

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI, Canadian WHMIS Standards, European Union CLP EC 1272/2008, and the Global Harmonization Standard

SECTION 1. PRODUCT IDENTIFICATION

PRODUCT NAME: HALON 1301

CHEMICAL NAME: BROMOTRIFLUOROMETHANE

SYNONYMS: Refrigerant gas, R 13B1, F 13B1; F-13B1; FC 13B1; Fluorocarbon 1301; Freon 13B1; Freon 13B1; R 13B1; Trifluorobromomethane; Frigen 13B1; Refrigerant 13B1; Halocarbon 13B1; Monobromotrifluoromethane; R 13B1; Refrigerant 13B1; Trifluorobromomethane; Trifluorobromomethane; CF3Br; Trifluoromethyl bromide; Trifluoromonobromomethane

PRODUCT USE: Fire Extinguishing Material

MANUFACTURER:

ADDRESS: H3R Clean Agents

483 Magnolia Ave
Larkspur, CA, U.S.A. 94939

PHONE: 800/249-4289 (8:00 a.m. to 4:30 p.m. PST)

FAX: 415/945-0311

WEB SITE: www.h3rcleanagents.com

EMERGENCY PHONE: CHEMTREC: 1-800-424-9300 (U.S./Canada/Puerto Rico) [24-hours]
CHEMTREC: +1-703-527-3887 (Outside North America) [24-hours]

DATE OF PREPARATION: October 21, 2011

DATE OF REVISION: New

ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-2004 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR. The product is also classified per all applicable European Union CLP EC 1272/2008 and the Global Harmonization Standard.

SECTION 3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Product Description: Halon 1301 is colorless and odorless or with a slightly ethereal odor and is shipped as liquid under its own vapor pressure. **Health Hazards:** The main acute health hazard associated with releases of this gas is asphyxiation by displacement of oxygen. This gas is heavier than air and will sink into low areas, creating an asphyxiation hazard. The main chronic health hazard associated with releases of this gas is possible adverse effects to the central nervous system and possible cardiac sensitization and arrhythmias. Chronic skin exposure may cause dermatitis. **Flammability Hazards:** This gas is not flammable, but can decompose at very high temperatures forming toxic gases such as hydrogen bromide, hydrogen fluoride and bromine. Cylinders or tanks may rupture and explode if heated. **Reactivity Hazards:** This material is not reactive. **Environmental Hazards:** This gas is a known ozone depletor and contributes to the destruction of the ozone. **Emergency Response Considerations:** Emergency responders must wear the proper personal protective equipment suitable for the situation to which they are responding. **WARNING**—If rescue personnel need to enter an area suspected of having a low level of Oxygen, they should be equipped with Self-Contained Breathing Apparatus (SCBA) and appropriate personal protective equipment.

GLOBAL HARMONIZATION AND EU CLP REGULATION (EC) 1272/2008 LABELING AND CLASSIFICATION: This product has been classified per GHS Standards under European regulations. For information on EU classification under (67/548/EEC), see below. This is a published classification.

Classification: Compressed Gas/Liquefied Gas Signal Word: Warning Hazard Statements: H280

Precautionary Statements: P410 + P403

Hazard Symbols/Pictograms: GHS04



EU 67/548/EEC LABELING/CLASSIFICATION: Currently, there is no classification applicable per Directives 67/548/EEC and 1999/45/EC and subsequent Directives.

Risk Phrases: Not Applicable Safety Phrases: Not Applicable Hazard Symbols: Not Applicable

See Section 16 (Other Information) for full Risk and Safety Phrase text.

SECTION 3. COMPOSITION and INFORMATION ON INGREDIENTS

| Chemical Name | Chemical Formula | CAS # | EINECS # | % Composition | EU Classification (67/548/EEC) GHS & EU Classification (1272/2008) Risk Phrases/Hazard Statements |
|-----------------------|--------------------|---------|-----------|---------------|--|
| Bromotrifluoromethane | CBBrF ₃ | 75-63-8 | 200-887-6 | > 99% | EU 67/548/EEC <u>Classification:</u> Not Applicable <u>Risk Phrases:</u> Not Applicable <u>Symbols:</u> Not Applicable GHS & EU CLP: 1272/2008: <u>Classification:</u> Compressed Gas/Liquefied Gas <u>Hazard Statement Codes:</u> H280 <u>Hazard Symbols/Pictograms:</u> GHS04 |

See Section 16 (Other Information) for full Risk and Safety Phrase text.

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: If skin contact causes adverse effects, begin decontamination with warm, running water. Minimum flushing is for 20 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention if any adverse effect occurs. 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.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None are anticipated.

INDICATION OF IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT IF NEEDED: Administer oxygen, if necessary, and treat symptoms. This gas is an asphyxiant and can induce cardiac muscle sensitization to circulating epinephrine-like compounds. Do NOT give adrenalin or similar sympathomimetic drugs. Do NOT allow victim to exercise until 24 hours following specific exposures. Freeze burns of mucosal tissue can develop following specific exposures.

SECTION 5. FIRE FIGHTING MEASURES

FLASH POINT: Not Applicable

AUTOIGNITION: Not Applicable

FLAMMABLE RANGE: Not Applicable

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

UNSUITABLE EXTINGUISHING MEDIA: None known.

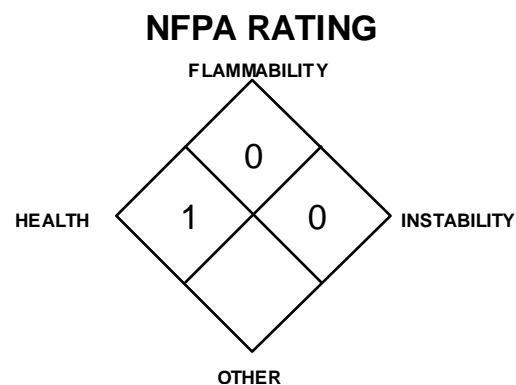
SPECIAL FIRE AND EXPLOSION HAZARDS: Bromotrifluoromethane is not combustible. Bromotrifluoromethane, in ambient total-flooding fire extinguishing systems can produce a dense fog (if relative humidity is about 50%) which may reduce visibility for a few seconds and delay evacuation in occupational areas. 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. **This gas is heavier than air, creating an asphyxiation hazard in low areas.**

EXPLOSION SENSITIVITY TO MECHANICAL IMPACT: Not sensitive.

