1. PRODUCT IDENTIFICATION

**CHEMICAL NAME; CLASS:** HELIUM/METHYL MERCAPTAN GAS MIXTURE

**CHEMICAL FAMILY:** Alkanethiol/Inert Gas Mixture  
**PRODUCT USE:** Research Gas

**MANUFACTURER**  
MATHESON TRI-GAS, INC.  
959 ROUTE 46 EAST  
PARSIPPANY, NJ 07054-0624  
USA  
Phone: 973/257-1100

**EMERGENCY PHONE:**  
CHEMTREC (U.S. DOMESTIC): 1-800-424-9300  
CHEMTREC INTERNATIONAL: 1-703-527-3887  
CANUTEC (CANADA): 1-613-996-6666

2. COMPOSITION and INFORMATION ON INGREDIENTS

(10,000 ppm = 1%)

<table>
<thead>
<tr>
<th>CHEMICAL NAME</th>
<th>CAS #</th>
<th>mole %</th>
<th>EXPOSURE LIMITS IN AIR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>ACGIH-TLV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TWA ppm</td>
</tr>
<tr>
<td>Methyl Mercaptan</td>
<td>7783-06-4</td>
<td>1 ppm-&lt;2.92</td>
<td>10</td>
</tr>
<tr>
<td>Helium</td>
<td>7440-59-7</td>
<td>Balance</td>
<td>There are no specific exposure limits for Helium. Oxygen levels should be maintained above 19.5%.</td>
</tr>
</tbody>
</table>

**NOTE:** All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1998 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR. See Section 16 for Definitions of Terms Used.
EMERGENCY OVERVIEW: This is a colorless, non-flammable gas mixture, with a strong odor of rotten cabbage or skunk, due to the presence of Methyl Mercaptan. The odor can serve as an adequate warning of the presence of the gas mixture, because the odor of Methyl Mercaptan can be detected at concentrations far below the level which will produce adverse health effects. This gas mixture may be irritating to exposed tissues. Inhalation of high concentrations may have adverse effects on the central nervous system. Additionally, releases of this gas mixture may produce oxygen-deficient atmospheres. Individuals in such atmospheres may be asphyxiated. This gas mixture presents no hazard of flammability or reactivity. Flame or high temperature impinging on a localized area of the cylinder can cause cylinder to rupture violently or explosively.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this product is by inhalation. The components of this gas mixture that are not indicated to have specific health effects are either not known to have adverse health effects or there are no data regarding adverse effects.

INHALATION: Based on animal evidence and human case reports, low levels of Methyl Mercaptan can cause eye, nose and throat irritation, and symptoms of central nervous system (CNS) depression such as headache, dizziness, staggering gait, nausea and vomiting. High concentrations can cause severe damage to the lungs (pulmonary edema), convulsions, respiratory paralysis, coma, and rapidly cause death. Only very limited information is available on the effects of chronic exposure to Methyl Mercaptan. The long-term health effects may be similar to those of hydrogen sulfide, that is, non-specific symptoms such as fatigue, headache, dizziness, hoarseness, cough and irritability. In addition, high concentrations of this gas mixture can cause an oxygen-deficient environment, especially if released in a poorly-ventilated area (e.g., an enclosed or confined space). 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 overexposure, death may occur. The 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 increase, muscular coordination slightly disturbed.</td>
</tr>
<tr>
<td>10-14% Oxygen:</td>
<td>Emotional upset, abnormal fatigue, disturbed respiration.</td>
</tr>
<tr>
<td>6-10% Oxygen:</td>
<td>Nausea, vomiting, collapse, or loss of consciousness.</td>
</tr>
<tr>
<td>Below 6%:</td>
<td>Convulsive movements, possible respiratory collapse, and death.</td>
</tr>
</tbody>
</table>

CONTACT WITH SKIN or EYES: Due to the presence of Methyl Mercaptan in this gas mixture, skin over-exposures to this product may lead to irritation or dermatitis (red, cracked, irritated skin), depending upon concentration and duration of exposure. Contact of the gas with the eyes can cause pain, redness, and irritation. In addition, contact with rapidly expanding gases (which are released under high pressure) may cause frostbite.

