



# 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 1% BROMODICHLOROMETHANE IN ARGON, KRYPTON, NITROGEN, or XENON

**CHEMICAL NAME:** Mixture of Bromodichloromethane (< 1%) and Balance Argon, Krypton, Nitrogen, or Xenon

**FORMULA:** Bromodichloromethane = CHBrCl<sub>2</sub>; Argon = Ar; Krypton = Kr; Nitrogen = N<sub>2</sub>; Xenon = Xe

**SYNONYMS:** Not Applicable for Mixture

**MANUFACTURER:**

**SPECTRA GASES, INC.**

**ADDRESS:**

3434 Route 22 West  
Branchburg, NJ 08876, U.S.A.

**PHONE:**

908/252-9300

**FAX:**

908/252-0811

**SPECTRA GASES EMERGENCY CONTACT:** 908/454-7455 8:00 am - 5:00 pm

**24 HOUR EMERGENCY CONTACT, CHEMTREC:** 800/424-9300, 202/484-7616

**DATE OF PREPARATION:** May 24, 1999

**MSDS NUMBER:** 1152

**PRODUCT USE:** Various

## SECTION 2. COMPOSITION and INFORMATION ON INGREDIENTS

**COMPOSITION:** Bromodichloromethane < 1% in Argon 0-99%; or Krypton 0-99%; Nitrogen 0-99.99%; or Xenon 0-99%;

**CAS NUMBER:** Bromodichloromethane: 75-27-4; Argon: 7440-37-1; Krypton: 7439-90-9; Nitrogen: 7727-37-9; Xenon: 7439-90-9

**EINECS NUMBER:** Bromodichloromethane: 200-856-7; Argon: 231-098-5; Krypton: 231-098-5; Nitrogen: 231-783-9; Xenon: 231-172-7

**EXPOSURE LIMITS:** (10,000 ppm = 1%)

**OSHA PELs:**

**ACGIH TLVs:**

**NIOSH RELs:**

Bromodichloromethane:

Currently, there are no established exposure limits for Bromodichloromethane.

Argon:

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

Krypton:

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

Nitrogen:

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

Xenon

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

## SECTION 3. HAZARD IDENTIFICATION

**EMERGENCY OVERVIEW:** This gas is a colorless, non-flammable, gas mixture with a faint chloroform-like odor, or no odor, shipped under pressure. High concentrations of this gas mixture may be irritating, due to the presence of Bromodichloromethane. Due to the low concentration in this mixture, the central nervous system effects of Bromodichloromethane are not expected to occur unless a release of this gas occurs in a confined space or when exposure is prolonged. Bromodichloromethane is a suspect carcinogen and mutagen. The main health hazard associated with releases of this gas mixture is asphyxiation, by displacement of oxygen. 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 in which a release of this gas mixture has occurred, 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 may cause irritation, or tearing of the eyes, due to the presence of Bromodichloromethane. Release of a high-pressure gas may result in airborne objects.

**SECTION 3. HAZARD IDENTIFICATION (Continued)**

**SKIN CONTACT:** Bromodichloromethane, a component of this gas mixture in less than 1%, can be absorbed through intact skin. Symptoms may include tingling, itching, scaling, and if exposure is prolonged, some blistering and possibly burns. Due to gaseous form and low concentration, symptoms are not highly probable.

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

**INHALATION:** High concentrations of this gas mixture may be irritating due to the presence of Bromodichloromethane. High concentrations can also 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.

**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:** Inhalation

**TARGET ORGANS:** Central Nervous System, Reproductive System, Liver and Kidneys

**SYMPTOMS:** Data exist on long-term effects to the central nervous system on persons exposed to Bromodichloromethane, as well as possible liver and kidney damage. Due to the low concentration of this compound in this gas mixture, these effects are expected to be greatly lessened. In addition, Bromodichloromethane has been shown to be carcinogenic in experimental tests to animals. There are human tissue and animal test data indicate that Bromodichloromethane can cause mutagenic effects. See Section 11 (Toxicological Information), for further information.

**MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE:** Pre-existing central nervous system conditions, and liver or kidney disorders may be aggravated by over-exposure to this gas mixture.

