

Product: Carbon Dioxide

Form No.: P-4574-G

Date: October 1997

Praxair™ Material Safety Data Sheet**#78****1. Chemical Product and Company Identification**

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| Product Name: Carbon Dioxide (MSDS No. P-4574-G) | Trade Name: Carbon Dioxide |
| Chemical Name: Carbon Dioxide | Synonyms: Carbonic Anhydride, Carbonic Acid Gas |
| Formula: CO ₂ | Chemical Family: Acid Anhydride |
| 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. Composition / Information on Ingredients

For custom mixtures of this product request a Material Safety Data Sheet for each component. See Section 16 for important information about mixtures.

| INGREDIENT NAME | CAS NUMBER | PERCENTAGE | OSHA PEL | ACGIH TLV-TWA |
|-----------------|------------|------------|-----------|---------------|
| Carbon Dioxide | 124-38-9 | >99%* | 5,000 ppm | 5,000 ppm** |

*The symbol ">" means "greater than."

**See section 3.

3. Hazards Identification**EMERGENCY OVERVIEW**

CAUTION! High-pressure liquid and gas.

Can cause rapid suffocation.

May cause frostbite.

Can increase respiration and heart rate.

May cause nervous system damage.

May cause dizziness and drowsiness.

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

Odor: None to slightly pungent

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THRESHOLD LIMIT VALUE: TLV-TWA 5,000 ppm (ACGIH 1997). Short Term Exposure Limit (STEL), 15 min, 30,000 ppm. TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

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. 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.

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.

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.

SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARD EVALUATION: A single study has shown an increase in heart defects in rats exposed to 6% carbon dioxide in air for 24 hours at different times during gestation. There is no evidence that carbon dioxide is teratogenic in humans.

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

4. First Aid Measures

INHALATION: 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 vapor or solid, immediately warm frostbite area with warm water not to exceed 105°F (41°C). In case of massive exposure, remove 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 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.*

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5. Fire Fighting Measures

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| FLASH POINT (test method) | Not applicable | AUTOIGNITION TEMPERATURE | Not applicable |
| FLAMMABLE LIMITS IN AIR, % by volume | LOWER | Not applicable | UPPER Not applicable |

EXTINGUISHING MEDIA: Carbon Dioxide cannot catch fire. Use media appropriate for surrounding fire.

SPECIAL FIRE FIGHTING PROCEDURES:

CAUTION! High-pressure liquid and gas. Evacuate all personnel from danger area. Immediately spray cylinders with water from maximum distance until cool, then move them away from fire area if without risk. Self-contained breathing apparatus may be required by rescue workers. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Carbon Dioxide cannot catch fire. Heat of fire can build pressure in cylinder and cause it to rupture. Carbon dioxide cylinders are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.) No part of cylinder should be subjected to a temperature higher than 125°F (52°C).

HAZARDOUS COMBUSTION PRODUCTS: None known.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

CAUTION! High-pressure liquid and gas. Carbon Dioxide is an asphyxiant. Lack of oxygen can kill. Evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Shut off leak if you can do so without risk. Ventilate area or move cylinder to a well-ventilated area. Test for sufficient oxygen, especially in confined spaces, before allowing reentry.

WASTE DISPOSAL METHOD: 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 STORAGE: Store and use with adequate ventilation. Firmly secure cylinders upright to keep them from falling or being knocked over. Screw valve protection cap firmly in place by hand. Store only where temperature will not exceed 125°F (52°C). Store full and empty cylinders separately. Use a first-in, first-out inventory system to prevent storing full cylinders for long periods.

PRECAUTIONS TO BE TAKEN IN HANDLING: Protect cylinders from damage. Use a suitable hand truck to move cylinders; do not drag, roll, slide, or drop. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. Never insert an object (e.g., wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Open valve slowly. If valve is hard to open, discontinue use and contact your supplier. Never apply flame or localized heat directly to any part of the cylinder. High temperatures may damage the cylinder and could cause the pressure relief device to fail prematurely, venting the cylinder

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contents. Never strike an arc on a compressed gas cylinder or make a cylinder part of an electrical circuit. For other precautions in using carbon dioxide, see section 16.

For additional information on storage and handling, refer to Compressed Gas Association (CGA) pamphlet P-1, "Safe Handling of Compressed Gases in Containers," available from the CGA. Refer to section 16 for the address and phone number along with a list of other available publications.

8. Exposure Controls/Personal Protection

VENTILATION/ENGINEERING CONTROLS:

LOCAL EXHAUST—Use a local exhaust system, if necessary, to control the concentration of carbon dioxide 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

RESPIRATORY PROTECTION: None required under normal use. An air-supplied respirator must be used in confined spaces. Respiratory protection must conform to OSHA rules as specified in 29 CFR 1910.134.

SKIN PROTECTION: Wear insulated neoprene gloves.

EYE PROTECTION: Select in accordance with OSHA 29 CFR 1910.133.

OTHER PROTECTIVE EQUIPMENT: Metatarsal shoes for cylinder handling. Select in accordance with OSHA 29 CFR 1910.132 and 1910.133. Regardless of protective equipment, never touch live electrical parts.