SKIN ABSORPTION: No component of this gas mixture presents a hazard of skin absorption.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: Over-exposure to this gas mixture may cause the following health effects:

ACUTE: This gas mixture may be irritating to the eyes, skin, mucous membranes, and any other exposed tissue. If this product is inhaled, irritation of the respiratory system may occur, with coughing, breathing difficulty, and the development of lung disorders. In high concentrations, this gas mixture may cause adverse effects on the central nervous system. Another significant health hazard associated with this gas mixture, is the potential for exposure to oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, ringing in ears, headaches, shortness of breath, wheezing, headache, dizziness, indigestion, nausea, unconsciousness, and death. The skin of a victim of over-exposure may have a blue color.
3. HAZARD IDENTIFICATION (Continued)

CHRONIC: Persistent irritation may result from repeated exposures to this gas mixture. Repeated Methyl Mercaptan overexposures by inhalation may cause permanent lung damage. Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may affect the heart and nervous system.

TARGET ORGANS: ACUTE: Respiratory system, skin, eyes, central nervous system. CHRONIC: Skin, respiratory system, heart and central nervous system.

HMIS RATING: HEALTH HAZARD = 2 FLAMMABILITY HAZARD = 0 PHYSICAL HAZARD = 0

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

4. FIRST-AID MEASURES

GENERAL INFORMATION: 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 and Fire-Retardant clothing must be worn. Remove to fresh air, as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. Seek medical attention immediately.

SKIN EXPOSURE: Rinse exposed skin for 15 minutes if any irritation adverse effects occur. If release of this gas mixture has resulted in frostbite, warm affected area slowly. Seek immediate medical attention.

EYE EXPOSURE: If release of this gas mixture has affected the eyes, seek immediate medical attention.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing acute or chronic respiratory conditions may be aggravated by overexposure to this gas mixture.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, if necessary; treat symptoms; reduce or eliminate exposure. Be observant for initial signs of pulmonary edema. The use of respiratory stimulants, such as caffeine and sodium benzoate (7.5 grains), eormaine (0.5 cm³, intramuscularly or intravenously), camphor in oil (1-2 cm³, intramuscularly) or metrazol (1.5 grains), are recommended to treat victims of over-exposure to Methyl Mercaptan.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable; non-flammable gas.

AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %): Not applicable.

FIRE EXTINGUISHING MATERIALS: Use fire-extinguishing material appropriate for surrounding materials. Use water spray to cool fire-exposed structures, cylinders and equipment.

UNUSUAL FIRE AND EXPLOSION HAZARD: None; this gas is non-flammable.

EXPLOSION SENSITIVITY TO MECHANICAL IMPACT: Not sensitive.

EXPLOSION SENSITIVITY TO STATIC DISCHARGE: Not sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Evacuate all personnel from danger area. Immediately cool cylinders with water spray from maximum distance, to avoid danger of cylinder rupture. Incipient fire responders should wear eye protection. Structural fire fighters must wear Self-Contained Breathing Apparatus and full protective equipment. When cool, move cylinders from fire area if this can be done without risk to firefighters.

NFPA RATING

See Section 16 for Definition of Ratings

MATHESON TRI-GAS
6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment, should be used in the event of a significant release from a single cylinder. Use only non-sparking tools. Call CHEMTREC (1-800-424-9300) for emergency assistance. Or if in Canada, call CANUTEC (613-996-6666).

Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in-place or remove it to a safe area and allow the gas to be released there. Protect personnel attempting to shut-off with water spray. Monitor the surrounding area for the level the level of Methyl Mercaptan and Oxygen. The atmosphere must have at least 19.5 percent Oxygen before non-emergency personnel can be allowed in the area without Self-Contained Breathing Apparatus.

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES

Do not eat or drink while handling chemicals.

Be aware of all potential exposure symptoms; exposures to a fatal oxygen-deficient atmosphere could occur without any significant warning symptoms.

All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a release.

Workers who handle this gas mixture should wear protective clothing, as listed in Section 8 (Exposure Controls and Personal Protection).

If ventilation controls are not adequate to provide sufficient oxygen content, proper respiratory protection equipment should be provided and workers using such equipment should be carefully trained in its operation and limitations.

Precautions must always be taken to prevent suck-back of foreign materials into the cylinder by using a check-valve, or vacuum break, since suck-back may cause dangerous pressure changes within the cylinder.