EXPLOSION SENSITIVITY TO STATIC DISCHARGE: Not sensitive.

HAZARDOUS COMBUSTION PRODUCTS: Combustion or decomposition products above 538°C (1000.4°F) irritating/toxic gases such as hydrogen bromide, hydrogen fluoride and bromine may be generated. These by-products have a sharp irritating odor and are dangerous even in low concentrations and in sufficient concentrations can result in personal injury or death.

ADVICE TO FIRE-FIGHTERS: Incipient fire responders should wear eye protection. Structural fire-fighters must wear Self-Contained Breathing Apparatus and full protective equipment. If possible, shut off the flow of gas. Immediately cool the cylinders with water spray from a maximum distance. When cool, move cylinders from fire area if this can be done without risk to firefighters.



Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate
3 = Serious 4 = Severe

SECTION 6. ACCIDENTAL RELEASE MEASURES

All release to the environment should be avoided as this material has an ozone depletion potential and a global warming potential.

PERSONAL PRECAUTIONS AND EMERGENCY PROCEDURES: Evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Vapors from liquefied gas are initially heavier than air and spread along ground, creating an oxygen-deficient atmosphere in low-lying areas or confined spaces.

PERSONAL PROTECTIVE EQUIPMENT: Proper protective equipment should be used.

All Releases: Minimum Personal Protective Equipment should be **Level B: Self-Contained Breathing Apparatus**. Note: chemically protective clothing may provide little or no thermal protection against the hazard of frostbite. The atmosphere must at least 19.5 percent Oxygen before non-emergency personnel can be allowed in the area without Self-Contained Breathing Apparatus and fire protection. If gas is leaking incidentally from the cylinder or its valve, contact your supplier.

METHODS FOR CLEAN-UP AND CONTAINMENT:

All Releases: Attempt to close the main source valve prior to entering the area. Locate and seal the source of the leaking gas. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in-place or remove it to a safe area and allow the gas to be released there. Call CHEMTREC (1-800-424-9300) for emergency assistance. Or if in Canada, call CANUTEC (613-996-6666).

ENVIRONMENTAL PRECAUTIONS: Avoid unintentional release to the environment. Run-off water may be contaminated by other materials and should be contained to prevent possible environmental damage.

REFERENCE TO OTHER SECTIONS: See information in Section 8 (Exposure Controls – Personal Protection) and Section 13 (Disposal Considerations) for additional information.

SECTION 7. HANDLING AND STORAGE

PRECAUTIONS FOR SAFE HANDLING: Releases of Halon 1301 can create an oxygen-deficient atmosphere. Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this gas could occur without any significant warning symptoms, due to oxygen-deficiency. Wearing contact lenses is not recommended when handling this gas. Follow all safety and work practices for handling of compressed gases safely. Compressed gases can present significant safety hazards. As with all chemicals, wash hands after handling. Do not smoke or eat in work areas. Use a check valve or other protective device in the discharge line to prevent hazardous backflow. Never tamper with pressure relief valves and cylinders. Periodic inspections of process equipment by knowledgeable persons should be made to ensure that the equipment is used appropriately and the system is kept in suitable operating condition. Emergency response equipment should be available near the point of use. 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.

Cylinder valves should be inspected regularly for physical damage or corrosion (apparent by discoloration or rust). Care should be taken to inspect the following valve locations for corrosion: neck (where valve inserts into cylinder); bonnet nut (where handle attaches to valve body). Close valve after each use and when empty.

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

CONDITIONS FOR SAFE STORAGE: Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, Inc. at www.cganet.com pamphlet CGA P-1, *Safe Handling of Compressed Gases in Containers*. Local regulations may require specific equipment for storage and use. Cylinders should be stored upright and be firmly secured to prevent falling or being knocked-over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Cylinders should be stored in dry, well-ventilated areas away from sources of heat, ignition and direct sunlight. Do not allow area where cylinders are stored to exceed 52°C (125°F). Store containers away from heavily trafficked areas and emergency exits. Isolate from other non compatible chemicals (refer to Section 10, Stability and Reactivity). Store away from process and production areas, away from elevators, building and room exits or main aisles leading to exits. Protect cylinders against physical damage. Full and empty cylinders should be segregated. Use a first-in, first-out inventory systems to prevent full containers from being stored for long periods of time.

NOTE: Use only DOT or ASME code containers designed for gas storage. Close valve after each use and when empty.

PRODUCT USE: This product is used as a fire-extinguishing agent, refrigerant gas and as a cleaning agent.

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

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMITS/CONTROL PARAMETERS:

VENTILATION AND ENGINEERING CONTROLS: Forced ventilation systems for the general work area should be provided. If appropriate, install automatic monitoring equipment to detect the level of oxygen.

OCCUPATIONAL/WORKPLACE EXPOSURE LIMITS/GUIDELINES:

| Chemical Name | CAS # | OSHA PELs ppm | ACGIH TLVs ppm | NIOSH RELs ppm | NIOSH IDLH ppm | DFG MAKs ppm | AIHA WEELs ppm |
|---------------|---------|------------------|-------------------|-------------------|-------------------|--|-------------------|
| Halon 1301 | 75-63-8 | TWA = 1000 | TWA = 1000 | TWA = 1000 | 40,000 | TWA = 1000 PEAK = 8•MAK 15 min. average, 1-hr interval, 4 per shift | NE |

NE = Not Established

INTERNATIONAL EXPOSURE LIMITS: Currently, the following international exposure limits are in place for Halon 1301 (specific country limits may become available or change-consult individual countries for most current information).