9. Physical and Chemical Properties

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|--|--|
| MOLECULAR WEIGHT: 44.01 | EXPANSION RATIO: Not applicable |
| SPECIFIC GRAVITY (air=1): At 70°F (21.1°C) and 1 atm: 1.522 | SOLUBILITY IN WATER: vol/vol at 68°F (20°C): 0.90 |
| GAS DENSITY: At 70°F (21.1°C) and 1 atm: 0.1144 lbs/ft ³ (1.833 kg/m ³) | VAPOR PRESSURE: At 70°F (21.1°C): 838 psig (5778 kPa) |
| PERCENT VOLATILES BY VOLUME: 100 | EVAPORATION RATE (Butyl Acetate=1): Gas, not applicable |
| BOILING POINT (1 atm): Not applicable | pH: 3.7 at 1 atm (for carbonic acid) |
| FREEZING POINT/MELTING POINT (1 atm): Not applicable. Sublimation temperature is -109.3°F (-78.5°C) | |

APPEARANCE, ODOR, AND STATE: Colorless and odorless. A slightly acid gas, it is felt by some persons to have a slight pungent odor and biting taste.

10. Stability and Reactivity

| | | | |
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| STABILITY: | Unstable | Stable | X |
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INCOMPATIBILITY (materials to avoid): 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 decompose carbon dioxide into carbon monoxide and oxygen.

| | | | | |
|----------------------------------|-----------|--|----------------|---|
| HAZARDOUS POLYMERIZATION: | May Occur | | Will Not Occur | X |
|----------------------------------|-----------|--|----------------|---|

CONDITIONS TO AVOID: None currently known.

11. Toxicological Information

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 |
|---|---------------|
| Slight increase in breathing rate | 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. | 50-100% |

12. Ecological Information

No adverse ecological effects expected. Carbon Dioxide does not contain any Class I or Class II ozone-depleting chemicals. Carbon Dioxide is not listed as a marine pollutant by DOT.

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

HAZARD CLASS: 2.2

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IDENTIFICATION NUMBER: UN 1013 | **PRODUCT RQ: None****SHIPPING LABEL(s): NONFLAMMABLE GAS****PLACARD (When required): NONFLAMMABLE GAS**

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 have been filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

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 (40 CFR Part 355):

Threshold Planning Quantity (TPQ): None.

Extremely Hazardous Substances (40 CFR 355): None.

- **SECTIONS 311/312:** Require submission of Material Safety Data Sheets (MSDSs) and chemical inventory reporting with identification of EPA hazard categories. The hazard categories for this products 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 does not require 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.

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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: This product is not listed by California under the Safe Drinking Water Toxic Enforcement Act of 1986 (Proposition 65).

PENNSYLVANIA: This product is subject to the Pennsylvania Worker and Community Right-To-Know Act (35 P.S. Sections 7301-7320).

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| 16. Other Information |
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Be sure to read and understand all labels and instructions supplied with all containers of this product.

SPECIAL PRECAUTIONS: *High-pressure liquid and gas.* Use piping and equipment adequately designed to withstand pressures to be encountered. *Gas can cause rapid suffocation due to oxygen deficiency.* Store and use with adequate ventilation. 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 cylinder valve after each use; keep closed even when empty. *Prevent reverse flow.* Reverse flow into cylinder may cause rupture. Use a check valve or other protective device in any line or piping from the cylinder. *Do not strike an arc on the cylinder.* The defect produced by an arc burn could lead to cylinder rupture. Do not ground the cylinder or allow it to become part of an electrical circuit. *Never work on a pressurized system.* If there is a leak, close the cylinder 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 ground a compressed gas cylinder or allow it to become part of an electrical circuit.*

MIXTURES: When you mix two or more gases or liquefied gases, 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, gases and liquids have properties that can cause serious injury or death.

HAZARD RATING SYSTEMS:**NFPA RATINGS:**

HEALTH = 1
 FLAMMABILITY = 0
 REACTIVITY = 0
 SPECIAL = SA (CGA recommends this to designate simple asphyxiant)

HMIS RATINGS:

HEALTH = 0
 FLAMMABILITY = 0
 REACTIVITY = 0

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STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

| | |
|---|-----------------------|
| THREADED: | CGA-320 |
| PIN-INDEXED YOKE: | CGA-940 (Medical Use) |
| ULTRA-HIGH-INTEGRITY CONNECTION: | CGA-716 |

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 referenced on the label for this product; you may also obtain copies by calling 1-800-PRAXAIR. Further information about carbon dioxide can be found in the following pamphlets published by the Compressed Gas Association, Inc. (CGA), 1725 Jefferson Davis Highway, Arlington, VA 22202-4102, Telephone (703) 412-0900.

- AV-1 *Safe Handling and Storage of Compressed Gases*
- G-6 *Carbon Dioxide*
- G-6.1 *Standard for Low Pressure Carbon Dioxide Systems at Customer Sites*
- G-6.2 *Commodity Specification for Carbon Dioxide*
- G-6.3 *Carbon Dioxide Cylinder Filling and Handling Procedures*
- P-1 *Safe Handling of Compressed Gases in Containers*
- P-14 *Accident Prevention in Oxygen-Rich, Oxygen-Deficient Atmospheres*
- SB-2 *Oxygen-Deficient Atmospheres*
- V-1 *Compressed Gas Cylinder Valve Inlet and Outlet Connections Handbook of Compressed Gases, Third Edition*

Praxair asks users of this product to study this Material Safety Data Sheet (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 on 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.

Praxair MSDSs are furnished on sale or delivery by Praxair or the independent distributors and suppliers who package and sell our products. To obtain current Praxair MSDSs for these products, contact your Praxair sales representative or local distributor or supplier. If you have questions regarding Praxair MSDSs, would like the form number and date of the latest MSDS, or would like the names of the Praxair suppliers in your area, phone or write the Praxair Call Center (Phone: 1-800-PRAXAIR; Address: Praxair Call Center, Praxair, Inc., PO Box 44, Tonawanda, NY 14150-7891).

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