STORAGE AND HANDLING PRACTICES:

Cylinders should be stored upright and be firmly secured to prevent falling or being knocked-over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Cylinders should be stored in dry, well-ventilated areas away from sources of heat or ignition. Do not allow the area where cylinders are stored to exceed 52°C (125°F).

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Compressed gases can present significant safety hazards. The following rules are applicable to work situations in which cylinders are being used.

Before Use: Move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap (where provided) in-place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not use oils or grease on gas-handling fittings or equipment. Immediately contact the supplier if there are any difficulties associated with operating the cylinder valve. Never insert an object (e.g wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage the valve, causing a leak to occur. Use an adjustable strap wrench to remove over-tight or rusted caps. Never strike an arc, on a compressed gas cylinder or make a cylinder part of an electric circuit.

After Use: Close main cylinder valve. Replace valve protection cap. Close valve after each use and when empty. Mark empty cylinders “EMPTY”.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Refer to current CGA Guidelines for information on protective practices during maintenance of contaminated equipment.
VENTILATION AND ENGINEERING CONTROLS: Use with adequate, explosion-proof ventilation to ensure compliance with exposure limits described in Section 2 (Composition and Information on Ingredients). Local exhaust ventilation is preferred, because it prevents dispersion of this gas mixture into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the level of Oxygen.

RESPIRATORY PROTECTION: Maintain the Oxygen level above 19.5% in the workplace. If necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent U.S. State standards and Canadian CSA Standard Z94.4-93. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA’s Respiratory Protection Standard (1910.134-1998). The following are NIOSH respiratory protection guidelines for the Methyl Mercaptan component of this gas mixture. These are presented as this component presents a risk of toxicity in this mixture.

METHYL MERCAPTAN CONCENTRATION RESPIRATORY PROTECTION
Up to 5 ppm: Any Chemical Cartridge Respirator with organic vapor cartridge(s), or any Supplied-Air Respirator (SAR).
Up to 12.5 ppm: Any SAR operated in a continuous-flow mode, or any Powered, Air-Purifying Respirator (PAPR) with organic vapor cartridge(s).
Up to 25 ppm: Any Chemical Cartridge Respirator with a full facepiece and organic vapor cartridge(s), or any Air-Purifying, Full-Facepiece Respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister, or any PAPR with a tight-fitting facepiece and organic vapor cartridge(s), or any SAR that has a tight-fitting facepiece and is operated in a continuous-flow mode, or any Self-Contained Breathing Apparatus (SCBA) with a full facepiece, or any SAR with a full facepiece.
Up to 150 ppm: Any SAR operated in a pressure-demand or other positive-pressure mode.
Emergency or Planned Entry into Unknown Concentrations or IDLH Conditions: Any SCBA that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode, or any SAR that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive-pressure mode.
Escape: Any Air-Purifying, Full-Facepiece Respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister, or any appropriate escape-type, SCBA.

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


BODY PROTECTION: Use body protection appropriate for task. Transfer of large quantities under pressure may require protective equipment appropriate to the task. 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, foot protection should be used, as described in U.S. OSHA 29 CFR 1910.136.

9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for Helium, the main component of this gas mixture:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAS DENSITY (lb/cu ft)</td>
<td>0.103</td>
</tr>
<tr>
<td>SPECIFIC GRAVITY (air = 1)</td>
<td>0.138</td>
</tr>
<tr>
<td>SOLUBILITY IN WATER</td>
<td>0.0094</td>
</tr>
<tr>
<td>EXPANSION RATIO</td>
<td>Not applicable</td>
</tr>
<tr>
<td>ODOR THRESHOLD</td>
<td>Not applicable</td>
</tr>
<tr>
<td>VAPOR PRESSURE (psia)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>COEFFICIENT WATER/OIL DISTRIBUTION</td>
<td>Not applicable</td>
</tr>
<tr>
<td>EVAPORATION RATE (nBuAc = 1)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>FREEZING POINT</td>
<td>Not applicable</td>
</tr>
<tr>
<td>BOILING POINT (@ 1 atmos)</td>
<td>-268.9°C (-452.1°F)</td>
</tr>
<tr>
<td>SPECIFIC VOLUME (ft³/lb)</td>
<td>97.09</td>
</tr>
<tr>
<td>MOLECULAR WEIGHT</td>
<td>4.00</td>
</tr>
</tbody>
</table>

