

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Carbon dioxide, solid or Dry ice (MSDS No. P-4575-D)	Trade Name: Dry Ice, UltraIce™
Chemical Name: Carbon dioxide	Synonyms: Dry ice (nuggets, pellets, or blocks), carbonice, carbonic anhydride
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

See section 16 for important information about mixtures.

INGREDIENT	CAS NUMBER	CONCENTRATION	OSHA PEL	ACGIH TLV-TWA (2004)
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

**WARNING! Frozen carbon dioxide—extremely cold solid.
Can cause severe frostbite.**

Vaporizes at normal temperatures without forming a liquid.

Vapor can cause rapid suffocation.

Vapor can increase respiration and heart rate.

Vapor may cause nervous system damage.

Vapor may cause dizziness and drowsiness.

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

Odor: None to slightly pungent

THRESHOLD LIMIT VALUE: TLV-TWA 5,000 ppm. Short Term Exposure Limit (STEL), 15 min, 30,000 ppm (ACGIH 2004). 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—Prolonged contact with solid carbon dioxide can cause severe frostbite. Cold vapors can cause frostbite.

SWALLOWING—Frostbite of the lips and mouth may result from contact with the solid. Severe internal frostbite injury will occur if the solid is swallowed.

EYE CONTACT—Cold vapors or crystals or flakes of solid carbon dioxide may cause frostbite injury.

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.

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 liquid, 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: Have victim, if conscious and alert, drink lukewarm water. Never give anything by mouth to an unconscious, convulsive, or unresponsive person. Get prompt medical attention.

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

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: WARNING! Frozen carbon dioxide—extremely cold solid. Vapor can cause rapid suffocation. Evacuate all personnel from danger area. Do not discharge sprays onto solid carbon dioxide. Solid carbon dioxide will freeze water rapidly. Never handle solid carbon dioxide with your bare hands. Use insulated, loose-fitting gloves (see section 8) and dry ice tongs, or use a dry shovel or scoop. Move packages 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: None known.

HAZARDOUS COMBUSTION PRODUCTS: Not applicable. Thermal decomposition releases carbon monoxide and oxygen. (See section 10.)

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: WARNING! Frozen carbon dioxide—extremely cold solid. Vapor can cause rapid suffocation. Carbon dioxide is an asphyxiant. Lack of oxygen can kill. Evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Never handle solid carbon dioxide with your bare hands. Use gloves (see section 8) and dry ice tongs or a dry shovel or scoop. Ventilate area or move material to a well-ventilated area. Test for sufficient oxygen, especially in confined spaces and low-lying areas, before allowing reentry.

WASTE DISPOSAL METHOD: Place outside in a protected area with good ventilation and allow to sublime. 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. Do not store in tight containers or confined spaces. Storage areas should be clean and dry. Solid carbon dioxide is generally delivered to customers in 50-lb (22.7-kg), ½-cu ft (0.0142 m³) blocks (approximate dimensions), wrapped in kraft paper. Small pellets or nuggets are also produced. The product should be stored in insulated containers that open from the top. Lids should fit loosely so the carbon dioxide vapor given off as the solid sublimates can escape into the atmosphere. Carbon dioxide gas is about 1½ times as heavy as air and will accumulate in low-lying areas, so ventilation must be adequate at floor or below grade level.

PRECAUTIONS TO BE TAKEN IN HANDLING: Never allow any unprotected part of your body to touch solid carbon dioxide or to touch uninsulated pipes or vessels containing solid or liquid carbon dioxide or cold carbon dioxide gas. Not only can you suffer frostbite, your skin may stick fast to the cold surfaces. Use tongs or insulated gloves when handling solid carbon dioxide or objects in contact cold carbon dioxide in any form. Wear protective clothing and equipment as prescribed in section 8. For other precautions in using carbon dioxide, see section 16.

For additional information on storage and handling, refer to Praxair pamphlet P-15-288, *Safe Handling and Storage of Dry Ice*, available from your local supplier. Refer to section 16 for a list of other available publications.

8. Exposure Controls/Personal Protection

VENTILATION/ENGINEERING CONTROLS:

LOCAL EXHAUST—Use a local exhaust system, if necessary, to maintain the concentration of carbon dioxide below the TLV 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. Select per OSHA 29 CFR 1910.134 and ANSI Z88.2.

SKIN PROTECTION: Wear loose-fitting, insulated gloves.

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

OTHER PROTECTIVE EQUIPMENT: Metatarsal shoes for product handling. Protective clothing where needed. Cuffless trousers should be worn outside the shoes. Portable CO₂ analyzer to check gas concentrations. Regardless of protective equipment, never touch live electrical parts.

9. Physical and Chemical Properties

MOLECULAR WEIGHT:	44.01
EXPANSION RATIO for solid to gas at sublimation point:	1 to 554
SPECIFIC GRAVITY (Air = 1) at 70°F (21.1°C) and 1 atm:	1.52
DENSITY at -109.3°F (-78.5°C):	97.5 lb/ft ³ (1562 kg/m ³)
SOLUBILITY IN WATER , vol/vol at 68°F (20°C):	0.90 (gas)
PERCENT VOLATILES BY VOLUME:	100
EVAPORATION RATE (Butyl Acetate = 1):	Sublimes
pH at 1 atm:	3.7 (for carbonic acid)
FREEZING POINT / MELTING POINT at 1 atm:	Not applicable. Sublimation temperature is -109.3°F (-78.5°C)

APPEARANCE, ODOR, AND STATE: White, opaque solid emitting a colorless, slightly acid vapor felt by some persons to have a slight pungent odor and biting taste.

10. Stability and Reactivity

STABILITY:

Unstable Stable

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 and high temperatures decompose carbon dioxide into carbon monoxide and oxygen.

HAZARDOUS POLYMERIZATION: May Occur Will Not Occur

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:
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%

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: See section 6.

14. Transport Information

DOT/IMO SHIPPING NAME: Carbon dioxide, solid or Dry ice

HAZARD CLASS: 9	PACKING GROUP: III	IDENTIFICATION NUMBER: UN 1845	PRODUCT RQ: None
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SHIPPING LABEL(s): None

PLACARD (when required): None

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

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):

Threshold Planning Quantity (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: No

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.

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 AND 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).

16. Other Information

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

SPECIAL PRECAUTIONS: *Frozen carbon dioxide—extremely cold solid.* Contact can cause frostbite. Use piping and equipment adequately designed to withstand pressures to be encountered. Avoid materials incompatible with cryogenic use; some metals such as carbon steel may fracture easily at low temperature. *Vapor can cause rapid suffocation due to oxygen deficiency.* Store and use with adequate ventilation. Carbon dioxide gas is heavier than air. It tends to accumulate near the floor of an enclosed space, displacing air and pushing it upward. In still air, this process may also occur in low-lying, below-grade areas outdoors. The effect is to create an oxygen-deficient atmosphere near the floor or ground. Ventilate space before entry. Verify sufficient oxygen concentration.

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

HMIS RATINGS:

HEALTH = 3
FLAMMABILITY = 0
PHYSICAL HAZARD = 0

Ask your supplier about free Praxair safety literature as referred to in this MSDS and on the label for this product. Further information about this product can be found in the following pamphlets 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 *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-6.9 *Dry Ice*
- SB-2 *Oxygen-Deficient Atmospheres*
- *Handbook of Compressed Gases, Fourth Edition*

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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Praxair, Inc.
39 Old Ridgebury Road
Danbury, CT 06810-5113