE MATERIALS: Alkali metals, alkaline earth metals, metal acetylides, chromium, titanium above 1022°F (550°C), uranium above 1382°F (750°C), magnesium above 1427°F (775°C)

HAZARDOUS DECOMPOSITION PRODUCTS: Electrical discharges and high temperatures decompose carbon dioxide into carbon monoxide and oxygen.

POSSIBILITY OF HAZARDOUS REACTIONS: May Occur Will Not Occur

Decomposition into toxic, flammable, and/or oxidizing materials under above-stated conditions.

11. Toxicological Information

ACUTE DOSE EFFECTS: The welding process may generate hazardous fumes and gases. If using carbon dioxide for welding and cutting, see Praxair MSDS P-4574, gaseous carbon dioxide.

Carbon dioxide is an asphyxiant. It initially stimulates respiration and then causes respiratory depression. High concentrations result in narcosis. Symptoms in humans are as follows:

| EFFECT: | CONCENTRATION: |
|---|-----------------------|
| Breathing rate increases slightly. | 1% |
| Breathing rate increases to 50% above normal level. Prolonged exposure can cause headache, tiredness. | 2% |
| Breathing increases to twice normal rate and becomes labored. Weak narcotic effect. Impaired hearing, headache, increased blood pressure and pulse rate. | 3% |
| Breathing increases to approximately four times normal rate, symptoms of intoxication become evident, and slight choking may be felt. | 4 - 5% |
| 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. | 5 - 10% |
| Unconsciousness occurs more rapidly above 10% level. Prolonged exposure to high concentrations may eventually result in death from asphyxiation. | 10 - 100% |

REPRODUCTIVE EFFECTS: A single study has shown an increase in heart defects in rats exposed to 6 percent carbon dioxide in air for 24 hours at different times during gestation. There is no evidence that carbon dioxide is teratogenic in humans.

12. Ecological Information

ECOTOXICITY: No adverse ecological effects expected.

OTHER ADVERSE EFFECTS: Carbon dioxide does not contain any Class I or Class II ozone-depleting chemicals.

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier.

14. Transport Information

DOT/IMO SHIPPING NAME: Carbon dioxide, refrigerated liquid

| HAZARD CLASS: | PACKING GROUP/Zone: | IDENTIFICATION NUMBER: | PRODUCT RQ: |
|--|----------------------------|-------------------------------|--------------------|
| 2.2 | NA* | UN2187 | None |
| SHIPPING LABEL(s): NONFLAMMABLE GAS | | | |
| PLACARD (when required): NONFLAMMABLE GAS | | | |

*NA = Not applicable.

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. Cylinders transported in an enclosed, nonventilated compartment of a vehicle can present serious safety hazards.

Shipment of compressed gas cylinders that were filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

MARINE POLLUTANTS: Carbon dioxide is not listed as a marine pollutant by DOT.

15. Regulatory Information

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product are solely responsible for compliance with all applicable federal, state, and local regulations.

U.S. FEDERAL REGULATIONS:

EPA (ENVIRONMENTAL PROTECTION AGENCY)

CERCLA: COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (40 CFR Parts 117 and 302):

Reportable Quantity (RQ): None

SARA: SUPERFUND AMENDMENT AND REAUTHORIZATION ACT:

SECTIONS 302/304: Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of Extremely Hazardous Substances (EHS) (40 CFR Part 355):

TPQ: None

EHS RQ (40 CFR 355): None

SECTIONS 311/312: Require submission of MSDSs and reporting of chemical inventories with identification of EPA hazard categories. The hazard categories for this product are as follows:

IMMEDIATE: Yes

PRESSURE: Yes

DELAYED: No

REACTIVITY: No

FIRE: No

SECTION 313: Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

Carbon dioxide is not subject to reporting under Section 313.

40 CFR 68: RISK MANAGEMENT PROGRAM FOR CHEMICAL ACCIDENTAL RELEASE PREVENTION: Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

Carbon dioxide is not listed as a regulated substance.

TSCA: TOXIC SUBSTANCES CONTROL ACT: Carbon dioxide is listed on the TSCA inventory.

OSHA: OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:

29 CFR 1910.119: PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS: Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

Carbon dioxide is not listed in Appendix A as a highly hazardous chemical.

STATE REGULATIONS:

CALIFORNIA: Carbon dioxide is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

PENNSYLVANIA: Carbon dioxide is subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

16. Other Information

Be sure to read and understand all labels and instructions supplied with all containers of this product.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: *Cold liquid and gas under pressure.* Contact may cause frostbite. Use piping and equipment adequately designed to withstand pressures to be encountered. Use a backflow prevention device in any piping. Avoid materials incompatible with cryogenic use; some metals such as carbon steel may fracture easily at low temperature. Never work on a pressurized system. If there is a leak, close the container valve. Blow the system down in a safe and environmentally sound manner in compliance with all federal, state, and local laws; then repair the leak. Never place a compressed gas cylinder where it may become part of an electrical circuit.

Mixtures. When you mix two or more chemicals, you can 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 evaluate the end product. Remember, chemicals have properties that can cause serious injury or death.

HAZARD RATING SYSTEMS:

NFPA RATINGS:

HEALTH = 3
 FLAMMABILITY = 0
 INSTABILITY = 0
 SPECIAL = SA (CGA recommends this to designate Simple Asphyxiant.)

HMIS RATINGS:

HEALTH = 3
 FLAMMABILITY = 0
 PHYSICAL HAZARD = 2

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:

CGA-320
 CGA-320 for withdrawal of refrigerated liquid

PIN-INDEXED YOKE:

Not applicable.

ULTRA-HIGH-INTEGRITY CONNECTION:

Not applicable.

Use the proper CGA connections. **DO NOT USE ADAPTERS.** Additional limited-standard connections may apply. See CGA pamphlet V-1 listed below. Ask your supplier about free Praxair safety literature as referred to in this MSDS and on the label for this product. Further information can be found in the following materials published by the Compressed Gas Association, Inc. (CGA), 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923, Telephone (703) 788-2700, <http://www.cganet.com/Publication.asp>.

| | |
|-------|---|
| AV-1 | <i>Safe Handling and Storage of Compressed Gases</i> |
| AV-7 | <i>Characteristics and Safe Handling of Carbon Dioxide</i> |
| 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> |
| P-1 | <i>Safe Handling of Compressed Gases in Containers</i> |
| P-2 | <i>Characteristics and Safe Handling of Medical Gases</i> |
| SB-2 | <i>Oxygen-Deficient Atmospheres</i> |
| V-1 | <i>Compressed Gas Cylinder Valve Inlet and Outlet Connections</i> |
| — | <i>Handbook of Compressed Gases, Fourth Edition</i> |

Praxair asks users of this product to study this MSDS and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this MSDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

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