

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: NON-FLAMMABLE GAS MIXTURE

Containing One or More of the Following Components in a Nitrogen Balance Gas:

Oxygen, 0-23.5%; Sulfur Dioxide, 0.0005-0.03%

SYNONYMS: Not Applicable

CHEMICAL FAMILY NAME: Not Applicable

FORMULA: Not Applicable

Document Number: 50021

Note: The Material Safety Data Sheet is for this gas mixture supplied in cylinders with 33 cubic feet (935 liters) or less gas capacity (DOT - 39 cylinders). This MSDS has been developed for various gas mixtures with the composition of components within the ranges listed in Section 2 (Composition and Information on Ingredients). Refer to the product label for information on the actual composition of the product.

| | |
|--------------------------------------|--|
| PRODUCT USE: | Calibration of Monitoring and Research Equipment |
| SUPPLIER/MANUFACTURER'S NAME: | CALGAZ |
| ADDRESS: | 821 Chesapeake Drive Cambridge, MD 21613 |
| EMERGENCY PHONE: | CHEMTREC: 1-800-424-9300 |
| BUSINESS PHONE: | 1-410-228-6400 |
| | General MSDS Information: 1-713/868-0440 |
| | Fax on Demand: 1-800/231-1366 |

2. COMPOSITION and INFORMATION ON INGREDIENTS

| CHEMICAL NAME | CAS # | mole % | EXPOSURE LIMITS IN AIR | | | | | |
|----------------|-----------|--------------|---|-------------|------------------------------------|-------------------------------|----------------------|---|
| | | | ACGIH-TLV | | OSHA | | NIOSH IDLH ppm | OTHER ppm |
| | | | TWA ppm | STEL ppm | TWA ppm | STEL ppm | | |
| Oxygen | 7782-44-7 | 0-23.5% | There are no specific exposure limits for Oxygen. Oxygen levels should be maintained above 19.5%. | | | | | |
| Sulfur Dioxide | 7446-09-5 | 0.0005-0.03% | 2 | 5 | 5 2 (Vacated 1989 PEL) | 5 (Vacated 1989 PEL) | 100 | NIOSH RELS: TWA = 2 STEL = 5 DFG MAKs: TWA = 0.5 PEAK = 1•MAK, 15 min., momentary value, 1 hr interval, (ceiling) DFG MAK Pregnancy Risk Classification: C Carcinogen: IARC-3, TLV-A4 |
| Nitrogen | 7727-37-9 | Balance | There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%. | | | | | |

NE = Not Established. See Section 16 for Definitions of Terms Used.
NOTE (1): ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This gas mixture has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This gas mixture is colorless and has a distinct sulfur-like odor (due to the presence of Sulfur Dioxide). Sulfur Dioxide is irritating to the respiratory system, the skin, and eyes in relatively low concentrations. Additionally, releases of this gas mixture may produce oxygen-deficient atmospheres (especially in confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this gas mixture is by inhalation.
INHALATION: Due to the small size of an individual cylinder of this gas mixture, no unusual health effects from over-exposure to the product are anticipated under routine circumstances of use. The chief health hazard associated with this gas mixture is the potential for over-exposure to Sulfur Dioxide (especially if this gas mixture is used in an enclosed area or confined space). Exposure to Sulfur Dioxide gas in low concentrations is irritating to the mucous membranes of the eyes, nose, throat, and lungs (due to the formation of sulfurous acid when it comes into contact with moist tissues or moist air). Over-exposure to Sulfur Dioxide may also result in dryness and irritation of the nose and throat, choking, coughing, and bronchospasm. Severe over-exposure may cause pulmonary edema, airway obstruction, respiratory arrest, unconsciousness, and death through systemic acidosis. The symptoms associated with exposure to specific Sulfur Dioxide concentrations are as follows:

CONCENTRATION OF

SULFUR DIOXIDE

1 ppm (1-6 hr duration)
5 ppm (10-30 min duration)
8 ppm (20 min duration)
20 ppm
500 ppm

OBSERVED EFFECT

Reversible decrease in lung function.
Constriction of bronchiole tubes.
Reddening of the throat and mild nose and throat irritation.
For most persons exposed, this level is objectionably irritating.
At this level, Sulfur Dioxide is so objectionable, that it is difficult to inhale a single deep breath without irritation.
This gas mixture contains a maximum of 300 ppm Sulfur Dioxide. The higher concentration values here are presented to address the complete health effects which have been observed for humans after exposure to Sulfur Dioxide.

