

**LIQUID AIR**

AN AIR LIQUIDE GROUP COMPANY

**Material Safety Data Sheet****OXYGEN GAS**

|  |   |   |                                    |
|--|---|---|------------------------------------|
| <b>PRODUCT NAME</b><br>Oxygen Gas  | <b>EMERGENCY RESPONSE INFORMATION</b>   |   |                                    |
| <b>TELEPHONE</b><br>(510) 977-6500   | IN CASE OF EMERGENCY INVOLVING THIS MATERIAL,<br>CALL DAY OR NIGHT ..... 1-800-231-1366<br>OR CALL CHEMTREC AT ..... 1-800-424-9300 |   |                                    |
| <b>LIQUID AIR CORPORATION</b><br>CALIFORNIA PLAZA, SUITE 350<br>2121 N. CALIFORNIA BLVD.<br>WALNUT CREEK, CALIFORNIA 94596 | <b>TRADE NAME AND SYNONYMS</b><br>Oxygen  | <b>CAS NUMBER</b><br>7782-44-7            |                                    |
|  | <b>CHEMICAL NAME AND SYNONYMS</b><br>Oxygen   | <b>NFPA 704 NUMBER (HFR)</b><br>0 0 0 OXY |                                    |
| <b>ISSUE DATE &amp; REVISIONS</b> Rev. Sept. 2, 1991<br><br>CORPORATE SAFETY DEPT.   | <b>FORMULA</b><br>O <sub>2</sub>  | <b>MOLECULAR WEIGHT</b><br>31.999         | <b>CHEMICAL FAMILY</b><br>Oxidizer |

**HEALTH HAZARD DATA****TIME WEIGHTED AVERAGE EXPOSURE LIMIT**

None established (ACGIH, 1989-90). Oxygen is the "vital element" in the atmosphere in which we live and breathe (approximately 21 molar (volume) percent of the atmosphere). The minimum oxygen content in workplace air is 18% by volume under normal atmospheric pressure, equivalent to a partial pressure, pO<sub>2</sub> of 135 torr, (ACGIH 1989-90).

**SYMPTOMS OF EXPOSURE**

The primary route of entry is inhalation. **Acute health effects:** Adults can satisfactorily breathe pure oxygen for extended periods at 0.33 atm, or at 1 atm for several days at less than 5 hours a day. However, irritation to mucous membranes may occur when 100% oxygen is inhaled continuously for several hours. Chest pains and cough can result from breathing O<sub>2</sub> at 1 atm for 8 to 24 hours or 2 atm for 2 to 3 hours or from an atmosphere of 60% oxygen for several days. Breathing high concentrations greater than 75 (molar) percent by volume at atmospheric pressure for more than a few hours causes symptoms of hyperoxia (high oxygen exposure) with a variety of central nervous system effects. These symptoms include cramps, nausea, dizziness, hypothermia (low body temperature), ambyopia (diminished vision), nasal stuffiness, cough, sore throat, chest pain, respiratory difficulties, bradycardia (slow heart rate), fainting spells, and convulsions capable of leading to death.

Breathing oxygen at higher pressures increases the likelihood of adverse effects within a shorter time period. For additional data on hyperoxia (high oxygen exposure) as it relates to oxygen pressure and exposure duration, refer to L'Air Liquide's Encyclopedie des Gaz. **Chronic health effects:** None established. **Medical conditions generally aggravated by exposure:** See **NOTES TO PHYSICIAN**, below.

**NOTES TO PHYSICIAN:**

Supportive treatment should include immediate sedation, anti-convulsive therapy if needed, and rest. 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.

Newborn premature infants exposed to high oxygen concentrations may suffer delayed retinal damage which can progress to retinal detachment and blindness (retrolental fibroplasia). Retinal damage can also occur in adults exposed to 100% oxygen under 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.

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**TOXICOLOGICAL PROPERTIES**

At normal concentration and pressure, oxygen poses no toxicity hazards. However, at elevated concentrations and pressures, oxygen may cause adverse effects of hyperoxia (high oxygen exposure) which leads to pneumonia. Concentrations between 25 and 75 molar percent present a risk of inflammation of organic matter in the body.

