# Material Safety Data Sheet

## 1. Product Identification

**Chemical Name:** Non-Flammable Gas Mixture

**Class:**

- Containing One or More of the Following Components in a Nitrogen Balance Gas:
  - Oxygen, 0.0015-23.5%;
  - Propane, 0-1.1%;
  - n-Pentane, 0-0.75%;
  - n-Hexane, 0-0.48%;
  - Carbon Monoxide, 0.0005-1.0%;
  - Hydrogen Sulfide, 0.001-0.025%

**Synonyms:**

- Nitrogen
- Carbon Monoxide
- Propane
- Oxygen, 0.0015-23.5%
- n-Pentane, 0-0.75%
- n-Hexane, 0-0.48%
- Carbon Monoxide, 0.0005-1.0%
- Hydrogen Sulfide, 0.001-0.025%

**Not Established:** (NE)

**Chemical Family Name:** Not Applicable

**Document Number:** 50016 (Replaces ISC MSDS No. 1810-2187, 1810-2343, 1810-3366, 1810-3937, 1810-7219, 1810-7599, 1810-6179, 1810-5403, 1810-9077, 1810-9103, 1810-9155, 1810-9197, 1810-9077, 1810-9103, 1810-9094, 1810-9157, 1810-9191, 1810-9188, 1810-9194, 1810-9181, 1810-9177, 1810-9159)

**Note:** 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.

## 2. Composition and Information on Ingredients

### Chemical Name: Oxygen

- **CAS #:** 7782-44-7
- **Mole %:** 0.0015 - 23.5%
- **ACGIH TLV:** TWA = 1000, STEL = 600 (Vacated 1989 PEL)
- **OSHA IDLH:** There are no specific exposure limits for Oxygen

### Chemical Name: Propane

- **CAS #:** 74-98-6
- **Mole %:** 0 - 1.1%
- **ACGIH TLV:** TWA = 1000, STEL = 600 (Vacated 1989 PEL)
- **OSHA IDLH:** There are no specific exposure limits for Propane

### Chemical Name: n-Pentane

- **CAS #:** 109-66-0
- **Mole %:** 0 - 0.75%
- **ACGIH TLV:** TWA = 750 (Vacated 1989 PEL)
- **OSHA IDLH:** There are no specific exposure limits for n-Pentane

### Chemical Name: n-Hexane

- **CAS #:** 110-54-3
- **Mole %:** 0 - 0.48%
- **ACGIH TLV:** TWA = 500, STEL = 50 (Vacated 1989 PEL)
- **OSHA IDLH:** There are no specific exposure limits for n-Hexane

### Chemical Name: Hydrogen Sulfide

- **CAS #:** 7783-06-4
- **Mole %:** 0.001-0.025%
- **ACGIH TLV:** TWA = 10 (ceiling), 10 minutes
- **OSHA IDLH:** STEL = 10 (ceiling), 10 minutes

### Chemical Name: Carbon Monoxide

- **CAS #:** 630-08-0
- **Mole %:** 0.0005 - 1.0%
- **ACGIH TLV:** TWA = 50, STEL = 200 ceiling
- **OSHA IDLH:** STEL = 35

### Chemical Name: Nitrogen

- **CAS #:** 7727-37-9
- **Mole %:** Balance
- **ACGIH TLV:** There are no specific exposure limits for Nitrogen

**Formulation:** Not Applicable

**Composition:** Not Applicable

**CAS #:** Not Applicable

**NOM:** Not Established

**NE:** Not Established

**Vacated:** (Vacated)

**DFG MAKs:**

- TWA = 10 (ceiling), 10 minutes
- STEL = 10 (ceiling), 10 minutes

**NIST REL:**

- TWA = 35
- STEL = 200 ceiling

**OSHA IDLH:**

- TWA = 35
- STEL = 200 ceiling

**Risk Classification:** B

**Effective Date:** May 29, 2012

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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 indication of the presence of this gas mixture, because olfactory fatigue occurs after over-exposure to Hydrogen Sulfide. Hydrogen Sulfide and Carbon Monoxide (another component of this gas mixture) are toxic to humans in relatively low concentrations. Over-exposure to this gas mixture can cause skin or eye irritation, nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. The Propane, n-Pentane, and n-Hexane components can cause anesthetic or peripheral neuropathy effects. 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 OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this gas mixture is by inhalation.