HELIEUM METHYL MERCAPTAN GAS MIXTURE MSDS
EFFECTIVE DATE: FEBRUARY 17, 2004
PAGE 5 OF 11
MATH0071
MATHESON TRI-GAS
9. PHYSICAL and CHEMICAL PROPERTIES

The following information is pertinent to this gas mixture:

**ODOR THRESHOLD:** For Methyl Mercaptan: 0.019-0.041 ppm (detection); 0.001 ppm (recognition); 2x10(-7) ppm (detection), also reported

**APPEARANCE, ODOR AND COLOR:** This gas mixture is colorless and has a strong odor of rotten cabbage or skunk, due to the presence of Methyl Mercaptan.

**HOW TO DETECT THIS SUBSTANCE (warning properties):** The odor can serve as an adequate warning of the presence of the gas mixture, because the odor of Methyl Mercaptan can be detected at concentrations far below the level which will produce adverse health effects. 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.

10. STABILITY and REACTIVITY

**STABILITY:** Stable at standard temperatures and pressures. The Methyl Mercaptan component can react with steam to produce toxic and flammable hydrogen sulfide gas.

**DECOMPOSITION PRODUCTS:** The decomposition products for individual components are as follows:

- **Helium** does not decompose, per se, but may react with other compounds in the heat of a fire.
- **Methyl Mercaptan**, when heated to decomposition, Methyl Mercaptan releases carbon monoxide, carbon dioxide, sulfur oxides, hydrogen sulfide. When in contact with steam, Methyl Mercaptan can react to evolve hydrogen sulfide gas.

**MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE:** Methyl Mercaptan is incompatible with strong oxidizing agents (e.g. sulfuric acid, sulfuryl chloride, hydrogen peroxide, potassium permanganate), acids, aldehydes, ketones, strong bases (e.g. sodium hydroxide), alkali metals (e.g. sodium, potassium), heavy metals (e.g. mercury, lead and zinc), mercury (ii) oxide, calcium hypochlorite. The Helium component is inert.

**HAZARDOUS POLYMERIZATION:** Will not occur.

**CONDITIONS TO AVOID:** Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

**TOXICITY DATA:** The Helium component is a simple asphyxiant (SA), which acts to displace oxygen in the environment. No toxicity data are applicable. The following are toxicity data for the Methyl Mercaptan component of this gas mixture:

**METHYL MERCAPTAN:**
- **LC50 (Inhalation-Rat)** 675 ppm: Lungs, Thorax, or Respiration: other changes; Gastrointestinal: hypermotility, diarrhea; Kidney, Ureter, Bladder: urine volume increased
- **LC50 (Inhalation-Mouse)** 6630 µg/m3/2 hours
- **LD50 (Unreported-Mammal-species unspecified)** 60,670 µg/kg
- **TCLo (Inhalation-Rat)** 17 ppm/7 hours/13 weeks-intermittent: Endocrine: changes in adrenal weight; Endocrine: changes in spleen weight; Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol)

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

**IRRITANCY OF PRODUCT:** This gas mixture may be irritating to contaminated tissue, due to the presence of Methyl Mercaptan.

**SENSITIZATION TO THE PRODUCT:** The components of this product are not known to be skin or respiratory sensitziers.

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

- **Mutagenicity:** The components of this gas mixture are not reported to cause mutagenic effects in humans.
- **Embryotoxicity:** The components of this gas mixture are not reported to cause embryotoxic effects in humans.
11. TOXICOLOGICAL INFORMATION (Continued)

REPRODUCTIVE TOXICITY INFORMATION (continued):
  Teratogenicity: The components of this gas mixture are not reported to cause teratogenic effects in humans.
  Reproductive Toxicity: The components of this gas mixture are not reported to cause adverse reproductive effects in humans.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, there are no Biological Exposure Indices (BEIs) determined for the components of this gas mixture.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: This gas mixture will be dissipated rapidly in well-ventilated areas. The following information is available for the Methyl Mercaptan component of this gas mixture.

