



MATERIAL SAFETY DATA SHEET

Carbon Dioxide (DRY ICE)

COMPANY INFORMATION

Company Name Reliant Gases, LTD
Company Address 300 N Marienfeld
Midland, TX 79701
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PRODUCT IDENTIFICATION

CAS#	Chemical Name	Percent	EINECS/ELINCS
124-38-9	Carbon Dioxide	100	

Proprietary: No NIOSH (RTECS) Number: FF6400000 Exposure Limits:
Carbon Dioxide: 5000 ppm (9000 mg/m³)
OSHA TWA 5000 ppm (9000 mg/m³)
ACGIH TWA: 30,000 ppm (54,000 mg/m³)
ACGIH STREL 5000 ppm (9000 mg/m³)
NIOSH recommended 10 hour TWA: 30,000 ppm (54,000 mg/m³)
NIOSH recommended STEL 5000 ppm (9000 mg/m³) DFG MAK TWA: 10,000 ppm (18,000 mg/m³) DFG
MAK 60 minute peak, molen momentary value Measurement method:
Gas collection bag: Gas chromatography with thermal conductivity Detector: (NIOSH III #S2491)

PHYSICAL & CHEMICAL INFORMATION

Appearance and Odor: colorless, odorless to slightly pungent
Boiling Point: -109.4 F
Melting Point: -109.3 F
Vapor Pressure (MM hg/70F): 831 PSIA
Solubility In Water: APPRECIABLE

Appearance, Odor & State: At room temperature and atmospheric pressure, carbon dioxide is a colorless, odorless, slightly acidic gas. Carbon Dioxide is shipped as a liquefied gas under its own vapor pressure.

Molecular weight: 44.011
Sublimation Point: -109.3 °F (-78.5 °C)
Critical temperature: 87.6 °F (30.9 °C)
Gas density (@ 70 °F (21.1 °C) and 1 atm): 0.114 lb/ft³ (1.832 kg/m³)

Vapor pressure (@ 70 °F (21.1 °C)):	838 psig
Specific volume (at 70 °F (21.1 °C) and 1 atm):	8.74 ft³/lb (0.5457 m³/kg)
Triple point (@ 60.4 psig):	-69.9 °F (-56.6 °C)
Specific gravity (Air = 1) at 70 °F (21.1 °C):	1.52
Solubility in water (vol / vol. at 68 °F (20 °C)):	0.90

HEALTH HAZARDS

Routes of Entry - Inhalation, Dermal, Eyes

Health Hazard Acute and Chronic: Concentration in excess of 1.5% carbon dioxide may cause death. At higher concentrations, displaces oxygen in air below levels necessary to support life.

Carcinogenicity-NTP: No

Carcinogenicity-IARC: No

Carcinogenicity-OSHA: No

Explanation Carcinogenicity: None

Signs/Symptoms of Overexposure: At concentrations >1.5%: Hyperventilation/headaches/dyspnea/perspiration. At 6-10%: Headaches/dyspnea/perspiration, tremors, visual disturbances. >10%: Unconsciousness without warning. Cryogenic burns.

Emergency/first Aid Procedures: Inhalation: Remove to fresh air. Assisted respirant and supplemental oxygen should be given if not breathing. Frozen tissues should be flooded/soaked with tepid water. Don't use hot water. Obtain medical attention in all cases.

CO₂ EXPOSURE LIMITS -

Carbon dioxide is regulated for diverse purposes but not as a toxic substance.

- **IDLH 40,000-ppm**
- **ACGIH CO₂ Exposure Limits:** 5000-ppm TWA with a 30,000-ppm STEL
- **NIOSH CO₂ Exposure Limits:** TWA of 5,000-ppm with a 10-minute 30,000-ppm ceiling limit
- **OSHA CO₂ Exposure Limits:** 5,000-ppm PEL as an 8-hour TWA and a 30,000-ppm STEL

Definitions

- **PEL** = Permissible Exposure Limit is the maximum amount or concentration that a worker may be exposed to.
- **TWA**=Time-Weighted Average is an average value of exposure over the course of an 8 hour work shift.
- **IDLH** = Immediate Danger to Life and Health

- **STEL**= Short Term Exposure Limit is the maximum concentration of a chemical to which workers may be exposed continuously for up to 15 minutes without danger to health or work efficiency and safety .

References:

<http://www.osha.gov/dts/sltc/methods/inorganic/id172/id172bkr.html>

<http://www.osha.gov/dts/sltc/methods/inorganic/id172/id172.html>

<http://www.cdc.gov/Niosh/pe188/124-38.html>

<http://www.cdc.gov/niosh/idlh/124389.html>

<http://www.cdc.gov/niosh/npg/npgd0103.html>

HAZARD RATINGS:

	NFPA	HMIS (gas)	HMIS (liquid)
HEALTH	1	1	3
FLAMMABILITY	0	0	0
REACTIVITY	0	0	0
SPECIAL	SA ⁽¹⁾		

(1) *Compressed Gas Association (CGA) recommendation to designate simple asphyxiant*

PERSONAL PROTECTION

Area Ventilation - Use local exhaust and general ventilation to prevent accumulation above the acceptable exposure limits and to prevent oxygen deficiency.