Listed as Carcinogen National Toxicology YES  I.A. R. C. YES  OSHA YES   
or Potential Carcinogen Program NO  Monographs NO  NO

**WARNING FOR MEDICAL OXYGEN U.S.P.:**

For oxygen deficiency in breathing persons or emergency resuscitation when used by personnel instructed in oxygen administration. For other medical applications, use only as directed by a licensed practitioner. Uninterrupted use of high concentrations of oxygen over a long duration, without monitoring its effect on oxygen content of arterial blood, may be harmful. Use only with pressure reducing equipment and apparatus designed for oxygen.

**RECOMMENDED FIRST AID TREATMENT**

**PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO OXYGEN. RESCUE PERSONNEL SHOULD BE AWARE OF EXTREME FIRE HAZARD ASSOCIATED WITH OXYGEN-RICH ATMOSPHERES. REDUCE OXYGEN PRESSURES TO 1 ATMOSPHERE AND/OR MOVE VICTIM INTO FRESH AIR.**

Conscious persons should be assisted to an uncontaminated area and breathe fresh air. They should be kept warm and quiet. The physician should be informed that the victim is experiencing (has experienced) hyperoxia (high oxygen exposure).

Unconscious persons should be moved to an uncontaminated area and given assisted respiration. When breathing has been restored, treatment should be as above. Continued treatment should be symptomatic and supportive.

**HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES**

Although not flammable itself, oxygen vigorously accelerates fire and combustion (burning). Contact with all flammable materials should be avoided. Some materials which are not flammable in air will burn in pure oxygen or oxygen-enriched atmospheres. Materials that burn in air can burn with explosive violence in a pure oxygen or oxygen-enriched atmosphere.

**PHYSICAL DATA**

|   |   |
|---|---|
| <b>BOILING POINT</b><br>-297.35°F (-182.97°C)   | <b>LIQUID DENSITY AT BOILING POINT</b><br>71.23 lb/ft <sup>3</sup> (1141 kg/m <sup>3</sup> ); specific gravity = 1.14 |
| <b>VAPOR PRESSURE</b> @ 70°F (21.1°C) above the critical temp. of -181.433°F (-118.574°C)                         | <b>GAS DENSITY AT 70° F 1ATM</b><br>.0828 lb/ft <sup>3</sup> (1.326 kg/m <sup>3</sup> )                               |
| <b>SOLUBILITY IN WATER</b><br>@ 68°F (20°C) Bunsen coefficient = 0.0310;<br>3.16cm <sup>3</sup> / 100g @ 25°C     | <b>FREEZING POINT</b><br>-361.838°F (-218.799°C)  |
| <b>APPEARANCE AND ODOR</b><br>Colorless, odorless and tasteless gas. Specific gravity @ 70°F (Air = 1.0) is 1.11. |   |

**FIRE AND EXPLOSION HAZARD DATA**

|  |  |   |
|--|--|---|
| <b>FLASH POINT (METHOD USED)</b><br>Not Applicable   | <b>AUTO IGNITION TEMPERATURE</b><br>Not Applicable | <b>FLAMMABLE LIMITS % BY VOLUME</b><br>Not Applicable |
| <b>EXTINGUISHING MEDIA</b><br>Copious quantities of water for fires with oxygen as the oxidizer. |  | <b>ELECTRICAL CLASSIFICATION</b><br>Nonhazardous      |

**SPECIAL FIRE FIGHTING PROCEDURES**

If possible, stop the flow of oxygen which is supporting the fire if you can do so without risk. Use media that are appropriate to the surrounding fire. Immediately cool fire-exposed container, standing at a safe distance as far away as possible and using a water spray. If feasible, remove oxygen containers from fire area. Containers may explode in the heat of fire. Though not flammable itself, oxygen vigorously supports combustion.

Materials that do not burn in air may burn in oxygen-enriched air (>23% oxygen). Some materials can even become spontaneously flammable in oxygen or oxygen-enriched air. Oxygen released in a fire situation greatly increases fire and explosion hazards. (Oxygen cylinders are equipped with safety devices to release O<sub>2</sub> at excessive temperature or pressure).