Russia: STEL = 1000 mg/m³, JAN 1993

PROTECTIVE EQUIPMENT: *The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132, including U.S. Federal OSHA Respiratory Protection (29 CFR 1910.134), OSHA Eye Protection 29 CFR 1910.133, OSHA Hard Protection 29 CFR 1910.138, OSHA Foot Protection 29 CFR 1910.136 and OSHA Body Protection 29 CFR 1910.132), equivalent standards of Canada (including CSA Respiratory Standard Z94.4-02, Z94.3-M1982, Industrial Eye and Face Protectors and CSA Standard Z195-02, Protective Footwear), or standards of EU member states (including EN 529:2005 for respiratory PPE, CEN/TR 15419:2006 for hand protection, and CR 13464:1999 for face/eye protection). Please reference applicable regulations and standards for relevant details.*

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 appropriate regulations and standards (see above). Oxygen levels below 19.5% are considered IDLH by U.S., OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, SAR with auxiliary self-contained air supply is required under U.S. OSHA Respiratory Protection Standard (1910.134-1998).

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION (Continued)

PROTECTIVE EQUIPMENT (continued):

RESPIRATORY PROTECTION (continued): The following are U.S. NIOSH respiratory protective equipment guidelines for this gas.

BROMOTRIFLUOROMETHANE

| CONCENTRATION | RESPIRATORY PROTECTION |
|----------------------|---|
| Up to 10,000 ppm: | Any Supplied-Air Respirator (SAR). |
| Up to 25,000 ppm: | Any SAR operated in a continuous-flow mode. |
| Up to 40,000 ppm: | Any SAR that has a tight-fitting facepiece and is operated in a continuous-flow mode, or any Self-Contained Breathing Apparatus (SCBA) with a full facepiece, or any SAR with a full facepiece. |
| 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, when cylinders are not closed and capped. Be aware that particles or objects propelled by high pressure gas can fly significant distances. Eyewear should be as described under appropriate regulations and standards.

HAND 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 is used. Use triple gloves for spill response. If necessary, refer to appropriate regulations and standards.

OTHER PROTECTIVE EQUIPMENT: Use body protection appropriate for task. Safety shoes are recommended when handling cylinders. Information on general protective measures can be found appropriate regulations and standards. OSHA Technical Manual (Section VII: Personal Protective Equipment), or appropriate standards and regulations stated earlier in this section. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in appropriate regulations and standards.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

| | Halon 1301 |
|--|---|
| Form | Liquefied gas under pressure |
| Color | Colorless |
| Odor | Odorless to slightly ethereal |
| Molecular Weight | 148.91 |
| Boiling Point @ 760 mmHg | -57.8°C (-27.6°F) |
| Melting Point @ 1 atm | -172°C (-142.8°F) |
| Gas Specific Gravity [Relative Density] (air = 1) | Gas |
| Liquid Specific Gravity [Relative Density] (air = 1) @ 20°C | 1.5800 g/mL |
| Solubility in Water @ 25°C | Practically insoluble (0.03% by weight) |
| Other Solubilities | Soluble in chloroform |
| Vapor Pressure @ 20°C | 10755 mmHg (1434 kPa) |
| Vapor Density (air=1) | 3.8 |
| Odor Threshold | Not determined |
| Critical Temperature | 67°C (152.6°F) |
| Critical Pressure | 4032 kPa (39.8 atm) |
| Liquid Viscosity @ 25°C | 0.157 mPa.s |
| Octanol/Water Partition Coefficient | log Kow= 1.86 |
| Henry's Law Constant @ 25°C | 0.4994 atm-cu m/mole |

WARNING PROPERTIES FOR THIS GAS: The odor is not a good a warning of a release. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.

SECTION 10. STABILITY AND REACTIVITY

REACTIVITY/CHEMICAL STABILITY: Stable under conditions of normal temperature and pressure.

CONDITIONS TO AVOID: Cylinders should not be exposed to temperatures in excess of 125°F (52°C). Avoid exposure to incompatible compounds (see below).

MATERIALS WITH WHICH GAS IS INCOMPATIBLE: Chemically active metals (e.g. sodium, potassium, calcium, powdered aluminum, zinc, magnesium).

REACTIVITY:

A) HAZARDOUS DECOMPOSITION PRODUCTS: Combustion: Decomposes above 538°C (1000.4°F). Forms hydrogen bromide, hydrogen fluoride and free bromine. In air, carbonyl fluoride and carbonyl bromide may form. Hydrolysis: At high temperature and in the presence of water, this gas may form acids (by hydrolysis or by catalytic decomposition) which may attack metallic surfaces..

B) HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 11. TOXICOLOGICAL INFORMATION

ROUTES OF ENTRY, SYMPTOMS OF ACUTE EXPOSURE:

WARNING-If rescue personnel need to enter an area in which a release of Halon 1301 has occurred, they should be equipped with Self-Contained Breathing Apparatus (SCBA) and appropriate personal protective equipment. High concentration of this gas will create an oxygen-deficient atmosphere, creating the risk of asphyxiation.

EYE CONTACT: Release of a high-pressure gas may result in airborne objects.

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

INHALATION: Inhalation of extremely high vapor concentrations may cause headache, nausea, dizziness, drowsiness, incoordination, confusion and an irregular heartbeat. 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 effects associated with various levels of oxygen are described below.

CONCENTRATION

of OXYGEN

20.9% Oxygen:

15–19% Oxygen:

12–15% Oxygen:

10–12% Oxygen:

8-10%Oxygen:

6–8% Oxygen:

4–6% Oxygen:

EXPOSURE SYMPTOM

Normal oxygen concentration in air.

