CONCENTRATION OF concentrations and observed effects are as follows:
Continuous inhalation of low concentrations of Hydrogen Sulfide may cause olfactory fatigue, so respiratory arrest, coma, or unconsciousness, due to the presence of Hydrogen Sulfide. Hydrogen Sulfide, a component of this gas mixture. Such over-exposures may occur if this gas use. A potential health hazard associated with this gas mixture is the potential of inhalation of this gas mixture. That the odor is no longer an effective warning of the presence of this gas. A summary of exposure health effects from over-exposure to the product are anticipated under routine circumstances of use. 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 nausia. 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 that 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:

CONTINUOUS INHALATION OF HYDROGEN SULFIDE

OBSERVED EFFECT

- Odor is unpleasant.
- 50 ppm: Eye irritation. Dryness and irritation of nose, throat.
- Slightly higher than 50 ppm: Irritation of the respiratory system.
- 100-150 ppm: Temporary loss of smell.
- 200-250 ppm: Headache, vomiting nausea. Prolonged exposure may lead to lung damage. Exposures of 4-8 hours can be fatal.
- 300-500 ppm: Swifter onset of symptoms. Death occurs in 1-4 hours.
- > 600 ppm: Rapid onset of unconsciousness, coma, death.
- > 1000 ppm: Immediate respiratory arrest.

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

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 carcinogen, 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 breathing in a confined space 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:

### CONCENTRATION OF CARBON MONOXIDE

<table>
<thead>
<tr>
<th>Concentration (ppm)</th>
<th>OBSERVED EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20</td>
<td>No unusual health effects are anticipated after exposure to this gas mixture, due to the small cylinder size. If any adverse symptom develops after exposure to this gas mixture, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary.</td>
</tr>
<tr>
<td>50-100</td>
<td>Possible for collapse and death before warning symptoms.</td>
</tr>
<tr>
<td>&gt;100</td>
<td>Severe over-exposures to this gas mixture can also irritate the skin and eyes; severe eye contamination can result in blindness.</td>
</tr>
</tbody>
</table>

**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 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 range being 2-2.5 atm. A special mask, or, preferably, a compressed air 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.

### 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 over-exposure to Hydrogen Sulfide and Carbon Monoxide, the toxic components of this gas mixture, and other safety hazards related to the remaining components of this gas mixture, 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. For emergency disposal,

**NON-FLAMMABLE GAS MIXTURE MSDS - 50018**

**EFFECTIVE DATE:** FEBRUARY 16, 2011

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**Page 2 of 6**
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 Hydrogen Sulfide, Carbon Monoxide, and Oxygen. Hydrogen Sulfide and Carbon Monoxide level must be below exposure level listed in Section 2 (Composition and Information on Ingredients) and Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area. If leaking incidentally from the cylinder, contact your supplier.

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; exposure 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, including a mixture containing 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 from any flammable gases, 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 operation, use equipment designed for the specific cylinder. Ensure all lines and equipment are rated for proper service pressure.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: 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 Oxygen, Hydrogen Sulfide, and Carbon Monoxide.

RESPIRATORY PROTECTION: No special respiratory protection is required under normal circumstances of use. Use supplied air respirator protection in the event of an emergency or if the concentrations exceed 100 ppm in the presence of other workers (see Table 6). Oxygen levels must be 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 Z195-94 and applicable standards of Canadian Provinces. Only the IDLH by OSHA is used. In such atmospheres, use of a full-facepiece pressure-demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA’s Respiratory Protection Standard (1910.134-1998). The following NIOSH respiratory protection recommendations for Hydrogen Sulfide and Carbon Monoxide are provided for further information.

NIOSH/OSHA RECOMMENDATIONS FOR HYDROGEN SULFIDE CONCENTRATIONS IN AIR:
- Up to 100 ppm: Powered air-purifying respirator with cartridge(s) to protect against hydrogen sulfide; gas mask with canister to protect against hydrogen sulfide; or SAR, or full-facepiece SCBA.
- Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.
- Escape: Gas mask with canister to protect against hydrogen sulfide; or escape-type SCBA.

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

NIOSH/OSHA RECOMMENDATIONS FOR CARBON MONOXIDE CONCENTRATIONS IN AIR:
- Up to 350 ppm: Supplied Air Respirator (SAR).
- Up to 675 ppm: Supplied Air Respirator (SAR) operated in a continuous flow mode.
- Up to 1200 ppm: Supplied Air Respirator (SAR) operated in a continuous flow mode.
- Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece Supplied Air Respirator (SAR) with an auxiliary positive pressure SCBA.
- Escape: Gas mask with canister to protect against carbon monoxide; or escape-type SCBA.

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

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

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 authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z195-94 and applicable standards of Canadian Provinces. Only the IDLH by OSHA is used. In such atmospheres, use of a full-facepiece pressure-demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA’s Respiratory Protection Standard (1910.134-1998). The following NIOSH respiratory protection recommendations for Hydrogen Sulfide and Carbon Monoxide are provided for further information.

