1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: NON-FLAMMABLE GAS MIXTURE

Containing One or More of the Following Components in a Nitrogen Balance Gas: Oxygen, 0.0015-23.5%; Methane, 0.0005-2.5%; Carbon Monoxide, 0.0005-1.0%; Hydrogen Sulfide, 0.001-0.025%

NOTE: MIXTURES COMPRISED OF AN AIR BALANCE GAS CONTAIN BETWEEN 19.5-23.5% OXYGEN.

SYNONYMS: Not Applicable

CHEMICAL FAMILY NAME: Not Applicable

FORMULA: Not Applicable

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</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TLV ppm</td>
</tr>
<tr>
<td>Oxygen</td>
<td>7782-44-7</td>
<td>0.0015-23.5%</td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>74-82-8</td>
<td>0.0005-2.5%</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>7783-06-4</td>
<td>0.001-0.025%</td>
<td></td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>630-08-0</td>
<td>0.0005-1.0%</td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td>7727-37-9</td>
<td>Balance</td>
<td></td>
</tr>
</tbody>
</table>

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This gas mixture is a colorless gas which has a rotten-egg odor (due to the presence of Hydrogen Sulfide). The odor cannot be relied on as an adequate warning of the presence of this gas mixture. Oxygen-deficient atmospheres (especially in small confined spaces or other poorly-ventilated environments) can be hazardous.

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.
SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure to 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. A potential health hazard associated with this gas mixture is the potential of inhalation of Hydrogen Sulfide, a component of this gas mixture. Such over-exposures may occur if this gas mixture is used in a confined space or other poorly ventilated area. Over-exposures to Hydrogen Sulfide can cause dizziness, headache, and nausea. Over-exposure to this gas could result in respiratory arrest, coma, or unconsciousness, due to the presence of Hydrogen Sulfide.

Continuous inhalation of low concentrations of Hydrogen Sulfide may cause olfactory fatigue, so the odor is no longer an effective warning of the presence of this gas. A summary of exposure concentrations and observed effects are as follows:

<table>
<thead>
<tr>
<th>CONCENTRATION OF HYDROGEN SULFIDE</th>
<th>OBSERVED EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 1000 ppm</td>
<td>Immediate respiratory arrest.</td>
</tr>
<tr>
<td>&gt; 500 ppm</td>
<td>Headache, excitation, staggering, and stomach ache after brief exposure. Death occurs within 0.5 - 1 hour of exposure.</td>
</tr>
<tr>
<td>&gt; 300-500 ppm</td>
<td>Swifter onset of symptoms. Death occurs in 1.4 hours.</td>
</tr>
<tr>
<td>200-250 ppm</td>
<td>Headache, vomiting, nausea. Prolonged exposure may lead to lung damage. Exposures of 4-8 hours can be fatal.</td>
</tr>
<tr>
<td>100-150 ppm</td>
<td>Temporarily blurs vision and replaces the available oxygen.</td>
</tr>
<tr>
<td>50 ppm</td>
<td>Eye irritation. Dryness and irritation of nose, throat.</td>
</tr>
<tr>
<td>0.3-30 ppm</td>
<td>Odor is unpleasant.</td>
</tr>
</tbody>
</table>

NOTE: This gas mixture contains a maximum of 250 ppm Hydrogen Sulfide. The higher concentration values listed are presented to delineate the complete health effects which have been observed for humans after exposure to Hydrogen Sulfide.

Inhalation over-exposures 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 at a higher rate than oxygen, 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:

<table>
<thead>
<tr>
<th>CONCENTRATION OF CARBON MONOXIDE</th>
<th>OBSERVED EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>All exposure levels</td>
<td>Over-exposure to Carbon Monoxide can be indicated by the lips and fingernails turning bright red.</td>
</tr>
<tr>
<td>&gt; 2500 ppm</td>
<td>Headache and discomfort experienced within 2-3 hours of exposure.</td>
</tr>
<tr>
<td>200-2500 ppm</td>
<td>Within 2 hours, there is mental confusion, headache, and nausea. Unconsciousness within 30 minutes.</td>
</tr>
<tr>
<td>100-200 ppm</td>
<td>Within 30 minutes, slight palpitations of the heart occurs. Within 1.5 hours, there is a tendency to stagger.</td>
</tr>
<tr>
<td>50 ppm</td>
<td>Potential for collapse and death before warning symptoms.</td>
</tr>
<tr>
<td>0.3-30 ppm</td>
<td>Rapid onset of unconsciousness, coma, death.</td>
</tr>
</tbody>
</table>

