



MATERIAL SAFETY DATA SHEET

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

SECTION 1. PRODUCT IDENTIFICATION

PRODUCT NAME: Less than 300 ppm Chlorobenzene-D5, in Nitrogen and/or Helium
CHEMICAL NAME: Mixture of Chlorobenzene-D5 (< 300 ppm) in Balance of Nitrogen and/or Helium
FORMULA: Chlorobenzene-D5 = C₆D₅Cl; Nitrogen = N₂; Helium = He
SYNONYMS: Not Applicable

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DATE OF PREPARATION: January 292, 2001
MSDS NUMBER: 1619
PRODUCT USE: Various

SECTION 2. COMPOSITION and INFORMATION ON INGREDIENTS

COMPOSITION: Chlorobenzene-D5 (< 300 ppm), Balance Nitrogen and/or Helium
CAS NUMBER: Chlorobenzene-D5: 3114-55-4; Nitrogen: 7727-37-9; Helium: 7440-59-7
EINECS NUMBER: Chlorobenzene-D5: 221-482-0; Nitrogen: 231-783-9; Helium: 231-168-5
EXPOSURE LIMITS: (10,000 ppm = 1%)

OSHA PELs:

ACGIH TLVs:

NIOSH RELs:

There are no exposure limits for Chlorobenzene-D5; it is suggested that the following limits for the related compound, Chlorobenzene are used:

TWA = 75 ppm

TWA = 10 ppm

IDLH = 1000 ppm

Helium:

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

Nitrogen:

There are no exposure limits for Nitrogen, Nitrogen is a simple asphyxiant.

SECTION 3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This gas mixture is non-flammable, colorless, and has a slightly sweet, almond-like odor. This gas mixture may cause significant, adverse health effects, because of the Chlorobenzene-D5 content, which can reach exposure limits determined for the related compound, Chlorobenzene, at the percentage in this mixture. This gas mixture may also cause asphyxiation, by displacement of oxygen. Pure Chlorobenzene-D5 has a sweet odor and a probable low odor threshold; accordingly, the odor of this gas mixture may provide a good warning of a release of this gas mixture. If involved in a fire, this gas mixture will decompose to evolve toxic gases of hydrogen chloride, carbon monoxide, carbon dioxide, and phosgene. Persons responding to releases of this gas mixture must protect themselves appropriately.

ROUTES OF ENTRY, SYMPTOMS OF ACUTE EXPOSURE: WARNING - If rescue personnel need to enter an area of release of this gas mixture, 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: Eye contact with this gas mixture will cause mild to moderate irritation, depending on concentration and duration of contact. Contact of the cold gas with the eyes can cause pain, redness, burns, and severe exposure could cause blindness. High-pressure gas may result in airborne objects.

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

INHALATION: Inhalation of this gas mixture will be irritating to the upper respiratory system and mucous membranes. Symptoms may include coughing, wheezing and difficulty breathing. Inhalation exposure may also result in gastric upset. (continued on following page)

SECTION 3. HAZARD IDENTIFICATION)Continued)

INHALATION (continued): Inhalation of this gas mixture for prolonged periods of time, in high concentration may have adverse effects on the central nervous system, due to the presence of Chlorobenzene-D5. Symptoms may include dizziness, nausea, headache and chest pains. 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****EXPOSURE SYMPTOM**

20.9% Oxygen:

Normal oxygen concentration in air.

15-19% Oxygen:

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

12-15% Oxygen:

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

10-12% Oxygen:

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

8-10% Oxygen:

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

6-8% Oxygen:

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.

4-6% Oxygen:

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: Due to the presence of Chlorobenzene-D5, skin contact with this gas mixture may be irritating. It is possible that the Chlorobenzene-D5 component of this gas mixture may be absorbed via intact skin; contact should be avoided in order to carrying other toxic materials into the system. Contact of the cold gas with the skin can lead to frostbite or dermatitis (red, cracked, irritated skin), depending upon concentration and duration of exposure.

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: = 1; 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: Skin contact, inhalation.

TARGET ORGANS: Respiratory system, skin, liver.

SYMPTOMS: Persistent irritation of skin and respiratory system may result from repeated exposure to this gas mixture. The Chlorobenzene-D5 component of this gas mixture is considered a narcotic of moderate intensity. Repeated over-exposure to a gas mixture that contains Chlorobenzene-D5 can result in damage to the liver and kidneys, based on animal test data.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: Pre-existing dermatitis, other skin conditions, and respiratory disorders may be aggravated by over-exposure to this gas mixture. Additionally, repeated over-exposure to the Chlorobenzene-D5 component of this gas mixture may aggravate pre-existing liver and kidney conditions.