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:** 0.077 lbs/ft³ (1.153 kg/m³)

**FREEZING/MELTING POINT @ 10 psig: 345°F (-10°C)**

**SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 0.966**

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

**COEFFICIENT WATER/OIL DISTRIBUTION:** Not applicable.

**APPEARANCE AND COLOR:** This gas mixture is a colorless gas which has an rotten egg-like odor, due to the presence of Hydrogen Sulfide.

**HOW TO DETECT THIS SUBSTANCE (warning properties):** Continuous inhalation of low concentrations of this gas mixture may cause offensive or fatigue; due to the presence of Hydrogen Sulfide, so the odor is not a good warning property of a release of this gas mixture. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation. Wet lead acetate paper can be used for leak detection. The paper turns black in the presence of Hydrogen Sulfide. Cadmium chloride solutions can also be used. Cadmium solutions will turn yellow upon contact with Hydrogen Sulfide.

10. STABILITY and REACTIVITY

**STABILITY:** Normally stable in gaseous state.

**DECOMPOSITION PRODUCTS:** The thermal decomposition products of Methane include carbon oxides. The decomposition products of Hydrogen Sulfide include water and sulfur oxides. The other components of this gas mixture do not decompose, per se, but can react with other compounds and 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 (Hydrogen Sulfide, Methane) are also incompatible with strong oxidizers (i.e. chlorine, bromine pentfluoride, oxygen, oxygen difluoride, and nitrogen trifluoride). Carbon Monoxide is mildly corrosive to nickel and iron (especially at high temperatures and pressures). Hydrogen Sulfide is corrosive to most metals, but reacts with these substances to form metal sulfides.

**HAZARDOUS SURFACE REACTION:** Will not occur.

**CONDITIONS TO AVOID:** Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.
TOXICITY DATA: The following toxicity data are available for the components of this gas mixture.

CARBON MONOXIDE (continued):

CARBON MONOXIDE:

CARBON MONOXIDE (continued):
12. ECOLOGICAL INFORMATION

leaves, basal and marginal scorching of older leaves. Mature leaves 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 plants 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 Beggiatoa, Thiochromatium, and Thiotrix 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 Chlorobiaceae 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 contamination 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:**
- LC_{50} (Asellus arthropods) 96 hours = 0.111 mg/L
- LC_{50} (Gammarus arthropods) 96 hours = 0.97 mg/L
- LC_{50} (Ephemerida) 96 hours = 0.0234 mg/L
- LC_{50} (Inhalation-Flies) > 960 minutes = 380 mg/L
- LC_{50} (bluegill, eggs) 72 hours = 0.0190 mg/L
- LC_{50} (fathead minnows) 96 hours = 0.09 mg/L
- ATC_{50} (bluegill, juveniles) 96 hours = 0.0173 mg/L

**HYDROGEN SULFIDE (continued):**
- LC_{50} (bluegill, 35-day-old fry) 96 hours = 0.0151 mg/L
- LC_{50} (bluegill, adults) 96 hours = 0.0448 mg/L
- LC_{50} (fathead minnows) 96 hours = 0.0090 mg/L
- LC_{50} (fathead trout) 96 hours = 0.0216-0.0308 mg/L
- LC_{50} (brook trout) 96 hours = 0.100 mg/L

**NITROGEN:**
- Toxic (tench) 3 hours = 100 mg/L
- Toxic (goldfish) 24 hours = 25 mg/L
- Toxic (carp) 24 hours = 6-25 mg/L
- Toxic (trout) 15 minutes = 10 mg/L
- Toxic (minnows) 24 hours = 5-6 mg/L
- Toxic (goldfish) 24 hours = 4.3 mg/L
- Toxic (carp) 24 hours = 4.3 mg/L
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**CHEMICAL NAME**
- Hydrogen Sulfide
- Nitrogen
- Oxygen

**U.S.SARA THRESHOLD PLANNING QUANTITY:**
- Hydrogen Sulfide = 500 lb (227 kg)
- Nitrogen = 500 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 50,000 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 (CFR 29 1910.119).
- Hydrogen Sulfide is listed in Appendix A of this regulation. The Threshold Quantity for Hydrogen Sulfide under this regulation is 1500 lbs (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.
15. REGULATORY INFORMATION (continued)

U.S. STATE REGULATORY INFORMATION:


California - Permissible Exposure Limits for Chemical Contaminants: Carbon Monoxide, Nitrogen, Hydrogen Sulfide, Methane.

Florida - Substance List: Oxygen, Carbon Monoxide, Hydrogen Sulfide.


Kansas - Section 302/313 List: No.

Massachusetts - Substance List: Oxygen, Carbon Monoxide, Hydrogen Sulfide, Methane.

Michigan - Critical Materials Register: No.


Missouri - Employer Information/Toxic Substance List: Hydrogen Sulfide, Methane.

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


Texas - Hazardous Substance List: Hydrogen Sulfide.

West Virginia - Hazardous Substance List: Hydrogen Sulfide.

Wisconsin - Toxic and Hazardous Substances: Hydrogen Sulfide.

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 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. Scrappling 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.