Additionally, if mixtures of this gas mixture contain less than 19.5% Oxygen and are 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 following effects associated with various levels of oxygen are as follows:

<table>
<thead>
<tr>
<th>CONCENTRATION OF OXYGEN</th>
<th>OBSERVED EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-16% Oxygen</td>
<td>Breathing and pulse rate increased, muscular coordination slightly disturbed.</td>
</tr>
<tr>
<td>10-12% Oxygen</td>
<td>Emotional upset, abnormal fatigue, disturbed respiration.</td>
</tr>
<tr>
<td>8-10% Oxygen</td>
<td>Nausea, vomiting, collapse, or loss of consciousness.</td>
</tr>
<tr>
<td>6-10% Oxygen</td>
<td>Convulsive movements, possible respiratory collapse, and death.</td>
</tr>
<tr>
<td>Below 6%</td>
<td></td>
</tr>
</tbody>
</table>

SKIN AND EYE CONTACT: Hydrogen Sulfide, a component of this gas mixture, may be irritating to the skin. Inflammation and irritation of the eyes can occur at very low airborne concentration of Hydrogen Sulfide (less than 10 ppm). Exposure over several hours may result in “gas eyes” or “sore eyes” with symptoms of scratchiness, irritation, tearing and burning. Above 50 ppm of Hydrogen Sulfide, there is an intense tearing, blurring of vision, and intense redness of the eyes. Above 500 ppm, the individual may see at all. Above 1,000 ppm of this gas mixture, individuals may see rings around bright lights. Most symptoms disappear when exposure ceases. However, in serious cases, the eye can be permanently damaged.

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. However the Hydrogen Sulfide and Carbon Monoxide components of this gas mixture are toxic to humans. Over-exposure to this gas mixture can cause irritations to the eyes, headaches, collapse, unconsciousness, coma, and death. Due to the presence of Carbon Monoxide, hydrocarbon gases may be released under conditions of over-exposure, the gas mixture may also irritate the skin and eyes; severe eye contamination can result in blindness.

CHRONIC: Severe over-exposures to the Hydrogen Sulfide component of this gas mixture, which do not result in death, may cause long-term symptoms such as memory loss, paralysis of facial muscles, severe tissue damage, or nerve damage. In some cases of over-exposure, the eyes can be permanently damaged. Skin disorders and respiratory conditions may be aggravated by repeated over-exposures to this gas product. Refer to Section 11 (Toxicology Information) for additional information on the components of this gas mixture. Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may affect the heart and nervous system.

TARGET ORGANS: ACUTE: Respiratory system, blood system, central nervous system effects, cardiovascular system, skin, eyes. CHRONIC: Neurological system, reproductive system, eyes.

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. Victim(s) who experience any adverse effects over-exposure to this gas mixture must be transported 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 victims.

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, seek medical attention as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary.

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: Pre-existing respiratory conditions may be aggravated by over-exposure 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. Because of the presence of Hydrogen Sulfide, eye disorders or skin problems may be aggravated by over-exposure to this gas mixture.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate over-exposure. Hyperbaric oxygen is the most efficient antidote to Carbon Monoxide poisoning, the optimum treatment 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. Be observant for initial signs of pulmonary edema in the event of severe inhalation over-exposures.
**WARNING!** Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.

