CHEMICAL NAME; CLASS: NON-FLAMMABLE GAS MIXTURE

Containing One or More of the Following Components in a Nitrogen or Helium Balance Gas:
- Oxygen, 0-23.5%; Carbon Dioxide, 0.005-50.0%; Methane; 0-2.5%

SYNONYMS: Not Applicable

CHEMICAL FAMILY NAME: Not Applicable

FORMULA: Not Applicable

Document Number: 50015

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, LLC

ADDRESS: 821 Chesapeake Drive

Cambridge, MD 21613

EMERGENCY PHONE: CHEMTREC: 1-800-424-9300

BUSINESS PHONE: 1-410-228-6400

General MSDS Information 1-713/668-0440

Fax on Demand: 1-800/231-1366

1. PRODUCT IDENTIFICATION

2. COMPOSITION and INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>CHEMICAL NAME</th>
<th>CAS #</th>
<th>mole %</th>
<th>EXPOSURE LIMITS IN AIR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACGIH TLV</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>124-38-9</td>
<td>0.005 - 50.0%</td>
<td>5000</td>
</tr>
<tr>
<td>Oxygen</td>
<td>7780-44-7</td>
<td>0 - 23.5%</td>
<td>There are no specific exposure limits for Oxygen. Oxygen levels should be maintained above 19.5%</td>
</tr>
<tr>
<td>Nitrogen/Helium</td>
<td>7727-37-9/ 7440-59-7</td>
<td>0 - 2.5%</td>
<td>There are no specific exposure limits for Nitrogen or Helium. These gases are simple asphyxiants (SA). Oxygen levels should be maintained above 19.5%</td>
</tr>
</tbody>
</table>

3. HAZARD IDENTIFICATION

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this gas mixture is by inhalation. Inhalation of Carbon Dioxide can increase respiration and heart rate, possibly resulting in circulatory insufficiency (which may lead to coma and death). At concentrations between 2-10%, Carbon Dioxide can cause nausea, dizziness, headache, mental confusion, increased blood pressure and respiratory rate. If the concentration of Carbon Dioxide reaches 10% or more, suffocation can occur within minutes. 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.

3.1 HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

3.2 HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

4. HAZARD IDENTIFICATION

Carbon Dioxide initially stimulates respiration and then causes respiratory depression. High concentrations result in narcosis. Symptoms in humans are as follows:

- **Concentration above 19.5%:**
  - **Breathing rate increases to approximately four times normal rate, symptoms of intoxication become evident and slight choking may be felt.**
  - **At concentrations between 2-10%, Carbon Dioxide can cause nausea, dizziness, headache, mental confusion, increased blood pressure and respiratory rate. If the concentration of Carbon Dioxide reaches 10% or more, suffocation can occur within minutes. 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.**

5. PROTECTIVE EQUIPMENT

For Routine Industrial Use and Handling Applications

- **Face Protection:** See Section 8
- **Body Protection:** See Section 8

6. HEALTH HAZARD (RED) 0

7. FLAMMABILITY HAZARD (YELLOW) 0

8. PHYSICAL HAZARD (RED) 0

9. PROTECTIVE EQUIPMENT

See Section 8

For Routine Industrial Use and Handling Applications

Additional guidelines are provided for routine industrial use and handling applications.
SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: WARNING!

- Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.
- Convulsive movements, possible respiratory collapse, and death.
- Contact with skin or eyes: Exposure to high concentrations of the Carbon Dioxide component of this gas mixture may cause eye irritation with symptoms such as pain, redness, and tearing. Prolonged contact of high concentrations of Carbon Dioxide with the eyes can cause damage to the retinal ganglion cells.

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. Inhalation of high concentrations of Carbon Dioxide (a component of this gas mixture) can cause nausea, dizziness, headache, nervous system depression, respiratory arrest, and death.

**Chronic:** Chronic exposure to oxygen-deficient atmospheres (below 19.5% oxygen in air) is the potential for exposure to oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, ringing in ears, headaches, shortness of breath, wheezing, headache, dizziness, indigestion, nausea, unconsciousness, and death. The skin of a victim of over-exposure may have a blue color.

**TARGET ORGANS:** ACUTE: Respiratory system. CHRONIC: Heart, central nervous system.

**MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:**
- Acute or chronic respiratory conditions may be aggravated by over-exposure to the components of this gas mixture.
- Additionally, over-exposure to Carbon Dioxide (a component of this gas mixture) may aggravate eye disorders and central nervous system conditions.