**UNUSUAL FIRE AND EXPLOSION HAZARDS**

High pressure oxidizing gas. Cylinder pressure can be 2,000 - 3,000 psi @ 70°F or up to 6,000 psi @ 70°F for ultra-high pressure cylinders. Vigorously accelerates combustion (burning). No smoking in cylinder area or while oxygen is in use. Keep oil and grease away. Keep oxygen cylinders away from flammables and combustibles.

## REACTIVITY DATA

| STABILITY                            |   | CONDITIONS TO AVOID   |
|--------------------------------------|---|---|
| UNSTABLE                             |   | Oxygen is stable when kept isolated as a compressed gas in cylinders. This material is an oxidizing agent that vigorously accelerates combustion (burning, fire). Oxygen will undergo highly exothermic reactions or explosions with many materials. The greater the concentration of O <sub>2</sub> in contact with a fuel or reducing agent, the greater the violence of the reaction. Air contains 21 percent oxygen; reactivity with environmental materials is substantially increased at above 23 percent oxygen by volume. |
| STABLE                               | X |   |
| INCOMPATIBILITY (MATERIALS TO AVOID) |   | Oxygen reacts explosively with phosphine, hydrazine, hydrogen sulfide, ethers, alcohols, hydrocarbons, etc. Red-hot steel burns in an oxygen atmosphere. This material is incompatible with oils, grease, lubricants, asphalt, and flammable materials. Keep oxygen cylinders free of oil and/or grease.  |
| All flammable materials.             |   |   |
| HAZARDOUS DECOMPOSITION PRODUCTS     |   | None  |
| HAZARDOUS POLYMERIZATION             |   |   |
| MAY OCCUR                            |   | CONDITIONS TO AVOID Not applicable  |
| WILL NOT OCCUR                       | X |   |

## SPILL OR LEAK PROCEDURES

## STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Evacuate all personnel from affected area. Use appropriate protective equipment (Refer to "SPECIAL PROTECTION INFORMATION" section). Provide optimum exhaust ventilation. If at all possible, shut off the source of the oxygen leak if you can do so without risk. Remove sources of heat, ignition and, if feasible, separate combustibles from the leak. Shut off all internal combustion engines within 50 feet of affected area. Small leaks in an oxygen system in an enclosed, unventilated area can build up a hazardous oxygen level. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. SNOOP® solutions for oxygen service may be used to detect gaseous leaks. If leak is in container or container valve, contact the closest Liquid Air Corporation location.

## WASTE DISPOSAL METHOD

Do not attempt to dispose of residual or unused quantities. Return in the shipping container tagged to indicate a defect, and properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to Liquid Air Corporation for proper disposal. For emergency disposal, contact the closest Liquid Air Corporation location.

## SPECIAL PROTECTION INFORMATION

|  |  |            |
|--|--|------------|
| RESPIRATORY PROTECTION (SPECIFY TYPE)          |  |            |
| Not applicable                                 |  |            |
| VENTILATION                                    | LOCAL EXHAUST                                  | SPECIAL    |
| To prevent accumulation above 23 molar percent | To prevent accumulation above 23 molar percent | See page 4 |
|  | MECHANICAL (GEN.)                              | OTHER      |
|  | See page 4                                     | See page 4 |
| PROTECTIVE GLOVES                              |  |            |
| As required, any material                      |  |            |
| EYE PROTECTION                                 |  |            |
| Safety goggles or glasses                      |  |            |
| OTHER PROTECTIVE EQUIPMENT                     |  |            |
| Safety shoes, safety shower                    |  |            |

## SPECIAL PRECAUTIONS\*

|  |   |
|--|---|
| SPECIAL LABELING INFORMATION   |   |
| DOT Shipping Name: Oxygen, compressed  | DOT Hazard Class: Nonflammable gas; Class 2, Division 2.2 |
| DOT Shipping Label: Oxidizer or Oxygen   | I.D. No.: UN 1072   |
| SPECIAL HANDLING RECOMMENDATIONS   |   |
| Use only in well-ventilated areas. Valve protection caps and valve outlet threaded plugs must remain in place unless cylinder is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3,000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder. Close cylinder valve after each use and when cylinder is empty. |   |
| For additional handling recommendations see References on last page.   |   |

\*Various Government agencies (i.e. Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which may not be contained herein. The customer or user of this product should be familiar with these regulations.