NOTE:

The onset of the symptoms of pulmonary edema can be delayed until hours or days after the exposure. All of the symptoms described above may be aggravated by physical exertion. As a result of severe over-exposures to Sulfur Dioxide, permanent lung injury may occur. Prolonged or repeated over-exposures to Sulfur Dioxide may cause impaired lung function, bronchitis, hacking cough, nasal irritation and discharge, increased fatigue, alteration in the senses of taste and smell, dental erosion and gum disorders. Additionally, when this gas mixture contains less than 19.5% Oxygen and is released in a small, poorly-ventilated area (i.e. an enclosed or confined space, an oxygen-deficient environment may occur. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of over-exposure, death may occur. The effects associated with various levels of oxygen are as follows:

CONCENTRATION OF OXYGEN

12-16% Oxygen:

10-14% Oxygen:
6-10% Oxygen:
Below 6%:

OBSERVED EFFECT

Breathing and pulse rate increased, muscular coordination slightly disturbed.
Emotional upset, abnormal fatigue, disturbed respiration.
Nausea, vomiting, collapse, or loss of consciousness.
Convulsive movements, possible respiratory collapse, and death.

| HAZARDOUS MATERIAL IDENTIFICATION SYSTEM | | | |
|--|-------------|-------|------|
| HEALTH HAZARD | (BLUE) | | 3 |
| FLAMMABILITY HAZARD | (RED) | | 0 |
| PHYSICAL HAZARD | (YELLOW) | | 0 |
| PROTECTIVE EQUIPMENT | | | |
| EYES | RESPIRATORY | HANDS | BODY |
| See Section 8 | | | |
| For Routine Industrial Use and Handling Applications | | | |

3. HAZARD IDENTIFICATION (continued)

SKIN and EYE CONTACT: Due to the presence of Sulfur Dioxide, this gas mixture may be irritating to the skin (especially in a moist environment). Sulfur Dioxide may react with moisture on the skin. Symptoms of skin over-exposure may include scratchiness, pain, and redness. If Sulfur Dioxide contaminates the eyes, damage to eye tissue will result in pain, inflammation, and potentially, blindness.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Over-exposure to this gas mixture may cause the following health effects:

ACUTE: Due to the small size of the individual cylinder of this gas mixture, no unusual health effects from exposure to the product are anticipated under routine circumstances of use. The chief health hazard associated with this gas mixture is the potential for over-exposure to Sulfur Dioxide (especially if this gas mixture is used in an enclosed area or confined space). This gas mixture can be irritating and damaging to the respiratory system, the skin, and eyes. If inhaled, irritation of the respiratory system may occur, with coughing and breathing difficulty. Symptoms of skin over-exposure may include scratchiness, pain, and redness. If Sulfur Dioxide contaminates the eyes, damage to eye tissue will result in pain, inflammation, and potentially, blindness. Over-exposure to this gas may be fatal.

CHRONIC: Due to the presence of Sulfur Dioxide, prolonged or repeated over-exposures to this gas mixture may cause respiratory problems, bronchitis, hacking cough, nasal irritation and discharge, increased fatigue, alteration in the senses of taste and smell. Repeated over exposures to Sulfur Dioxide can also result in dental erosion and gum disorders. Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may affect the heart and nervous system.

TARGET ORGANS: ACUTE: Respiratory system, skin, eyes. CHRONIC: Skin, respiratory system, heart, teeth.