**CARCINOGENICITY:** The Bromodichloromethane component of this gas mixture is found on the following lists:

**EPA B2** (Sufficient Evidence from Animal Studies - Inadequate Evidence or no Data from Epidemiologic Studies)

**IARC 2B** (Possibly Carcinogenic to Humans - Limited Evidence in Humans in the Absence of Sufficient Evidence in Experimental Animals)

**NTP 2B** (Reasonably Anticipated to be a Carcinogen - Sufficient Evidence of Carcinogenicity from Studies in Humans which Indicates that a Causal Relationship is Credible)

Bromodichloromethane is not listed by the ACGIH, FEDERAL OSHA Z LIST, NIOSH, CAL/OSHA, or the German MAK 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

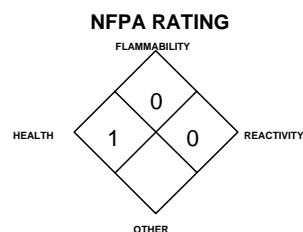
**NFPA RATINGS:**

HEALTH: = 1

FLAMMABILITY: = 0

REACTIVITY: = 0

SPECIAL: None



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

**SPECIAL FIRE-FIGHTING PROCEDURES:** Non-flammable. Use extinguishing media appropriate for surrounding fire. In the event of fire, cool containers of this product with water spray to prevent failure.

**See Section 16 for Definition of Ratings**

**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:** The inert gases in this mixture will not decompose in fire to produce toxic compounds. The Bromodichloromethane component of this gas mixture will decompose into hydrogen bromide and hydrogen chloride, traces of phosgene and carbon oxides.

**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.

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

**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 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. Wearing contact lenses is not recommended when handling this gas.

**SECTION 7. HANDLING AND STORAGE (Continued)**

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. 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. 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:** Purge gas handling equipment with inert gas and relieve pressure before attempting repairs. Follow all cautionary procedures described above during maintenance operations.

**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. 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 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 EN166, and EC member states.

**SKIN PROTECTION:** Work (such as leather) gloves are recommended when handling cylinders of this gas. Use appropriate 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 Argon, which may be a component of this mixture:

**MOLECULAR WEIGHT:** 39.95

**GAS DENSITY @ 21.1°C (70°F):** 0.103 lb./ft<sup>3</sup> (1.650 kg/m<sup>3</sup>)

**BOILING POINT @ 1 atm:** -185.9°C (-302.6°F)

**FREEZING/MELTING POINT @ 1 atm:** -189.2°C (-308.6°F)

**SPECIFIC GRAVITY (air = 1) @ 21.1°C (70°F):** 1.38

**SOLUBILITY IN WATER vol/vol at 0°C (32°F) and 1 atm:** 0.056

**SPECIFIC VOLUME @ 21.1°C (70°F):** 9.71 lb/ft<sup>3</sup> (0.606 m<sup>3</sup>/kg)

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

**CRITICAL PRESSURE:** 711.5 psia (4905 kPa abs)

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

**MOLECULAR WEIGHT:** 83.80

**GAS DENSITY @ 21.1°C (70°F):** 0.2172 lbs ft<sup>3</sup> (3.479 kg/m<sup>3</sup>)

**BOILING POINT @ 1 atm:** -153.4°C (-244.0°F)

**FREEZING/MELTING POINT @ 1 atm:** -157°C (-251°F)

**SPECIFIC GRAVITY (air = 1) @ 21.1°C (70°F):** 2.899

**SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES Continued**

Information for Krypton, continued:

**SOLUBILITY IN WATER vol/vol at 20°C (68°F) and 1 atm:** 0.0594

**SPECIFIC VOLUME @ 21.1°C (70°F):** 4.604 lb/ft<sup>3</sup> (0.287 m<sup>3</sup>/kg)

**CRITICAL PRESSURE:** 798.0 psia (5502 kPa abs)

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

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./ft<sup>3</sup> (1.153 kg/m<sup>3</sup>)

**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/ft<sup>3</sup> (0.867 m<sup>3</sup>/kg)

**CRITICAL PRESSURE:** 492.9 psia (3399 kPa abs)

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

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

**MOLECULAR WEIGHT:** 131.3

**GAS DENSITY @ 21.1°C (70°F):** 0.3416 lbs ft<sup>3</sup> (5.472 kg/m<sup>3</sup>)

**BOILING POINT @ 1 atm:** -108.2°C (-162.6°F)

**FREEZING/MELTING POINT @ 1 atm:** -168°F (-111°C)

**SPECIFIC GRAVITY (air = 1) @ 21.1°C (70°F):** 4.560

**SOLUBILITY IN WATER vol/vol at 20°C (68°F) and 1 atm:** 0.108

**SPECIFIC VOLUME @ 21.1°C (70°F):** 2.927 lb/ft<sup>3</sup> (0.183 m<sup>3</sup>/kg)

**CRITICAL PRESSURE:** 847.0 psia (5840 kPa abs)

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

The following information is for the Bromodichloromethane component of this gas mixture.

