



MATERIAL SAFETY DATA SHEET

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

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: NONFLAMMABLE GAS MIXTURE

Containing One or More of the Following Components in a Nitrogen

or Helium Balance Gas: Carbon Dioxide, 0.005-50%; Oxygen, 0-23.5%; Methane, 0-2.5%; Carbon Monoxide, 0.0005-1.0%

SYNONYMS: Not Applicable

CHEMICAL FAMILY NAME: Not Applicable

FORMULA: Not Applicable

Document Number: 50057

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
U.S. SUPPLIER/MANUFACTURER'S NAME:	CALGAZ
ADDRESS:	821 Chesapeake Drive Cambridge, MD 21613
BUSINESS PHONE:	1-410-228-6400 (8 a.m. to 5 p.m. U.S. EST)
General MSDS Information:	1-713-868-0440
Fax on Demand:	1-800-231-1366
EMERGENCY PHONE:	
Chemtrec: United States/Canada/Puerto Rico:	1-800-424-9300 [24-hours]
Chemtrec International:	1-703-527-3887 [24-hours]

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH-TLV		OSHA-PEL		NIOSH IDLH ppm	OTHER ppm
			TWA ppm	STEL ppm	TWA ppm	STEL ppm		
Carbon Monoxide	630-08-0	0.0005-1.0%	25	NE	50 35 (Vacated 1989 PEL)	200 [ceiling] (Vacated 1989 PEL)	1200	NIOSH REL: TWA = 35 STEL = 200 (ceiling) DFG MAKs: TWA = 30 PEAK = 1•MAK 15 min., average value, 1 hr interval DFG MAK Pregnancy Risk Classification: B
Methane	74-82-8	0-2.5%	NIC=1000	There are no specific exposure limits for Methane. Methane is a simple asphyxiant (SA).				
Oxygen	7782-44-7	0-23.5%	There are no specific exposure limits for Oxygen.					
Carbon Dioxide	124-38-9	0.0005-50.0%	5000	30,000	5000 10,000 (Vacated 1989 PEL)	30,000 (Vacated 1989 PEL)	40,000	DFG-MAK: 5000 NIOSH REL TWA: 5000 ST: 30000
Helium	7440-59-7	0.0-99.0%	There are no specific exposure limits for Helium. Helium is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					
Nitrogen	7727-37-9	0.0-99.0%	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. NIC = Notice of Intended Change 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 is a colorless gas mixture which is odorless or which has a sharp odor, due to the presence of Carbon Dioxide. A significant, potential hazard associated with releases of this gas mixture is overexposure to Carbon Dioxide or Carbon Monoxide, components of this gas mixture. Inhalation of this gas mixture can cause nausea, dizziness, headache, mental confusion, increased blood pressure and respiratory rate, collapse, and death. Carbon Monoxide is a potential reproductive toxin. This gas mixture may irritate the eyes. Additionally, releases of this gas mixture may produce oxygen-deficient atmospheres (especially in small confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: The most significant route of overexposure 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 overexposure to the product are anticipated under routine circumstances of use. A potential, significant health hazards associated with this gas mixture is the potential for overexposure to Carbon Dioxide. Carbon Dioxide is an asphyxiant and a powerful cerebral vasodilator. If the concentration of Carbon Dioxide reaches 10% or more, suffocation can occur rapidly. Inhalation of concentrations between 2 and 10% can cause nausea, dizziness, headache, mental confusion, increased blood pressure and respiratory rate. Carbon Dioxide initially stimulates respiration and then causes respiratory depression. Inhalation of low concentrations (3-5%) has no known permanent harmful effects.

CONCENTRATION OF CARBON DIOXIDE SYMPTOMS OF EXPOSURE

- 1%: Slight increase in breathing rate.
- 2%: Breathing rate increases to 50% above normal; headache; tiredness.
- 3%: Breathing increases to twice normal rate, becoming labored; weak narcotic effect; impaired hearing; headache; increase in blood pressure and pulse rate.
- 4-5%: Breathing increases to four times normal rate; symptoms of intoxication become evident and slight choking may be felt.
- 5-10%: Characteristic sharp odor noticeable. Very labored breathing, headache, visual impairment and ringing in the ears. Judgment may be impaired, followed by loss of consciousness.
- > 10%: Unconsciousness occurs more rapidly above 10% level. Prolonged exposure to high concentrations may eventually result in death from asphyxiation.