**5. FIRE-FIGHTING MEASURES**

**FLASH POINT:** Not applicable.

**AUTOIGNITION TEMPERATURE:** Not applicable.

**FLAMMABLE LIMITS (in air by volume, %):**

<table>
<thead>
<tr>
<th>Lower (LEL)</th>
<th>Upper (UEL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not applicable.</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

**GASEOUS SPECIFIC GRAVITY (Air = 1):**

<table>
<thead>
<tr>
<th>Gas</th>
<th>70°F (21.1°C)</th>
<th>77°F (25°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen Sulfide</td>
<td>0.072</td>
<td>0.490</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>0.906</td>
<td>0.921</td>
</tr>
<tr>
<td>Oxygen</td>
<td>1.000</td>
<td>1.000</td>
</tr>
</tbody>
</table>

**EXPANSION RATIO:**

<table>
<thead>
<tr>
<th>Gas</th>
<th>70°F (21.1°C)</th>
<th>77°F (25°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen Sulfide</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>1.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Oxygen</td>
<td>1.000</td>
<td>1.000</td>
</tr>
</tbody>
</table>

**BOILING POINT:**

- Hydrogen Sulfide: -345.8°F (-210°C)
- Carbon Monoxide: -139°F (-55°C)
- Oxygen: 50°F (10°C)

**PH:** Not applicable.

**SOLUBILITY IN WATER (vol/vol):**

<table>
<thead>
<tr>
<th>Gas</th>
<th>70°F (21.1°C)</th>
<th>77°F (25°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen Sulfide</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Oxygen</td>
<td>Not applicable.</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

**ELECTRIC CHARGING (RISK OF EXPLOSION):**

- Not applicable.

**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 olfactory fatigue or oxygen deficiency. Do not attempt to repair, adjust, or in any other way modify cylinders containing a gas mixture with Hydrogen Sulfide or Carbon Monoxide. If there is a malfunction or another type of operational problem, contact 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 Hydrogen Sulfide and Carbon Monoxide-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:**

- **HAND PROTECTION:** All gloves should be impervious to Hydrogen Sulfide and Carbon Monoxide. If there is a malfunction or another type of operational problem, contact 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 Hydrogen Sulfide and Carbon Monoxide-containing gas mixtures.

**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 1910.133 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, objects may penetrate 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.

**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 Oxygen, Hydrogen Sulfide, and Carbon Monoxide.

**RESPIRATORY PROTECTION:** No special respiratory protection is required under normal circumstances of use. Use supplied air respiratory protection if the levels of components exceed exposure limits presented in Section 2 (Composition and Information of 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 cases, use positive pressure, full-facepiece SCBA. If there is a malfunction or another type of operational problem, contact 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 Hydrogen Sulfide and Carbon Monoxide-containing gas mixtures.

**EMERGENCY OR PLANNED ENTRY INTO UNKNOWN CONCENTRATION OR IDLH CONDITIONS:**

**Escape:**

- Up to 875 ppm: Supplied Air Respirator (SAR) operated in a continuous flow mode.
- Up to 350 ppm: Supplied Air Respirator (SAR). 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.

**NOTE:** The IDLH concentration for Hydrogen Sulfide is 100 ppm.

**END OF SERVICE LIFE INDICATOR (ESLI) REQUIRED FOR GAS MASKS:**

- End of Service Life Indicator (ESLI) required for gas masks.

**NOTE:** The IDLH concentration for Carbon Monoxide is 1200 ppm.

**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 POINT @ 10 psig:** 10°F (-12°C)

**WEIGHT:** Not applicable.

**pH:** Not applicable.

**SPECIFIC VOLUME @ 32°F (0°C) and 1 atm:** 0.023

**EVAPORATION RATE (nBuOH = 1):** Not applicable.

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

**SPECIFIC VOLUME (ρ/V):** 1.38

**COEFFICIENT WATER/OL DISTRIBUTION:** Not applicable.
The following information is for this gas mixture.

**CARCINOGENICITY:**
- There are no specific toxicity data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the environment.

**METHANE:**
- There is specific toxicity data for Methane. Methane is a simple asphyxiant, which acts to displace oxygen in the environment.