CARCINOGENICITY: The Chlorobenzene-D5 component is not specifically listed as a carcinogen or suspect carcinogen by any agency tracking carcinogenic effects; however, as the related compound, Chlorobenzene is listed as an ACGIH-A3, and EPA-D suspect carcinogen, Chlorobenzene-D5 should also be viewed and treated to be a suspect carcinogen as well. The remaining components of this gas mixture are 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 this gas mixture enters the eyes, open victim's eyes while under gentle, lukewarm, running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Victim must seek immediate medical attention from an ophthalmologist. In the event of mechanical injury, cover eye with bandage and seek appropriate medical attention.

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

INHALATION: Remove victim(s) to fresh air, as quickly as possible. Trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. In the event of severe, immediate effects or delayed symptoms that develop after exposure, victim must seek appropriate medical attention.

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: Not applicable.

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

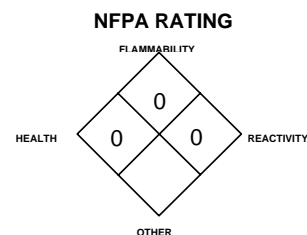
SPECIAL FIRE-FIGHTING PROCEDURES: Non-flammable gas. Use extinguishing media appropriate for surrounding fire.

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: When heated to decomposition, this gas will emit fumes of hydrogen chloride, carbon dioxide, and phosgene.



**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 leak of this product, operator should close the gas source if possible to do so safely. Evacuate immediate area. Only trained personnel, wearing Self-Contained Breathing Apparatus (SCBA) and a chemically resistant suit should re-enter a contaminated area.

Persons responding to a release of a pressurized gas should be aware of the severe hazard of mechanical injury in the event of valve failure or other event causing a rapid release of cylinder contents.

If leak is in user's gas handling equipment or system, close cylinder valve, safely vent high pressure and purge with inert gas, being sure to bring purge gas to near atmospheric pressure before attempting repairs. If leak is from the cylinder, cylinder valve or the valve pressure relief device (PRD), contact your supplier. Levels of Chlorobenzene-D5 should be below applicable exposure levels listed for the related compound Chlorobenzene in Section 2 (Composition / Information on Ingredients) before personnel can be allowed in the area without SCBA. Detection systems may be considered to monitor for leaks and to measure the level of Chlorobenzene-D5.

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.

SECTION 7. HANDLING AND STORAGE (Contained)

HANDLING: This gas mixture can be harmful and should only be handled by trained personnel. Wearing contact lenses is not recommended when handling this material. Monitoring may be considered for areas in which this compound is used.

Releases of this gas mixture can create an oxygen-deficient atmosphere. Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this gas mixture could occur without any significant warning symptoms, due to oxygen-deficiency. Cylinder valves should be inspected regularly for physical damage or corrosion (apparent by discoloration or rust). 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. Emergency personnel should 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. Spectra Gases, Inc. recommends that cylinders in use be secured within a ventilated enclosure such as a gas cabinet. Employee exposure should be monitored and reduced to the lowest practical levels using ventilation or other appropriate engineering controls. If appropriate, install automatic monitoring equipment to detect the level of Chlorobenzene-D5. 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, Canadian CSA Standard Z94.4-93, the European Standard EN149, and EC member states. The following are NIOSH respiratory protection equipment recommendations for Chlorobenzene, a compound related to Chlorobenzene-D5:

CONCENTRATION

RESPIRATORY PROTECTION

Up to 1000 ppm:

Any Supplied-Air Respirator (SAR) operated in a continuous-flow mode, or any Powered, Air-Purifying Respirator (PAPR) with organic vapor cartridge(s), or any Chemical Cartridge Respirator with a full facepiece and organic vapor cartridge(s), or any Air-Purifying, Full-Facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister, or any Self-Contained Breathing Apparatus (SCBA) with a full facepiece, or any SAR.

Emergency or Planned Entry into Unknown Concentrations or IDLH Conditions: Any SCBA that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode, or any SAR that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive-pressure mode.

Escape:

Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister, or any appropriate escape-type, SCBA.

EYE PROTECTION: Use approved safety goggles or safety glasses, as described in OSHA 29 CFR 1910.133 or by the European Standard EN166. Eye wash stations/safety showers should be available.