Decreased ability to perform tasks. May impair coordination and may induce early symptoms in persons with heart, lung, or circulatory problems. Breathing increases, especially in exertion. Pulse up. Impaired coordination, perception, and judgment.

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

Mental failure, fainting, unconsciousness, ashen face, blueness of lips, nausea (upset stomach), and vomiting. 8 minutes, may be fatal in 50–100% of cases; 6 minutes, may be fatal in 25 to 50% of cases; 4–5 minutes, recovery with treatment.

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

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

SKIN CONTACT: Transitory skin contact should not cause any adverse effects.

OTHER ACUTE 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.

ACUTE EXPOSURE TARGET ORGANS: Respiratory system.

ROUTES OF ENTRY, SYMPTOMS OF CHRONIC EXPOSURE:

INHALATION: No specific data are available for this gas. Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may affect the heart and nervous system. Inhalation of very high concentration may cause adverse effects on the central nervous system.

SKIN CONTACT: Prolonged contact may cause dermatitis (dry, red, cracked skin) due to defatting of the skin.

ACUTE EXPOSURE TARGET ORGANS: Skin, cardiac system, central nervous system.

CARCINOGENIC POTENTIAL: Halon 1301 is not listed as a carcinogen or as a potential carcinogen on EPA, NIOSH, GERMAN MAK, OSHA, NTP, IARC, or CAL/OSHA Carcinogen lists.

TOXICITY DATA: There toxicology data are currently available for Halon 1301.

TCLo (Inhalation-Human) 399 gm/m³/3 minute: Peripheral Nerve and Sensation: paresthesia; Behavioral: ataxia, headache

TCLo (Inhalation-Human) 997.5 gm/m³/1 minute: Behavioral: ataxia

LC (Inhalation-Man) > 15 pph/1 minute: Behavioral: hallucinations, distorted perceptions; Cardiac: pulse rate increase, without fall in BP

LC₅₀ (Inhalation-Rat) 84,000 ppm/15 minutes

LC₅₀ (Inhalation-Rat) 430 gm/m³/4 hours

LC₅₀ (Inhalation-Mouse) 381 gm/m³

LC₅₀ (Inhalation-Mouse) 350 gm/m³/2 hours

LC₅₀ (Inhalation-Guinea Pig) 88,000 ppm/15 minutes

LC (Inhalation-Dog) > 30 pph/15 minutes: Behavioral: tremor; Gastrointestinal: changes in structure or function of salivary glands

LCLo (Inhalation-Rat) 5054 gm/m³/15 minutes

TCLo (Inhalation-Rat) 4056 gm/m³/2 minutes: Behavioral: general anesthetic

TCLo (Inhalation-Rat) 2128 gm/m³/12 minutes: Behavioral: general anesthetic

TCLo (Inhalation-Dog) 1662 gm/m³/45 minutes: Blood: other changes

TCLo (Inhalation-Dog) 1330 gm/m³/20 seconds: Behavioral: convulsions or effect on seizure threshold; Cardiac: arrhythmias (including changes in conduction);

Vascular: BP lowering not characterized in autonomic section

TCLo (Inhalation-Monkey) 2660 gm/m³/2 minutes: Behavioral: convulsions or effect on seizure threshold, general anesthetic

TCLo (Inhalation-Monkey) 1330 gm/m³/15 minutes: Behavioral: convulsions or effect on seizure threshold, general anesthetic



HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

| | | |
|----------------------|--------|---|
| HEALTH HAZARD | (BLUE) | 1 |
|----------------------|--------|---|

| | | |
|----------------------------|-------|---|
| FLAMMABILITY HAZARD | (RED) | 0 |
|----------------------------|-------|---|

| | | |
|------------------------|----------|---|
| PHYSICAL HAZARD | (YELLOW) | 0 |
|------------------------|----------|---|

PROTECTIVE EQUIPMENT

| EYES | RESPIRATORY | HANDS | BODY |
|--|---------------|---|--------------|
|  | SEE SECTION 8 |  | SEESECTION 8 |

For Routine Industrial Use and Handling Applications

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate
3 = Serious 4 = Severe * = Chronic hazard

SECTION 11. TOXICOLOGICAL INFORMATION (Continued)

ADDITIONAL TOXICOLOGICAL DATA:

Bromotrifluoromethane is low in toxicity. However, exposure to high concentrations (about 5-17%) (50,000-170,000 ppm) can affect the central nervous system and cause light-headedness, numbness, tingling and a feeling of drunkenness. Other symptoms reported include slight decrease in judgment, alertness or coordination, buzzing in the ears, and a feeling of gradual loss of consciousness. There are no experimental or occupational reports of unconsciousness. Effects are temporary with rapid recovery upon breathing fresh air. Exposure to very high levels (over 15% (150,000 ppm) for 15 to 25 minutes) can cause irregular heartbeat (arrhythmia). Human volunteers exposed to concentrations of 1-10% (10,000 - 100,000 ppm) for 3.0 to 3.5 minutes did not experience heart effects. Reports of occupational exposures to Bromotrifluoromethane are generally the result of accidental release from a total flooding fire extinguishing system. Since most fire extinguishing systems only reach 5-7% (50,000-70,000 ppm) Bromotrifluoromethane in air, effects should not develop.

IRRITANCY OF PRODUCT: Not applicable.

SENSITIZATION OF PRODUCT: Halon 1301 is not a human skin or respiratory sensitizer, but has been shown to be a cardiac sensitizer in animal studies.

REPRODUCTIVE TOXICITY INFORMATION: This gas has no potential human mutagenic, embryotoxic, teratogenic or reproductive effects.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) have not been determined for Halon 1301.

SECTION 12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

MOBILITY: The Koc of Bromotrifluoromethane is estimated as 49, using a log Kow of 1.86 and a regression-derived equation. According to a classification scheme, this estimated Koc value suggests that Bromotrifluoromethane is expected to have very high mobility in soil.