**CARBON MONOXIDE (Inhalation-Mouse):**
- 100 ppm/8 hours/30 days-
- 150 ppm/24 hours: female 0-20 days after conception; effects on fetuses: other effects; Effects on Newborn: behavioral
- 250 ppm/7 hours: female 6-15 day(s) after conception; effects on fetuses: other; Effects on Newborn: behavioral
- 65 ppm/24 hours: female 6-15 day(s) after conception: Reproductive: Specific Developmental Abnormalities: immune and reticuloendothelial system
- 1500 ppm/10 minutes: Male 0-20 days after conception: effects on fetuses: other effects; Effects on Newborn: behavioral

**CARBON MONOXIDE (Inhalation-Mouse):**
- 50 ppm/30 days-
- 25 ppm/30 days-
- 40 ppm/30 days-
- 60 ppm/30 days-
- 75 ppm/24 hours: female 0-20 days after conception: Reproductive: Specific Developmental Abnormalities: cardiovascular (muscular) system

**CARBON MONOXIDE (Inhalation-Rat):**
- 75 ppm/24 hours: female 0-20 days after conception; effects on fetuses: other effects; Effects on Newborn: behavioral
- 100 ppm/8 hours/5 weeks-
- 150 ppm/24 hours: female 0-20 days after conception; effects on fetuses: other; Effects on Newborn: behavioral
- 200 ppm/4 hours: female 0-20 days after conception: effects on fetuses: other effects; Effects on Newborn: behavioral

**CARBON MONOXIDE (Inhalation-Rat):**
- 150 ppm/24 hours: female 1-22 days after conception; Effects: other; Effects on Newborn: behavioral
- 1200 mg/m
- 900 mg/m
- 600 mg/m
- 300 mg/m
- 200 mg/m
- 100 mg/m
- 75 mg/m
- 25 mg/m
- 5 mg/m
- 2 mg/m
- 1 mg/m

**CARBON MONOXIDE (Inhalation-Human):**
- 800 ppm/5 minutes-
- 600 ppm/30 minutes-
- 400 ppm/48 minutes-
- 30 ppm/6 hours/10 weeks-
- 150 ppm/24 hours: female 1-22 days after conception; Effects: other; Effects on Newborn: behavioral
- 1 mg/m
- 100 ppm/8 hours/90 days-
- 250 ppm/6 hours/90 days-
- 150 ppm/24 hours: female 0-20 days after conception; effects on fetuses: other; Effects on Newborn: behavioral
- 75 ppm/24 hours: female 1-22 days after conception; Effects: other; Effects on Newborn: behavioral
- 75 ppm/24 hours: female 6-15 day(s) after conception: Reproductive: Specific Developmental Abnormalities: immune and reticuloendothelial system
- 65 ppm/24 hours: female 0-20 days after conception; effects on fetuses: other; Effects on Newborn: behavioral
- 50 ppm/24 hours: female 0-20 days after conception: effects on fetuses: other; Effects on Newborn: behavioral
- 250 ppm/7 hours: female 6-15 days after conception: Reproductive: Specific Developmental Abnormalities: immune and reticuloendothelial system
- 250 ppm/24 hours: female 6-15 day(s) after conception: Reproductive: Specific Developmental Abnormalities: cardiovascular (muscular) system
- 250 ppm/24 hours: female 6-15 day(s) after conception: Reproductive: Specific Developmental Abnormalities: cardiovascular (muscular) system
- 250 ppm/24 hours: female 22 day(s) after conception: Reproductive: Specific Developmental Abnormalities: cardiovascular (muscular) system
- 250 ppm/24 hours: female 22 day(s) after conception: Reproductive: Specific Developmental Abnormalities: cardiovascular (muscular) system

**CARBON MONOXIDE (Inhalation-Human):**
- 1000 ppm/5 minutes-
- 500 ppm/20 minutes-
- 100 ppm/2 weeks-
- 50 ppm/30 days-
- 50 ppm/10 minutes-
- 25 ppm/30 minutes-
- 10 ppm/12 hours-
- 10 ppm/24 hours-
- 1 ppm/24 hours-

**CARBON MONOXIDE (Inhalation-Human):**
- 75 ppm/24 hours-
- 65 ppm/24 hours-
- 50 ppm/30 days-
- 25 ppm/30 minutes-
- 10 ppm/12 hours-
- 1 ppm/24 hours-