It is also important to note that Inhalation overexposures to atmospheres containing more than the Threshold Limit Value of Carbon Monoxide (25 ppm), another component of this gas mixture, can result in serious health consequences. Carbon Monoxide is classified as a chemical asphyxiant, producing a toxic action by combining with the hemoglobin of the blood and replacing the available oxygen. Through this replacement, the body is deprived of the required oxygen, and asphyxiation occurs.

Since the affinity of carbon monoxide for hemoglobin is about 200-300 times that of oxygen, only a small amount of Carbon Monoxide will cause a toxic reaction to occur. Carbon Monoxide exposures in excess of 50 ppm will produce symptoms of poisoning if breathed for a sufficiently long time. If this gas mixture is released in a small, poorly ventilated area (i.e. an enclosed or confined space), symptoms which may develop include the following:

3. HAZARD IDENTIFICATION (Continued)

CONCENTRATION OF CARBON MONOXIDE

All exposure levels:

200 ppm:

400 ppm:

1,000 -2000 ppm:

200-2500 ppm:

> 2500 ppm:

OBSERVED EFFECT

Overexposure to Carbon Monoxide can be indicated by the lips and fingernails turning bright red.

Slight symptoms (headache, discomfort) after several hours of exposure.

Headache and discomfort experienced within 2-3 hours of exposure.

Within 30 minutes, slight palpitations of the heart occurs. Within 1.5 hours, there is a tendency to stagger.

Within 2 hours, there is mental confusion, headaches, and nausea. Unconsciousness within 30 minutes.

Potential for collapse and death before warning symptoms are produced.

Additionally, releases of this gas mixture may produce oxygen-deficient atmospheres (especially in small confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated. Depending on the specific gas mixture, the health effects of Carbon Dioxide or Carbon Monoxide may develop before asphyxiation occurs.

OTHER POTENTIAL HEALTH EFFECTS: Moisture in the air could lead to the formation of carbonic acid, which can be irritating to the eyes. Contact with the eyes can cause damage to the retinal ganglion cells.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Overexposure 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. Depending on the concentration and duration of exposure, inhalation of this gas mixture may cause nausea, dizziness, visual disturbances, shaking, headache, mental confusion, sweating, reddening of the lips and fingernails, increased heartbeat, and elevated blood pressure and respiratory rate. Severe inhalation overexposures may be fatal, due the effects of Carbon Dioxide, Carbon Monoxide, or asphyxiation. High concentrations of the gas mixture may cause eye irritation.

CHRONIC: Reversible effects on the acid-base balance in the blood, blood pressure, and circulatory system may occur after prolonged exposure to elevated Carbon Dioxide levels. Carbon Monoxide is a potential reproductive toxin. Refer to Section 11 (Toxicological Information) of this MSDS for further information.

TARGET ORGANS: ACUTE: Respiratory system, blood system, cardiovascular system, eyes. CHRONIC: reproductive system, eyes.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM			
HEALTH HAZARD	(BLUE)	2	
FLAMMABILITY HAZARD	(RED)	0	
PHYSICAL HAZARD	(YELLOW)	0	
PROTECTIVE EQUIPMENT			
EYES	RESPIRATORY	HANDS	BODY
See Section 8			
For Routine Industrial Use and Handling Applications			

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 overexposure 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 overexposure 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).