INHALATION: Due to the small size of an individual cylinder of this gas mixture, no unusual health effects from over-exposure to the product are anticipated under routine circumstances of use. A significant 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. Exposure to this component can result in respiratory arrest, coma, or unconsciousness. Continuous inhalation of low concentrations of Hydrogen Sulfide may cause 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:

CONCENTRATION OF HYDROGEN SULFIDE OBSERVED EFFECT
0.3 – 50 ppm Odor is obvious and unpleasant.
50 ppm Eye irritation. Dryness and irritation of nose, throat.
Slightly higher than 50 ppm Irritation of the respiratory system.
100 – 200 ppm Temporary loss of consciousness.
200 – 250 ppm Headache, vomiting, nausea. Prolonged exposure may lead to lung damage. Exposures of 4-8 hours can be fatal.
300 – 500 Swifter onset of symptoms. Death occurs in 1-4 hours.
500 ppm Headache, excitement, staggering, and stomach ache after brief exposure.
> 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.

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 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:

CONCENTRATION OF CARBON MONOXIDE OBSERVED EFFECT
All exposure levels: Over-exposure to Carbon Monoxide can be indicated by the lips and fingernails turning bright red.
200 ppm: ...... Slight symptoms (i.e. headache) after several hours of exposure.
400 ppm: Headache and discomfort experienced within 2-3 hours of exposure.
1,000 - 2000 ppm: Within 30 minutes, slight palpitations of the heart occurs. Within 1.5 hours, there is a tendency to stagger.
2000-2500 ppm: Within 2 hours, there is mental confusion, headaches, and nausea. Unconsciousness within 30 minutes.
> 2500 ppm: Potential for collapse and death before warning symptoms.

Another hazard associated with this gas mixture is the potential for anesthetic and peripheral neuropathy effects after inhalation over-exposures to the Propane, n-Pentane and n-Hexane components of this gas mixture. Specific human over-exposure data are available for n-Pentane and n-Hexane. As follows:

CONCENTRATION OF n-PENTANE OBSERVED EFFECT
Brief (10 minute) up to 5,000 ppm: No symptoms.
Higher than 5,000 ppm: Exhilaration, dizziness and headache can occur.
Long term: Can cause chronic neurological disorder causing damage to the nerves in the hands and feet (peripheral neuropathy)

CONCENTRATION OF n-HEXANE OBSERVED EFFECT
Brief of the respiratory tract, nausea and headache.
5000 ppm: Dizziness and drowsiness can occur.
Long term at 500 ppm: Can affect the nerves in the arms and legs. Effects include numbing or tingling sensations in the fingers and toes, tiredness, muscle weakness, cramps and spasms in the leg, difficulty in holding objects or walking, abdominal pains, loss of appetite, weight loss. More serious exposures can cause damage to the nerves in the hands and feet (peripheral neuropathy).

 Eyes and Vision: Abnormal color perception and pigment changes in the eyes have been reported among industrial workers exposed to 423-1280 ppm for 5 or more years.

 Blood Cells: Mild forms of anaemia have also been associated with exposure to hexane. These are of temporary nature.

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 headache, dizziness, drowsiness, loss of consciousness, 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:

CONCENTRATION OF OXYGEN OBSERVED EFFECT
12-16% Oxygen: Breathing and pulse rate increased, muscular coordination slightly disturbed.
10-14% Oxygen: Emotional upset, abnormal fatigue, disturbed respiration.
6-10% Oxygen: Nausea, vomiting, collapse, or loss of consciousness.
Below 6%: Convoluted movements, possible respiratory collapse, and death.