**CARBON MONOXIDE (Inhalation-Human):**
- 75 ppm/24 hours-
- 100 ppm/24 hours-
- 150 ppm/24 hours: female 1-22 days after conception; Effects: other; Effects on Newborn: behavioral
- 200 ppm/4 hours: female 22 day(s) after conception: Reproductive: Specific Developmental Abnormalities: cardiovascular (muscular) system

**CARBON MONOXIDE (Inhalation-Rabbit):**
- 250 ppm/7 hours: female 6-15 days after conception: Reproductive: Specific Developmental Abnormalities: immune and reticuloendothelial system
- 250 ppm/24 hours: female 22 day(s) after conception: Reproductive: Specific Developmental Abnormalities: cardiovascular (muscular) system
- 250 ppm/24 hours: female 22 day(s) after conception: Reproductive: Specific Developmental Abnormalities: cardiovascular (muscular) system
- 250 ppm/24 hours: female 22 day(s) after conception: Reproductive: Specific Developmental Abnormalities: cardiovascular (muscular) system
- 250 ppm/24 hours: female 22 day(s) after conception: Reproductive: Specific Developmental Abnormalities: cardiovascular (muscular) system

**CARBON MONOXIDE (Inhalation-Frog):**
- 800 ppm/30 minutes-
- 500 ppm/60 minutes-
- 200 ppm/24 hours-
- 100 ppm/24 hours-
- 50 ppm/30 days-
- 25 ppm/30 minutes-
- 10 ppm/12 hours-
- 1 ppm/24 hours-

**CARBON MONOXIDE (Inhalation-Man):**
- 1200 mg/m
- 900 mg/m
- 600 mg/m
- 300 mg/m
- 200 mg/m
- 100 mg/m
- 75 mg/m
- 50 ppm/120 minutes-
- 25 ppm/60 minutes-
- 10 ppm/12 hours-
- 1 ppm/24 hours-

**CARBON MONOXIDE (Inhalation-Mouse):**
- 800 ppm/5 minutes-
- 600 ppm/30 minutes-
- 200 ppm/24 hours-
- 100 ppm/24 hours-
- 50 ppm/30 days-
- 25 ppm/30 minutes-
- 10 ppm/12 hours-
- 1 ppm/24 hours-

**CARBON MONOXIDE (Inhalation-Human):**
- 500 ppm/5 minutes-
- 400 ppm/46 minutes-
- 30 ppm/6 hours/10 weeks-
- 150 ppm/24 hours: female 1-22 days after conception; Effects: other; Effects on Newborn: behavioral
- 100 ppm/8 hours/90 days-
- 75 ppm/24 hours: female 0-20 days after conception; effects on fetuses: other; Effects on Newborn: behavioral
- 50 ppm/30 days-
- 25 ppm/30 minutes-
- 10 ppm/12 hours-
- 1 ppm/24 hours-

**CARBON MONOXIDE (Inhalation-Mouse):**
- 1500 ppm/10 minutes-
- 1200 mg/m
- 900 mg/m
- 600 mg/m
- 300 mg/m
- 200 mg/m
- 100 mg/m
- 75 mg/m
- 50 ppm/120 minutes-
- 25 ppm/60 minutes-
- 10 ppm/12 hours-
- 1 ppm/24 hours-

**CARBON MONOXIDE (Inhalation-Rabbit):**
- 50 ppm/5 minutes-
- 30 ppm/6 hours/90 days-
- 15 ppm/24 hours-
- 5 ppm/24 hours-
- 1 ppm/24 hours-

**CARBON MONOXIDE (Inhalation-Frog):**
- 800 ppm/30 minutes-
- 500 ppm/60 minutes-
- 200 ppm/24 hours-
- 100 ppm/24 hours-
- 50 ppm/30 days-
- 25 ppm/30 minutes-
- 10 ppm/12 hours-
- 1 ppm/24 hours-

**CARBON MONOXIDE (Inhalation-Man):**
- 1200 mg/m
- 900 mg/m
- 600 mg/m
- 300 mg/m
- 200 mg/m
- 100 mg/m
- 75 mg/m
- 50 ppm/120 minutes-
- 25 ppm/60 minutes-
- 10 ppm/12 hours-
- 1 ppm/24 hours-