PERSISTENCE AND BIODEGRADABILITY: If released to air, a vapor pressure of 1.22×10^4 mm Hg at 25°C indicates Bromotrifluoromethane will exist solely in the gas phase in the ambient atmosphere. Gas-phase Bromotrifluoromethane will be degraded slowly in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life of this reaction in air is estimated to be greater than 44 years. The primary decomposition process to occur in the stratosphere is UV photolysis. It has an estimated photolysis half-life of 72 yrs in the ambient atmosphere. If released to soil, Bromotrifluoromethane is expected to have very high mobility based upon an estimated Koc of 49. Volatilization from moist soil surfaces is expected to be an important fate process based upon a Henry's Law constant of 0.499 atm-cu m/mole. If released into water, Bromotrifluoromethane is not expected to adsorb to suspended solids and sediment in the water based upon the estimated Koc. Volatilization from water surfaces is expected to be an important fate process based upon this compound's Henry's Law constant. Estimated volatilization half-lives for a model river and model lake are 1.2 hrs and 4.8 days, respectively. Based upon the high degree of stability, Bromotrifluoromethane biodegradation is expected to be slow. Hydrolysis is not expected to occur due to the lack of hydrolyzable functional groups.

POTENTIAL TO BIOACCUMULATE: An estimated BCF of 5.4 suggests the potential for bioconcentration in aquatic organisms is low.

ECOTOXICITY: Immediate adverse effect on plants would be related to oxygen-deficient environments or frost from rapidly expanding gases, unless exposure occurs in a confined space. There is currently no evidence of adverse effects from exposure to Halon 1301 on aquatic life.

OZONE-DEPLETION POTENTIAL: Halon 1301 is a Class I, Group II, Ozone Depleting Chemical per U.S. 40 CFR Part 82. Halon 1301 may contribute to global warming.

ENVIRONMENTAL EXPOSURE CONTROLS: Controls should be engineered to prevent release to the environment, including procedures to prevent spills, atmospheric release and release to waterways.

RESULTS OF PBT and vPvB ASSESSMENT: No data available. PBT and vPvB assessments are part of the chemical safety report required for some substances in European Union Regulation (EC) 1907/2006, Article 14.

SECTION 13. DISPOSAL CONSIDERATIONS

UNUSED PRODUCT / EMPTY CONTAINER: Do not dispose of residual product. Return used product in cylinders to: H3R Clean Agent Specialists, Inc.

U.S. EPA WASTE NUMBER: Not applicable.

EUROPEAN (EWC) WASTE CODES: 16 05 05: Gases in pressure containers other than those mentioned in 16 05 04.

DISPOSAL INFORMATION: Relative to the environment, this material has an ozone depletion potential and a global warming potential. Refer to the regulations of the U.S. EPA or the State-specific regulations for proper waste disposal, regulations of Canada and its Provinces, or regulations of EU member states.

SECTION 14. TRANSPORT INFORMATION

U.S. SHIPPING INFORMATION:

| | |
|---|--|
| U.S. DOT PROPER SHIPPING NAME: | Fire extinguisher with compressed or liquefied gas |
| UN IDENTIFICATION NUMBER: | UN 1044 |
| HAZARD CLASS NUMBER and DESCRIPTION: | 2.2 (Non-Flammable Gas) |
| U.S. DOT SHIPPING LABEL(S) REQUIRED: | Class 2.2 (Non-Flammable Gas) |

SECTION 14. TRANSPORT INFORMATION (Continued)

U.S. SHIPPING INFORMATION (continued):

PACKING GROUP: Not Applicable
PLACARD (When required): Class 2.2 (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).
ERG (EMERGENCY RESPONSE GUIDEBOOK) #: 126
SPECIAL PROVISIONS: T50 Portable tanks - Applies to various liquefied compressed gases: Consult the regulations for specific requirements Sec. 172.102 Special Provision Portable Tank Code T50.

CANADIAN SHIPPING INFORMATION:

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This product is classified as Dangerous Goods, per regulations of Transport Canada. The use of the above U.S. DOT information from the U.S. 49 CFR regulations is allowed for shipments that originate in the U.S. For shipments via ground vehicle or rail that originate in Canada, the following information is applicable.

PROPER SHIPPING NAME: Fire extinguisher with compressed or liquefied gas
UN IDENTIFICATION NUMBER: UN 1044
HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)
PACKING GROUP: Not Applicable
HAZARD SHIPPING LABEL(S) REQUIRED: Class 2.2 (Non-Flammable Gas)
SPECIAL PROVISIONS: None
EXPLOSIVE LIMIT & LIMITED QUANTITY INDEX: 0.125
ERAP INDEX: None
PASSENGER CARRYING SHIP INDEX: None
PASSENGER CARRYING ROAD OR RAIL VEHICLE INDEX: 75

INTERNATIONAL AIR TRANSPORT ASSOCIATION SHIPPING INFORMATION (IATA):

UN IDENTIFICATION NUMBER: UN 1044
PROPER SHIPPING NAME/DESCRIPTION: Fire extinguisher with compressed or liquefied gas
HAZARD CLASS or DIVISION: 2.2 (Non-Flammable Gas)
HAZARD LABEL(S) REQUIRED: Class 2.2 (Non-Flammable Gas)
PACKING GROUP: Not Applicable
EXCEPTED QUANTITIES: E0
PASSENGER and CARGO AIRCRAFT PACKING INSTRUCTION: 213
PASSENGER and CARGO AIRCRAFT MAXIMUM NET QUANTITY PER PKG: 75 kg
PASSENGER and CARGO AIRCRAFT LIMITED QUANTITY PACKING INSTRUCTION: Forbidden
PASSENGER and CARGO AIRCRAFT LIMITED QUANTITY MAXIMUM NET QUANTITY PER PKG: Forbidden
CARGO AIRCRAFT ONLY PACKING INSTRUCTION: 213
CARGO AIRCRAFT ONLY MAXIMUM NET QUANTITY PER PKG: 150 kg
SPECIAL PROVISIONS: A19
ERG CODE: 2L