METHYL MERCAPTAN:
Terrestrial Fate: If released on land, gaseous Methyl Mercaptan will adsorb strongly to the soil and may oxidize. It should also oxidize when released on soil in dilute aqueous solutions, although adsorption to soil would be much less than with the vapor.
Aquatic Fate: When released in water, Methyl Mercaptan will be rapidly lost through volatilization (estimated half-life 2 hours in a model river). Oxidation should occur in the water column at a rate depending on the pH, natural oxidants and metal catalysts in the water. No data concerning the oxidation rates of Methyl Mercaptan in natural waters are available. In anoxic sediments, Methyl Mercaptan will rapidly mineralize in a time period of hours to a week.
Atmospheric Fate: In the atmosphere, Methyl Mercaptan will be oxidized by photochemically generated hydroxyl radicals. The half-life for this reaction is 11.6 hours. Under photochemical smog conditions, the loss is much faster with a half-life of 2 hours being reported. At night Methyl Mercaptan will degrade by reaction with nitrate radicals. Its half-life will be 0.7-1 hours.
Bioconcentration: Methyl Mercaptan is highly soluble in water (23.3 g/L) and is therefore unlikely to bioconcentrate in aquatic organisms.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Any adverse effect on animals would be related to oxygen deficient environments.

EFFECT OF CHEMICAL ON AQUATIC LIFE: There are no data on possible adverse effects from this gas mixture on aquatic life. The following are aquatic toxicity data for the Methyl Mercaptan component:
- LC50 (salmonides) 0.55-0.9 mg/L
- TLm (Fathead minnows) 48 hours = 1.0 ppm
- Lethal (White bass) 105 minutes = 1.0 ppm
- Lethal (Bluegill sunfish) 6-8 hours = 1.0 ppm
- Lethal (Shiners) 120 hours = 0.5 ppm
- Lethal (Daphnia magna) = 1.0

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual product to Matheson Tri-Gas. Do not dispose of locally.

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.
(Helium, Methyl Mercaptan)
HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)
UN IDENTIFICATION NUMBER: UN 1956
PACKING GROUP: Not Applicable
D.O.T HAZARD LABEL: Class 2.2 (Non-Flammable Gas)
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126
MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as a Marine Pollutant (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-body vehicles present serious safety hazards and should be discouraged.
NOTE: Shipment of compressed gas cylinders which have not been filled with the owner’s consent is a violation of Federal law (49 CFR, Part 173.301 (b).
TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This gas mixture is considered as Dangerous Goods, per regulations of Transport Canada. The use of the above U.S. DOT information from the U.S. 49 CFR regulations is allowed for shipments that originate in the U.S. For shipments via ground vehicle or rail that originate in Canada, the following information is applicable.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (Helium, Methyl Mercaptan)
HAZARD CLASS NUMBER and DESCRIPTION: Class 2.2 (Non-Flammable Gas)
UN IDENTIFICATION NUMBER: UN 1956
PACKING GROUP: Not Applicable
HAZARD LABEL(S) REQUIRED: Class 2.2 (Non-Flammable Gas)
SPECIAL PROVISIONS: None
EXPLOSIVE LIMIT & LIMITED QUANTITY INDEX: 0.12
ERAP INDEX: None
PASSENGER CARRYING SHIP INDEX: None
PASSENGER CARRYING ROAD OR RAIL VEHICLE INDEX: 75
MARINE POLLUTANT: The components of this gas mixture are not Marine Pollutants.
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126
NOTE: Shipment of compressed gas cylinders via Public Passenger Road Vehicle is a violation of Canadian law (Transport Canada Transportation of Dangerous Goods Act, 1992).

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The Methyl Mercaptan component of 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>Methyl Mercaptan</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

U.S. SARA HAZARD CATEGORIES (SECTION 311/312, 40 CFR 370-21): ACUTE: Yes; CHRONIC: Yes; FIRE: No; REACTIVE: No; SUDDEN RELEASE: Yes

U.S. TSCA INVENTORY STATUS: Components of this product are listed on the TSCA Inventory.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Methyl Mercaptan = 100 lb (45.4 kg)

OTHER U.S. FEDERAL REGULATIONS: Methyl Mercaptan is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The threshold quantity for this gas is 10,000 lbs (4,540 kg).

U.S. STATE REGULATORY INFORMATION: Components of this product are covered under some specific State regulations, as denoted below (other State regulatory lists may exist; individual States should be contacted regarding full compliance).

California - Permissible Exposure Limits for Chemical Contaminants: Methyl Mercaptan, Helium.
New Jersey - Right to Know List: Methyl Mercaptan, Helium.
Pennsylvania - Hazardous Substance List: Methyl Mercaptan, Helium.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): No component of this product is on the California Proposition 65 lists.