**RECOMMENDATIONS TO PHYSICIANS:**
- Administer oxygen, if necessary; treat symptoms and eliminate exposure.

**5. FIRE-FIGHTING MEASURES**

**Miscellaneous: Non-flammable gas mixture.**

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** This gas mixture is not flammable; however, cylinders, when involved in fire, may rupture or burn in the heat of the fire. Pressure in a container can build-up due to heat and it may rupture if pressure relief devices should fail to function.

**Explosion Sensitivity to Mechanical Impact:** Not sensitive.

**Explosion Sensitivity to Static Discharge:** Not sensitive.

**SPECIAL FIRE-FIGHTING PROCEDURES:** Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment.

**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 an oxygen-deficient atmosphere 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. If necessary, monitor the surrounding area (and the original area of the release) for Carbon Dioxide and oxygen. Carbon Dioxide and oxygen should not be above background levels and Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area.

**7. HANDLING and USE**

**WORK PRACTICES AND HYGIENE PRACTICES:** Be aware of any signs of dizziness or fatigue, especially if work is done in a poorly ventilated area; exposures to fatal concentrations of this gas mixture could occur without any significant warning symptoms, due to carbon dioxide over-exposure and oxygen deficiency. Do not attempt to repair, adjust, or in any other way modify the cylinders containing this gas mixture. If there is a malfunction or another type of operational problem, contact nearest distributor immediately.

**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:**
- 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 CONTAINED 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 Carbon Dioxide and Oxygen.

**RESPIRATORY PROTECTION:** No special respiratory protection is required under normal circumstances of use. Use supplied air respiratory protection if the level of Carbon Dioxide exceeds exposure limits presented in Section 2 (Composition and Information of Ingredients) and oxygen levels are below 19.5% of the ambient atmospheric oxygen content 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 and applicable standards of Canadian Provinces. Oxygen levels below 19.16.33% are considered IDLH by OSHA. In such atmospheres, use 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).
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: 0.0716 lbs/ft³ (1.153 kg/m³)
FREQUENCY/MELTING POINT @ 10 psig: -210°C (-345.8°F)
SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 0.968
SOLUBILITY IN WATER vol/mol at 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/ROIL DISTRIBUTION: Not applicable.

BOILING POINT - 206.8°C (-421.6°F)
PH: Not applicable.
MOLECULAR WEIGHT: 4.00
EXPANSION RATIO: Not applicable.
SPECIFIC VOLUME (ft³/lb): 96.7

The following information is for Helium, a main component of this gas mixture.

GAS DENSITY @ 32°F (0°C) and 1 atm: 0.0103 lbs/ft³ (0.0156 kg/m³)
FREQUENCY/MELTING POINT @ 10 psig: Not Applicable.
SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 0.1381
SOLUBILITY IN WATER vol/mol at 32°F (0°C) and 1 atm: 0.0094
EVAPORATION RATE (nBuAc = 1): Not applicable.
ODOR THRESHOLD: Not applicable. Odorless.
VAPOR PRESSURE @ 70°F (21.1°C) (psig): Not applicable.
COEFFICIENT WATER/ROIL DISTRIBUTION: Not applicable.
COEFFICIENT WATER/ROIL DISTRIBUTION: Not applicable.

The following information is available for the gas mixture.

APPEARANCE AND COLOR: This gas mixture is a colorless, odorless gas.

HOW TO DETECT THIS SUBSTANCE (warning properties): There are no unusual warning properties associated with a release of this gas mixture.

10. STABILITY and REACTIVITY

STABILITY: Normally stable in gaseous state. Moisture in the air could lead to the formation of carbonic acid from Carbon Dioxide.

DECOMPOSITION PRODUCTS: Methane, a component of this gas mixture, will thermally decompose in air to generate carbon monoxide and carbon dioxide. The other components of this gas mixture do not decompose, per se, but may react with other compounds in the heat of a fire.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Titanium will burn in the Nitrogen component of this gas mixture. Lithium reacts slowly with nitrogen at ambient temperatures. The Methane component of this gas mixture is also incompatible with strong oxidizers (i.e. chlorine, bromine pentfluoride, oxygen difluoride, and nitrogen trifluoride). The Carbon Dioxide component of this gas mixture, will ignore and explode when heated with powdered aluminum, beryllium, cerium alloys, chromium, magnesium-aluminum alloys, manganese, thorium, titanium, and zirconium. In the presence of moisture, Carbon Dioxide will ignite with cesium oxide. Metal acetylides will also ignite and explode on contact with Carbon Dioxide.