**CARBON MONOXIDE (Inhalation-Mouse):**
- 800 ppm/5 minutes-
- 600 ppm/30 minutes-
- 200 ppm/24 hours-
- 100 ppm/24 hours-
- 50 ppm/30 days-
- 25 ppm/30 minutes-
- 10 ppm/12 hours-
- 1 ppm/24 hours-

**CARBON MONOXIDE (Inhalation-Man):**
- 1200 mg/m
- 900 mg/m
- 600 mg/m
- 300 mg/m
- 200 mg/m
- 100 mg/m
- 75 mg/m
- 50 ppm/120 minutes-
- 25 ppm/60 minutes-
- 10 ppm/12 hours-
- 1 ppm/24 hours-
11. TOXICOLOGICAL INFORMATION (cont.)

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.

Carbon Monoxide: Atmospheric Fate: A photochemical model was used to quantify the sensitivity of the tropospheric oxidants ozone (O₃) and OH to changes in mixing ratios of (CO), Carbon Monoxide (CO), and NO emissions and to perturbations in climate and stratospheric chemistry. In most cases, increased CH₄ and CO emissions will suppress OH (negative coefficients) in increased O₃ (positive coefficients) except where NO and O₂ influence by pollution are sufficient to increase OH. In most regions, NO, CO, and CH₄ emission increase will suppress OH and increased O₃, but these trends may be opposed by stratospheric O₃ depletion and climate change.

Hydrogen Sulfide: Water Solubility = 1 g/242 mL at 20°C.

Plant toxicity: Continuous fumigation of plants with 300 or 3000 ppm Hydrogen Sulfide caused leaf lesions, defoliation, and reduced growth with severity of injury correlated to dose. At higher (3.25 and 5.03 ppm) Hydrogen Sulfide, significant reductions in leaf CO₂ and water vapor exchange occurred, and stomatal openings were depressed. When Hydrogen Sulfide gas was applied to 29 species of green plants for 5 hours, young, rapidly elongating tissues were more sensitive to injury than older tissues. Symptoms included scorching of young shoots and leaves, basal and marginal scorching of older leaves. Mature leg were unaffected. Seeds exposed to Hydrogen Sulfide gas showed delay in germination.

Persistence: Converts to elemental sulfur upon standing in water.

Major Species Threatened: Aquatic and animal life plant may be injured if exposed to 5 ppm in air over 24 hours.

Biodegradation: Microorganisms in soil and water are involved in oxidation-reduction reactions that oxidize hydrogen sulfide to elemental sulfur. Members of the genera Beggiatia, Thioploca, and Thiothrix function in transition zones between aerobic and anaerobic conditions where both molecular oxygen and hydrogen sulfide are found. Also, some photosynthetic bacteria oxidize hydrogen sulfide to elemental sulfur. Members of the families Chorobiaceae and Chromatiaceae (purple sulfur bacteria) are obligate aerobes and are phototrophic, and are found in waters with high H₂S concentrations. The interactions of these organisms form part of the global sulfur cycle.

Bioconcentration: Does not have bioaccumulation or food chain transfer potential.

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: No evidence is currently available on this gas mixture's effects on plant and animal life.

Hydrogen Sulfide and Carbon Monoxide, components of this gas mixture, can be deadly to exposed animal life, producing symptoms similar to those experienced by humans. This gas mixture may also be harmful to plant life.