SKIN AND EYE CONTACT: The Hydrogen Sulfide component of this gas mixture may be irritating to the skin. Irritation of the skin can occur more readily of exposed hydrogen sulfide (less than 10 ppm). Exposure over several hours may result in "gas eyes" or "bore eyes" with symptoms of scratching, irritation, tearing and burning. Above 50 ppm of Hydrogen Sulfide, there is an intense tearing, blurring of vision, and pain when looking at light. Over-exposed 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 nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. Due to the presence of Hydrogen Sulfide, over-exposures to this gas mixture can also irritate the skin and eyes; severe eye irritation can result in blindness. Inhalation over-exposures to Propane, n-Pentane, and n-Hexane can cause anesthetic effects and motor neuropathy (i.e. pain and tingling in feet and hands).
3. HAZARD IDENTIFICATION (Continued)

CHRONIC: Abnormal color perception and pigment changes in the eyes have been reported among persons exposed to 420 ppm of n-Hexane for five years. Additionally, long-term exposure to low levels of n-Hexane or n-Pentane can affect the nervous in the arms and legs. Effects include numbness or tingling sensation, tiredness, cramps, spasms in legs, difficulty holding objects or walking, loss of appetite and weight loss. Pentane isomers, such as n-Pentane, and Pentane and isomers can cause sensitization of the heart to epinephrine. Refer to Section 11 (Toxicology Information) for additional information on the components of this gas mixture.

TARGET ORGANS: ACUTE: Respiratory system, blood system, central nervous system, cardiovascular system. CHRONIC: Reproductive system, cardiovascular system.

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS GAS MIXTURE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn. No unusual health effects are anticipated after exposure to this gas mixture, due to the small cylinder size. If any adverse symptom develops after over-exposure to this gas mixture, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary. Victim(s) who experience any adverse effect after over-exposure to this gas mixture must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).

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

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

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: 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, n-Hexane or n-Pentane in this gas mixture, cardiovascular system conditions, 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 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.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS: Not 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 contains toxic gases, Hydrogen Sulfide and Carbon Monoxide, and presents an extreme health hazard to firefighters. This gas mixture is not flammable, however, contained, 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 over-exposure to Hydrogen Sulfide and Carbon Monoxide, the toxic components of this gas mixture, and other safety hazards related to the remaining components and other gas mixtures, than an accidental release of 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, 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; 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 live cylinders must be segregated. If any adverse symptom develops, all live cylinders must be removed. Full cylinders must be locked and tagged 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 from physical damage. Full cylinders should not be transported or shipped. 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 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 Carbon Monoxide levels exceed the exposure levels given in Section 2 (Composition and Information on Ingredients) or if oxygen levels are below 19.5%, or if either level is unknown during emergency response to a release of this gas mixture. If respiratory protection is required for emergency response to this gas mixture, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134) or equivalent State standards. The following NIOSH respiratory protection recommendations for Hydrogen Sulfide and Carbon Monoxide are provided for further information.
5. PHYSICAL AND CHEMICAL PROPERTIES

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

GAS DENSITY @ 32°F (0°C) and 1 atm: 0.072 lbs/ft³ (1.153 kg/m³)
FREEZING/MELTING POINT @ 10 atm: -210°C (0.0°F)
SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 0.96
SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm: 0.023
EVAPORATION RATE (nBuCe = 1): Not applicable.
ODOR THRESHOLD: Not applicable.
VAPOR PRESSURE @ 70°F (21.1°C) psig: Not applicable.
COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

The following information is for the gas mixture.

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

HOW TO DETECT THIS SUBSTANCE (warning properties): Continuous inhalation of low concentrations of Hydrogen Sulfide (a component of this gas mixture) may cause olfactory fatigue, so that there are no distinct warning properties. In terms of leak detection, fittings and joints can be identified 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.