**ODOR THRESHOLD:** 1680 mg/m<sup>3</sup>

**LIQUID DENSITY @ 21.1°C (70°F):** 1.98 g/cm<sup>3</sup>

**VAPOR PRESSURE @ 20°C (68°F):** 50 torr

Information for gas mixture:

**APPEARANCE, ODOR AND STATE:** Colorless, gas mixture, with faint chloroform-like odor.

**WARNING PROPERTIES FOR THIS GAS MIXTURE:** There are no good warning properties for this gas mixture. 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:** All components of this gas mixture are stable.

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

**MATERIALS WITH WHICH GAS MIXTURE IS INCOMPATIBLE:** Although the components of greatest percentage are inert, the Bromodichloromethane present in this mixture is incompatible with strong oxidizers and strong bases and magnesium.

**REACTIVITY:**

**A) HAZARDOUS DECOMPOSITION PRODUCTS:** None except those of thermal decomposition given in Section 5 (Fire-Fighting Measures).

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

**SECTION 11. TOXICOLOGICAL INFORMATION**

**TOXICITY DATA:** There are no specific toxicology data for Argon, Krypton, Nitrogen, or Xenon. These gases are simple asphyxiants, which cause suffocation by replacing air (oxygen). Suffocation without warning may be a hazard with this mixture even though the Bromodichloromethane component does provides an odor warning. The following toxicological data are available for Bromodichloromethane.

LD<sub>50</sub> (Oral-Rat) 916 mg/kg

LD<sub>50</sub> (Oral-Rat) 430 mg/kg: Behavioral: somnolence (general depressed activity), tremor; Liver: other changes

LD<sub>50</sub> (Oral-Mouse) 450 mg/kg: Brain and Coverings: changes in circulation (hemorrhage, thrombosis, etc.); Liver: fatty liver degeneration; Blood: hemorrhage

TDLo (Oral-Oral-Rat) 25,500 mg/kg/2 years-continuous: Carcinogenic effects

## SECTION 11. TOXICOLOGICAL INFORMATION (Continued)

## TOXICITY DATA (continued):

TDLo (Oral-Oral-Rat) 25500 mg/kg/2 years-continuous: Tumorigenic: Carcinogenic by RTECS criteria; Kidney, Ureter, Bladder: Kidney tumors	TDLo (Oral-Mouse) 750 mg/kg/5 days-intermittent: Liver: changes in liver weight; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: dehydrogenases, Enzyme inhibition, induction, or change in blood or tissue levels: transaminases	Mutation in Microorganisms (Mouse-Lymphocyte) 180 mg/L Sister Chromatid Exchange (Human-Lymphocyte) 400 mmol/L
TDLo (Oral-Mouse) 3500 mg/kg/14 days-intermittent: Liver: changes in liver weight; Endocrine: changes in spleen weight; Nutritional and Gross Metabolic: weight loss or decreased weight gain	TD (Oral-Rat) 51 g/kg/2 years-continuous: Carcinogenic effects	Sister Chromatid Exchange (Oral-Mouse) 200 mg/kg/4 days-intermittent Sister Chromatid Exchange (Oral-Mouse) 200 mg/kg/4 days-intermittent
TDLo (Oral-Mouse) 25,500 mg/kg/2 years-continuous: Carcinogenic effects	TD (Oral-Mouse) 38,250 mg/kg/2 years-continuous: Carcinogenic effects Mutation in Microorganisms (Salmonella typhimurium) 10 µg/plate Mutation in Microorganisms (Salmonella typhimurium) 50 mL/plate	Sister Chromatid Exchange (Rat-Leukocyte) 200 µmol/L Cytogenetic analysis (Intraperitoneal-Rat) 164 mg/kg Cytogenetic analysis (Hamster-Lung) 10 µmol/L