SKIN PROTECTION: Work (such as leather) gloves are recommended when handling cylinders of this gas. Wear gloves appropriate to the specific operation for which this gas mixture 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

The following information is for Helium, which may be a component of this mixture:

MOLECULAR WEIGHT: 4.00
GAS DENSITY @ 21.1°C (70°F): 0.0103 lb./ft³ (0.165 kg/m³)
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): 1.38
SOLUBILITY IN WATER vol/vol at 0°C (32°F) and 1 atm: 0.094
SPECIFIC VOLUME @ 21.1°C (70°F): 97.09 lb/ft³ (6.061 m³/kg)
CRITICAL PRESSURE: 33.0 psia (227 kPa abs)
COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.
ODOR THRESHOLD: Helium is odorless.

The following information is for Nitrogen, which may be a component of this mixture:

MOLECULAR WEIGHT: 28.01
GAS DENSITY @ 21.1°C (70°F): 0.072 lb./ft³ (1.153 kg/m³)
BOILING POINT @ 1 atm: -195.8°C (-320.4°F)
FREEZING/MELTING POINT @ 1 atm: -210°C (-345.8°F)
SPECIFIC GRAVITY (air = 1) @ 21.1°C (70°F): 0.906
SOLUBILITY IN WATER vol/vol at 0°C (32°F) and 1 atm: 0.023
SPECIFIC VOLUME @ 21.1°C (70°F): 13.8 lb/ft³ (0.867 m³/kg)
CRITICAL PRESSURE: 492.9 psia (3399 kPa abs)
COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

The following information is for the Chlorobenzene-D5 component of this gas mixture:

MOLECULAR WEIGHT: 117.60
SPECIFIC GRAVITY @ 20°C (68°F): 1.157
ODOR THRESHOLD: 0.87-5.9 ppm [For related compound, Chlorobenzene] (detection)
VAPOR DENSITY (air = 1): 3.88 [For related compound, Chlorobenzene]
VAPOR PRESSURE @ 25°C (70°F): 11.8 mm Hg [For related compound, Chlorobenzene]
COEFFICIENT WATER/OIL DISTRIBUTION: 2.18-2.84 [For related compound, Chlorobenzene]

The following is information on the gas mixture:

APPEARANCE, ODOR AND STATE: Colorless, gas with a mild, sweet, almond-like odor.
WARNING PROPERTIES FOR THIS GAS: The odor of this gas mixture may act as a good warning property in event of accidental release.

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: The Chlorobenzene-D5 component of this gas mixture is incompatible with strong bases, and strong oxidizers. The Chlorobenzene-D5 may also be incompatible with materials that are incompatible with the related material Chlorobenzene, including alkali metals (i.e. sodium and potassium and their alloys), alkaline earth metals (i.e. calcium, magnesium), dimethyl sulfoxide, silver perchlorate and acetic acid, phosphorous trichloride and sodium. The Chlorobenzene-D5 component may also attack some forms of plastics, rubbers and coatings.

REACTIVITY:

- A) HAZARDOUS DECOMPOSITION PRODUCTS:** When heated to decomposition, this gas will emit fumes of hydrogen chloride, carbon monoxide, carbon dioxide, and phosgene.
B) HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The Helium and Nitrogen components of this gas mixture are inert; toxicity data are not applicable to these gases. There are no specific toxicity data are for the Chlorobenzene-D5 component. The following data are for the related compound, Chlorobenzene:

LC₅₀ (Inhalation-Rat) 2965 ppm
 LC₅₀ (Inhalation-Mammal-species unspecified) 10 gm/m³
 TCLo (Inhalation-Rat) 210 ppm/6 hours (6-15 days preg): Teratogenic effects

(continued on following page)

SECTION 11. TOXICOLOGICAL INFORMATION (Continued)

TOXICITY DATA (continued):

TCLo (Inhalation-Rat) 250 ppm/7 hours/24 weeks-intermittent: Liver: changes in liver weight; Blood: other changes; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: transaminases

TCLo (Inhalation-Rat) 1 mg/m³/60 days-continuous: Brain and Coverings: recordings from specific areas of CNS; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels:- true cholinesterase, Metabolism (Intermediary): Plasma proteins not involving coagulation

TCLo (Inhalation-Rat) 210 ppm/6 hours: female 6-15 day(s) after conception: Reproductive: Specific Developmental Abnormalities: hepatobiliary system