INTERNATIONAL MARITIME ORGANIZATION SHIPPING INFORMATION (IMO):

UN No.: 1044
PROPER SHIPPING NAME: Fire extinguisher with compressed or liquefied gas
HAZARD CLASS NUMBER: 2.2
PACKING GROUP: None
SPECIAL PROVISIONS: 225
LIMITED QUANTITIES: 120 mL
EXCEPTED QUANTITIES: E0
PACKING: Instructions: P003; Provisions: None
IBCs: Instructions: None; Provisions: None
TANKS: Instructions: None; Provisions: None
EmS: F-C, S-V
STOWAGE CATEGORY: Category A.
MARINE POLLUTANT: This material is not designated by the IMO to be a Marine Pollutant.

EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR):

UN NO.: 1044
NAME and DESCRIPTON: Fire extinguisher with compressed or liquefied gas
CLASS: 2.2
CLASSIFICATION CODE: 6A
PACKING GROUP: None

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| SECTION 14. TRANSPORT INFORMATION (Continued) |
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EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR) [continued]:

| | |
|--|--|
| LABELS: | 2.2 |
| SPECIAL PROVISIONS: | 225, 394 |
| LIMITED QUANTITIES: | LQ0 |
| EXCEPTED QUANTITIES: | E0 |
| PACKING INSTRUCTIONS: | P003 |
| SPECIAL PACKING INSTRUCTIONS: | None |
| MIXED PACKING PROVISIONS: | MP9 |
| PORTABLE TANK and BULK CONTAINER: | Instructions: None; Special Provisions: None |
| HAZARD IDENTIFICATION No.: | None |

TRANSPORT IN BULK ACCORDING TO THE IBC CODE: See the information under the individual jurisdiction listings for IBC information.

ENVIRONMENTAL HAZARDS: This gas does not meet the criteria of environmentally hazardous according to the criteria of the UN Model Regulations (as reflected in the IMDG Code, ADR, RID, and ADN); this gas is not specifically listed in Annex III under MARPOL 73/78.

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| SECTION 15. REGULATORY INFORMATION |
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U.S. FEDERAL REGULATIONS:

EPA - ENVIRONMENTAL PROTECTION AGENCY:

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act of 1990 (40 CFR Parts 117 and 302)
Reportable Quantity (RQ): Not Applicable

SARA TITLE III: Superfund Amendment and Reauthorization Act

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

Extremely Hazardous Substances: Halon 1301 is not listed.

Threshold Planning Quantity (TPQ): Not Applicable

Reportable Quantity (RQ): Not Applicable

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

IMMEDIATE HEALTH: No PRESSURE: Yes DELAYED HEALTH: No REACTIVITY: No FIRE: No

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

Releases of Halon 1301 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

Halon 1301 is listed in 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

OTHER U.S. FEDERAL REGULATIONS: Requirements under (40 CFR Part 82) may be applicable as Halon 1301 is designated as an ozone-depleting compound.

U.S. STATE REGULATORY INFORMATION:

CALIFORNIA PROPOSITION 65: Halon 1301 is NOT listed on the California Proposition 65 lists.

CANADIAN FEDERAL REGULATIONS:

CANADIAN DSL INVENTORY STATUS: Halon 1301 is listed on the DSL Inventory.

OTHER CANADIAN REGULATIONS: Halon 1301 is not on the CEPA Priorities Substances Lists.

CANADIAN WHMIS CLASSIFICATION and SYMBOLS: Halon 1301 is categorized as a Controlled Product, Hazard Class A, as per the Controlled Product Regulations. **Class A:** Compressed Gas



EUROPEAN UNION REGULATIONS:

SAFETY, HEALTH, AND ENVIRONMENTAL REGULATIONS/LEGISLATION SPECIFIC FOR THE PRODUCT:

Manufacture of this gas other than for fire extinguishing is forbidden under the Montreal Protocol.

CHEMICAL SAFETY ASSESSMENT: No data available. The chemical safety assessment is required for some substances according to European Union Regulation (EC) 1907/2006, Article 14.

SECTION 16. OTHER INFORMATION

GLOBAL HARMONIZATION AND EU CLP REGULATION (EC) 1272/2008 LABELING AND CLASSIFICATION:

Classified in accordance with CLP Regulation (EC) 1272/2008. For information on classification under (67/548/EEC), see below.

Classification: Compressed Gas/Liquefied Gas

Signal Words: Warning

Hazard Statements: H280: Contains gas under pressure; may explode if heated.

Prevention Statements:

Precautionary: None.

Response: None.

Storage: P410 + P403: Protect from sunlight. Store in a well-ventilated place. P405: Store locked up.

Disposal: P501: Dispose of contents/containers in accordance with all local, regional, national and international regulations.

Hazard Symbol: GHS04

EU 67/548/EEC LABELING AND CLASSIFICATION: Currently, this substance is not classified, as per European Union Council Directives 67/548/EEC and 1999/45/EC and subsequent Directives.

Classification: Not Applicable

Risk Phrases: Not Applicable

Safety Phrases: Not Applicable

Hazard Symbol: Not Applicable

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 Union Directives and the Global Harmonization Standard. 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 H₂R Aviation, believes to be reliable and accurate. H₂R Aviation 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.

REFERENCES AND DATA SOURCES: Contact the supplier for information.

METHODS OF EVALUATING INFORMATION FOR THE PURPOSE OF CLASSIFICATION: Bridging principles were used to classify this product.

REVISION DETAILS: New.

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.

PO Box 1961, Hilo, HI 96721

800/441-3365

REVISION INFORMATION:

August 2009: Review and up-date of MSDS to current Standards.

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 that uniquely identifies each constituent.