LABELING: Cylinders of this gas mixture should be labeled for precautionary information per the guidelines of the CGA. Refer to the CGA for further information.

ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL/NDSL INVENTORY STATUS: The components of this product are listed on the DSL Inventory.
ADDITIONAL CANADIAN REGULATIONS (continued):

OTHER CANADIAN REGULATIONS: Not applicable.

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

CANADIAN WHMIS CLASSIFICATION AND SYMBOLS: This gas mixture would be categorized as a Controlled Product, Hazard Classes: A (compressed gas), and D2B (Materials Causing Other Toxic Effects - Acute and Chronic Toxic Effects). The following symbol is required for WHMIS compliance for this gas mixture.

16. OTHER INFORMATION

CREATION DATE: February 16, 2004

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 use 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 gas mixtures can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923 Telephone: (703) 788-2700.

“Safe Handling of Compressed Gases in Containers” (P-1, 1999)
“Safe Handling and Storage of Compressed Gases” (AV-1, 1999)
“Handbook of Compressed Gases” (1992)

PREPARED BY:
CHEMICAL SAFETY ASSOCIATES, Inc.
PO Box 3519, La Mesa, CA 91944-3519
800/441-3365

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number that uniquely identifies each constituent.

EXPOSURE LIMITS IN AIR:

CEILING LEVEL: The concentration that shall not be exceeded during any part of the working exposure.
LOQ: Limit of Quantitation.
MAK: Federal Republic of Germany Maximum Concentration Values in the workplace.
NE: Not Established. When no exposure guidelines are established, an entry of NE is made for reference.
NIC: Notice of Intended Change.
NIOSH CEILING: The exposure that shall not be exceeded during any part of the workday. If instantaneous monitoring is not feasible, the ceiling shall be assumed as a 15-minute TWA exposure (unless otherwise specified) that shall not be exceeded at any time during a workday.

NIOSH RELs: NIOSH’s Recommended Exposure Limits.
OSHA’s Permissible Exposure Limits. This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, “Vacated 1989 PEL,” is placed next to the PEL that was vacated by Court Order.

SKIN: Used when there is a danger of cutaneous absorption.

EXPOSURE LIMITS IN AIR (continued):

STEL-Short Term Exposure Limit: Short Term Exposure Limit, usually a 15-minute time-weighted average (TWA) exposure that should not be exceeded at any time during a workday, even if the 8-hr TWA is within the TLV-TWA, PEL-TWA or REL-TWA.

TLV-Threshold Limit Value: An airborne concentration of a substance that represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour.

TWA-Time Weighted Average: Time Weighted Average exposure concentration for a conventional 8-hr (TLV, PEL) or up to a 10-hr (REL) workday and a 40-hr workweek.

IDLH-Immediately Dangerous to Life and Health: This level represents a concentration from which one can escape within 30- minutes without suffering escape-preventing or permanent injury.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM

HAZARD RATINGS: This rating system was developed by the National Paint and Coating Association and has been adopted by industry to identify the degree of chemical hazards.

HEALTH HAZARD:

0 (Minimal Hazard): No significant health risk, irritation of skin or eyes not anticipated. Skin Irritation: Essentially non-irritating. PII or Draize = “0”. Eye Irritation: Essentially non-irritating, or minimal effects which clear in < 24 hours [e.g. mechanical irritation]. Draize = “0”.

MATHESON TRI-GAS
HAZARDOUS MATERIALS IDENTIFICATION SYSTEM
HAZARD RATINGS (continued):

HEALTH HAZARD (continued):