TCLo (Inhalation-Rabbit) 590 ppm/6 hours (6-18 days preg): Reproductive effects

TCLo (Inhalation-Rabbit) 250 ppm/7 hours/24 weeks-intermittent: Liver: changes in liver weight; Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol); Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: transaminases

TCLo (Inhalation-Rabbit) 10 ppm/6 hours: female 6-18 day(s) after conception: Reproductive: Specific Developmental Abnormalities: musculoskeletal system

LCLo (Inhalation-Mouse) 15 g/m³

LD₅₀ (Oral-Rat) 2290 mg/kg

LD₅₀ (Oral-Rat) 1110 mg/kg: Behavioral: somnolence (general depressed activity), tremor, ataxia

LD₅₀ (Oral-Mouse) 2300 mg/kg

LD₅₀ (Oral-Rabbit, adult) 2830 mg/kg

LD₅₀ (Oral-Rabbit) 2250 mg/kg

LD₅₀ (Oral-Guinea Pig) 2250 mg/kg

LD₅₀ (Oral-Mammal-species unspecified) 2300 mg/kg

LD₅₀ (Intraperitoneal-Rat) 1655 mg/kg

LD₅₀ (Intraperitoneal-Mouse) 515 mg/kg

LD₅₀ (Unreported-Mammal-species unspecified) 2300 mg/kg

LD (Skin-rabbit) > 2200 mg/kg

LD (Skin-Guinea Pig) > 11 gm/kg

TDLo (Oral-Rat) 14 gm/kg/14 days-intermittent: Behavioral: somnolence (general depressed activity); Related to Chronic Data: death

TDLo (Oral-Rat) 32,500 mg/kg/13 weeks-intermittent: Liver: changes in liver weight; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: peptidases; Related to Chronic Data: death

TDLo (Oral-Rat) 27300 µg/kg/39 weeks-intermittent: Blood: pigmented or nucleated red blood cells, eosinophilia, changes in erythrocyte (RBC) count

TDLo (Oral-Rat): 61800 mg/kg/2 years-intermittent: Tumorigenic: neoplastic by RTECS criteria; Liver: tumors; Blood: tumors

TDLo (Oral-Mouse) 16,250 mg/kg/13 weeks-intermittent: Liver: hepatitis (hepatocellular necrosis), diffuse; Kidney, Urethra, Bladder: other changes in urine composition; Related to Chronic Data: death

TDLo (Oral-Rabbit) 441 mg/kg/63 weeks-intermittent: Gastrointestinal: gastritis; Liver: hepatitis (hepatocellular necrosis), zonal; Kidney, Urethra, Bladder: changes in tubules (including acute renal failure, acute tubular necrosis)

TDLo (Oral-Guinea Pig) 441 mg/kg/63 weeks-intermittent: Gastrointestinal: gastritis; Liver: hepatitis (hepatocellular necrosis), zonal; Kidney, Urethra, Bladder: changes in tubules (including acute renal failure, acute tubular necrosis)

TDLo (Oral-Dog) 17712 mg/kg/93 days-intermittent: Blood: changes in leukocyte (WBC) count; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: transaminases; Related to Chronic Data: death

LDLo (Subcutaneous-Rat) 7000 mg/kg

LDLo (Intraperitoneal-Guinea Pig, adult) 4100 mg/kg

LDLo (Intraperitoneal-guinea pig) 4100 mg/kg: Behavioral: muscle weakness; Liver: fatty liver degeneration; Kidney, Urethra, Bladder: other changes

Micronucleus Test (Intraperitoneal-mouse) 225 mg/kg/24 hours

Cytogenetic Analysis (Intraperitoneal-mouse) 1 gm/kg

Mutation in Microorganisms (Lymphocyte-mouse) 70 mg/L

Mutation in Mammalian Somatic Cells (Lymphocyte-mouse) 100 mg/L

Gene Conversion and Mitotic Recombination (*Saccharomyces cerevisiae*) 1000 ppm

Sister Chromatid Exchange (Hamster-Ovary) 300 mg/L

CARCINOGENICITY: The Chlorobenzene-D5 component is not specifically listed as a carcinogen or suspect carcinogen by any agency tracking carcinogenic effects; however, as the related compound, Chlorobenzene is listed as an ACGIH-A3, and EPA-D suspect carcinogen, Chlorobenzene-D5 should also be viewed and treated to be a suspect carcinogen as well.