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory conditions and other disorders involving the "Target Organs" (See Section 3, Hazard Identification) may be aggravated by overexposure to this gas mixture. Carbon Monoxide, a component of this gas mixture, can aggravate some diseases of the cardiovascular system, such as coronary artery disease and angina pectoris.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate overexposure. If necessary, treat for Carbon Monoxide poisoning. Hyperbaric oxygen is the most efficient antidote to Carbon Monoxide poisoning, the optimum range being 2-2.5 atm. A special mask, or, preferably, a compression chamber to utilize oxygen at these pressures is required. Avoid administering stimulant drugs.

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.

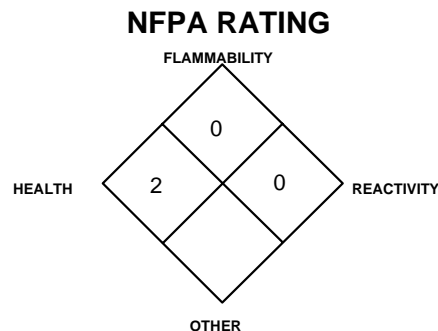
FIRE EXTINGUISHING MATERIALS: Non-flammable gas mixture. Use extinguishing media appropriate for surrounding fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS: This gas mixture is not flammable; however, containers, when involved in fire, may rupture or burst in the heat of the fire.

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 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 and protect people.

For emergency disposal, secure the cylinder and slowly discharge the gas to the atmosphere in a well-ventilated area or outdoors. Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for oxygen, Carbon Dioxide, and Carbon Monoxide. Carbon Dioxide and Carbon Monoxide level must be below exposure level listed in Section 2 (Composition and Information on Ingredients) before non-emergency personnel are allowed to re-enter area.

If leaking incidentally from the cylinder or its valve, contact your supplier.

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this gas mixture could occur without any significant warning symptoms, due to 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: 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 Carbon Dioxide, Carbon Monoxide and oxygen.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (continued)

RESPIRATORY PROTECTION: No special respiratory protection is required under normal circumstances of use. Use supplied air respiratory protection if Carbon Dioxide or Carbon Monoxide level exceeds limits given in Section 2 (Composition Information on Ingredients) and oxygen levels are below 19.5% or unknown 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 19.5% 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). Respiratory selection guidelines from NIOSH for Carbon Dioxide are provided below for information.

CARBON DIOXIDE CONCENTRATION

Up to 40,000 ppm:

Emergency or Planned Entry into Unknown Concentrations or IDLH Conditions: Any SCBA that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode, or any SAR that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive-pressure mode.

Escape: Any appropriate escape-type, SCBA.

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

HAND PROTECTION: Wear leather gloves when handling cylinders. Chemically resistant gloves should be worn when using this gas mixture. 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.

RESPIRATORY PROTECTION

Any Supplied-Air Respirator (SAR), or any Self-Contained Breathing Apparatus (SCBA) with a full facepiece.

Any SCBA that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode, or any SAR that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive-pressure mode.

Any appropriate escape-type, SCBA.

9. PHYSICAL and CHEMICAL PROPERTIES

Unless otherwise specified, the following information is for Carbon Dioxide, a main component of this gas mixture.

GAS DENSITY @ 21.1°C (70°F) and 1 atm: 0.1144 lb/ft³ (1.833 kg/m³)

LIQUID DENSITY @ 21.1°C (70°F) and 838 psig (5778 kPa): 47.35 lb/ft³ (761.3 kg/m³)

FREEZING/MELTING POINT: (sublimation temperature) -78.5°C (-109.3°F)

TRIPLE POINT: -55.6°C (-69.9°F) @ 60.4 psig (416 kPa)

SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 1.522

ODOR THRESHOLD: Not available.

EVAPORATION RATE (nBuAc = 1): Not applicable.

VAPOR PRESSURE @ 21.1°C (70°F) psig: 838 psig (5778 kPa)

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

SUBLIMATION POINT: -78.5°C (-109.3°F)

pH: 3.7 at 1 atm (form carbonic acid)

MOLECULAR WEIGHT: 44.01

EXPANSION RATIO: Not applicable.

SPECIFIC VOLUME (ft³/lb): 8.76

SOLUBILITY IN WATER vol/vol 20°C (68°F) & 1 atm: 0.90

Unless otherwise specified, the following information is for Helium, a main component of this gas mixture.