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS GAS MIXTURE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn.

No unusual health effects are anticipated after exposure to this gas mixture, due to the small cylinder size. If any adverse symptom develops after over-exposure to this gas mixture, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary. Victim(s) who experience any adverse effect after over-exposure to this gas mixture must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).

SKIN EXPOSURE: If irritation of the skin develops after exposure to this gas mixture, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention.

EYE EXPOSURE: If irritation of the eye develops after exposure to this gas mixture, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Seek medical assistance immediately, preferably an ophthalmologist.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Acute or chronic respiratory conditions may be aggravated by over-exposure to the components of this gas mixture. Additionally, due to the presence of Sulfur Dioxide, skin and eye conditions may be aggravated by over-exposures to this gas mixture.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms; eliminate exposure. Be observant for signs of pulmonary edema.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): Not applicable.

Upper (UEL): Not applicable

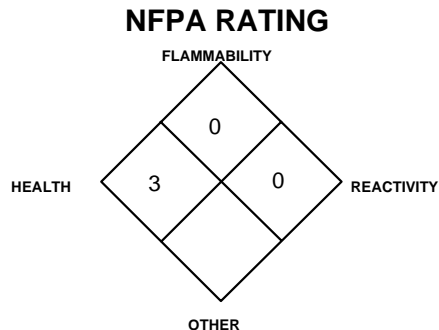
FIRE EXTINGUISHING MATERIALS: Non-flammable gas mixture. Use extinguishing media appropriate for surrounding fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Due to the presence of Sulfur Dioxide, this gas mixture is extremely irritating to the respiratory system, skin, and eyes; this mixture may pose a severe health hazard to firefighters. Sulfur Dioxide can react with water to form a corrosive solution of sulfurous acid. Sulfurous acid can corrode metal and cause injury to firefighters. If cylinders are exposed to heat, the cylinder may rupture or burst and release the contents.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. In the event of fire, cool containers of this gas mixture with water to prevent failure. Use a water spray or fog to reduce or direct vapors. Do not direct a water spray at the source of a release. Water spray should be used with care. If this gas mixture is involved in a fire, fire run-off water should be contained to prevent possible environmental damage. It may be prudent to remove potentially heat-exposed cylinders from the area surrounding a fire, if it is safe for firefighters to do so.



6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Due to the small size and content of the cylinder, an accidental release of this gas mixture presents significantly less risk of Sulfur-Dioxide over-exposure, development of an oxygen deficient environment, and other safety hazards than a similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in which other chemicals are potentially involved, evacuate immediate area. Such releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel. Allow the gas mixture to dissipate. Monitor the surrounding area for Sulfur Dioxide levels and for Oxygen content. A colorimetric tube is available for Sulfur Dioxide. The atmosphere must have exposure levels of Sulfur Dioxide below those listed in Section 2 (Composition and Information on Ingredients) and at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus.

If leaking incidentally from the cylinder, contact your supplier.

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES: Be observant for the odor of sulfur; this odor is indicative of a potential over-exposure to Sulfur Dioxide. Do not attempt to repair, adjust, or in any other way modify cylinders containing this gas mixture. If there is a malfunction or another type of operational problem, contact the nearest distributor immediately. Eye wash stations/safety showers should be near areas where this gas mixture is used or stored. All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a release. All work practices should minimize releases of Sulfur-Dioxide-containing gas mixtures.

STORAGE AND HANDLING PRACTICES: Cylinders should be firmly secured to prevent falling or being knocked-over. Cylinders must be protected from the environment, and preferably kept at room temperature (approximately 21°C [70°F]). Cylinders should be stored in dry, well-ventilated areas, away from sources of heat, ignition, and direct sunlight. Protect cylinders against physical damage.

Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. These cylinders are not refillable. **WARNING! Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.**

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: WARNING! Compressed gases can present significant safety hazards. During cylinder use, use equipment designed for these specific cylinders. Ensure all lines and equipment are rated for proper service pressure.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: No special ventilation systems or engineering controls are needed under normal circumstances of use. As with all chemicals, use this gas mixture in well-ventilated areas. If this gas mixture is used in a poorly-ventilated area, install automatic monitoring equipment to detect the levels of Sulfur Dioxide and Oxygen.

RESPIRATORY PROTECTION: Maintain exposure levels of Sulfur Dioxide below the levels listed in Section 2 (Composition and Information on Ingredients) and Oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if Sulfur Dioxide levels exceed exposure limits and if Oxygen level is below 19.5% or during emergency response to a release of this gas mixture. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998). The following NIOSH respiratory protection recommendations for Sulfur Dioxide are provided for further information.

SULFUR DIOXIDE CONCENTRATION

Up to 20 ppm
Up to 50 ppm
Up to 100 ppm

RESPIRATORY EQUIPMENT

Chemical Cartridge Respirator with cartridge(s); or Supplied Air Respirator (SAR).
Powered Air-Purifying Respirator (PAPR) with cartridge(s); or SAR operated in continuous-flow mode.
Full-Facepiece Chemical Cartridge Respirator with cartridge(s); or gas mask with canister; or powered air-purifying respirator with a tight-fitting facepiece and cartridge(s); or full-facepiece Self-Contained Breathing Apparatus (SCBA); or full-facepiece SAR; or SAR with a tight-fitting facepiece operated in a continuous-flow mode.

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA. The IDLH concentration for Sulfur Dioxide is 100 ppm.

EYE PROTECTION: Safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards.

HAND PROTECTION: No special protection is needed under normal circumstances of use. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: No special protection is needed under normal circumstances of use. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR 1910.136.

9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for Nitrogen, the main component of this gas mixture.

GAS DENSITY @ 32°F (0°C) and 1 atm: 0.072 lbs/ft³ (1.153 kg/m³)

FREEZING/MELTING POINT @ 10 psig: -210°C (-345.8°F)

SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 0.906

SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm: 0.023

EVAPORATION RATE (nBuAc = 1): Not applicable.

ODOR THRESHOLD: Not applicable.

VAPOR PRESSURE @ 70°F (21.1°C) psig: Not applicable.

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

BOILING POINT: -195.8°C (-320.4°F)

pH: Not applicable.

MOLECULAR WEIGHT: 28.01

EXPANSION RATIO: Not applicable.

SPECIFIC VOLUME (ft³/lb): 13.8

The following information is for the gas mixture.

APPEARANCE, ODOR AND COLOR: This gas mixture is colorless and has a distinct, sulfur-like odor.

HOW TO DETECT THIS SUBSTANCE (warning properties): The odor is a distinctive characteristic of this gas mixture. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.

10. STABILITY and REACTIVITY

STABILITY: Normally stable in gaseous state.

DECOMPOSITION PRODUCTS: Sulfur Dioxide will react with water or moist air to form sulfurous acid. The other components of this gas mixture do not decompose, per se, but can react with other compounds in the heat of a fire.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Titanium will burn in Nitrogen (the main component of this gas mixture). Lithium reacts slowly with Nitrogen at ambient temperatures. The Sulfur Dioxide component of this gas mixture is not compatible with the following materials: strong bases, strong oxidizers, powdered metals, metal oxides, interhalogens, metal acetylides, sodium hydride, silver azide, cesium azide, fluorine, zinc, zinc compounds.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are available for the components of this gas mixture:

NITROGEN:

There are no specific toxicology data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the environment.

SULFUR DIOXIDE:

Eye, rabbit = 6 ppm/4 hours/32 days; mild effects
Mutation in Microorganisms System Test = 10 mmol/L

DNA damage System Test (human, lymphocyte) = 5700 ppb

TCLo (inhalation, mouse) = 32 ppm/ 24 hours (female 7-28 day post); reproductive effects.

