



# MATERIAL SAFETY DATA SHEET

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

## SECTION 1. PRODUCT IDENTIFICATION

**PRODUCT NAME:** HELIUM-3  
**PRODUCT USE:** Various.  
**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 8:30 am - 6:00 pm  
**24 HOUR EMERGENCY CONTACT, CHEMTREC:** 800/424-9300, 703-527-3887

## SECTION 2. COMPOSITION and INFORMATION ON INGREDIENTS

**CHEMICAL NAME:** Helium-3  
**FORMULA:** <sup>3</sup>He  
**SYNONYMS:** Helium, Isotopic Helium, <sup>3</sup>He  
**COMPOSITION:** Helium  
**CAS NUMBER:** 7440-59-7  
**EINECS NUMBER:** 231-168-5  
**EXPOSURE LIMITS:**

**OSHA PELs:**

**ACGIH TLVs:**

**NIOSH RELs:**

There are no exposure limits for Helium-3. Helium-3 is a simple asphyxiant.

## SECTION 3. HAZARD IDENTIFICATION

**EMERGENCY OVERVIEW:** Helium-3 is a colorless, odorless, non-toxic, non-radioactive, isotopic gas. The main health hazard associated with releases of this gas is asphyxiation, by displacement of oxygen.

**ROUTES OF ENTRY, SYMPTOMS OF ACUTE EXPOSURE: WARNING** - If rescue personnel need to enter an area of release of Helium, they should be equipped with Self-Contained Breathing Apparatus (SCBA). 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.

**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. 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:

Less than 10% 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, inability to perform various movements, loss of consciousness without warning, convulsions, death.

### SECTION 3. HAZARD IDENTIFICATION (Continued)

**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:** Not applicable.

**OTHER HEALTH EFFECTS:** Contact with rapidly expanding gases (which are released from under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain caused by frostbite can quickly subside, masking the injury. In addition, the sudden release of a pressurized gas (such as may occur in the event of a valve failure), presents a severe hazard of mechanical injury.

**HMIS RATINGS:** HEALTH: = 0; FLAMMABILITY: = 0; 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:** Helium-3 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

**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:** Not Applicable

**AUTOIGNITION:** Not Applicable

**FLAMMABLE RANGE:** Not Applicable

**NFPA RATINGS:**

HEALTH: = 0                      FLAMMABILITY: = 0  
REACTIVITY: = 0                SPECIAL: Simple Asphyxiant

**EXTINGUISHING MEDIA:** This is a non-flammable, inert gas; use fire-extinguishing media appropriate for the surrounding materials.

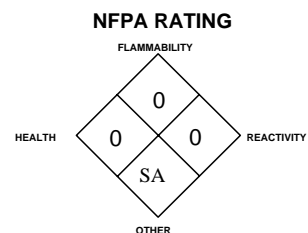
**SPECIAL FIRE-FIGHTING PROCEDURES:** Non-flammable, inert gas. Use extinguishing media appropriate for surrounding fire.

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** This gas does not burn; however, containers, when involved in fire, may rupture or burst in the heat of the fire. Most cylinders have a pressure release device, which will vent contents if the cylinder is exposed to high temperatures.

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

**EXPLOSION SENSITIVITY TO STATIC DISCHARGE:** Not sensitive.

**HAZARDOUS COMBUSTION PRODUCTS:** None known.



**See Section 16 for  
Definition of Ratings**

**SECTION 6. ACCIDENTAL RELEASE MEASURES**

**STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:** In the event of a release of this product, operator should close the gas source if possible to do so safely. Evacuate area in the event of a significant release. Only trained personnel, wearing Self-Contained Breathing Apparatus (SCBA) should re-enter a contaminated area if oxygen levels are below 19.5% or unknown.

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

The level of oxygen should be above 19.5% before personnel can be allowed in the area without SCBA.

Detection systems should be available to monitor for level of oxygen.

**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. Consideration should be taken to install leak detection and alarm equipment for storage areas. **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.

**HANDLING: Releases of Helium-3 can create an oxygen-deficient atmosphere.** Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of Helium-3 could occur without any significant warning symptoms, due to oxygen-deficiency. 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.

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. 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:** Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this gas 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. 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 ventilation systems for the general work area should be provided. If appropriate, install automatic monitoring equipment to detect the level of oxygen.

**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, standards of Canada, 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.

**SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION (Continued)**

**SKIN PROTECTION:** Work (such as leather) gloves are recommended when handling cylinders of this gas. Wear gloves appropriate to the specific operation for which Helium-3 is used. Use triple gloves for spill response.

**OTHER PROTECTIVE EQUIPMENT:** Use body protection appropriate for task. Safety shoes are recommended when handling cylinders.

**SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES**

**MOLECULAR WEIGHT:** 3.06 g/mole

**GAS DENSITY @ 21.1°C (70°F) ("NTP"):** 0.0078 lb/ft<sup>3</sup> (0.125 kg/m<sup>3</sup>) (0.125 g/ltr)  
@ 0°C ("STP"): 0.0084 lb/ft<sup>3</sup> (0.135 kg/m<sup>3</sup>) (0.135 g/ltr)

**BOILING POINT @ 1 atm:** -268.9°C (-452.1°F)

**FREEZING/MELTING POINT @ 1 atm:** None.

**SPECIFIC GRAVITY (air = 1) @ 21.1°C (70°F):** 0.138

**SOLUBILITY IN WATER vol/vol at 20°C (68°F) and 1 atm:** 8.61 m<sup>3</sup>/1 kg water

**SPECIFIC VOLUME @ 21.1°C (70°F):** 97.09 lb./ft<sup>3</sup> (6.061 m<sup>3</sup>/kg)

**CRITICAL PRESSURE:** -2.7 psia (0.186 bar)

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

**ODOR THRESHOLD:** Helium-3 is odorless.

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

**WARNING PROPERTIES FOR THIS GAS:** 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.

**SECTION 10. STABILITY AND REACTIVITY**

**CHEMICAL STABILITY:** Stable.

**CONDITIONS TO AVOID:** Cylinders should not be exposed to temperatures in excess of 125°F (52°C).

**MATERIALS WITH WHICH GAS IS INCOMPATIBLE:** None. Helium-3 is an inert gas.

**REACTIVITY:**

A) **HAZARDOUS DECOMPOSITION PRODUCTS:** None.

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

**SECTION 11. TOXICOLOGICAL INFORMATION**

**TOXICITY DATA:** There are no specific toxicology data for Helium-3. Helium-3 is a simple asphyxiant, which acts to displace oxygen in the environment.

**CARCINOGENICITY:** Helium-3 has not been found to be carcinogenic.

**IRRITANCY OF PRODUCT:** Not applicable.

**SENSITIZATION OF PRODUCT:** Helium-3 is not a sensitizer.

**REPRODUCTIVE TOXICITY INFORMATION:** Listed below is information concerning the effects of Helium-3 on the human reproductive system.

Mutagenicity: Helium-3 has not been found to cause mutagenic effects in humans.

Embryotoxicity: Helium-3 has not been found to cause embryotoxic effects in humans.

Teratogenicity: Helium-3 has not been found to cause teratogenic effects in humans.

Reproductive Toxicity: Helium-3 has not been found to 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 Helium-3.

### SECTION 12. ECOLOGICAL INFORMATION

**ENVIRONMENTAL STABILITY:** The gas 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 Helium-3 on aquatic life.

**MOBILITY:** Helium-3 is inert and does not present a hazard of mobility.

**PERSISTENCE AND BIODEGRADABILITY:** Persistence: Helium-3 presents no hazard of persistence. Biodegradation: Helium-3 is fully biodegradable.

**POTENTIAL TO BIOACCUMULATE:** Helium-3 will not bioaccumulate.

**OZONE-DEPLETION POTENTIAL:** Helium-3 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 unused 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:** Helium, compressed

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

**UN IDENTIFICATION NUMBER:** UN 1046

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

**PLACARD (When required):** Not Applicable

**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) #: 121**

#### CANADIAN SHIPPING INFORMATION:

**TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:** This gas is considered as dangerous goods; use the above 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:** Helium, compressed

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

**UN IDENTIFICATION NUMBER:** UN 1046

**HAZARD LABEL(S) REQUIRED:** Not Applicable

**ERG CODE:** 2L

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				
//////	//////	200	75 kg	200	150 kg

<b>SECTION 14. TRANSPORT INFORMATION (Continued)</b>
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**INTERNATIONAL MARITIME ORGANIZATION SHIPPING INFORMATION (IMO):**