Eye protection - Safety goggles, glasses, or face shields should be worn when handling liquid carbon dioxide to prevent contact with the eyes.

Skin protection - Use loose fitting insulated gloves, long sleeved shirts or coveralls, long legged trousers, or accepted clothing to protect from frostbite or cryogenic "burns".

Respiratory protection - When needed, use positive pressure breathing apparatus or self contained air supply systems. These should also be available for emergency use.

Hearing protection – Hearing protection that is of the approved variety should be worn to prevent hearing damage in the event that nearby relief valves may open unexpectedly and anytime that the lines or valves in the area may be relieved of pressure.

Other protection - Safety shoes or boots should be worn to protect against contact with liquid or cryogenic carbon dioxide.

FIRST AID

Skin Contact - flush the affected area with tepid water. DO NOT USE HOT WATER! A physician should be consulted promptly if the cryogenic "burn" has resulted in the blistering of the dermal surface or in deep tissue freezing.

Eyes - Never introduce ointments or oils into the eyes without medical advice. In case of freezing or cryogenic "burns" caused by rapidly evaporating liquid; DO NOT WASH THE EYES WITH HOT OR EVEN TEPID WATER! Remove the victim from the source of contamination. Open the eyelids wide to allow liquid to evaporate. If pain is present, refer the victim to an ophthalmologist for treatment and follow-up. If the victim cannot tolerate light, protect the eyes with a light bandage.

Ingestion - Treat in a manner similar to that of skin contact. Seek medical attention. Never give anything by mouth to an unconscious victim.

Inhalation - Prompt medical attention is mandatory in cases of overexposure to carbon dioxide. Rescue personnel should be equipped with self-contained breathing apparatus. Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given artificial resuscitation and supplemental oxygen. Further treatment should be symptomatic and supportive. Treat areas exposed to liquid carbon dioxide as "frostbite".

GENERAL RESCUE AND FIRST AID - In all cases of exposure, rescue personnel should use appropriate protective equipment. Victims should be immediately removed from the contaminated area. Particular attention should be given to establishing and maintaining proper respiration and cardiac function of the victims seek immediate medical help, keep victims warm and comfortable.

Note to Physician – There is no specific antidote. Treatment for overexposure should be directed at the control of symptoms and the clinical condition.

TOXICOLOGICAL INFORMATION & EXPOSURE AND EFFECTS

Overexposure –

- At 1% concentration of carbon dioxide CO₂ (10,000 parts per million or ppm) and under continuous exposure at that level, such as in an auditorium filled with occupants and poor fresh air ventilation, some occupants are likely to feel drowsy.
- The concentration of carbon dioxide must be over about 2% (20,000 ppm) before most people are aware of its presence unless the odor of an associated material (auto exhaust or fermenting yeast, for instance) is present at lower concentrations.
- Above 2%, carbon dioxide may cause a feeling of heaviness in the chest and/or more frequent and deeper respirations.
- If exposure continues at that level for several hours, minimal "acidosis" (an acid condition of the blood) may occur but more frequently is absent.
- **Breathing rate** doubles at 3% CO₂ and is four times the normal rate at 5% CO₂.
- **Toxic levels of carbon dioxide:** at levels above 5%, concentration CO₂ is directly toxic. [At lower levels we may be seeing effects of a reduction in the relative amount of oxygen rather than direct toxicity of CO₂.]

Symptoms of high or prolonged exposure to carbon dioxide include headache, increased heart rate, dizziness, fatigue, rapid breathing, visual and hearing dysfunctions. Exposure to higher levels may cause unconsciousness or death within minutes of exposure.

Steps if Material Released/Spill: Ventilate indoor areas well to avoid hazardous CO₂ concentrations. Ventilate area well and avoid contact with cold vapors/dry ice. CO₂ is heavy gas and will remain in low spots without assisted ventilation.

Special Precautions for Handling of Solid Carbon Dioxide: Do not handle solid Carbon Dioxide with bare hands. Use heavy gloves, dry ice tongs or plastic scoop or shovel. Handle blocks of dry ice carefully, as

injuries can occur if one is accidentally dropped on the feet. Containers of solid Carbon Dioxide should be stored upright and be firmly secured to prevent falling or being knocked over. Containers should be vented, to prevent the build-up of Carbon Dioxide gas. Carbon Dioxide sublimates at -78.5°C (-109.3°F); containers should be thermally insulated and kept at the lowest possible temperature to maintain the solid and avoid generation of Carbon Dioxide gas. Storage containers and equipment used with Carbon Dioxide 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. Solid consignment of dry ice in a gas-tight vessel can lead to catastrophic failure of the vessel by over-pressurization. Storage of dry ice should never occur in a gas-tight container.

Skin - Contact with liquid carbon dioxide can cause tissue freezing or frostbite and cryogenic "burns".