0 (continued): Oral Toxicity LD$_{50}$ Rat: < 5000 mg/kg.  Dermal Toxicity LD$_{50}$Rat or Rabbit: < 2000 mg/kg.  Inhalation Toxicity 4-hrs LC$_{50}$ Rat or Rabbit: < 20 mg/L; 1 (Slight Hazard: Minor reversible injury may occur; slightly or mildly irritating.  Skin Irritation: Slightly or mildly irritating.  Eye Irritation: Slightly or mildly irritating.  Skin Irritation: Moderately irritating; primary irritant; sensitizer.  P.I. or Draize > 0, < 5.  Eye Irritation: Moderately to severely irritating and/or corrosive; irreversible corneal opacity; corneal involvement or irritation clearing in 8-21 days. Draize > 0, < 25. Oral Toxicity LD$_{50}$ Rat: > 50-500 mg/kg.  Dermal Toxicity LD$_{50}$Rat or Rabbit: > 2000-1000 mg/kg.  Inhalation Toxicity LC$_{50}$ 4-hrs Rat: > 0.5-2 mg/L; 3 (Serious Hazard: Major injury likely unless prompt action is taken and medical treatment is given; high level of toxicity; corrosive.  Skin Irritation: Severely irritating and/or corrosive; may destroy dermal tissue, cause skin burns; dermal necrosis.  P.I. or Draize > 5-8 with destruction of tissue.  Eye Irritation: Corrosive.  irreversible destruction of ocular tissue; corneal involvement or irritation persisting for more than 21 days. Draize > 80 with effects irreversible in 21 days. Oral Toxicity LD$_{50}$ Rat: > 1-50 mg/kg.  Dermal Toxicity LD$_{50}$Rat or Rabbit: > 20-200 mg/kg.  Inhalation Toxicity LC$_{50}$ 4-hrs Rat: > 0.05-0.5 mg/L; 4 (Severe Hazard: Life-threatening; permanent damage or injury may result from short term or repeated exposure. Skin Irritation: Not appropriate. Do not rate as a "4", based on skin irritation alone.  Eye Irritation: Not appropriate. Do not rate as a "4", based on eye irritation alone. Oral Toxicity LD$_{50}$ Rat: < 1 mg/kg.  Dermal Toxicity LD$_{50}$Rat or Rabbit: < 20 mg/kg.  Inhalation Toxicity LC$_{50}$ 4-hrs Rat: < 0.05 mg/L).

FLAMMABILITY HAZARD:

0 (Non-Explosive).  Unstable Compressed Gases: No Rating.  Pyrophorics: No Rating.  Oxidizers: No "0" rating allowed.  Unstable Reactives: Substances that will not polymerize, decompose, condense or self-react.; 1 (Water Reactivity: Materials that polymerize, decompose, condense or self-react with water.  Organic Peroxides: Materials that may form peroxides; 2 (Severe Hazard: Materials that may react violently with water.  Organic Peroxides: Materials that may form peroxides; 3 (Explosive materials that may react violently with water.  Organic Peroxides: Materials that may form peroxides).

3 (continued): Materials that burn extremely rapidly, usually by reason of self-contained oxygen [e.g. dry nitrocellulose and many organic peroxides] or materials that are readily dispersed in air, and which will burn readily, including: Flammable gases; Flammable cryogenic materials; Any liquid or gaseous material that is liquid while under pressure and has a flash point below 22.8°C [73°F] and a boiling point below 37.8°C [100°F] for an 8:1 mixture or below 130°F [54.4°C] for an 8:1 mixture or below [e.g. pyrophoric].

Packing Group: Hazard:

0 (Water Reactivity: Materials that do not react with water.  Organic Peroxides: Materials that are normally stable, even under fire conditions and will not react with water.  Explosives: Substances that are Non-Explosive.  Unstable Compressed Gases: No Rating.  Pyrophorics: No Rating.  Oxidizers: No "0" rating allowed.  Unstable Reactives: Substances that will not polymerize, decompose, condense or self-react.; 1 (Water Reactivity: Materials that change or decompose upon exposure to moisture.  Organic Peroxides: Materials that are normally stable, but can become unstable at high temperatures and pressures.  These materials may react with water, but will not release energy. Explosives: Division 1.5 & 1.6 substances that are very insensitive explosives or that do not have a mass explosion hazard.  Compressed Gases: Pressure below OSHA definition.  Pyrophorics: No Rating.  Oxidizers: Packaging Group III; Solids: any material that in either concentration tested, exhibits a mean burning time less than or equal to the mean burning time of a 3:7 potassium bromate/cellulose mixture and the criteria for Packing Group I and II are not met. Liquids: any material that exhibits a mean pressure rise time less than or equal to the pressure rise time of a 1:1 nitric acid (65%)/cellulose mixture and the criteria for Packing Group I and II are not met. Unstable Reactives: Substances that may decompose, condense or self-react, but only under conditions of high temperature and/or pressure and have little or no potential to cause significant heat generation or explosive hazard. Substances that readily undergo hazardous polymerization in the absence of inhibitors.; 2 (Water Reactivity: Materials that may react violently with water.  Organic Peroxides: Materials that, in themselves, are normally unstable and will readily undergo hazardous polymerization in the absence of inhibitors; 3 (Explosive materials that may react violently with water.  Organic Peroxides: Materials that may form peroxides; 4 (Severe Hazard: Materials that may form peroxides; 5 (Explosive materials that may form peroxides; 6 (Explosive materials that may form peroxides).
DEFINITIONS OF TERMS (Continued)