EXPOSURE LIMITS IN AIR:

CEILING LEVEL: The concentration that shall not be exceeded during any part of the working exposure.

DFG MAK Germ Cell Mutagen Categories: **1:** Germ cell mutagens which have been shown to increase the mutant frequency in the progeny of exposed humans. **2:** Germ cell mutagens which have been shown to increase the mutant frequency in the progeny of exposed mammals. **3A:** Substances which have been shown to induce genetic damage in germ cells of human of animals, or which produce mutagenic effects in somatic cells of mammals *in vivo* and have been shown to reach the germ cells in an active form. **3B:** Substances which are suspected of being germ cell mutagens because of their genotoxic effects in mammalian somatic cell *in vivo*; in exceptional cases, substances for which there are no *in vivo* data, but which are clearly mutagenic *in vitro* and structurally related to known *in vivo* mutagens. **4:** Not applicable (Category 4 carcinogenic substances are those with non-genotoxic mechanisms of action. By definition, germ cell mutagens are genotoxic. Therefore, a Category 4 for germ cell mutagens cannot apply. At some time in the future, it is conceivable that a Category 4 could be established for genotoxic substances with primary targets other than DNA [e.g. purely aneugenic substances] if research results make this seem sensible.) **5:** Germ cell mutagens, the potency of which is considered to be so low that, provided the MAK value is observed, their contribution to genetic risk for humans is expected not to be significant.

DFG MAK Pregnancy Risk Group Classification: **Group A:** A risk of damage to the developing embryo or fetus has been unequivocally demonstrated. Exposure of pregnant women can lead to damage of the developing organism, even when MAK and BAT (Biological Tolerance Value for Working Materials) values are observed. **Group B:** Currently available information indicates a risk of damage to the developing embryo or fetus must be considered to be probable. Damage to the developing organism cannot be excluded when pregnant women are exposed, even when MAK and BAT values are observed. **Group C:** There is no reason to fear a risk of damage to the developing embryo or fetus when MAK and BAT values are observed. **Group D:** Classification in one of the groups A-C is not yet possible because, although the data available may indicate a trend, they are not sufficient for final evaluation.

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.

LOQ: Limit of Quantitation.

MAK: Federal Republic of Germany Maximum Concentration Values in the workplace.

NE: Not Established. When no exposure guidelines are established, an entry of NE is made for reference.

NIC: Notice of Intended Change.

NIOSH CEILING: The exposure that shall not be exceeded during any part of the workday. If instantaneous monitoring is not feasible, the ceiling shall be assumed as a 15-minute TWA exposure (unless otherwise specified) that shall not be exceeded at any time during a workday.

NIOSH RELS: NIOSH's Recommended Exposure Limits.

EXPOSURE LIMITS IN AIR (continued):

PEL-Permissible Exposure Limit: OSHA's Permissible Exposure Limits. 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 that was vacated by Court Order.

SKIN: Used when there is a danger of cutaneous absorption.

STEL-Short Term Exposure Limit: Short Term Exposure Limit, usually a 15-minute time-weighted average (TWA) exposure that should not be exceeded at any time during a workday, even if the 8-hr TWA is within the TLV-TWA, PEL-TWA or REL-TWA.

SKIN: Used when there is a danger of cutaneous absorption.

STEL-Short Term Exposure Limit: Short Term Exposure Limit, usually a 15-minute time-weighted average (TWA) exposure that should not be exceeded at any time during a workday, even if the 8-hr TWA is within the TLV-TWA, PEL-TWA or REL-TWA.

TLV-Threshold Limit Value: An airborne concentration of a substance that 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.

TWA-Time Weighted Average: Time Weighted Average exposure concentration for a conventional 8-hr (TLV, PEL) or up to a 10-hr (REL) workday and a 40-hr workweek.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM

HAZARD RATINGS: This rating system was developed by the National Paint and Coating Association and has been adopted by industry to identify the degree of chemical hazards.

HEALTH HAZARD: 0 (Minimal Hazard): No significant health risk, irritation of skin or eyes not anticipated. *Skin Irritation:* Essentially non-irritating. PII or Draize = "0". *Eye Irritation:* Essentially non-irritating, or minimal effects which clear in < 24 hours [e.g. mechanical irritation]. Draize = "0". *Oral Toxicity LD₅₀ Rat < 5000 mg/kg. Dermal Toxicity LD₅₀ Rat or Rabbit < 2000 mg/kg. Inhalation Toxicity 4-hrs LC₅₀ Rat < 20 mg/L;* **1 (Slight Hazard):** Minor reversible injury may occur; slightly or mildly irritating. *Skin Irritation:* Slightly or mildly irritating. *Eye Irritation:* Slightly or mildly irritating. *Oral Toxicity LD₅₀ Rat > 500-5000 mg/kg. Dermal Toxicity LD₅₀ Rat or Rabbit > 1000-2000 mg/kg. Inhalation Toxicity LC₅₀ 4-hrs Rat > 2-20 mg/L;* **2 (Moderate Hazard):** Temporary or transitory injury may occur. *Skin Irritation:* Moderately irritating; primary irritant; sensitizer. PII or Draize > 0, < 5. *Eye Irritation:* Moderately to severely irritating and/or corrosive; reversible corneal opacity; corneal involvement or irritation clearing in 8-21 days. Draize > 0, < 25. *Oral Toxicity LD₅₀ Rat > 50-500 mg/kg. Dermal Toxicity LD₅₀ Rat or Rabbit > 200-1000 mg/kg. Inhalation Toxicity LC₅₀ 4-hrs Rat > 0.5-2 mg/L;* **3 (Serious Hazard):** Major injury likely unless prompt action is taken and medical treatment is given; high level of toxicity; corrosive. *Skin Irritation:* Severely irritating and/or corrosive; may destroy dermal tissue, cause skin burns, dermal necrosis. PII or Draize > 5-8 with destruction of tissue. *Eye Irritation:* Corrosive, irreversible destruction of ocular tissue; corneal involvement or irritation persisting for more than 21 days. Draize > 80 with effects irreversible in 21 days. *Oral Toxicity LD₅₀ Rat > 1-50 mg/kg. Dermal Toxicity LD₅₀ Rat or Rabbit > 20-200 mg/kg. Inhalation Toxicity LC₅₀ 4-hrs Rat > 0.05-0.5 mg/L;*