FREEZING/MELTING POINT (@ 10 psig): Not Applicable.

GAS DENSITY @ 0°C (32°F) and 1 atm: 0.0103 lb./cu ft (1.165 kg/m³)

SPECIFIC GRAVITY (air = 1) @ 21.1°C (70°F): 0.1381

SOLUBILITY IN WATER vol/vol @ 0°C (32°F) and 1 atm: 0.0094

EVAPORATION RATE (nBuAc = 1): Not applicable.

ODOR THRESHOLD: Not applicable. Odorless.

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

BOILING POINT: -268.9°C (-452.1°F)

pH: Not applicable.

MOLECULAR WEIGHT: 4.00

EXPANSION RATIO: Not applicable.

SPECIFIC VOLUME (ft³/lb): 96.7

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

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

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

BOILING POINT: -320.4°F (-195.8°C)

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.

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

pH: Not applicable.

MOLECULAR WEIGHT: 28.01

EXPANSION RATIO: Not applicable.

SPECIFIC VOLUME (ft³/lb): 13.8

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

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

GAS DENSITY @ 32°F (0°C) and 1 atm: 0.083 lb/cu ft (1.326 kg/m³)

FREEZING/MELTING POINT @ 10 psig: -218.8°C (-361.8°F)

SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 1.105

SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm: 0.04.91

EVAPORATION RATE (nBuAc = 1): Not applicable.

ODOR THRESHOLD: Not applicable.

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

BOILING POINT: -183.0°C (-297.4°F)

pH: Not applicable.

MOLECULAR WEIGHT: 32.00

EXPANSION RATIO: Not applicable.

VOLUME (ft³/lb): 12.1

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

The following information is for this gas mixture.

APPEARANCE AND COLOR: This gas mixture is a colorless gas mixture which is odorless or which has a sharp odor, depending on the amount of Carbon Dioxide in the mixture.

HOW TO DETECT THIS SUBSTANCE (warning properties): The odor may be a distinguishing characteristic for mixtures containing high Carbon Dioxide concentrations. Otherwise, there are no unusual warning properties associated with a release of this gas mixture.

10. STABILITY and REACTIVITY

STABILITY: Normally stable in gaseous state.

DECOMPOSITION PRODUCTS: The thermal decomposition products of Methane include carbon oxides. 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. Components of this gas mixture (Carbon Monoxide, Methane) are also incompatible with strong oxidizers (i.e. chlorine, bromine pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride). Due to the presence of Carbon Dioxide, this gas mixture may be incompatible with a variety of metals, alloys, and metal acetylides (e.g., aluminum, chromium, and zirconium). Carbon Dioxide will react with alkaline materials to form carbonates and bicarbonates. Carbon Monoxide is mildly corrosive to nickel and iron (especially at high temperatures and pressures). Helium is inert.

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:

CARBON DIOXIDE:

LCLo (Inhalation-Human) 9 pph/5 minutes

LCLo (Inhalation-Mammal-species unspecified) 90000 ppm/5 minutes

TCLo (Inhalation-Rat) 10000 ppm/24

hours/days-continuous: Blood: other changes

TCLo (Inhalation-Rat) 6 pph/24 hours: female

10 day(s) after conception: Reproductive:

Specific Developmental Abnormalities:

musculoskeletal system, cardiovascular

(circulatory) system, respiratory system

TCLo (Inhalation-Rabbit) 27,000 ppm/24

hours/30 days-continuous: Behavioral:

somnolence (general depressed activity)

TCLo (Inhalation-Rat) 6 pph/24 hours: female

10 day(s) after conception: Reproductive:

Effects on Newborn: growth statistics (e.g.%,

reduced weight gain)

TCLo (Inhalation-Rabbit) 13 pph/4 hours:

female 9-12 day(s) after conception:

Reproductive: Specific Developmental

Abnormalities: musculoskeletal system

TCLo (Inhalation-Mouse) 55 pph/2 hours: male

3 day(s) pre-mating: Reproductive: Paternal

Effects: spermatogenesis (incl. genetic

material, sperm morphology, motility, and

count)

TCLo (Inhalation-Mouse) 55 pph/4 hours: male

6 day(s) pre-mating: Reproductive: Fertility:

male fertility index (e.g. # males impregnating

females per # males exposed to fertile non-

pregnant females)

TCLo (Inhalation-Mouse) 2 pph/8 hours:

female 10 day(s) after conception:

Reproductive: Fertility: post-implantation

mortality (e.g. dead and/or resorbed implants

per total number of implants); Specific

Developmental Abnormalities

LC₅₀ (Inhalation-Rat) 1807 ppm/4 hours

LC₅₀ (Inhalation-Mouse) 2444 ppm/4 hours

LC₅₀ (Inhalation-Guinea Pig) 5718 ppm/4 hours

LC₅₀ (Inhalation-wild bird species) 1334 ppm

LCLo (Inhalation-Human) 4 mg/m³/12 hours:

Behavioral: coma; Vascular: BP lowering

not characterized in autonomic section;

Blood: methemoglobinemia-

carboxyhemoglobin

LCLo (Inhalation-Man) 4000 ppm/30 minutes

LCLo (Inhalation-Human) 5000 ppm/5 minutes

LCLo (Inhalation-Dog) 4000 ppm/46 minutes

LCLo (Inhalation-Rabbit) 4000 ppm

LCLo (Inhalation-Mammal-species unspecified)

5000 ppm/5 minutes

TCLo (Inhalation-Human) 600 mg/m³/10

minutes: Behavioral: headache

TCLo (Inhalation-Man) 650 ppm/45 minutes:

Blood: methemoglobinemia-

carboxyhemoglobin; Behavioral: changes

in psychophysiological tests

TCLo (Inhalation-Rat) 1800 ppm/1 hour/14

days-intermittent: Cardiac: other changes

11. TOXICOLOGICAL INFORMATION (continued)

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

CARBON MONOXIDE (continued):

TCLo (Inhalation-Rat) 30 mg/m³/8 hours/10 weeks-intermittent: Brain and Coverings: other degenerative changes; Behavioral: muscle contraction or spasticity
 TCLo (Inhalation-Rat) 96 ppm/24 hours/90 days-continuous: Blood: pigmented or nucleated red blood cells, other changes
 TCLo (Inhalation-Rat) 250 ppm/5 hours/20 days-intermittent: Blood: pigmented or nucleated red blood cells, changes in other cell count (unspecified), changes in erythrocyte (RBC) count
 TDLo (Subcutaneous-Rat) 5983 mg/kg/18 weeks-intermittent: Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol)
 TCLo (Inhalation-Mouse) 50 ppm/30 days-intermittent: Lungs, Thorax, or Respiration: structural or functional change in trachea or bronchi
 TCLo (Inhalation-Monkey) 200 ppm/24 hours/90 days-continuous: Blood: pigmented or nucleated red blood cells, other changes
 TCLo (Inhalation-Rabbit) 200 mg/m³/13 weeks-intermittent: Brain and Coverings: other degenerative changes; Cardiac: other changes; Blood: hemorrhage
 TCLo (Inhalation-Rabbit) 50 ppm/24 hours/8 weeks-continuous: Blood: changes in platelet count
 TCLo (Inhalation-Guinea Pig) 200 mg/m³/5 hours/4 weeks-intermittent: Endocrine: hyperglycemia
 TCLo (Inhalation-Guinea Pig) 200 mg/m³/5 hours/30 weeks-continuous: Cardiac: arrhythmias (including changes in conduction), EKG changes not diagnostic of specified effects, pulse rate increase, without fall in BP
 TCLo (Inhalation-Guinea Pig) 200 ppm/24 hours/90 days-continuous: Blood: pigmented or nucleated red blood cells, other changes