**CARCINOGENICITY:** The Bromodichloromethane component of this gas mixture is found on the following lists:

**EPA B2** (Sufficient Evidence from Animal Studies - Inadequate Evidence or no Data from Epidemiologic Studies)

**IARC 2B** (Possibly Carcinogenic to Humans - Limited Evidence in Humans in the Absence of Sufficient Evidence in Experimental Animals)

**NTP 2B** (Reasonably Anticipated to be a Carcinogen - Sufficient Evidence of Carcinogenicity from Studies in Humans which Indicates that a Causal Relationship is Credible)

Bromodichloromethane is not listed by the ACGIH, FEDERAL OSHA Z LIST, NIOSH, CAL/OSHA, or the German MAK and therefore is neither considered to be nor suspected to be a cancer-causing agent by these agencies.

**IRRITANCY OF PRODUCT:** This gas mixture may be mildly irritating to contaminated tissue, depending on the duration of contact.

**SENSITIZATION OF PRODUCT:** The components of this gas mixture are not sensitizers.

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

Mutagenicity: This gas mixture is not expected to cause mutagenic effects in humans. Human mutation data are available for Bromodichloromethane from studies of specific human tissues exposed to high levels of this compound.

Embryotoxicity: This gas mixture is not expected to cause embryotoxic effects in humans.

Teratogenicity: This gas mixture is not expected to cause teratogenic effects in humans.

Reproductive Toxicity: This gas mixture is not expected 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, there are no Biological Exposure Indices (BEIs) for the components of this gas mixture.

## SECTION 12. ECOLOGICAL INFORMATION

**ENVIRONMENTAL STABILITY:** Argon, Krypton, Nitrogen, and Xenon occur naturally in the atmosphere. Bromodichloromethane will mainly volatilize from soil, water and the atmosphere. Laboratory studies have indicated that significant biodegradation of Bromodichloromethane can occur under anaerobic conditions, therefore, where volatilization does not occur, biodegradation may be a significant removal process.

**EFFECT OF MATERIAL ON PLANTS or ANIMALS:** It is unknown if any effects of this gas mixture will occur to exposed plants or animals.

**EFFECT OF CHEMICAL ON AQUATIC LIFE:** Currently, there are no data on the effects of this gas mixture on an aquatic environment.

**MOBILITY:** Argon, Krypton, Nitrogen, and Xenon are inert and do not present a hazard of mobility. Bromodichloromethane will be highly mobile in soil and can leach to the groundwater. Due to the gaseous form of Bromodichloromethane in this product, this is unlikely to be a significant environmental threat for this product.

**SECTION 12. ECOLOGICAL INFORMATION (Continued)**

**PERSISTENCE AND BIODEGRADABILITY:** Persistence: Argon, Krypton, Nitrogen, and Xenon are natural elements and present no hazard of persistence. If released on soil, Bromodichloromethane is expected to volatilize from soil surface and leach into the ground. If released to water, Bromodichloromethane would primarily volatilize, with an estimated half-life of 33 minutes to 12 days, with a typical half-life of 35 hours. If released to the atmosphere, due to its high vapor pressure, Bromodichloromethane should exist entirely in vapor-phase. Bromodichloromethane will react with photochemically produced hydroxyl radicals. The estimated half-life for this reaction is estimated to be 3.92 months in typical air. Biodegradation: Bromodichloromethane will readily biodegrade, with tests indicating that it can be biodegraded under anaerobic conditions completely within two weeks.

**POTENTIAL TO BIOACCUMULATE:** No data are currently available on the components of this gas mixture for bioaccumulation.

**OZONE-DEPLETION POTENTIAL:** The components of this gas mixture are not a 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 residual 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:** Compressed gases, n.o.s. (Argon, Bromodichloromethane) *or* (Krypton, Bromodichloromethane) *or* (Nitrogen, Bromodichloromethane) *or* (Xenon, Bromodichloromethane)

**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 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) #:** 126

**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 mixture is considered as dangerous goods, per the International Air Transport Association.

**PROPER SHIPPING NAME:** Compressed gas, n.o.s. (Argon, Bromodichloromethane) *or* (Krypton, Bromodichloromethane) *or* (Nitrogen, Bromodichloromethane) *or* (Xenon, Bromodichloromethane)

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

**UN IDENTIFICATION NUMBER:** UN 1956

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

**SECTION 14. TRANSPORT INFORMATION (Continued)**

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

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 mixture is considered as dangerous goods, per the International Maritime Organization.