Eyes - Eye contact with solid CO₂ or compressed carbon dioxide should be considered as a corneal burn. Frostbite of the eye structure may also occur.

Ingestion - Ingestion is unlikely. Tissue contact with large quantities of carbon dioxide may cause tissue freezing and frostbite, similar to that of skin contact.

Avoid direct contact or exposure with carbon dioxide while in a cryogenic state as it may cause immediate freezing or frostbite to tissue.

Avoid areas near leaks or spills where heavy concentrations may have settled, displacing the oxygen, thus possibly causing suffocation!

FIRE AND EXPLOSION HAZARD

Flash Point: No Applicable

Auto ignition: Nonflammable

Flammable limits in air: Nonflammable

Firefighting instructions: Use extinguishing agent suitable for surrounding fires

Firefighting procedures - Carbon dioxide is nonflammable and as such does not present a fire hazard. However, cylinders that are exposed to fire may rupture with explosive and violent force. Extinguish surrounding fire and keep cylinders cool by using a cold water spray applied from the maximum possible distance.

HANDLING AND STORAGE

Reactivity Data

Dry ice sublimates; if confined in a gas tight container, it will build up a pressure of 850 psig at 70° F. Do not put dry ice in an airtight container or confined space

Stability: Yes

Conditions To Avoid (Stability): Moisture

Materials to Avoid: Carbonic acid/salt/corrosive chemicals

Hazardous Polymerization Occurrence: No

Conditions to Avoid - Avoid trapping or sealing of liquid carbon dioxide in lines, containers, or vessels

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 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.

without the benefit of pressure release valves or rupture disks set at the proper release points. These lines, containers or vessels could otherwise rupture with extremely violent force!

Avoid contact with eyes, skin and clothing. Keep container closed. Use only with adequate ventilation. Do not puncture or incinerate container. Wash thoroughly after handling. High pressure gas. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement. Never allow any unprotected part of the body to touch uninsulated pipes or vessels that contain cryogenic liquids. Prevent entrapment of liquid in closed systems or piping without pressure relief devices. Some materials may become brittle at low temperatures and will easily fracture.

Incompatible Materials - None known

Hazardous Decomposition Products - Carbonic acid in the presence of water or moisture. Hazardous polymerization will not occur.

Spills, leaks, or disposal procedure - Using appropriate protective equipment, evacuate all personnel from the affected area. If the leak or spill is from a valve, try to stop the flow of CO₂ by closing off valves. Avoid contact with the CO₂. Avoid contact with cold materials. Self-contained breathing apparatus may necessary where the oxygen has been replaced.

Special precautions - Keep all areas well ventilated. Never allow liquid to become entrapped in non-relieved lines, containers, or vessels. Be alert for the formation of "ice plugs" when venting lines or plumbing. Never hit or hammer on lines or plumbing that is frozen or pressurized. Always use lines, hoses, and vessels that are designed for the safe handling of liquid carbon dioxide.

Keep container tightly closed. Keep container in a cool, well-ventilated area. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

SHIPPING INFORMATION))

Shipping information: Packages should be transported in a secure position in a well ventilated vehicle. Product transported in an enclosed, non ventilated compartment of a vehicle can present serious safety hazards.

WASTE DISPOSAL METHOD: Place outside in a protected area with good ventilaton 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.

Do Not Dispose of In Unsecured Dumpsters or Trash Bins

It is better to place dry ice in a safe secure location and let sublimate

Label Required: Yes

Technical Review Date: September 1, 2004

Label Date: September 1, 2004

Common Name: Solid Carbon Dioxide/Dry Ice

Chronic Hazard: Yes **Acute Health Hazard-Severe**

Contact Hazard-Slight

Fire Hazard-Minimal

Reactivity Hazard-None

Special Hazard Precautions: Concentration in excess of 1.5% carbon dioxide may cause death. At higher concentrations, displaces oxygen in air below levels necessary to support life.

Target organs: Respiratory system, skin

Protect Eye: Y

Protect Skin: Y

Protect Respiratory: Y

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.

US FEDERAL REGULATIONS

TSCA 8(b) inventory: Carbon Dioxide

SARA 302/304/311/312 extremely hazardous substances: No products were found.

SARA 302/304 emergency planning and notification: No products were found.

SARA 302/304/311/312 hazardous chemicals: Carbon Dioxide

SARA 311/312 MSDS distribution - chemical inventory - hazard identification: Carbon Dioxide: Sudden Release of Pressure, Immediate (Acute) Health Hazard, Delayed (Chronic) Health Hazard

Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: No products were found.

Clean air act (CAA) 112 accidental release prevention: No products were found.

Clean air act (CAA) 112 regulated flammable substances: No products were found.

Clean air act (CAA) 112 regulated toxic substances: No products were found.

STATE REGULATIONS

Pennsylvania RTK: Carbon Dioxide: (generic environmental hazard)

Massachusetts RTK: Carbon Dioxide

New Jersey: Carbon Dioxide

DISCLAIMER OF LIABILITY

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