MATERIAL SAFETY
DATA SHEET
Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: METHANE
SYNONYMS: Methyl Hydride; Marsh Gas
CHEMICAL FAMILY: Alkane (hydrocarbon)
FORMULA: CH₄

PRODUCT USE: Calibration of Monitoring and Research Equipment
SUPPLIER/manufacturer's NAME: CALGAZ
ADDRESS: 821 Chesapeake Drive Cambridge, MD 21613
EMERGENCY PHONE: 410-228-6400
BUSINESS PHONE: General MSDS Information: 713-889-0440
Fax on Demand: 50006 (Replaces ISC MSDS No.1810-2312, 1810-4778)

2. COMPOSITION and INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>CHEMICAL NAME</th>
<th>CAS #</th>
<th>mole %</th>
<th>EXPOSURE LIMITS IN AIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>74-82-8</td>
<td>&gt; 98%</td>
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NOTE: This Material Safety Data Sheet is for Methane supplied in cylinders with 33 cubic feet (935 liters) or less gas capacity (DOT 39 cylinders). For Methane in large cylinders refer to Document Number 10060.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This is a colorless, flammable gas. The main health hazard associated with overexposure to this gas is asphyxiation, by displacement of oxygen. The gas poses a serious fire hazard when accidentally released. Flame or high temperature impinging on a localized area of the cylinder of this product can cause the cylinder to burst or rupture without activating the cylinder's relief devices. The gas is lighter than air, and may spread long distances. Distant ignition and flashback are possible. Provide adequate fire protection during emergency response situations.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this product is by inhalation.

INHALATION: Due to the small size of an individual cylinder of this product, no unusual health effects from exposure to the product are anticipated under routine circumstances of use. If this product is released in a small, poorly ventilated area (i.e. an enclosed or confined space), an oxygen-deficient environment may occur. It should be noted that before suffocation could occur, the lower flammability limit of Methane in air would be exceeded; possibly causing an oxygen-deficient and explosive atmosphere. Individuals breathing an oxygen deficient atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of over-exposure, death may occur. The following effects associated with various levels of oxygen are as follows:

OXYGEN CONCENTRATION SYMPTOMS OF EXPOSURE
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 and vomiting, collapse or loss of consciousness.
Below 6%: Convulsive movements, possible respiratory collapse, and death.

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 product, no unusual health effects from exposure to the product are anticipated under routine circumstances of use. The most significant hazard associated with this product is inhalation of oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, ringing in ears, headaches, shortness of breath, wheezing, headache, dizziness, indigestion, nausea, and, at high concentrations, unconsciousness or death may occur. The skin of a victim of over-exposure may have a blue color.

CHRONIC: Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may effect the heart and nervous system.

TARGET ORGANS: ACUTE: Respiratory system. CHRONIC: Heart, central nervous system.

4. PROTECTIVE EQUIPMENT

For Routine Industrial Use and Handling Applications:

Hazardous Material Identification System

Health Hazard (Blue) 1
Flammability Hazard (Red) 4
Physical Hazard (Yellow) 0

PN 3471 EFFECTIVE DATE: JUNE 7, 2010
PAGE 1 OF 4
4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF OVER-EXPOSURE TO THIS PRODUCT WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus and Fire-Resistant Personal Protective equipment should be worn. Adequate fire protection must be provided during rescue situations.

No unusual health effects are anticipated after exposure to this product, due to the small cylinder size. If any adverse symptom develops after over-exposure to this product, 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 product must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to physician or other health professional with victim(s).

THERMAL BURNS: In the event personnel are burned as a result of a Hydrogen release, if burns are first degree or second degree with closed blisters, flush area with cold water until pain subsides. Apply loose, moist, sterile dressings, and bandage. Treat for shock. If burns are second degree with open blisters then third degree, apply loose, dry, sterile dressings and bandage. Treat for shock. Transfer immediately to hospital or emergency center. Burns over an area of 20% or more of body are life-threatening, medical attention should be immediately sought.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: None known.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and reduce over-exposure.

5. FIRE-FIGHTING MEASURES

FLASH POINT: -187.7°C (-330°F)
AUTOIGNITION TEMPERATURE: 650°C (1202°F)
FLAMMABLE LIMITS (in air by volume, %):  Lower (LEL) 5.0%  Upper (UEL) 15.0%

6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: LEAK RESPONSE: Due to the small size and content of the cylinder, an accidental release of this product presents significantly less risk of a flammability and Oxygen deficient environment and other safety hazards than a similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in which other chemicals are potentially involved, evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a gas release, clear the affected area, protect people, and respond with trained personnel.