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM
HAZARD RATINGS (continued):

PHYSICAL HAZARD (continued):

3 (continued): Organic Peroxides: Materials that are capable of detonation or explosive reaction, but require a strong initiating source, or must be heated under confinement before initiation; or materials that react explosively with water. Explosives: Division 1.2 – Explosive substances that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but do not have a mass explosion hazard. Compressed Gases: Pressure > 514.7 psi absolute at 21.1°C (70°F) [500 psig]. Pyrophorics: No Rating. Oxidizers: Packing Group I Solids: any material that, in either concentration tested, exhibits a mean burning time less than the mean burning time of a 3.2 potassium bromate/cellulose mixture. Liquids: Any material that spontaneously ignites when mixed with cellulose in a 1:1 ratio, or which exhibits a mean pressure rise time less than the pressure rise time of a 1:1 perchloric acid (50%)/cellulose mixture. Unstable Reactives: Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a moderate potential to cause significant heat generation or explosion. Organic Peroxides: Materials that are readily capable of detonation or explosive decomposition at normal temperature and pressures. Explosives: Division 1.1 & 1.2-explosive substances that have a mass explosion hazard or have a projection hazard. A mass explosion is one that affects almost the entire load instantaneously. Compressed Gases: No Rating. Pyrophorics: Add to the definition of Flammability “4”. Oxidizers: No “4” rating. Unstable Reactives: Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a high potential to cause significant heat generation or explosion.

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS:

HEALTH HAZARD: 0 (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); 1 (materials that on exposure under fire conditions could cause irritation or minor residual injury); 2 (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); 3 (materials that can on short exposure could cause serious temporary or residual injury); 4 (materials that under very short exposure could cause death or major residual injury).

FLAMMABILITY HAZARD: 0 Materials that will not burn under typical fire conditions, including intrinsically noncombustible materials such as concrete, stone, and sand. 1 Materials that must be preheated before ignition can occur. Materials in this degree require considerable preheating, under all ambient temperature conditions, before ignition and combustion can occur. 2 Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not under normal conditions form hazardous atmospheres with air, but under high ambient temperatures or under moderate heating could release vapor in sufficient quantities to produce hazardous atmospheres with air. 3 Liquids and solids that can be ignited under all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures or, though unaffected by ambient temperatures, are readily ignited under almost all conditions. 4 Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air and will burn readily.

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

INSTABILITY HAZARD: 0 Materials that in themselves are normally stable, even under fire conditions. 1 Materials that in themselves are normally stable, but that can become unstable at elevated temperatures and pressures. 2 Materials that readily undergo violent chemical change at elevated temperatures and pressures. 3 Materials that in themselves are capable of detonation or explosive decomposition or explosive reaction, but that require a strong initiating source or that must be heated under confinement before initiation. 4 Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures.

FLAMMABILITY LIMITS IN AIR: Much of the information related to fire and explosion is derived from the National Fire Protection Association (NFPA). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Human and Animal Toxicology: Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: LD50 - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; LC50 - Lethal Concentration (gases) which kills 50% of the exposed animals; ppm concentration expressed in parts of material per million parts of air or water; mg/m3 concentration expressed in weight of substance per volume of air; mg/kg quantity of material, by weight, administered to a test subject, based on their body weight in kg. Other measures of toxicity include TDLo, the lowest dose to cause a symptom and TCLo the lowest concentration to cause a symptom; TDLo, TCLo, LDo, or LC0, the lowest dose (or concentration) to cause lethal or toxic effects. Cancer Information: The sources are: IARC - the International Agency for Research on Cancer; NTP - the National Toxicology Program. RTECS - the Registry of Toxic Effects of Chemical Substances, OSHA and CAL/OSHA. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other Information: BEI - ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV.