



# MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI, Canadian WHMIS Standards and EC Standards

## SECTION 1. PRODUCT IDENTIFICATION

**PRODUCT NAME:** DEUTERATED METHANE  
**CHEMICAL NAME:** Deuterated Alkane (hydrocarbon)  
**FORMULA:** CD<sub>4</sub>  
**SYNONYMS:** Methane, Deuterated, Compressed; CD<sub>4</sub>; Tetradeuteromethane; Tetradeuteromethane; Methane (CD<sub>4</sub>); Perdeuteromethane.

**MANUFACTURER:** SPECTRA GASES, INC.  
**ADDRESS:** 3434 Route 22 West  
 Branchburg, NJ 08876, U.S.A.  
**PHONE:** 908/252-9300  
**FAX:** 908/252-0811  
**WEB SITE:** www.spectra-gases.com

**SPECTRA GASES EMERGENCY CONTACT:** 800/932-0624 8:30am - 7:00pm (EST)  
**24 HOUR EMERGENCY CONTACT, CHEMTREC:** 800/424-9300, 202/484-7616  
**DATE OF PREPARATION:** December 7, 2001  
**MSDS NUMBER:** 1054  
**PRODUCT USE:** Various

## SECTION 2. COMPOSITION and INFORMATION ON INGREDIENTS

**COMPOSITION:** Methane, Deuterated 100%  
**CAS NUMBER:** 558-20-3  
**EINECS NUMBER:** 200-812-7  
**EXPOSURE LIMITS:** (10,000 ppm = 1%)

**OSHA PELs:**

**ACGIH TLVs:**

**NIOSH RELs:**

There are no specific exposure limits for Deuterated Methane (or Methane).

## SECTION 3. HAZARD IDENTIFICATION

**EMERGENCY OVERVIEW:** Deuterated Methane is a colorless, extremely-flammable, liquefied gas. Deuterated Methane may be odorless, but has been reported to have a slightly sweet, oily odor. An odorant may be added to the gas. 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 or accumulate near ceiling. Distant ignition and flashback are possible. Provide adequate fire protection and respiratory protection during emergency response situations. For emergency situations, all guidance info for normal Methane is applicable).

**ROUTES OF ENTRY, SYMPTOMS OF ACUTE EXPOSURE: WARNING** - If rescue personnel need to enter an area of release of Deuterated Methane, they should be equipped with Self-Contained Breathing Apparatus (SCBA) and fire-retardant gear. Although fire or explosion is most probable source of injury in a leak situation, it should also be noted that high concentration of this gas will create an oxygen-deficient atmosphere, creating the risk of asphyxiation. Acute overexposure to this gas may cause the following health effects:

**EYE CONTACT:** High-pressure gas may result in airborne objects. Contact of the liquefied gas with the eye may result in frostbite.

**INGESTION:** Ingestion of this gas is not a likely route of industrial exposure.

**INHALATION:** High concentrations of this gas can cause an oxygen-deficient environment. 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. The skin of a victim may have a blue color. Under some circumstances of over-exposure, death may occur, due to the displacement of oxygen.

(continued on following page)

### SECTION 3. HAZARD IDENTIFICATION (Continued)

**INHALATION (continued):** The following effects associated with various levels of oxygen are as follows:

**CONCENTRATION**  
**of OXYGEN**

20.9% Oxygen:  
15-19% Oxygen:

12-15% Oxygen:

10-12% Oxygen:

8-10 Oxygen:

6-8% Oxygen:

4-6% Oxygen:

**EXPOSURE SYMPTOM**

Normal oxygen concentration in air.

Decreased ability to perform tasks. May impair coordination and may induce early symptoms in persons with heart, lung, or circulatory problems.

Breathing increases, especially in exertion. Pulse up. Impaired coordination, perception, and judgment.

Breathing further increases in rate and depth, poor coordination and judgment, lips slightly blue.

Mental failure, fainting, unconsciousness, ashen face, blueness of lips, nausea (upset stomach), and vomiting.

8 minutes, may be fatal in 50-100% of cases; 6 minutes, may be fatal in 25 to 50% of cases; 4-5 minutes, recovery with treatment.

Coma in 40 seconds, followed by convulsion, breathing failure, death.

**WARNING:** Exposure to atmospheres containing 8-10% or less oxygen will bring about unconsciousness without warning and so quickly that individuals cannot help or protect themselves. Lack of sufficient oxygen may cause serious injury or death.

**SKIN CONTACT:** Contact with the liquefied gas may result in frostbite.

**HMIS RATINGS:** HEALTH: = 1; FLAMMABILITY: = 4; REACTIVITY: = 0;

PPE: Level B (see Section 8, Exposure Controls/Personal protective Equipment)

**ROUTES OF ENTRY, SYMPTOMS OF CHRONIC EXPOSURE:**

**ROUTE OF ENTRY:** Not Applicable

**TARGET ORGANS:** None.

**SYMPTOMS:** None.

**MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE:** None are anticipated.

**CARCINOGENICITY:** Deuterated Methane is not found on the FEDERAL OSHA Z LIST, NTP, CAL/OSHA, or IARC Carcinogenicity lists and therefore is neither considered to be nor suspected to be a cancer-causing agent by these agencies.

### SECTION 4. FIRST AID MEASURES

**THERMAL BURNS:** In the event personnel are burned as a result of a Deuterated Methane 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 or third degree, apply loose, dry, sterile dressings and bandage. Treat for shock. Transport victim 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.

**EYE CONTACT:** If mechanical injury occurs, cover eye with bandage and seek appropriate medical attention.

**INGESTION:** Ingestion is an unlikely route of exposure for this gas.

**INHALATION:** Remove victim(s) to fresh air, as quickly as possible. Trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary.

**SKIN CONTACT:** In case of frostbite, place the frostbitten part in warm water. DO NOT USE HOT WATER. If warm water is not available, or is impractical to use, wrap the affected parts gently in blankets. Alternatively, if the fingers or hands are frostbitten, place the affected area in the armpit. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention.

**NOTES TO PHYSICIANS:** Administer oxygen, if necessary, and treat symptoms.

### SECTION 5. FIRE FIGHTING MEASURES

**FLASH POINT:** -306°F (-187.7°C)

**AUTOIGNITION:** 650°C (1202°F)

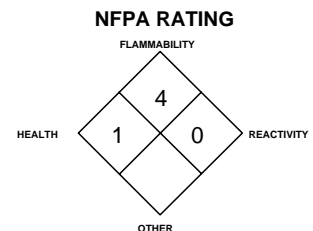
**FLAMMABLE RANGE:** Lower (LEL): 5.0%      Upper (UEL): 15.0%

**NFPA RATINGS:**

HEALTH: = 1      FLAMMABILITY: = 4

REACTIVITY: = 0      SPECIAL:

**EXTINGUISHING MEDIA:** Extinguish Deuterated Methane fires by shutting-off the source of the gas. Use water spray to cool fire-exposed containers, structures, and equipment.



**See Section 16 for  
Definition of Ratings**

**SECTION 5. FIRE FIGHTING MEASURES (Continued)**

**SPECIAL FIRE-FIGHTING PROCEDURES:** The best fire-fighting technique may be simply to let the burning gas escape from the cylinder or pipeline. Stop the leak before extinguishing fire. If the fire is extinguished before the leak is sealed, the still-leaking gas could explosively re-ignite without warning and cause extensive damage, injury, or fatality. Consider increasing ventilation to prevent flammable or explosive mixture formation. An extreme explosion hazard exists in areas in which the gas has been released, but the material has not yet ignited.

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** An extreme explosion hazard exists in areas in which the gas has been released, but the material has not yet ignited. **DANGER!** Fires impinging (direct flame) on the outside surface of unprotected cylinders of Methane can be very dangerous. Exposure to fire could cause a catastrophic failure of the cylinder releasing the contents into a fireball and explosion of released gas. The resulting fire and explosion can result in severe equipment damage and personnel injury or death over a large area around the cylinder. For massive fires in large areas, use unmanned hose holder or monitor nozzles; if this is not possible, withdraw from area and allow fire to burn.

**EXPLOSION SENSITIVITY TO MECHANICAL IMPACT:** Not sensitive.

**EXPLOSION SENSITIVITY TO STATIC DISCHARGE:** Static discharge may cause this gas to ignite explosively. Due to low electrical conductivity, this substance can generate electrostatic charges during handling operations.

**HAZARDOUS COMBUSTION PRODUCTS:** When involved in a fire, Deuterated Methane may decompose and produce toxic gases including carbon monoxide and carbon dioxide.

**SECTION 6. ACCIDENTAL RELEASE MEASURES**

**STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:** All releases of this gas pose a very serious hazard of fire. If any possibility of fire is suspected, personnel entering the area of a release should be fire-response personnel who are trained and equipped appropriately in the response to fires of flammable gases.

In the event of a leak of this product, operator should close the gas source if possible to do so safely. Evacuate area in the event of a significant release. The North American Emergency Response Guidebook (Guide #115) recommends 0.5 miles.

Only trained personnel should re-enter a contaminated area. Combustible gas concentration must be below 10% of the LEL (5.0%) prior to entry. Minimum Personal Protective Equipment should be **Level B: fire-retardant protective clothing, gloves and Self-Contained Breathing Apparatus**. Use only non-sparking tools and equipment. If it is not possible to close the source cylinder or otherwise stop the release, allow the gas to release in-place or remove it to a safe area, away from sources of ignition, and allow the gas to be released there. Allow the gas, which is lighter than air, to dissipate. Monitor the surrounding area for combustible gas levels. Although the hazard due to combustible gas level is the greatest hazard due to the great potential for fire, monitoring of oxygen level should also be considered to prevent an oxygen-deficient atmosphere.

If leak was in user's gas handling equipment or system, safely vent high pressure before attempting repairs. If leak was from the cylinder, cylinder valve or the valve pressure relief device (PRD), contact your supplier.

**THIS IS AN EXTREMELY FLAMMABLE GAS.** Protection of all personnel and the area must be maintained. Detection systems should be available to monitor for combustible gas levels.

**SECTION 7. HANDLING AND STORAGE**

**STORAGE:** Cylinders should be stored upright (with valve protection caps or plugs in place) and firmly secured to prevent falling or being knocked over. Cylinders should be stored in dry, well-ventilated areas. Protect from salt or other corrosive materials. Storage should be away from heavily traveled areas, walkways, elevators, platform edges or other objects or situations that could damage the cylinder wall. Do not store in a manner that will block emergency exits, fire extinguishers or other safety equipment. Do not allow storage temperature to exceed 125°F (52°C). Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. Store empty cylinders away from full cylinders. **NOTE:** Use only DOT or ASME code cylinders designed for compressed gas storage. Cylinders must not be recharged except by or with the consent of owner.

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

Use non-sparking ventilation systems, approved explosion-proof equipment, and appropriate electrical systems. Electrical equipment used in gas-handling operations, or located in storage areas, should be non-sparking or explosion proof.

## SECTION 7. HANDLING AND STORAGE (Continued)

**STORAGE (continued):** 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). **NOTE:** This gas is lighter than air and must not be allowed to accumulate in elevated locations.

**HANDLING:** Wearing contact lenses is not recommended when handling this gas. Cylinder valves should be inspected regularly for physical damage or corrosion (apparent by discoloration or rust). Care should be taken to inspect the following valve locations for corrosion: neck (where valve inserts into cylinder); bonnet nut (where handle attaches to valve body). Close valve after each use and when empty. Never tamper with pressure relief devices in valves and cylinders. The failure of a valve can result in violent release of the pressurized gas, creating a severe mechanical injury hazard.

Do not drag, roll, slide or drop cylinder. Use a suitable hand truck designed for cylinder movement. Never attempt to lift a cylinder by its cap. Secure cylinders at all times while in use. Use a pressure regulator to safely discharge product from cylinder. Use a check valve to prevent reverse flow into cylinder. Consideration should be made on the use of a flash arrestor on cylinders of Deuterated Methane, due to its extreme flammability. Once cylinder has been connected to properly purged process, open cylinder valve slowly and carefully. If user experiences any difficulty operating cylinder valve, discontinue use and contact supplier. Never insert an object (e.g., wrench, screwdriver, etc.) into valve cap openings; doing so may damage valve, causing a leak to occur. Use an adjustable strap-wrench to remove over-tight or rusted caps.

Do not heat cylinders by any means to increase the discharge rate of product from the cylinder. Never apply flame or localized heat directly to any part of the cylinder. Cylinders should not be artificially cooled as certain types of steel undergo property changes when cryogenically cooled, thus making the cylinder unstable.

**PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT:** Follow practices indicated in Section 6 (Accidental Release Measures). Relieve pressure before attempting repairs.

**SPECIAL PRECAUTIONS** All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a significant release. Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, Inc. (telephone 703-412-0900) pamphlet CGA P-1, *Safe Handling of Compressed Gases in Containers*. Local regulations may require specific equipment for storage and use.

## SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

**VENTILATION AND ENGINEERING CONTROLS:** Forced explosion-proof ventilation systems for the general work area should be provided to ensure Deuterated Methane does not reach its lower flammability limit of 5.0%. If appropriate, install automatic monitoring equipment to detect the level of flammable gas.

**RESPIRATORY PROTECTION:** Maintain oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if oxygen level is below 19.5%, or during emergency response to a release of this product. If respiratory protection is required, follow the requirements of the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent U.S. State standards, Canadian CSA Standard Z94.4-93, the European Standard EN149, and EC member states.

**EYE PROTECTION:** Use approved safety goggles or safety glasses, as described in OSHA 29 CFR 1910.133 or by the European Standard EN166.

**SKIN PROTECTION:** Work (such as leather) gloves are recommended when handling cylinders of this gas. Wear gloves appropriate to the specific operation for which Deuterated Methane is used. If necessary, refer to U.S. OSHA 29 CFR 1910.138 appropriate Standards of Canada, or appropriate Standards of the European Economic Community.

**OTHER PROTECTIVE EQUIPMENT:** Use body protection appropriate for task. Cotton or Nomex clothing is recommended to prevent static build-up. Safety shoes are recommended when handling cylinders. Transfer of large quantities under pressure may require fire-retardant clothing. 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.

## SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

**MOLECULAR WEIGHT:** 20.075

**GAS DENSITY @ 21.1°C (70°F):** 0.05223 lb/ft<sup>3</sup> (0.836 kg/m<sup>3</sup>)

**BOILING POINT @ 1 atm:** -258.7°F (-161°C)

**FREEZING/MELTING POINT @ 1 atm:** -297°F (-183°C)

**SPECIFIC GRAVITY (air = 1) @ 21.1°C (70°F):** 0.693

## SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (Continued)

**SOLUBILITY IN WATER @ 20°C (68°F) and 1 atm:** 3.3 mL/100 mL gas

**VAPOR PRESSURE:** Not Applicable

**COEFFICIENT WATER/OIL DISTRIBUTION:** 1.09

**CRITICAL PRESSURE:** 4,640 kPa (45.9 atm)

**ODOR THRESHOLD:** Not determined.

**APPEARANCE, ODOR AND STATE:** Deuterated Methane may be odorless, but has been reported to have a slightly sweet, oily odor. An odorant may be added to the gas to aid in detection of leaks.

**WARNING PROPERTIES FOR THIS GAS:** Although an odorant may be added to the gas to aid in detection of leaks, it must be considered that there are no warning properties in the event of a release. 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.

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

## SECTION 10. STABILITY AND REACTIVITY

**CHEMICAL STABILITY:** Stable under conditions of normal temperature.

**CONDITIONS TO AVOID:** Contact with incompatible materials and exposure to heat, sparks and other sources of ignition. Cylinders should not be exposed to temperatures in excess of 125°F (52°C).

**MATERIALS WITH WHICH GAS IS INCOMPATIBLE:** Strong oxidizers, (e.g. chlorine, bromine pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride) can increase the risk of fire and explosion.

**REACTIVITY:**

**A) HAZARDOUS DECOMPOSITION PRODUCTS:** None other than those of thermal decomposition (see Section 5, Fire-Fighting Measures).

**B) HAZARDOUS POLYMERIZATION:** Will not occur.

## SECTION 11. TOXICOLOGICAL INFORMATION

**TOXICITY DATA:** There are no toxicological data for Deuterated Methane. Deuterated Methane is an asphyxiant because it can displace oxygen in the environment needed for breathing.

**CARCINOGENICITY:** Not applicable.

**IRRITANCY OF PRODUCT:** Not applicable.

**SENSITIZATION OF PRODUCT:** Not applicable.

**REPRODUCTIVE TOXICITY INFORMATION:** Toxicological information for Deuterated Methane is expected to be similar to that of normal Methane. Listed below is information concerning the effects of Methane on the human reproductive system.

Mutagenicity: Methane does not cause mutagenic effects in humans.

Embryotoxicity: Methane does not cause embryotoxic effects in humans. In one study, pregnant mice were exposed for 1 hour to 5-8% fuel gas (85% Methane). Abnormalities of fetal brains were found. Eight cases of fetal brain hemorrhage occurred. Of these, five cases occurred at a concentration of 8% fuel-gas, which caused maternal toxicity. It is not clear whether the study results were statistically significant since no statistical analysis was performed during the study. These data has not been verified.

Teratogenicity: Methane does not cause teratogenic effects in humans.

Reproductive Toxicity: Methane does not cause adverse reproductive effects in humans.

*A mutagen is a chemical that causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An embryotoxin is a chemical that 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 that causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance that interferes in any way with the reproductive process.*

**BIOLOGICAL EXPOSURE INDICES (BEIs):** Currently, Biological Exposure Indices (BEIs) are not applicable for Deuterated Methane.

## SECTION 12. ECOLOGICAL INFORMATION

**ENVIRONMENTAL STABILITY:** Deuterated Methane will be dissipated rapidly in well-ventilated areas.

**EFFECT OF MATERIAL ON PLANTS or ANIMALS:** Any adverse effect on plants would be related to oxygen-deficient environments or frost from rapidly expanding gases.

**EFFECT OF CHEMICAL ON AQUATIC LIFE:** There is currently no evidence of adverse effects from exposure to Deuterated Methane (or Methane) on aquatic life.

## SECTION 12. ECOLOGICAL INFORMATION (Continued)

**MOBILITY:** Based upon a measured water solubility of 24.4 ppm at 25°C, the Koc for Deuterated Methane can be estimated to be approximately 753 from a recommended regression derived equation. This Koc value suggests that Deuterated Methane has low mobility with water in soil. However, the high vapor pressure of Deuterated Methane would suggest that the gas may permeate through soil.

**PERSISTENCE AND BIODEGRADABILITY:** Persistence: Deuterated Methane presents no hazard of persistence. Biodegradation: The utilization of Deuterated Methane by some cultures, such as Methylococcus, as a carbon source suggests that Deuterated Methane is biodegradable.

**POTENTIAL TO BIOACCUMULATE:** Deuterated Methane will not bioaccumulate.

**OZONE-DEPLETION POTENTIAL:** Deuterated Methane is not a Class I or Class II ozone depleting chemical (40 CFR Part 82).

