Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Carbon dioxide, refrigerated liquid (MSDS No. P-4573-A)	**Trade Name:** LIQUIFLOW
Chemical Name: Carbon dioxide	**Synonyms:** Carbon dioxide (cryogenic liquid), LCO_2, liquefied CO_2
Formula: CO_2	**Chemical Family:** Acid anhydrides
Telephone: **Emergencies:** 1-800-633-8253* **PERS:** 1-800-633-8253*	**Company Name:** Alliance Gas Products 2001-F Peralta Street Oakland, CA 94607

** Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product.*

2. Composition/Information on Ingredients

This section covers materials of manufacture only. See sections 3, 8, 10, 11, 15, and 16 for information on by-products generated during use, especially use in welding and cutting. For custom mixtures of this product, request an MSDS for each component. See section 16 for important information about mixtures.

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

** The symbol > means "greater than"; the symbol <, "less than."*

*** See section 3.*

3. Hazards Identification

EMERGENCY OVERVIEW

WARNING! Cold liquid and gas under pressure.
Can cause rapid suffocation.
Can 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

THRESHOLD LIMIT VALUE: TLV-TWA, 5,000 ppm (ACGIH, 1998). TLV-TWA, 15 min STEL, 30,000 ppm. ACGIH recommends a TLV-TWA of 5 mg/m3 for welding fumes not otherwise classified (NOC) that may be generated during welding with this product. TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

Revised

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.

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: 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

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! 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 may be required by rescue workers. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

UNUSUAL FIRE AND EXPLOSION 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.

HAZARDOUS COMBUSTION PRODUCTS: None known.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: WARNING! Cold liquid and gas under pressure. Carbon dioxide is an asphyxiant. Lack of oxygen can kill. Evacuate all personnel from danger area. Use self-contained breathing apparatus 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.

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. Do not store in a confined space. Storage areas should be clean and dry, free of oils and dust, which 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 will 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.

PRECAUTIONS TO BE TAKEN IN HANDLING: Never allow any unprotected part of your body to touch uninsulated pipes or vessels containing cryogenic fluids. Flesh will stick to the extremely cold metal and will tear when you try to pull free.

Use a suitable hand truck to move containers. Cryogenic 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.

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 for cylinder handling.

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

OTHER PROTECTIVE EQUIPMENT: 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.

9. Physical and Chemical Properties

MOLECULAR WEIGHT:	44.01
SPECIFIC GRAVITY (Air = 1) at 70°F (21.1°C) and 1 atm**:**	1.522
GAS DENSITY at 70°F (21.1°C) and 1 atm**:**	0.1444 lb/ft^3 (1.833 kg/m^3)
LIQUID DENSITY (saturated) at 70°F (21.1°C) and 1 atm**:**	47.6 lb/ft^3 (762 kg/m^3)
VAPOR PRESSURE at 70°F (21.1°C)**:**	838 psig (5778 kPa)
SOLUBILITY IN WATER, vol/vol at 68°F (20°C) and 1 atm**:**	0.90
PERCENT VOLATILES BY VOLUME:	100
EVAPORATION RATE (Butyl Acetate = 1)**:**	High
pH:	3.7 (for carbonic acid)
SUBLIMATION POINT at 1 atm**:**	-109.3°F (-78.5°C)

APPEARANCE, ODOR, AND STATE: Colorless, odorless, liquid. Converts to white crystalline particles when discharged from container. The gas is slightly acid and is felt by some 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 known.

11. Toxicological Information

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.	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, refrigerated liquid

HAZARD CLASS: 2.2	**IDENTIFICATION NUMBER:** UN 2187	**PRODUCT RQ:** Not applicable
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 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 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: Carbon dioxide is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

WARNING: The combustion of this gas produces carbon monoxide—a chemical known to the State of California to cause birth defects or other reproductive harm.

(California Health and Safety Code §25249.5 et seq.)

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.

ADDITIONAL SAFETY AND HEALTH HAZARDS: 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.

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. Avoid materials incompatible with cryogenic use; some metals such as carbon steel may fracture easily at low temperature. ***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 container may cause rupture. Use a check valve or other protective device in any line or piping from the cylinder. ***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 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:		**HMIS RATINGS:**	
HEALTH	= 3	HEALTH	= 3
FLAMMABILITY	= 0	FLAMMABILITY	= 0
REACTIVITY	= 0	REACTIVITY	= 0
SPECIAL	= SA (CGA recommends this to designate Simple Asphyxiant.)		

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:	CGA-320 CGA-622 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 about this product 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*
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 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.

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.

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