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

<b>PROPER SHIPPING NAME:</b>	Helium, compressed
<b>HAZARD CLASS NUMBER and DESCRIPTION:</b>	2.2 (Non-Flammable Gas)
<b>UN IDENTIFICATION NUMBER:</b>	UN 1046
<b>HAZARD LABEL(S) REQUIRED:</b>	Not Applicable
<b>IMDG CODE:</b>	Page 41

**MARINE POLLUTANT:** Helium-3 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:

<b>SUBSTANCE IDENTIFICATION NO.:</b>	1046
<b>NAME OF SUBSTANCE:</b>	Helium, compressed
<b>HAZARD IDENTIFICATION NO.:</b>	20
<b>LABEL:</b>	2
<b>CLASS AND ITEM NUMBER:</b>	2, 1°A

<b>SECTION 15. REGULATORY INFORMATION</b>
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**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: Helium-3 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: No

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

Releases of Helium-3 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): Not Applicable

**TSCA:** Toxic Substances Control Act

Helium 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): Not Applicable

**U.S. STATE REGULATORY INFORMATION:**

**CALIFORNIA PROPOSITION 65:** Helium-3 is not a listed substance which the State of California requires warning under this statute.

<b>SECTION 15. REGULATORY INFORMATION (Continued)</b>
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**U.S. STATE REGULATORY INFORMATION (continued):**

Helium is listed by the following State regulations (more specific regulations exist in some States):

<p><b>Alaska - Designated Toxic and Hazardous Substances:</b> Helium.</p> <p><b>California - Permissible Exposure Limits for Chemical Contaminants:</b> Helium.</p> <p><b>Florida - Substance List:</b> Helium.</p> <p><b>Illinois - Toxic Substance List:</b> Helium.</p> <p><b>Kansas - Section 302/313 List:</b> No.</p> <p><b>Massachusetts - Substance List:</b> Helium.</p>	<p><b>Michigan - Critical Materials Register:</b> Helium.</p> <p><b>Minnesota - List of Hazardous Substances:</b> Helium.</p> <p><b>Missouri - Employer Information/Toxic Substance List:</b> Helium.</p> <p><b>Massachusetts - Substance List:</b> Helium.</p> <p><b>New Jersey - Right to Know Hazardous Substance List:</b> Helium.</p> <p><b>North Dakota - List of Hazardous Chemicals, Reportable Quantities:</b> No.</p>	<p><b>Pennsylvania - Hazardous Substance List:</b> Helium-3.</p> <p><b>Rhode Island - Hazardous Substance List:</b> Helium-3.</p> <p><b>Texas - Hazardous Substance List:</b> No.</p> <p><b>West Virginia - Hazardous Substance List:</b> No.</p> <p><b>Wisconsin - Toxic and Hazardous Substances:</b> No.</p>
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**CANADIAN FEDERAL REGULATIONS:**

**CANADIAN DSL INVENTORY STATUS:** Helium-3 is listed on the Canadian DSL Inventory (as Helium).

**OTHER CANADIAN REGULATIONS:** Helium-3 is categorized as a Controlled Product, Hazard Class A, as per the Controlled Product Regulations. Helium-3 is not on the CEPA Priorities Substances Lists.

**EUROPEAN ECONOMIC COMMUNITY REGULATIONS:**

**EC LABELING AND CLASSIFICATION:** Helium-3 does not meet the definition of any hazard class as defined by the European Community Council Directive 67/548/EEC. Additionally, an official classification for this substance has not been published in Commission Directives 93/72/EEC, 94/69 EC, or and 96/54/EC.

**EC CLASSIFICATION:** Not applicable.

**EC RISK PHRASES:** Not applicable.

**EC SAFETY PHRASES:** Not applicable.

**EUROPEAN COMMUNITY ANNEX II HAZARD SYMBOL:** Not applicable.

<b>SECTION 16. OTHER INFORMATION</b>
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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.

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  
 619/670-0609

1/8/02 Revision: Addition of Simple Asphyxiant "SA" to NFPA Ratings. Addition of IATA ERG Code.  
 8/24/04 Revision: Corrected Gas Density at NPT, added detail for STP  
 8/14/07 Revision: New Chemtrec intrn'l phone #; Sec. 3 revised O2 concn. symptoms

## 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. It is used for computer-related searching.

### 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/NDSL**); 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 is 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