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. The following aquatic toxicity data are available for the Hydrogen Sulfide component of this gas mixture:

Hydrogen Sulfide: Toxics (goldfish) 96 hours = 10 mg/L

Hydrogen Sulfide (continued): Toxic (carp) 24 hours = 3.3 mg/L

Hydrogen Sulfide (continued): Toxic (goldfish) 24 hours = 4.3 mg/L

Hydrogen Sulfide (continued): Toxic (sunfish) 1 hour = 4.9 = 5.3 mg/L

Hydrogen Sulfide (continued): Toxic (goldfish) 24 hours = 5 mg/L

Hydrogen Sulfide (continued): Toxic (minnows) 24 hours = 5-6 mg/L

Hydrogen Sulfide (continued): Toxic (trout) 15 minutes = 10 mg/L

Hydrogen Sulfide (continued): Toxic (goldfish) 24 hours = 25 mg/L

Hydrogen Sulfide (continued): Toxic (tench) 3 hours = 100 mg/L

Hydrogen Sulfide (continued): MATC,F (fathead minnows) 0.0037 mg/L

Hydrogen Sulfide (continued): MATC,F (bluegill) 0.004 mg/L

Hydrogen Sulfide (continued): MATC,F (brook trout) 0.055 mg/L

13. DISPOSAL CONSIDERATIONS

Preparing Wastes for Disposal: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Cylinders with undersired 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 classified as Nitrogen as defined by 49 CFR 172.101 by the U.S. Department of Transportation.

Proprietary Shipping Name: Compressed gases, n.o.s. ("Oxygen, Nitrogen") or the gas component with the next highest concentration next to Nitrogen.

Hazard Class and Number and Description: 2.2 (Non-Flammable Gas)

UN Identification Number: UN 1956

Packaging Group: Not Applicable

DOT Label(s) Required: Non-Flammable Gas


U.S. Department of Transportation Information (continued):

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-bodied 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). Perinent shipping information goes on the outside of the overpack. DOT 39 Cylinders do not have transportation information on the cylinder itself.

Canadian Transportation of Dangerous Goods Regulations: This gas mixture is considered as Dangerous Goods, per regulations of Transport Canada.

Proprietary Shipping Name: Compressed gases, n.o.s. ("Oxygen, Nitrogen") or the gas component with the next highest concentration next to Nitrogen.

Hazard Class and Number and Description: 2.2 (Non-Flammable Gas)

UN Identification Number: UN 1956

Packaging Group: Not Applicable

Hazard Label: Class 2.2 (Non-Flammable Gas)

Special Provisions: None

Explosive Limit and Limited Quantity Index: 0.12

ERAP Index: 3000

Passenger Carrying Ship Index: Forbidden

Passenger Carrying Road Vehicle or Passenger Carrying Railway Vehicle Index: Forbidden


Note: Shipment of compressed gas cylinders via Public Passenger Road Vehicle is a violation of Canadian law (Transport Canada Transportation of Dangerous Goods Act, 1995).
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.

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

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

<table>
<thead>
<tr>
<th>CHEMICAL NAME</th>
<th>SARA 302 (40 CFR 355, Appendix A)</th>
<th>SARA 304 (40 CFR Table 302.4)</th>
<th>SARA 313 (40 CFR 372.65)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen Sulfide</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

U.S. SARA THRESHOLD PLANNING QUANTITY: Hydrogen Sulfide = 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): Hydrogen Sulfide = 100 lb (45 kg)

OTHER U.S. FEDERAL REGULATIONS:
- Hydrogen Sulfide and Carbon Monoxide are subject to the reporting requirements of CFR 29 1910.1000.
- Hydrogen Sulfide and Methane are subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for each of these gases is 10,000 pounds and so this mixture will not be affected by the regulation.
- Depending on specific operations involving the use of this gas mixture, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Hydrogen Sulfide is listed in Appendix A of this regulation. The Threshold Quantity for Hydrogen Sulfide under this regulation is 1500 lb (and so one cylinder of this gas mixture will not be affected by this regulation).
- 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 Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Hydrogen Sulfide is listed under this regulation in Table 1 as a Regulated Substance (Toxic Substance), in quantities of 10,000 lbs (4,553 kg) or greater.

U.S. STATE REGULATORY INFORMATION:

Michigan - Critical Materials Register: No.
- New Jersey - Right to Know Hazardous Substance List: Oxygen, Carbon Monoxide, Methane.

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. WARNING! This gas mixture contains a compound known to the State of California to cause birth defects or other reproductive harm.

ADDITIONAL CANADIAN REGULATIONS:

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

CANADIAN 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 recommend 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. Scraping 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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