TCLo (Inhalation-Rat) 75 ppm/24 hours: female 0-20 day(s) after conception: Reproductive: Maternal Effects: other effects; Effects on Newborn: behavioral
 TCLo (Inhalation-Rat) 150 ppm/24 hours: female 1-22 day(s) after conception: Reproductive: Specific Developmental Abnormalities: cardiovascular (circulatory) system
 TCLo (Inhalation-Rat) 150 ppm/24 hours: female 1-22 day(s) after conception: Reproductive: Effects on Newborn: growth statistics (e.g.%, reduced weight gain), behavioral
 TCLo (Inhalation-Rat) 1 mg/m³/24 hours: female 72 day(s) pre-mating: Reproductive: Maternal Effects: menstrual cycle changes or disorders, parturition; Fertility: female fertility index (e.g. # females pregnant per # sperm positive females; # females pregnant per # females mated)
CARBON MONOXIDE (continued):
 TCLo (Inhalation-Rat) 150 ppm/24 hours: female 0-20 day(s) after conception: Reproductive: Effects on Newborn: behavioral
 TCLo (Inhalation-Rat) 75 ppm/24 hours: female 0-20 day(s) after conception: Reproductive: Specific Developmental Abnormalities: immune and reticuloendothelial system
 TCLo (Inhalation-Mouse) 65 ppm/24 hours: female 7-18 day(s) after conception: Reproductive: Effects on Newborn: behavioral
 TCLo (Inhalation-Mouse) 250 ppm/7 hours: female 6-15 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants); Specific Developmental Abnormalities: musculoskeletal system
 TCLo (Inhalation-Mouse) 125 ppm/24 hours: female 7-18 day(s) after conception:

Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)
 TCLo (Inhalation-Mouse) 8 pph/1 hour: female 8 day(s) after conception: Reproductive: Fertility: litter size (e.g. # fetuses per litter; measured before birth); Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus), fetal death
 TCLo (Inhalation-Mouse) 8 pph/1 hour: female 8 day(s) after conception: Reproductive: Specific Developmental Abnormalities: Central Nervous System
 TCLo (Inhalation-Rabbit) 180 ppm/24 hours: female 1-30 day(s) after conception: Reproductive: Effects on Newborn: stillbirth, viability index (e.g., # alive at day 4 per # born alive)
 Micronucleus Test (Inhalation-Mouse) 1500 ppm/10 minutes
 Sister Chromatid Exchange (Inhalation-Mouse) 2500 ppm/10 minutes

HELIUM:

There are no specific toxicology data for Helium. Helium is a simple asphyxiant.

METHANE: There are no specific toxicology data for Methane. Methane is a simple asphyxiant.

NITROGEN: There are no specific toxicology data for Nitrogen. Nitrogen is a simple asphyxiant.

OXYGEN:

Oxygen is the vital element in the atmosphere in which we live and breathe. The atmosphere contains approximately 21% oxygen. Toxicological data are available for Oxygen, but due to the small cylinder size and subsequent small total amount of Oxygen in this mixture, no effects are anticipated.

SUSPECTED CANCER AGENT: The components of this gas mixture are not found on the following lists: U.S. FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC; therefore are not considered to be, nor suspected to be, cancer-causing agents by these agencies.

IRRITANCY OF PRODUCT: Due to the formation of carbonic acid, this gas mixture can be slightly irritating to contaminated eyes.

SENSITIZATION OF PRODUCT: The components of this gas mixture are not skin or respiratory sensitizers.

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

Mutagenicity: The components of this gas mixture are not reported to cause mutagenic effects in humans.

Embryotoxicity: The components of this gas mixture are not reported to cause embryotoxic effects in humans.

Teratogenicity: This gas mixture is not expected to cause teratogenic effects in humans due to the small cylinder size and small total amount of all components. The Carbon Monoxide component of this gas mixture in up to 1%, can cause teratogenic effects in humans. Severe exposure to Carbon Monoxide during pregnancy has caused adverse effects and the death of the fetus. In general, maternal symptoms are an indicator of the potential risk to the fetus since Carbon Monoxide is toxic to the mother before it is toxic to the fetus. Additionally, clinical studies involving test animals exposed to high concentrations of Carbon Dioxide indicate teratogenic effects (e.g., cardiac and skeletal malformations, stillbirths).