TCLo (inhalation, mouse) = 25 ppm/7 hours (female 6-15 days post); teratogenic effects

TCLo (inhalation, mouse) = 500 ppm/5 minutes/30 weeks; equivocal tumorigenic data

LCLo (inhalation, human) = 1000 ppm/10 minutes; pulmonary effects

TCLo (inhalation, human) = 3 ppm/5 days; pulmonary effected

TCLo (inhalation, human) = 12 ppm/1 hour; pulmonary effects

SULFUR DIOXIDE (continued):

LCLo (inhalation, human) = 3000 ppm/5 minutes

LC50 (inhalation, rat) = 2520 ppm/1 hour

LC50 (inhalation, mouse) = 3000 ppm/30 minutes

LCLo (inhalation, guinea pig) = 1039 ppm/24 hours

LCLo (inhalation, frog) = 1 pph/ 15 minutes

SHORT-TERM INHALATION STUDIES: Most studies indicate that high concentrations of Sulfur Dioxide effect the mechanics of respiration. A dose-related narrowing of the bronchiole tubes leading to bronchio-constriction was seen in guinea pigs exposed to concentrations of 0.2-100 ppm for 1 hour. Exposure of male mice for up to 72 hours to concentrations around 10 ppm produced nasal cavity injury (runny nose, ciliary loss, fluid accumulation, and tissue death). The effects became more severe as exposure time increased. Less severe effects were seen in the trachea and lungs. Other studies have not been reported any effects after 1-2 hour exposures to less than 1 ppm.

SULFUR DIOXIDE (continued):

LONG-TERM INHALATION STUDIES: Exposure to 5 ppm for 225 days produced pulmonary function changes in dogs. Increased swelling, secretions, and reddening of the trachea, as well as decreased mucosal flow was seen in dogs intermittently exposed to 1 ppm for 12 months. There was no apparent effect on pulmonary function. No adverse effects were seen in guinea pigs exposed for 22 hours day, 7 days a week, for 52 weeks to concentrations of 0.13-5.72 ppm. No adverse effects were seen in monkeys exposed for 78 weeks to 0.14 - 1.28 ppm.

EYE IRRITATION: Temporary clouding of eyes was seen in rabbits, guinea pigs, and mice exposed to 400 ppm for 4 hours. Very severe eye injury in rabbits was produced by a 5-second exposure to a stream of pure sulfur dioxide.

SUSPECTED CANCER AGENT: The components of this gas mixture are listed by agencies tracking the carcinogenic potential of chemical compounds, as follows:

SULFUR DIOXIDE: ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen); IARC-3 (Unclassifiable as to Carcinogenicity in Humans)

The remaining component, Nitrogen, is not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC; therefore, they are not considered to be, nor suspected to be, cancer-causing agents by these agencies.

IRRITANCY OF PRODUCT: Due to the presence of Sulfur Dioxide, this gas mixture can be very irritating to the skin, eyes, and respiratory system.

SENSITIZATION TO THE PRODUCT: The components of this gas mixture are not known to cause sensitization.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this gas mixture and its components on the human reproductive system.

Mutagenicity: No mutagenicity effects have been described for the components of this gas mixture. The Sulfur Dioxide component of this gas mixture has produced mutagenic effects on specific animal tissues exposed to relatively large doses.

Embryotoxicity: No embryotoxic effects have been described for the components of this gas mixture.

11. TOXICOLOGICAL INFORMATION (Continued)

REPRODUCTIVE TOXICITY INFORMATION (continued):

Teratogenicity: No teratogenicity effects have been described for the components of this gas mixture. The Sulfur Dioxide component has produced teratogenic effects during clinical studies on test animals exposed to relatively large doses.

Reproductive Toxicity: No reproductive toxicity effects have been described for the components of this gas mixture.

A **mutagen** is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An **embryotoxin** is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A **teratogen** is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A **reproductive toxin** is any substance which interferes in any way with the reproductive process.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) have not been determined for the components of this gas mixture.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: The gas will be dissipated rapidly in well-ventilated areas. The following environmental data are applicable to the components of this gas mixture.