## SECTION 13. DISPOSAL CONSIDERATIONS

**UNUSED PRODUCT / EMPTY CONTAINER:** Do not dispose of residual product. Return used product in cylinders to: Spectra Gases, Inc., 80 Industrial Drive, Alpha, NJ 08865 or Spectra Gases, Inc., 1261 Activity Drive, Vista, CA 92083.

**DISPOSAL INFORMATION:** Residual product may be safely released in a well-ventilated area. This shall be done in accordance with U.S. Federal, State and local regulations, regulations of the provinces of Canada or EC member states.

## SECTION 14. TRANSPORT INFORMATION

### U.S. SHIPPING INFORMATION:

**U.S. DOT PROPER SHIPPING NAME:** Methane, compressed (Deuterated Methane)

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

**UN IDENTIFICATION NUMBER:** UN 1971

**U.S. DOT SHIPPING LABEL(S) REQUIRED:** Flammable Gas

**PLACARD (When required):** Flammable

**SPECIAL SHIPPING INFORMATION:** Cylinders should be transported in a secure position in a well-ventilated truck (never transport in passenger compartment of a vehicle). Ensure cylinder valve is properly closed, valve outlet cap has been reinstalled, and valve protection cap is secured before shipping cylinder.

**CAUTION:** Compressed gas cylinders shall not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with the owner's written consent is a violation of Federal law (49 CFR 173.301).

**NAERG (NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK) #: 115**

### CANADIAN SHIPPING INFORMATION:

**TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:** This gas is considered as dangerous goods; use the above U.S. DOT information for the preparation of Canadian Shipments.

### INTERNATIONAL AIR TRANSPORT ASSOCIATION SHIPPING INFORMATION (IATA):

**IATA DESIGNATION:** This gas is considered as dangerous goods, per the International Air Transport Association.

**PROPER SHIPPING NAME:** Methane, compressed (Deuterated)

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

**UN IDENTIFICATION NUMBER:** UN 1971

**HAZARD LABEL(S) REQUIRED:** Flammable Gas

**IATA ERG CODE:** 10L

The following Packaging Information is applicable to this product:

PASSENGER AND CARGO AIRCRAFT				CARGO AIRCRAFT ONLY	
Limited Quantity		Packing Instruction	Max. Qty per Pkg	Packing Instruction	Max. Qty per Pkg
Packing Instruction	Max. Qty per Pkg				
//////	//////	Forbidden	Forbidden	200	150 kg

(IATA information continued on following page)

<b>SECTION 14. TRANSPORT INFORMATION (Continued)</b>
--

**INTERNATIONAL AIR TRANSPORT ASSOCIATION SHIPPING INFORMATION (IATA) [continued]:**

NOTE A1: Under IATA regulations, Compressed Deuterated Methane can only be shipped on passenger aircraft with the prior approval of appropriate authorities of the State of origin under the written conditions established by that authority. A copy of the document of approval, showing the quantity limitations and packing requirements, must accompany the consignment. The commodity may be carried on cargo aircraft in accordance with other provisions of IATA for the compound.

**INTERNATIONAL MARITIME ORGANIZATION SHIPPING INFORMATION (IMO):**

**IMO DESIGNATION:** This gas is considered as dangerous goods, per the International Maritime Organization.

**PROPER SHIPPING NAME:** Methane, compressed (Deuterated)

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

**UN IDENTIFICATION NUMBER:** UN 1971

**HAZARD LABEL(S) REQUIRED:** Flammable Gas

**IMDG CODE:** Page 93

**STOWAGE CATEGORY:** Category E. Clear of Living Quarters

**MARINE POLLUTANT:** Deuterated Methane is not designated by the IMO to be a Marine Pollutant.

**EUROPEAN SHIPPING INFORMATION:****EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS**

**BY ROAD (ADR):** This gas is considered by the Economic Commission for Europe to be dangerous goods.

Additional information is as follows:

**SUBSTANCE IDENTIFICATION NO.:** 1971

**NAME OF SUBSTANCE:** Methane, compressed (Deuterated)

**HAZARD IDENTIFICATION NO.:** 23

**LABEL:** 3

**CLASS AND ITEM NUMBER:** 2, 1°F

<b>SECTION 15. REGULATORY INFORMATION</b>
---

**U.S. FEDERAL REGULATIONS:****EPA - ENVIRONMENTAL PROTECTION AGENCY:**

**CERCLA:** Comprehensive Environmental Response, Compensation, and Liability Act of 1990  
(40 CFR Parts 117 and 302)

Reportable Quantity (RQ): Not Applicable

**SARA TITLE III:** Superfund Amendment and Reauthorization Act

**SECTIONS 302/304:** Emergency Planning and Notification (40 CFR Part 355)

Extremely Hazardous Substances: Deuterated Methane is not listed.

Threshold Planning Quantity (TPQ): Not Applicable

Reportable Quantity (RQ): Not Applicable

**SECTIONS 311/312:** Hazardous Chemical Reporting (40 CFR Part 370)

IMMEDIATE HEALTH: No                      PRESSURE: Yes

DELAYED HEALTH: No                      REACTIVITY: No

FIRE: Yes

**SECTION 313:** Toxic Chemical Release Reporting (40 CFR 372)

Releases of Methane do not require reporting under Section 313.

**CLEAN AIR ACT:**

**SECTION 112 (r):** Risk Management Programs for Chemical Accidental Release  
(40 CFR Part 68)

Threshold Planning Quantity (TPQ): 10,000 lbs (4,540 kg)

**TSCA:** Toxic Substances Control Act

Methane is listed on the TSCA Inventory.

**OSHA - OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:**

**29 CFR Part 1910.119:** Process Safety Management of Highly Hazardous Chemicals.

Threshold Planning Quantity (TPQ): 10,000 lbs (4,540 kg) [for all flammable gases, unless it is used as fuel]

## SECTION 15. REGULATORY INFORMATION (Continued)

### U.S. STATE REGULATORY INFORMATION:

**CALIFORNIA PROPOSITION 65:** Deuterated Methane is not a listed substance which the State of California requires warning under this statute.

The components of this gas are covered under the following specific State regulations:

**Alaska - Designated Toxic and Hazardous Substances:** Methane.

**California - Permissible Exposure Limits for Chemical Contaminants:** Methane.

**Florida - Substance List:** No.

**Illinois - Toxic Substance List:** Methane.

**Kansas - Section 302/313 List:** No.

**Massachusetts - Substance List:** Methane.

**Michigan - Critical Materials Register:** No.

**Minnesota - List of Hazardous Substances:** Methane.

**Missouri - Employer Information/Toxic Substance List:** Methane.

**New Jersey - Right to Know Hazardous Substance List:** Methane.

**North Dakota - List of Hazardous Chemicals, Reportable Quantities:** No.

**Pennsylvania - Hazardous Substance List:** Methane.

**Rhode Island - Hazardous Substance List:** Methane.

**Texas - Hazardous Substance List:** No.

**West Virginia - Hazardous Substance List:** No.

**Wisconsin - Toxic and Hazardous Substances:** No.

### CANADIAN FEDERAL REGULATIONS:

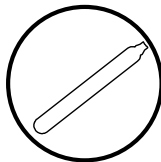
**CANADIAN DSL INVENTORY STATUS:** Methane is listed on the Canadian DSL Inventory.

**OTHER CANADIAN REGULATIONS:** Methane is categorized as a Controlled Product, Hazard Classes A, and B1, as per the Controlled Product Regulations. Methane is not on the CEPA Priorities Substances Lists.