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 toxicity data are available for the components of this gas mixture:

CARBON DIOXIDE: This gas is a simple asphyxiant with physiological effects at high concentration.
TCLO (inhalation, rat) = 6 hph/24 hours; reproductive and teratogenic effects
LCLo (inhalation, human) = 9 hph/5 minutes
LCC (inhalation, mammal) = 90,000 ppm/5 minutes

HELIUM: There are no specific toxicity data for Helium. Helium is a simple asphyxiant, which acts to displace oxygen in the environment.
HELIUM: There are no specific toxicity data for Helium. Helium is a simple asphyxiant, which acts to displace oxygen in the environment.
NITROGEN: There are no specific toxicity data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the environment.
SUSPECTED CANCER AGENT: The components of this gas mixture are not found on the following lists: FEDERAL OSHA 2 LIST, HTP, CAL/OSHA, and IARC; therefore, they are not considered to be, nor suspected to be, cancer-causing agents by these agencies.
IRRITANT OF PROTECTION: This gas mixture is not irritating; however, contact with rapidly expanding gases can cause frostbite to exposed tissue.
SENSITIZATION TO THE PRODUCT: The components of this gas mixture are not known to be sensitizers.

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.
Embryotoxicity: No embryotoxic effects have been described for the components of this gas mixture.
Teratogenicity: This gas mixture is not expected to cause teratogenic effects in humans. Clinical studies involving test animals exposed to high concentrations of Carbon Dioxide indicate teratogenic effects.
Reproductive Toxicity: This gas mixture is not expected to cause adverse reproductive effects in humans. Clinical studies involving test animals exposed to high concentrations of Carbon Dioxide indicate reproductive effects. A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxic 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 toxic is any substance which interferes in any way with the reproductive process.

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

12. ECOLOGICAL INFORMATION

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

OXYGEN: Water Solubility = 1 volume Oxygen/52 volumes water at 20°C. Log Kow = 0.85
NITROGEN: Water Solubility = 2.4 volumes Nitrogen/100 volumes water at 20°C. 1.6 volumes Nitrogen/100 volumes water at 20°C.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: No evidence is currently available on this gas mixture’s effects on plant and animal life.
EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on this gas mixture’s effects on aquatic life.

13. DISPOSAL CONSIDERATIONS
PREPARING WASTES FOR DISPOSAL: Compressed gases, n.o.s. ("Oxygen, Nitrogen") or the gas component with the next highest concentration next to Nitrogen.

14. TRANSPORTATION INFORMATION

THIS MATERIAL 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.
14. TRANSPORTATION INFORMATION (Continued)

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)
UN IDENTIFICATION NUMBER: UN 1956
PACKING GROUP: Not applicable.
DOT LABEL(S) REQUIRED: Class 2.2 (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 gases 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). punkent 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 regulation 1.2 of the Transport Canada "Handbook of Compressed Gases"

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for this gas. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

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

OTHER U.S. FEDERAL REGULATIONS:
• Methane is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 10,000 pounds.
• The gas mixture does not contain any Class I or Class II ozone-depleting chemicals (40 CFR part 60).

U.S. STATE REGULATORY INFORMATION:

Florida - Substance List: Nitrogen, Helium, Carbon Dioxide, and Oxygen.

Helium.

California - Permissible Exposure Limits for Chemical Contaminants: Nitrogen, Methane, Carbon Dioxide, Helium.

Missouri - Substance List: Oxygen, Carbon Dioxide, Helium.

Florida - Substance List: Oxygen, Carbon Dioxide, Helium.

Carbon Dioxide, Helium.

New Jersey - Right to Know Hazardous Substance List: Oxygen, Nitrogen, Methane, Carbon Dioxide, Helium.


Rhode Island - Hazardous Substance List: Oxygen, Nitrogen, Methane, Carbon Dioxide, Helium.

Texas - Hazardous Substance List: Carbon Dioxide.

West Virginia - Toxic and Hazardous Substance List: Carbon Dioxide.

Wisconsin - Toxic and Hazardous Substance List: Carbon Dioxide.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65):

The components of this gas mixture are on the Proposition 65 lists.

ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSDL/INVENTORY STATUS: The components of this gas mixture are on the Canadian DSDL Inventory.

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

CANADIAN WHMIS CLASSIFICATION: This gas mixture is categorized as a Controlled Product, Hazard Class A, 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 materials because toxic in this type of cylinder are prohibited. The components of this gas mixture 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 or oxidizing gas mixtures.

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.

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.

"Safe Handling and Storage of Compressed Gases"
"Handbook of Compressed Gases"

PREPARED BY:
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PO Box 3519, La Mesa, CA 91944-3519
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AIR LIQUIDE

NON-FLAMMABLE GAS MIXTURE MSDS - 50015

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EFFECTIVE DATE: APRIL 19, 2005