6. TOXICOLOGICAL INFORMATION

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

NITROGEN: There are no specific toxicity data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the body.

n-PENTANE: LCLo (inhalation, rat) = 364 g/m³/4 hours
LCLo (inhalation, mouse) = 120,000 mg/kg
LD50 (oral, rat) = 2871 mg/kg
LD50 (intraperitoneal, rat) = 9100 mg/kg
LD50 (inhalation, mouse) = 325 g/m³/2 hours
n-HEXANE: Eye, rabbit = 10 mg/ mild
TCLo (inhalation, rat) = 10,000 ppm/7 hr.
TCLo (inhalation, rat) = 5000 ppm/20 hours; teratogenic effects
LCLo (inhalation, rat) = 4000 ppm/20 hours
Hydrocarbon: Chickens: Inhalation (rat): 400-600 ppm, 5 days/week, peripheral neuropathy in 45 days; 850 ppm for 143 days, loss of weight and degeneration of the sciatic nerve. (mouse): 250 ppm, peripheral neuropathy within 7 months; no effects at 100 ppm.

PROPAINE: Long-Term Inhalation: No toxicity or abnormalities were observed when monkeys were exposed to approximately 750 ppm for 90 days. Similar results were obtained when monkeys were exposed to an aerosol spray containing 65% propane and isobutane.

CARBON MONOXIDE (continued): TCLo (inhalation, human) = 600 mg/m³/10 minutes
TCLo (inhalation, man) = 4000 ppm/30 minutes
TCLo (inhalation, man) = 650 ppm/45 minutes: central nervous system and blood system effects.
TCLo (inhalation, human) = 5000 ppm/5 minutes
TCLo (inhalation, dog) = 4000 ppm/46 minutes
TCLo (inhalation, rabbit) = 4000 ppm
TCLo (inhalation, rat) = 1811 ppm/4 hours
TCLo (inhalation, guinea pig) = 2450 ppm/4 hours
TCLo (inhalation, guinea pig) = 5718 ppm/4 hours
TCLo (inhalation, mammal) = 5000 ppm/5 minutes
LD50 (inhalation, wild bird) = 1334 ppm
TCLo (inhalation, human) = 673 ppm/1 hour
TCLo (inhalation, mammal) = 800 ppm/5 minutes

CARBON MONOXIDE (continued):

HYDROGEN SULFIDE (continued): LCLo (inhalation, mouse) = 600 ppm/30 minutes
LD50 (inhalation, man) = 5.7 mg/kg; central nervous system, pulmonary effects
SUSPECTED CANCER AGENT: The components of this gas mixture are not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC; therefore, they are not considered to be, nor suspected to be, cancer-causing agents by these agencies.
IRRITANT OF PRODUCTION: The Hydrogen Sulfide component of this gas mixture, is irritating to the eyes, and may be irritating to the skin.
SENSITIZATION OF PRODUCTION: The components of this gas mixture are not known to be skin or respiratory sensitizers. Pentane isomers (i.e. n-Pentane) and Propane can cause cardiac sensitization to epinephrine.

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

Mutagenicity: No mutagenicity effects have been described for the components of this gas mixture.
Teratogenicity: This gas mixture contains components that may cause embryotoxic effects in humans; however, due to the small total amount of the components, embryotoxic effects are not expected to occur.
Todergarten: 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 which exists up to 1%, can cause teratogenic effects in humans. Severe
11. TOXICOLOGICAL INFORMATION (continued)

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. Reproductive Toxicity: The components of this gas mixture are not expected 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 embryotoxicity 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:

<table>
<thead>
<tr>
<th>CHEMICAL DETERMINANT</th>
<th>SAMPLING TIME</th>
<th>BEI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>End of shift</td>
<td>3.5% of hemoglobin</td>
</tr>
<tr>
<td>Carbon monoxide in end-exhaled air</td>
<td>End of shift</td>
<td>20 ppm</td>
</tr>
<tr>
<td>n-Hexane</td>
<td>End of shift</td>
<td>5 mg/g creatinine</td>
</tr>
<tr>
<td>2,5-Hexanediol in urine</td>
<td>End of shift</td>
<td>-</td>
</tr>
<tr>
<td>n-Hexane in end-exhaled air</td>
<td>End of shift</td>
<td>-</td>
</tr>
</tbody>
</table>