Eliminate any possible sources of ignition, and provide maximum explosion-proof ventilation. If the gas is leaking from cylinder contact the supplier. Adequate fire protection must be provided. Use only non-sparking tools and equipment during the response. Allow the gas, which is lighter than air to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for oxygen. Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area. Combustible gas concentration must be below 10% of the LEL (5.0%) prior to entry.

This is an extremely FLAMMABLE GAS. Protection of all personnel and the area must be maintained.

7. HANDLING and USE

WORK PRACTICES and HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this product could extend over long periods of time. Use non-sparking tools when working with Methane.

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 sun. Keep storage area clear of materials which can burn. Protect cylinders against physical damage.

Cylinders should be separated from oxygen cylinders, or other oxidizers, by a minimum distance of 20 ft., or by a barrier of non-combustible material at least 5 ft. high, having a fire-resistance rating of at least 0.5 hours. Isolate from other incompatible chemicals (refer to Section 10, Stability and Reactivity).

Storage areas must meet national electrical codes for Class 1 Hazardous Areas. Post "No Smoking or Open Flames" signs in storage or use areas. Consider installation of leak detection for combustible gas levels and alarm for storage and use areas. Have appropriate extinguishing equipment in the storage area (i.e. sprinkler system, portable fire extinguishers).

Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. These cylinders are not refillable. WARNING! Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: WARNING! Compressed gases can present significantly safety hazards. During cylinder use, use equipment designed for these specific containers. Ensure all lines and equipment are rated for proper service pressure.

REPLACEMENT PARTS DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas (i.e. nitrogen) before attempting repairs. 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 product in well-ventilated areas. Monitoring may be appropriate to detect if the level of Methane exceeds 10% of the LEL (5%).

RESPIRATORY PROTECTION: No special respiratory protection is required under normal circumstances of use. Use supplied air respiratory protection if Oxygen levels are below 19.5%, or unknown, during emergency response to a release of this product. If respiratory protection is needed, use a protective device in accordance with the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93 and applicable standards of Canadian Provinces. Oxygen levels below 19.16.33% 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).

METHANE-CH₄ MSDS - 50006
PN 3471  EFFECTIVE DATE: JUNE 7, 2010
PAGE 2 OF 4
8. EXPOSURE CONTROLS - PERSONAL PROTECTION (CONTINUED)

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

HAND PROTECTION: No special protection is needed under normal circumstances of use. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: No special protection is needed under normal circumstances of use. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR 1910.136.

9. PHYSICAL and CHEMICAL PROPERTIES

**GAS DENSITY @ 60°F (15.6°C) and 1 atm:** 0.0425 lb/ft³

**BOILING POINT:** -161°C (-258.7°F)

**FREEZING/MELTING POINT (at 10 psig):** -182°C (-296.5°F)

**SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C):** 0.555

**SOLUBILITY IN WATER/LIQUID WEIGHT:** Very slight. MOLECULAR WEIGHT: 16.042

**EVAPORATION RATE (nBuAc = 1):** Not applicable. EXPANSION RATIO: Not applicable.

**ODOR THRESHOLD:** Not determined. SPECIFIC VOLUME (m³/lb): 23.6

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

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

**APPEARANCE, ODOR AND COLOR:** Colorless, odorless gas.

**NOTE:** This gas is lighter than air and must not be allowed to accumulate in elevated locations

10. STABILITY and REACTIVITY

**STABILITY:** Stable under conditions of normal temperature and pressure.

**DECOMPOSITION PRODUCTS:** When ignited in the presence of air, this gas will burn to produce carbon monoxide, carbon dioxide.

**MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE:** Strong oxidizers (i.e. chlorine, bromine pentfluoride, oxygen, oxygen difluoride, and nitrogen trifluoride).

**HAZARDOUS POLYMERIZATION:** Will not occur.

**CONDITIONS TO AVOID:** Contact with incompatible materials and exposure to heat, sparks and other sources of ignition. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

**TOXICITY DATA:** There is no specific toxicity data for Methane. Methane is a simple asphyxiant, which acts to displace oxygen in the environment.

**SUSPECTED CANCER AGENT:** Methane is not found on the following lists: FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA; therefore is not considered to be a suspected to be a cancer-causing agent by these agencies.

**IRRITANCY OF PRODUCT:** Methane is not irritating; however, contact with rapidly expanding gases can cause frostbite to exposed tissue.

**SENSITIZATION OF PRODUCT:** Methane is not a sensitizer.

**REPRODUCTIVE TOXICITY INFORMATION:** Listed below is information concerning the effects of Methane on the human reproductive system.

- Mutagenicity: No mutagenicity effects have been described for Methane.
- Embryotoxicity: No embryotoxic effects have been described for Methane.
- Teratogenicity: No teratogenicity effects have been described for Methane.

**A mutagen** is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generations. An **embryotoxin** is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A **reproductive toxin** is any substance which interferes in any way with the reproductive process.

**BIOLOGICAL EXPOSURE INDICES (BEIs):** Currently, Biological Exposure Indices (BEIs) have not been determined for Methane.

12. ECOLOGICAL INFORMATION

**ENVIRONMENTAL STABILITY:** This gas will be dissipated rapidly in well-ventilated areas.

**EFFECT OF MATERIAL ON PLANTS or ANIMALS:** Due to the small cylinder size no adverse effect on animals or animals would be anticipated if one cylinder of this product is released.

**EFFECT OF CHEMICAL ON AQUATIC LIFE:** No evidence is currently available on this product’s effects on aquatic life.

13. DISPOSAL CONSIDERATIONS

**PREPARING WASTE 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 IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.**

**PROPER SHIPPING NAME:** Methane, compressed

**HAZARD CLASS NUMBER and DESCRIPTION:** 2.1 (Flammable Gas)

**UN IDENTIFICATION NUMBER:** UN 1971

**PACKING GROUP:** Not applicable.

**DOT LABEL(S) REQUIRED:** Class 2.1 (Flammable Gas)

**NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000):** 115

**MARINE POLLUTANT:** Methane is not classified 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 can present serious safety hazards. If transporting these cylinders in vehicles, ensure the cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

**Note:** D.O.T. 39 Cylinders ship in a strong outer carton (overpack). Pertinent shipping information goes on the outside of the overpack. DOT 39 Cylinders do not have transportation information on the cylinder itself.

**TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:** This gas is considered as Dangerous Goods, per regulations of Transport Canada.

**PROPER SHIPPING NAME:** Methane, compressed

**HAZARD CLASS NUMBER and DESCRIPTION:** 2.1 (Flammable Gas)

**UN IDENTIFICATION NUMBER:** UN 1971

**PACKING GROUP:** Not Applicable

**HAZARD LABEL:** Class 2.1 (Flammable Gas)

**SPECIAL PROVISIONS:** None

**EXPLOSIVE LIMIT AND LIMITED QUANTITY INDEX:** 0.12

**ERAP INDEX:** 3000

**PASSENGER CARRYING SHIP INDEX:** Forbiden

**PASSENGER CARRYING ROAD VEHICLE OR PASSENGER CARRYING RAILWAY VEHICLE INDEX:** Forbiden

**NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000):** 115

METHANE- CH₄ MSDS - 50006

PN 3471

PAGE 3 OF 4

EFFECTIVE DATE: JUNE 7, 2010
15. REGULATORY INFORMATION

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).

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:

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for this gas. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

U.S. TSCA INVENTORY STATUS: Methane is listed on the TSCA Inventory.

U.S. ERCRA REPORTABLE QUANTITIES (RQ): Not applicable.

U.S. STATE REGULATORY INFORMATION:

Methane is covered under specific State regulations, as denoted below:

- Alaska - Designated Toxic and Hazardous Substances: Methane.
- California - Permissible Exposure Limits for Chemicals: Methane.
- Florida - Toxic Substance List: Methane.
- Kansas - Section 302/313 List: No.
- Massachusetts - Substance List: Methane.
- North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.
- Wisconsin - Toxic and Hazardous Substances List: No.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Methane is not on the California Proposition 65 list.

OTHER U.S. FEDERAL REGULATIONS:

- Methane does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
- Methane is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 10,000 pounds.
- Depending on specific operations involving the use of this product, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Under this regulation Methane is not listed in Appendix A, however, any process that involves a flammable gas on-site, in one location, in quantities of 10,000 lbs (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.
- Methane is listed as a Regulated Substance, per 40 CFR, Part 68, of the Risk Management for Chemical Releases as a flammable substance.

ADDITIONAL CANADIAN REGULATIONS:

- CANADIAN DSL/NDSL INVENTORY STATUS: Methane on the Canadian DSL Inventory.
- CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: Methane is not on the CEPA Priorities Substances List.
- CANADIAN WHMIS CLASSIFICATION: Methane is categorized as a Controlled Product, Hazard Classes A and B1, 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 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. Scraping cylinders involves some preparation before the metal dealer may accept them. We perform this operation as a service to valued customers who want to participate.

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information 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”
- P-14 “Accident Prevention in Oxygen-Rich and Oxygen Deficient Atmospheres”
- SB-8 “Use of Oxy-fuel Gas Welding and Cutting Apparatus”
- SB-2 “Oxygen Deficient Atmospheres”
- “Handbook of Compressed Gases”

PREPARED BY: CHEMICAL SAFETY ASSOCIATES, Inc. PO Box 3519, La Mesa, CA 91944-3519 619/670-0609

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 product. 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 product 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.