Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name:	Oxygen, Refrigerated Liquid (MSDS No. P-4637-E); this product is also known as Oxygen (Cryogenic Liquid)	**Trade Name:**	Oxygen Liquid
Chemical Name:	Oxygen	**Synonyms:**	Not Applicable
Formula:	O_2	**Chemical Family:**	Not Applicable
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. For routine information contact your supplier.

2. Composition / Information on Ingredients

INGREDIENT NAME	CAS NUMBER	PERCENTAGE	OSHA PEL	ACGIH TLV-TWA*
Oxygen	7782-44-7	>99%*	None currently established	None currently established

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

3. Hazards Identification

EMERGENCY OVERVIEW

WARNING! Extremely cold, oxidizing liquid and gas under pressure.
Vigorously accelerates combustion.
Can cause severe frostbite.
Combustibles in contact with liquid oxygen may explode on ignition or impact.
May cause dizziness and drowsiness.
Self-contained breathing apparatus may be required by rescue workers.
Odor: None

THRESHOLD LIMIT VALUE: None currently established.

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EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:

INHALATION–Breathing 80% or more oxygen at atmospheric pressure for more than a few hours may cause nasal stuffiness, cough, sore throat, chest pain and breathing difficulty. At higher pressures, adverse effects from breathing pure oxygen are more likely and may occur sooner. Breathing pure oxygen under pressure may damage the lungs and affect the central nervous system, producing dizziness, poor coordination, a tingling sensation, visual and hearing disturbances, muscular twitching, unconsciousness, and convulsions. Persons who breathe oxygen under pressure may adapt more slowly to darkness and may suffer reduced peripheral vision.

SKIN CONTACT–No harm expected from vapor. Cold gas or liquid may cause severe frostbite.

SWALLOWING–An unlikely route of exposure, but severe frostbite of the lips and mouth may result from contact with the liquid.

EYE CONTACT–No harm expected from vapor. Cold gas or liquid may cause severe frostbite.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE: No harm expected.

OTHER EFFECTS OF OVEREXPOSURE: See section 11, Toxicological Information.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: See section 11, Toxicological Information.

SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARD EVALUATION: None known.

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

4. First Aid Measures

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. Keep victim warm and at rest. Call a physician. Advise the physician that the victim has been exposed to a high concentration of oxygen.

SKIN CONTACT: For exposure to liquid, 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: 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: *Supportive treatment should include immediate sedation, anti-convulsive therapy if needed, and rest. See section 11, Toxicological Information.*

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: Vigorously accelerates combustion. Use media appropriate for surrounding fire. Water (e.g. safety shower) is the preferred extinguishing media for clothing fires.

SPECIAL FIRE FIGHTING PROCEDURES:
WARNING! Extremely cold, oxidizing 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 oxygen. Liquid oxygen 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: Oxidizing agent; vigorously accelerates combustion. Contact with flammable materials may cause fire or explosion. Do not walk on or roll equipment over spill; any impact could cause an explosion. Smoking, flames, and electric sparks are potential explosion hazards in enriched oxygen atmospheres. Heat of fire can build pressure in closed container and cause it to rupture. No part of a container should be subjected to a temperature higher than 125°F (52°C). Liquid Oxygen containers are equipped with pressure relief devices. Venting vapors may obscure visibility. Liquid causes severe frostbite, a burn-like injury. (See section 3.)

HAZARDOUS COMBUSTION PRODUCTS: None known.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:
WARNING! Extremely cold, oxidizing liquid and gas under pressure. Immediately evacuate all personnel from danger area. Avoid contact with spilled liquid and allow it to evaporate. Extremely cold oxidizing liquid and gas. Liquid causes severe frostbite, a burn-like injury. (See section 3.) Do not walk on or roll equipment over spill; any impact could cause an explosion. Contact with flammable materials may cause fire or explosion. Smoking, flames, and electric sparks are potential explosion hazards in enriched oxygen atmospheres. Shut off leak if without risk. Ventilate area or move leaking container to ventilated area. Remove all flammable materials from vicinity. Oxygen must never be permitted to strike an oily surface, greasy clothes, or other combustible material.

EMERGENCY DISPOSAL MEASURES: Keep personnel away. Liquid oxygen should be dumped into an outdoor pit filled with clean gravel free of grease and oil, where it will safely evaporate. Prevent waste from contaminating the surrounding environment. 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, away from oil, grease, and other hydrocarbons. Do not store in a confined space. Cryogenic containers are equipped with a pressure relief device and a pressure controlling valve. Under normal conditions these containers will periodically vent product. Separate oxygen containers from flammables by at least 20 feet or use a barricade of noncombustible material. This barricade should be at least 5 feet high and have a fire resistance rating of at least ½ hour. Use adequate pressure relief devices in systems and piping to prevent pressure buildup; entrapped liquid can generate extremely high pressures when vaporized by warming.

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 oxygen, see section 16.

8. Exposure Controls/Personal Protection

VENTILATION/ENGINEERING CONTROLS:

LOCAL EXHAUST–Use a local exhaust system, if necessary, to prevent increased oxygen concentration.
MECHANICAL (general)–Adequate
SPECIAL–Not applicable
OTHER–Not applicable

RESPIRATORY PROTECTION: None required under normal use. However an air-supplied respirator must be used while working in confined spaces with this product. The respiratory protection use must conform with OSHA rules as specified in 29 CFR 1910.134.

SKIN PROTECTION: Wear loose-fitting, cryogenic gloves. Gloves must be free of oil and grease.

EYE PROTECTION: Safety glasses and a full face shield are recommended. Select in accordance with OSHA 29 CFR 1910.133.

OTHER PROTECTIVE EQUIPMENT: Metatarsal shoes for container handling. Protective clothing where needed. Cuffless trousers should be worn outside the shoes. 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

MOLECULAR WEIGHT: 31.998	**EXPANSION RATIO:** 1 to 860.5
SPECIFIC GRAVITY (air=1): At 70°F (21.1°C) and 1 atm: 1.14	**SOLUBILITY IN WATER**: vol/vol at 32°F (0°C) at 1 atm: 0.491
LIQUID DENSITY: At boiling point and 1 atm: 71.23 lb/ft^3 (1141 kg/m^3)	**VAPOR PRESSURE:** AT 68°F (20°C)**:** Not applicable
PERCENT VOLATILES BY VOLUME: 100	**EVAPORATION RATE (Butyl Acetate=1):** High
BOILING POINT (1 atm): -297.33°F (-182.96°C)	**pH:** Not applicable
FREEZING POINT (1 atm): -361.8°F (-218.78 °C)	
APPEARANCE, ODOR, AND STATE: Pale blue, odorless cryogenic liquid	

10. Stability and Reactivity

STABILITY:	**Unstable**		**Stable**	X

INCOMPATIBILITY (materials to avoid): Flammable materials, hydrocarbons such as oils and grease, asphalt, ethers, alcohols, acids, and aldehydes. Oxygen reacts with many materials. See NFPA 491M, *Manual of Hazardous Chemical Reactions* for details.

HAZARDOUS DECOMPOSITION PRODUCTS: None

HAZARDOUS POLYMERIZATION:	**May Occur**		**Will Not Occur**	X

CONDITIONS TO AVOID: None

11. Toxicological Information

At atmospheric concentration and pressure, oxygen poses no toxicity hazards. At high concentrations, newborn premature infants may suffer delayed retinal damage (retrolental fibroplasia) that can progress to retinal detachment and blindness. Retinal damage may also occur in adults exposed to 100% oxygen for extended periods (24 to 48 hours) or at greater than atmospheric pressure, particularly in individuals whose retinal circulation has been previously compromised. All individuals exposed for long periods to oxygen at high pressure and all who exhibit overt oxygen toxicity should have ophthalmologic examinations.

At two or more atmospheres, toxicity to the Central Nervous System (CNS) occurs. Symptoms include nausea, vomiting, dizziness or vertigo, muscle twitching, vision changes, and loss of consciousness and generalized seizures. At three atmospheres, CNS toxicity occurs in less than two hours; at six atmospheres, in only a few minutes.

Patients with chronic obstructive pulmonary disease retain carbon dioxide abnormally. If oxygen is administered, raising their blood oxygen concentration, their breathing becomes depressed and retained carbon dioxide rises to a dangerous level.

Animal studies suggest that the administration of certain drugs, including phenothiazine drugs and chloroquine, increases the susceptibility to toxicity from oxygen at high concentrations or pressures. Animal studies also indicate that vitamin E deficiency may increase susceptibility to oxygen toxicity.

Airway obstruction during high oxygen tension may cause alveolar collapse following absorption of the oxygen. Similarly, occlusion of the eustachian tubes may cause retraction of the eardrum and obstruction of the paranasal sinuses may produce vacuum-type headache.

12. Ecological Information

The atmosphere contains approximately 21% oxygen. No adverse ecological effects expected. Oxygen does not contain any Class I or Class II ozone-depleting chemicals. Oxygen 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. Contact your supplier. For emergency disposal, discharge slowly to the atmosphere in a well-ventilated area or outdoors. Also see section 6 for disposal following spills.

14. Transport Information

DOT/IMO SHIPPING NAME: Oxygen, refrigerated liquid	**HAZARD CLASS:** 2.2
IDENTIFICATION NUMBER: UN 1073	**PRODUCT RQ:** Not applicable

SHIPPING LABEL(s): Oxygen. An oxygen label may be used for domestic shipment in the United States and Canada in place of the nonflammable and oxidizer labels (49 CFR Part 172).

PLACARD (When required): NONFLAMMABLE GASor OXYGEN

SPECIAL SHIPPING INFORMATION: Containers should be transported in a secure position, in a well-ventilated vehicle. Containers 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: Yes
	FIRE: Yes

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

  Oxygen does not require reporting under this section.

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.

Oxygen is not listed as a regulated substance.

TSCA: Toxic Substances Control Act: Oxygen 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.

Oxygen 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).

16. Other Information

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

WARNING: Medical grades of Oxygen are subject to strict federal regulation, and are for use only under the control of a licensed physician or clinician, familiar with the product and its hazards.

SPECIAL PRECAUTIONS: ***Extremely cold, oxidizing liquid and gas under pressure.*** All gauges, valves, regulators, piping, and equipment to be used in oxygen service must be cleaned for oxygen service in accordance with CGA pamphlet G-4.1. Keep containers and their valves free of oil and grease. 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. ***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.To prevent cryogenic liquid or cold gas from being trapped in piping between valves, equip the piping with pressure relief devices; entrapped liquid can generate extremely high pressures when vaporized by warming. Use only transfer lines designed for cryogenic liquids. Praxair recommends piping all vents to the exterior of the building. ***Never use oxygen as a substitute for compressed air.*** Never use an oxygen jet for cleaning of any sort, especially for cleaning clothing. Oxygen saturated clothing may burst into flame at the slightest spark and be quickly consumed in an engulfing fire. ***Do not get liquid on clothing.*** Persons exposed to liquid high concentrations of oxygen gas should stay in a well-ventilated or open area for 30 minutes before entering a confined space or going near any source of ignition. ***Never work on a pressurized system.*** If a leak occurs, close the cylinder valve, blow the system down by venting vapor to a safe place, then repair the leak. ***Never ground a compressed gas cylinder or allow it to become part of an electrical circuit.***

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: Store and use with adequate ventilation. Close valve after each use; keep closed even when empty. Immediately remove clothing exposed to oxygen and air it out to reduce the likelihood of an engulfing fire. Prevent ignition sources such as static electricity generated in clothing while walking. Protect container against physical damage. Isolate it from combustible gas installations and combustible materials by an adequate distance or by gas-tight, fire resistant barriers. Protect against overheating.

Use of this product in manufacturing may generate toxic fumes and gases or create additional toxicity hazards. Consult an industrial hygienist or other appropriately trained person to evaluate end-use operations or processes for hazards and to establish measures to protect employees.

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	OX (oxidizer)		

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:	CGA-440 (cryogenic liquid withdrawal)
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 referenced on the label for this product; you may also obtain copies by calling 1-800-PRAXAIR. Further information about oxygen 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*
AV-8 *Characteristics and Safe Handling of Cryogenic Liquid and Gaseous Oxygen*
G-4 *Oxygen*
G-4.1 *Cleaning Equipment for Oxygen Service*
G-4.3 *Commodity Specification for Oxygen*
P-1 *Safe Handling of Compressed Gases in Containers*
P-2 *Characteristics and Safe Handling of Medical Gases*
P-12 *Safe Handling of Cryogenic Liquids*
P-14 *Accident Prevention in Oxygen-Rich, Oxygen-Deficient Atmospheres*
SB-2 *Oxygen-Deficient Atmospheres*
SB-8 *Use of Oxy-fuel Gas Welding and Cutting Apparatus*
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 nditions 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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