ACGIH-A3 (Confirmed Animal Carcinogen with Unknown Relevance to Humans); **EPA-D** (Not Classifiable as to Human Carcinogenicity: Inadequate human and animal evidence of carcinogenicity, or no data are available; however, there are data indicative of genotoxic effects and structural relationships to halogenated methanes)

IRRITANCY OF PRODUCT: At high concentration, inhalation of this gas mixture may cause irritation of the respiratory system, eyes and skin.

SENSITIZATION OF PRODUCT: No component of this product is known to be a skin or respiratory sensitizer.

SECTION 11. TOXICOLOGICAL INFORMATION (Continued)

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

Mutagenicity: There are no human mutagenic data for the components of this gas mixture. Mutagenic data are available for Chlorobenzene, a compound related to the Chlorobenzene-D5 component of this gas mixture.

Embryotoxicity: There are no human embryotoxic data for the components of this gas mixture.

Teratogenicity: There are no teratogenic data for the components of this gas mixture.

Reproductive Toxicity: There are no human reproductive toxicity data for the components of this product. Animal data indicate that Chlorobenzene (a compound related to the Chlorobenzene-D5 component) can cause adverse reproductive effects.

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) have not been determined for the components of this gas mixture. BEIs have been determined for Chlorobenzene, a compound similar in chemical structure to the Chlorobenzene-D5 component of this product, as follows:

CHEMICAL: DETERMINANT	SAMPLING TIME	BEI
<ul style="list-style-type: none"> • Total 4-chlorocatechol in urine • Total p-chlorophenol in urine 	<ul style="list-style-type: none"> • End of shift • End of shift 	<ul style="list-style-type: none"> • 150 mg/g creatinine • 25 mg/g creatinine

SECTION 12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: The Helium and Nitrogen components of this gas mixture occur naturally in the atmosphere and are stable. The Chlorobenzene-D5 component is slowly degraded by sunlight, forming monochlorobiphenyl and hydrogen chloride.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Currently, there are no data on the possible effect of this gas mixture on plants and animals in the natural environment.

EFFECT OF CHEMICAL ON AQUATIC LIFE: The Nitrogen and Helium components of this gas mixture are not toxic in an aquatic environment. Due to the low level of the Chlorobenzene-D5 component of this gas should not cause significant adverse effects in an aquatic environment.

MOBILITY: Based on a classification scheme, an estimated Koc value of 24, determined from a structure estimation method, indicates that Chlorobenzene-D5 is expected to have very high mobility in soil.

PERSISTENCE AND BIODEGRADABILITY: The Nitrogen and Helium components of this gas mixture have no hazard of persistence and are elements which do not biodegrade. A large number of bacteria and fungi found in the environment are capable of degrading the Chlorobenzene-D5 component of this product.

POTENTIAL TO BIOACCUMULATE: The components of this gas mixture will not bioaccumulate.

OZONE-DEPLETION POTENTIAL: The components of this gas mixture are not Class I or Class II ozone depleting chemicals (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. DOT SHIPPING INFORMATION:

U.S. DOT PROPER SHIPPING NAME: Compressed gas, n.o.s. (Chlorobenzene-D5, Helium) *or*
(Chlorobenzene-D5, Nitrogen)

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

UN IDENTIFICATION NUMBER: UN 1956

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

PLACARD (When required): Non-Flammable Gas

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position. 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) #: 126

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: Compressed gas, n.o.s. (Chlorobenzene-D5, Helium) *or*
(Chlorobenzene-D5, Nitrogen)

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

UN IDENTIFICATION NUMBER: UN 1956

HAZARD LABEL(S) REQUIRED: Non-Flammable Gas

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

INTERNATIONAL MARITIME ORGANIZATION SHIPPING INFORMATION (IMO):

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

PROPER SHIPPING NAME: Compressed gas, n.o.s. (Chlorobenzene-D5, Helium) *or*
(Chlorobenzene-D5, Nitrogen)

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

UN IDENTIFICATION NUMBER: UN 1956

HAZARD LABEL(S) REQUIRED: Non-Flammable Gas

IMDG CODE: Page 2124

STOWAGE CATEGORY: Category A

MARINE POLLUTANT: The components of this product are not designated by the IMO to be Marine Pollutants.