12. ECOLOGICAL INFORMATION

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

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


PENTANE: Log Kow = 3.39. Water Solubility = 38.5 mg/L, LOG BCF (n-pentane) = calculated, 1.90 and 2.35, respectively. Photolysis, hydrolysis, and bioconcentration are not anticipated to be important fate processes. Biodegradation and soil adsorption are anticipated to be more important processes for this compound.

n-HEXANE: Log Kow = 3.90-4.11. Water Solubility = 9.5 mg/L. Estimated Bioconcentration Factor =2.24 and 2.89. Bioconcentration in aquatic organisms is low. Hexane is volatile. Rapid volatilization from water and soil is anticipated for this compound. Hexane will float in slick on surface of the water

HYDROGEN SULFIDE: Water Solubility = 1 g/242 mL at 20°C.

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

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. The Hydrogen Sulphide 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 the effects of this gas effects on aquatic life. The presence of more than a trace of Carbon Monoxide is a hazard to fish. The following aquatic toxicity data are available for the Hydrogen Sulfide component of this gas mixture.

TLm (Lepomis macrochirus, bluegill sunfish) = 0.0478 mg/L/96 hour

13. DISPOSAL CONSIDERATIONS

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

14. TRANSPORTATION INFORMATION

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

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

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

UN IDENTIFICATION NUMBER: Not Applicable

PACKING GROUP: DOT (US) REQUIRED: Class 2.2 (Non-Flammable Gas)

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 129

MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172, Appendix B).

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

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: Not Applicable

HAZARD LABEL: Class 2.2 (Non-Flammable Gas)

SPECIAL PROVISIONS: None

EXPLOSIVE LIMIT AND LIMITED QUANTITY INDEX: None

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 by 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: This gas is not 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>COMPONENT</th>
<th>SARA 302</th>
<th>SARA 304</th>
<th>SARA 313</th>
</tr>
</thead>
<tbody>
<tr>
<td>n-Hexane</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>
15. REGULATORY INFORMATION (continued)

U.S. SARA THRESHOLD PLANNING QUANTITY: Section 302 EHS TPRQ – Hydrogen Sulfide = 500 lbs (227 kg); Hydrogen Fluoride = 500 lbs (227 kg).  Hydrogen Chloride = 500 lbs (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): Hexane = 5000 lb (2270 kg); Hydrogen Sulfide = 100 lbs (45.4 lb)

OTHER U.S. FEDERAL REGULATIONS:

- Hydrogen Sulfide; Carbon Monoxide, Propane, n-Pentane, and n-Hexane are subject to the reporting requirements of CERCLA 90610.1000.
- Hydrogen Sulfide; Propane and n-Pentane 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 (39 CFR 1910.119). Hydrogen Sulfide is listed in Appendix A of this regulation. The Threshold Quantity for Hydrogen Sulfide under this regulation is 1500 lbs. This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
- Nitrogen, Oxygen and n-Hexane are not listed as 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 (4553 kg) or greater. Carbon Monoxide, Propane, and n-Pentane are listed under this regulation in Table 3 as, Regulated Substances (Flammable), in quantities of 10,000 lbs (4553 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:
  - Kansas: Section 302/313 List: No.

ADDITIONAL CANADIAN REGULATIONS:

- CANADIAN DISL/NDLS INVENTORY STATUS: The components of this gas mixture are on the Canadian DSL Inventory.
- CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: The components of this gas mixture are not on the CEPA Priorities Substances List.

CANADIAN WHMIS 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 pack as Flammable n.o.s., UN 39. MIXTURES typically packaged in these cylinders are Nonflammable n.o.s., UN 1956.

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 them to us prepared. 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 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) 412-0960.

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.