SULFUR DIOXIDE: Sulfur Dioxide is extremely stable to heat (up to 2000 °C). Complex reactions of Sulfur Dioxide occur in the atmosphere, producing sulfates and other sulfur compounds which contribute to air pollution.

OXYGEN: Water Solubility = 1 volume Oxygen/32 volumes water at 20°C. Log K_{ow} = -0.65

NITROGEN: Water Solubility = 2.4 volumes Nitrogen/100 volumes water at 0°C. 1.6 volumes Nitrogen/100 volumes water at 20°C.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Due to the presence of Sulfur Dioxide in this gas mixture, over-exposed animals would develop respiratory system damage, as well as skin and eye disorders. Because Sulfur Dioxide produces corrosive sulfurous acid upon contact with moisture, plants may be damaged or destroyed

EFFECT OF CHEMICAL ON AQUATIC LIFE: The Sulfur Dioxide component of this gas mixture hydrolyzes to sulfurous acid solution when in contact with water. Sulfurous acid is very soluble in water, and even low concentrations of Sulfur Dioxide or sulfurous acid in water is detrimental to aquatic life. If a release this gas mixture occurs near a body of water, the release may be harmful or fatal to fish and other aquatic life.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Cylinders with undesired residual product may be safely vented outdoors with the proper regulator. For further information, refer to Section 16 (Other Information).

14. TRANSPORTATION INFORMATION

THIS GAS MIXTURE IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (*Oxygen, Nitrogen)*or the gas component with the next highest concentration next to Nitrogen.

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)

UN IDENTIFICATION NUMBER: UN 1956

PACKING GROUP: Not applicable.

DOT LABEL(S) REQUIRED: Non-Flammable Gas

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126

MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101, Appendix B).

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

Note: DOT 39 Cylinders ship in a strong outer carton (overpack). Pertinent shipping information goes on the outside of the overpack. DOT 39 Cylinders do not have transportation information on the cylinder itself.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This gas is considered as Dangerous Goods, per regulations of Transport Canada.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (*Oxygen, Nitrogen)*or the gas component with the next highest concentration next to Nitrogen.

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)

UN IDENTIFICATION NUMBER: UN 1956

PACKING GROUP: Not Applicable

HAZARD LABEL: Class 2.2 (Non-Flammable Gas)

SPECIAL PROVISIONS: None

EXPLOSIVE LIMIT AND LIMITED QUANTITY INDEX: 0.12

ERAP INDEX: None

PASSENGER CARRYING SHIP INDEX: None

PASSENGER CARRYING ROAD VEHICLE OR PASSENGER CARRYING RAILWAY VEHICLE INDEX: 75

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 121

NOTE: Shipment of compressed gas cylinders via Public Passenger Road Vehicle is a violation of Canadian law (Transport Canada Transportation of Dangerous Goods Act, 1992).

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The components of this gas mixture are subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

| COMPONENT | SARA 302 (40 CFR 355, Appendix A) | SARA 304 (40 CFR Table 302.4) | SARA 313 (40 CFR 372.65) |
|----------------|--------------------------------------|----------------------------------|-----------------------------|
| Sulfur Dioxide | YES | YES | NO |

U.S. SARA SECTION 302 EXTREMELY HAZARDOUS SUBSTANCE THRESHOLD PLANNING QUANTITY: Sulfur Dioxide = 500 lb (227 kg)

U.S. SARA SECTION 304 EXTREMELY HAZARDOUS SUBSTANCE REPORTABLE QUANTITY: Sulfur Dioxide = 500 lb (227 kg)

U.S. TSCA INVENTORY STATUS: The components of this gas mixture are listed on the TSCA Inventory.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

OTHER U.S. FEDERAL REGULATIONS:

- Sulfur Dioxide is subject to the reporting requirements of CFR 29 1910.1000. Sulfur Dioxide is listed on Table Z.1.
- Sulfur Dioxide is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 5,000 lb (2270 kg).
- Sulfur Dioxide is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 5,000 lb (2270 kg).
- Sulfur Dioxide is listed in Appendix A as a highly hazardous chemical, per 29 CFR 1910.119: Process Safety Management of Highly Hazardous Chemicals. The threshold quantity for Sulfur Dioxide under this regulation is 1000 lb (454 kg).
- This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
- Nitrogen and Oxygen are not listed as Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Sulfur Dioxide is listed under this regulation in Table 1 as a Regulated Substance (Toxic Substance), in quantities of 5000 lb (2270 kg) or greater. The basis for listing for Sulfur Dioxide is by mandate by Congress and as an extremely hazardous substance, with a vapor pressure of 10 mmHg or greater.

15. REGULATORY INFORMATION (Continued)

U.S. STATE REGULATORY INFORMATION: The components of this gas mixture are covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: Sulfur Dioxide.

California - Permissible Exposure Limits for Chemical Contaminants: Nitrogen, Sulfur Dioxide.

Florida - Substance List: Oxygen, Sulfur Dioxide.

Illinois - Toxic Substance List: Sulfur Dioxide.

Kansas - Section 302/313 List: Sulfur Dioxide.

Michigan - Critical Materials Register: No.

Massachusetts - Substance List: Oxygen, Sulfur Dioxide.

Minnesota - List of Hazardous Substances: Sulfur Dioxide.

Missouri - Employer Information/Toxic Substance List: Sulfur Dioxide.

New Jersey - Right to Know Hazardous Substance List: Oxygen, Nitrogen, Sulfur Dioxide.

North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.

Pennsylvania - Hazardous Substance List: Oxygen, Nitrogen, Sulfur Dioxide.

Rhode Island - Hazardous Substance List: Oxygen, Nitrogen Sulfur Dioxide.

Texas - Hazardous Substance List: Sulfur Dioxide.

West Virginia - Hazardous Substance List: Sulfur Dioxide.

Wisconsin - Toxic and Hazardous Substances: Sulfur Dioxide.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): No component of this gas mixture is on the California Proposition 65 lists.

ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL INVENTORY STATUS: The components of this gas mixture are listed on the DSL Inventory.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: The components of this gas mixture are not on the CEPA Priorities Substances List.

CANADIAN WHMIS INFORMATION: This gas mixture is categorized as a Controlled Product, Hazard Classes A and D2B, as per the Controlled Product Regulations.

16. OTHER INFORMATION

INFORMATION ABOUT DOT-39 NRC (Non-Refillable Cylinder) PRODUCTS

DOT 39 cylinders ship as hazardous materials when full. Once the cylinders are relieved of pressure (empty) they are not considered hazardous material or waste. Residual gas in this type of cylinder is not an issue because toxic gas mixtures are prohibited. Calibration gas mixtures typically packaged in these cylinders are Nonflammable n.o.s., UN 1956. A small percentage of calibration gases packaged in DOT 39 cylinders are flammable or oxidizing gas mixtures.

For disposal of used DOT-39 cylinders, it is acceptable to place them in a landfill if local laws permit. Their disposal is no different than that employed with other DOT containers such as spray paint cans, household aerosols, or disposable cylinders of propane (for camping, torch etc.). When feasible, we recommended recycling for scrap metal content. CALGAZ will do this for any customer that wishes to return cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival. Scrapping cylinders involves some preparation before the metal dealer may accept them. We perform this operation as a service to valued customers who want to participate.

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to 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 make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information about the handling of compressed gases can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0900.

P-1 "Safe Handling of Compressed Gases in Containers"

AV-1 "Safe Handling and Storage of Compressed Gases"

"Handbook of Compressed Gases"

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AIR LIQUIDE

This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this gas mixture. To the best of CALGAZ knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this gas mixture is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.