**SPECIAL STORAGE RECOMMENDATIONS**

Protect cylinders from physical damage. Store in clean, cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits, away from combustibles and away from full or empty stored cylinders which contain flammable products. Do not allow the temperature where cylinders are stored to exceed 125°F (52°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in - first out" inventory system to prevent full cylinders being stored for excessive periods of time.

For additional storage recommendations see Reference section on this page.

**SPECIAL PACKAGING RECOMMENDATIONS**

Carbon steels and low alloy steels are acceptable for use at lower pressures (less than 1,000 psig). For higher (to 2900 psig) pressure applications, use stainless steels, copper and its alloys, nickel and its alloys, brass, bronze, silicon alloys, Monel®, Inconel®, or beryllium. Lead and silver or lead and tin alloys are good gasketing materials. Teflon® and Kel-F® are the preferred nonmetal gaskets. CGA valve outlet for oxygen gas is CGA 540 (to 3,000 psig); CGA 870 for medical gas pin-indexed yoke connection.

Special Note: It should be recognized that the ignition temperature of metals and nonmetals in pure oxygen service decreases with increasing oxygen pressure. For additional information refer to L'Air Liquide's Encyclopedie des Gaz. It is also important to avoid high gas velocities which tend to increase the possibility of ignition by friction, impact and static discharge. Refer to Compressed Gas Association Pamphlet G-4.4 for velocity limits.

**OTHER RECOMMENDATIONS OR PRECAUTIONS**

Oxygen **must not** be used as a substitute for compressed air in pneumatic equipment since this type generally contains flammable lubricants. Do not use oil or grease to lubricate the valve on an oxygen cylinder or regulator. Equipment to contain oxygen must be "cleaned for oxygen service" and rated for cylinder pressure. See Compressed Gas Association Pamphlets G-4 and G-4.1. Open and close cylinder valve slowly. Ground equipment to eliminate buildup of static charge. Keep sparks, flame and lighted cigarettes away from cylinders and under no circumstances allow a torch flame to come in contact with cylinders, valves, or pressure relief devices. Should the valve outlet of a cylinder become clogged with ice, thaw with warm -- not boiling -- water. Compressed gas cylinders should not be refilled except by qualified suppliers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR). **WHEN USED IN WELDING AND CUTTING:** Read and understand the manufacturer's instructions and the precautionary label on the product. See American National Standard Z49.1 "Safety in Welding and Cutting" published by the American Welding Society, P.O. Box 351040, Miami, Florida 33135 and OSHA Publication 2206 (29CFR1910), U.S. Government Printing Office, Washington, D.C. 20402 for more detail. **NOTE:** Suitability for use as a component in underwater breathing gas mixtures is to be determined by or under the supervision of personnel experienced in the use of underwater breathing gas mixtures and familiar with the effects, methods, frequency and duration of use, hazards, side effects and precautions to be taken.

Use in accordance with Material Safety Data Sheet.

**SPECIAL PROTECTION INFORMATION (SPECIAL, MECHANICAL, OTHER; CONTINUED):**

Where oxygen may be released, provide adequate ventilation to prevent excessive oxygen enrichment of the workplace atmosphere (holding at <23% O<sub>2</sub> by volume is recommended for fire safety). Personnel who have been exposed to high concentrations of oxygen should stay in a well-ventilated or open area for 30 minutes before going into a confined space or near an ignition source.

Safety shoes and safety glasses are recommended when handling cylinders of compressed gas. Clothing that has been overexposed or contaminated with oxygen should be removed and considered unsafe (highly flammable) to wear for at least 30 minutes. If oxygen-enriched clothing catches fire, extinguish the flame under a safety shower; a fire blanket may not be effective in this situation. Use a continuous water spray to soak the clothing of a rescuer who must operate in an oxygen-enriched fire area. Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them.

**REFERENCES**

1. L'Air Liquide Encyclopedie des Gaz. Contact Liquid Air Corporation Corporate Safety Department, 510-977-6500.

2. Compressed Gas Association (CGA) Pamphlet P-1 "Safe Handling of Compressed Gases in Containers"; G-4 "Oxygen"; G-4.1 "Cleaning Equipment for Oxygen Service"; G-4.4 "Industrial Practices for Gaseous Oxygen Transmission and Distribution Piping Systems".

CGA telephone number is 703-979-0900.