### CANADIAN WHMIS SYMBOLS:

**Class A:** Compressed Gas

**Class B1:** Flammable Gas



**EC LABELING AND CLASSIFICATION:** There is no specific classification for Deuterated Methane. Normal Methane meets the following definition of hazard class, per the European Community Council Directive 67/548/EEC.

**EC EINECS/ELINCS NUMBER:** 200-812-7

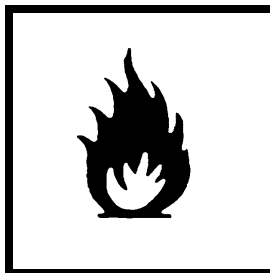
**EC CLASSIFICATION:** F+; (Extremely Flammable)

**EC RISK PHRASES:** Extremely flammable. [R:12]

**EC SAFETY PHRASES:** Keep out of reach of children (may be omitted from label if for industrial use only).

Keep container in well-ventilated place. Keep away from sources of ignition - No smoking. Take precautionary measures against static discharges. [S: 2, 9; S: 16; 33]

**EUROPEAN COMMUNITY ANNEX II HAZARD SYMBOL:** F+ (Extremely Flammable)



## SECTION 16. OTHER INFORMATION

Information contained in this Material Safety Data Sheet is provided to our customers so they may comply with 29 CFR 1910.1200, Hazard Communication Standard, the Canadian WHMIS Standard, and the requirements of the European Community Directives. The intent of this Material Safety Data Sheet is to provide end users of this product with the health and physical hazards associated with possible exposure to this product. All statements, technical data and recommendations are based on readily available texts and data that Spectra Gases, Inc., believes to be reliable and accurate. Spectra Gases, Inc., makes no warranties, guarantees or representations of any kind with respect to this product or this data. It is the responsibility of the user to obtain and use the most recent version of this MSDS.

## SECTION 16. OTHER INFORMATION (Continued)

Further information about compressed gases can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0900.

P-1 "Safe Handling of Compressed Gases in Containers"

AV-1 "Safe Handling and Storage of Compressed Gases"

"Handbook of Compressed Gases"

## 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 which uniquely identifies each constituent.

**EXPOSURE LIMITS IN AIR:**

**ACGIH** - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits.

**TLV** - Threshold Limit Value - an airborne concentration of a substance which 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 Time Weighted Average (**TWA**), the 15-minute Short Term Exposure Limit (**STEL**), and the instantaneous Ceiling Level (**C**). Skin absorption effects must also be considered.

**OSHA** - U.S. Occupational Safety and Health Administration.

**PEL** - Permissible Exposure Limit - 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 which was vacated by Court Order.

**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. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL.

**NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). NIOSH issues exposure guidelines called **Recommended Exposure Levels (RELs)**. When no exposure guidelines are established, an entry of **NE** is made for reference.

**HAZARD RATINGS:**

**HAZARDOUS MATERIALS IDENTIFICATION SYSTEM:** Health Hazard: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]). Reactivity Hazard: **0** (normally stable); **1** (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).

**NATIONAL FIRE PROTECTION ASSOCIATION:** 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 and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

**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:**

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: **LD<sub>50</sub>** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC<sub>50</sub>** - 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/m<sup>3</sup>** 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. Data from several sources are used to evaluate the cancer-causing potential of the material. 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 measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - 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. Ecological Information: **EC** is the effect concentration in water.

**REGULATORY INFORMATION:**

**U.S. and CANADA:** This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (**SARA**); the Canadian Domestic/Non-Domestic Substances List (**DSL/NDL**); the U.S. Toxic Substance Control Act (**TSCA**); Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA** or **Superfund**); and various state regulations. This section also includes information on the precautionary warnings which appear on the material's package label.

**EUROPEAN:** **EC** is the European Community (formerly known as the **EEC**, European Economic Community). **EINECS**: This the European Inventory of Now-Existing Chemical Substances. The **ARD** is the European Agreement Concerning the International Carriage of Dangerous Goods by Road and the **RID** are the International Regulations Concerning the Carriage of Dangerous Goods by Rail.