EUROPEAN SHIPPING INFORMATION:

EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR): This gas mixture is considered by the Economic Commission for Europe to be dangerous goods. Additional information is as follows:

SUBSTANCE IDENTIFICATION NO.: 1956

NAME OF SUBSTANCE: Compressed gas, n.o.s. (Chlorobenzene-D5, Helium) *or*
(Chlorobenzene-D5, Nitrogen)

HAZARD IDENTIFICATION NO.: 20

LABEL: 2

CLASS AND ITEM NUMBER: 2, 1°A

SECTION 15. REGULATORY INFORMATION

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: The components of this gas mixture are 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: Yes PRESSURE: Yes

DELAYED HEALTH: No REACTIVITY: No

FIRE: No

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

Releases of this gas mixture (or its components) 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

The components of this gas mixture are 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

CALIFORNIA PROPOSITION 65: The components of this gas mixture are not listed substances 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: Helium.

California - Permissible Exposure Limits for Chemical Contaminants: Helium, Nitrogen.

Florida - Substance List: Helium, Nitrogen.

Illinois - Toxic Substance List: Helium.

Kansas - Section 302/313 List: None.

Massachusetts - Substance List: Helium, Nitrogen.

Michigan - Critical Materials Register: None.

Minnesota - List of Hazardous Substances: Helium.

Missouri - Employer Information/Toxic Substance List: Helium.

New Jersey - Right to Know Hazardous Substance List: Helium, Nitrogen.

North Dakota - List of Hazardous Chemicals, Reportable Quantities: None.

Pennsylvania - Hazardous Substance List: Helium, Nitrogen.

Rhode Island - Hazardous Substance List: Helium, Nitrogen.

Texas - Hazardous Substance List: None.

West Virginia - Hazardous Substance List: None.

Wisconsin - Toxic and Hazardous Substances: None.

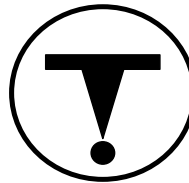
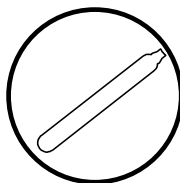
CANADIAN FEDERAL REGULATIONS:

CANADIAN DSL/NDL INVENTORY STATUS: The Helium and Nitrogen components of this gas mixture are listed on the DSL Inventory. Chlorobenzene-D5 is not listed on the Canadian DSL or NDSL Inventories; however, the compound from which Chlorobenzene-D5 is derived, Chlorobenzene, is listed on the DSL Inventory.

OTHER CANADIAN REGULATIONS: This gas mixture would be categorized as a Controlled Product, Hazard Classes A, and D2B, as per the Controlled Product Regulations. The components of this gas mixture are not on the CEPA Priorities Substances Lists.

CANADIAN WHMIS SYMBOLS: **Class A:** Compressed Gas

Class D2B: Toxic Material/Materials Causing Other Toxic Effects- Irritation



SECTION 15. REGULATORY INFORMATION (Continued)**EUROPEAN ECONOMIC COMMUNITY REGULATIONS:**

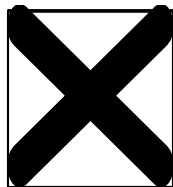
EC LABELING AND CLASSIFICATION: This gas mixture meets the definition hazardous, as defined by the European Community Council Directive 67/548/EEC, as follows:

EC CLASSIFICATION: [Xn] Irritating

EC RISK PHRASES: [R: 36/37/38] Irritating to eyes, respiratory system and skin.

EC SAFETY PHRASES: [S: 23] Do not breathe gas. [S: 24/25] Avoid contact with skin and eyes. [S: 26] In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. [S: 36] Wear suitable protective clothing. [S: 38] In case of insufficient ventilation, wear suitable respiratory protection.

EUROPEAN COMMUNITY ANNEX II HAZARD SYMBOL: Xn (Irritating)

**EUROPEAN COMMUNITY INFORMATION FOR COMPONENTS:****CHLOROBENZENE-D5:**

EC EINECS/ELINCS NUMBER: 221-482-0

EC CLASSIFICATION: An official classification for this substance has not been published in Commission Directives 93/72/EEC, 94/69 EC, or and 96/54/EC.

HELIUM:

EC EINECS/ELINCS NUMBER: 231-168-5

EC CLASSIFICATION: An official classification for this substance has not been published in Commission Directives 93/72/EEC, 94/69 EC, or and 96/54/EC.

NITROGEN:

EC EINECS/ELINCS NUMBER: 231-783-9

EC CLASSIFICATION: An official classification for this substance has not been published in Commission Directives 93/72/EEC, 94/69 EC, or and 96/54/EC.

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.

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.
 9163 Chesapeake Drive, San Diego, CA 92123-1002
 858/565-0302

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: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m³** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. 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 Transport by Rail.