**PROPER SHIPPING NAME:** Compressed gas, n.o.s. (Argon, Bromodichloromethane) **or** (Krypton, Bromodichloromethane) **or** (Nitrogen, Bromodichloromethane) **or** (Xenon, Bromodichloromethane)

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

**UN IDENTIFICATION NUMBER:** UN 1956

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

**STOWAGE CATEGORY:** Category A

**IMDG CODE:** Page 2124

**MARINE POLLUTANT:** The components of this gas mixture 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. (Argon, Bromodichloromethane) **or** (Krypton, Bromodichloromethane) **or** (Nitrogen, Bromodichloromethane) **or** (Xenon, Bromodichloromethane)

**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): Bromodichloromethane = 5000 lbs (2270 kg)

**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. .

The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lbs (4,540 kg) therefore applies, per 40 CFR 370.20.

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: Yes                      REACTIVITY: No

FIRE: No

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

Releases of the Bromodichloromethane component of this gas require reporting under Section 313.

**SECTION 15. REGULATORY INFORMATION (Continued)****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

Argon, Krypton, Nitrogen, Xenon and Bromodichloromethane 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.

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

**CALIFORNIA PROPOSITION 65:** No component of this gas mixture is a listed substance which the State of California requires warning under this statute.

The components of this gas mixture are covered under the following specific State regulations (more specific regulations exist in some States):

**Alaska - Designated Toxic and Hazardous Substances:** No.

**California - Permissible Exposure Limits for Chemical Contaminants:** No.

**Florida - Substance List:** No.

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

**Kansas - Section 302/313 List:** Bromodichloromethane.

**Massachusetts - Substance List:** No.

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

**Minnesota - List of Hazardous Substances:** No.

**Missouri - Employer Information/Toxic Substance List:** No.

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

**North Dakota - List of Hazardous Chemicals, Reportable Quantities:** Bromodichloromethane.

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

**Rhode Island - Hazardous Substance List:** No.

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

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

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

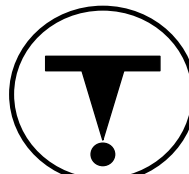
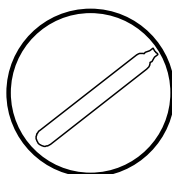
**CANADIAN FEDERAL REGULATIONS:**

**CANADIAN DSL INVENTORY STATUS:** All components of this gas mixture are listed on the Canadian 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

**EUROPEAN ECONOMIC COMMUNITY REGULATIONS:**

**EC LABELING AND CLASSIFICATION:** This gas mixture does not meet the definition of any hazard class as defined by the European Community Council Directive 67/548/EEC.

**EC CLASSIFICATION:** Not applicable.

**EC RISK PHRASES:** Not applicable.

**EC SAFETY PHRASES:** Not applicable.

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

## SECTION 15. REGULATORY INFORMATION (Continued)

## EUROPEAN COMMUNITY INFORMATION FOR COMPONENTS:

**BROMODICHLOROMETHANE:****EC EINECS/ELINCS NUMBER:** 200-856-7**EC CLASSIFICATION:** Toxic: [T]**EC RISK PHRASES:** May cause cancer. May cause heritable genetic damage. Harmful by inhalation, in contact with skin and if swallowed. Irritating to eyes, respiratory system and skin. [R: 45, 46, 20/21/22, 36/37/38]**EC SAFETY PHRASES:** Keep locked up and out of the reach of children.\* *\*This safety phrase can be omitted from the label when the substance or preparation is sold for industrial use only.* In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Keep container tightly closed and in a well ventilated place. Avoid contact with skin. After contact with skin, wash immediately with plenty of water. Take off immediately, all contaminated clothing. Wear suitable protective clothing, gloves, eye/face protection. In case of accident or if you feel unwell, seek medical advice immediately (show label where possible). [S:(1/2)\*, 7/9, 24, 26, 28, 27, 36/37/39, 45]**EC COMMENTS:** No comments in currently in place.**ARGON:****EC EINECS/ELINCS NUMBER:** 231-098-5**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.**KRYPTON:****EC EINECS/ELINCS NUMBER:** 231-098-5**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.**XENON:****EC EINECS/ELINCS NUMBER:** 231-172-7**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:**

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## 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