Reproductive Toxicity: The components of this gas mixture are not reported to cause adverse reproductive effects in humans.

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): Biological Exposure Indices (BEIs) have been determined for the components of this gas mixture, as follows:

CHEMICAL DETERMINANT	SAMPLING TIME	BEI
CARBON MONOXIDE • Carboxyhemoglobin in Blood • Carbon monoxide in End-Exhaled Air	• End of Shift • End of Shift	• 3.5% of Hemoglobin • 20 ppm

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 applicable to the components of this gas mixture.

CARBON DIOXIDE: Food chain concentration potential: None. Biological Oxygen Demand: None

CARBON MONOXIDE: Water solubility = 3.3 ml/100 cc at 0°C, 2.3 ml at 20°C.

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: The Carbon Monoxide component of this gas mixture can be deadly to exposed animal life, producing symptoms similar to those experienced by humans. Carbon Monoxide may also be harmful to plant life. The following information is available on the components of this gas mixture: **CARBON DIOXIDE:** Waterfowl toxicity: Inhalation 5-8%, no effect.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on this gas mixture's effects on aquatic life. The presence of more than a trace of the Carbon Monoxide component of this gas mixture is a hazard to fish. Additional aquatic toxicity data are available on this gas mixture's components, as follows:

CARBON DIOXIDE: Aquatic toxicity: 100-200 mg/L/no time specified/various organisms/fresh water. LD (sunfish) = 1.5 ppm/1-6 hours, fresh water.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate U.S. Federal, State, and local regulations, or the applicable standards of Canada and its Provinces. 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 (1996): 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).

14. TRANSPORTATION INFORMATION (continued)

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 (outer package). Pertinent shipping information goes on the outside of the outer package. 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): 126

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 not subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act.

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

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

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

OTHER U.S. FEDERAL REGULATIONS:

- Carbon Dioxide and Carbon Monoxide are subject to the reporting requirements of CFR 29 1910.1000. Carbon Dioxide and Carbon Monoxide are listed on Table Z.1.
- Methane is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for each of this gas is 10,000 pounds and so this mixture will not be affected by the regulation.
- This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
- Helium, Nitrogen and Oxygen are not listed as Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Carbon Monoxide and Methane are listed under this regulation in Table 3 as Regulated Substances (Flammable Substances), in quantities of 10,000 lbs (4,553 kg) or greater, and so this mixture will not be affected by the regulation.

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: Carbon Dioxide, Carbon Monoxide, Helium, Methane.

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

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

Illinois - Toxic Substance List: Carbon Dioxide, Carbon Monoxide, Helium.

Kansas - Section 302/313 List: No.

Massachusetts - Substance List: Carbon Dioxide, Oxygen, Carbon Monoxide, Helium, Methane.

Michigan - Critical Materials Register: No.

Minnesota - List of Hazardous Substances: Carbon Dioxide, Carbon Monoxide, Helium, Methane.

Missouri - Employer Information/Toxic Substance List: Carbon Dioxide, Methane, Helium.

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

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

Pennsylvania - Hazardous Substance List: Carbon Dioxide, Oxygen, Carbon Monoxide, Helium, Nitrogen, Methane.

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

Texas - Hazardous Substance List: No.

West Virginia - Hazardous Substance List: Carbon Dioxide.

Wisconsin - Toxic and Hazardous Substances: Carbon Dioxide.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): The Carbon Monoxide component of this gas mixture is on the California Proposition 65 lists as a chemical known to the State of California to cause birth defects or other reproductive harm. **WARNING:** This gas mixture contains a chemical that is known to the State of California to cause birth defects or other reproductive harm.

ADDITIONAL CANADIAN REGULATIONS:

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

OTHER CANADIAN REGULATIONS: Not applicable.

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 Classes A and D2A, 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"



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.