DEFINITIONS OF TERMS (Continued)

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM

HAZARD RATINGS (continued):

HEALTH HAZARD (continued): 4 (Severe Hazard: Life-threatening; major or permanent damage may result from single or repeated exposure. *Skin Irritation:* Not appropriate. Do not rate as a "4", based on skin irritation alone. *Eye Irritation:* Not appropriate. Do not rate as a "4", based on eye irritation alone. *Oral Toxicity LD₅₀ Rat* ≤ 1 mg/kg. *Dermal Toxicity LD₅₀Rat or Rabbit* ≤ 20 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat* ≤ 0.05 mg/L).

FLAMMABILITY HAZARD: 0 (Minimal Hazard-Materials that will not burn in air when exposure to a temperature of 815.5°C [1500°F] for a period of 5 minutes.); 1 (Slight Hazard-Materials that must be pre-heated before ignition can occur. Material require considerable pre-heating, under all ambient temperature conditions before ignition and combustion can occur, including: Materials that will burn in air when exposed to a temperature of 815.5°C (1500°F) for a period of 5 minutes or less; Liquids, solids and semisolids having a flash point at or above 93.3°C [200°F] (e.g. OSHA Class IIIB, or; Most ordinary combustible materials [e.g. wood, paper, etc.]; 2 (Moderate Hazard-Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not, under normal conditions, form hazardous atmospheres in air, but under high ambient temperatures or moderate heating may release vapor in sufficient quantities to produce hazardous atmospheres in air, including: Liquids having a flash-point at or above 37.8°C [100°F]; Solid materials in the form of coarse dusts that may burn rapidly but that generally do not form explosive atmospheres; Solid materials in a fibrous or shredded form that may burn rapidly and create flash fire hazards (e.g. cotton, sisal, hemp; Solids and semisolids that readily give off flammable vapors.); 3 (Serious Hazard- Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures, or, unaffected by ambient temperature, are readily ignited under almost all conditions, including: Liquids having a flash point below 22.8°C [73°F] and having a boiling point at or above 38°C [100°F] and below 37.8°C [100°F] [e.g. OSHA Class IB and IC]; Materials that on account of their physical form or environmental conditions can form explosive mixtures with air and are readily dispersed in air [e.g., dusts of combustible solids, mists or droplets of flammable liquids]; Materials that burn extremely rapidly, usually by reason of self-contained oxygen [e.g. dry nitrocellulose and many organic peroxides]); 4 (Severe Hazard-Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air, and which will burn readily, including: Flammable gases; Flammable cryogenic materials; Any liquid or gaseous material that is liquid while under pressure and has a flash point below 22.8°C [73°F] and a boiling point below 37.8°C [100°F] [e.g. OSHA Class IA; Material that ignite spontaneously when exposed to air at a temperature of 54.4°C [130°F] or below [e.g. pyrophoric]).

PHYSICAL HAZARD: 0 (*Water Reactivity:* Materials that do not react with water. *Organic Peroxides:* Materials that are normally stable, even under fire conditions and will not react with water. *Explosives:* Substances that are Non-Explosive. *Unstable Compressed Gases:* No Rating. *Pyrophorics:* No Rating. *Oxidizers:* No "0" rating allowed. *Unstable Reactives:* Substances that will not polymerize, decompose, condense or self-react.); 1 (*Water Reactivity:* Materials that change or decompose upon exposure to moisture. *Organic Peroxides:* Materials that are normally stable, but can become unstable at high temperatures and pressures. These materials may react with water, but will not release energy. *Explosives:* Division 1.5 & 1.6 substances that are very insensitive explosives or that do not have a mass explosion hazard. *Compressed Gases:* Pressure below OSHA definition. *Pyrophorics:* No Rating. *Oxidizers:* Packaging Group III; *Solids:* any material that in either concentration tested, exhibits a mean burning time less than or equal to the mean burning time of a 3:7 potassium bromate/cellulose mixture and the criteria for Packing Group I and II are not met. *Liquids:* any material that exhibits a mean pressure rise time less than or equal to the pressure rise time of a 1:1 nitric acid (65%)/cellulose mixture and the criteria for Packing Group I and II are not met. *Unstable Reactives:* Substances that may decompose, condense or self-react, but only under conditions of high temperature and/or pressure and have little or no potential to cause significant heat generation or explosive hazard. Substances that readily undergo hazardous polymerization in the absence of inhibitors.); 2 (*Water Reactivity:* Materials that may react violently with water. *Organic Peroxides:* Materials that, in themselves, are normally unstable and will readily undergo violent chemical change, but will not detonate. These materials may also react violently with water. *Explosives:* Division 1.4 – Explosive substances where the explosive effect are largely confined to the package and no projection of fragments of appreciable size or range are expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package. *Compressed Gases:* Pressurized and meet OSHA definition but < 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics:* No Rating. *Oxidizers:* Packaging Group II *Solids:* any material that, either in concentration tested, exhibits a mean burning time of less than or equal to the mean burning time of a 2:3 potassium bromate/cellulose mixture and the criteria for Packing Group I are not met. *Liquids:* any material that exhibits a mean pressure rise time less than or equal to the pressure rise of a 1:1 aqueous sodium chlorate solution (40%)/cellulose mixture and the criteria for Packing Group I are not met. *Unstable Reactives:* Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure, but have a low potential for significant heat generation or explosion. Substances that readily form peroxides upon exposure to air or oxygen at room temperature); 3 (*Water Reactivity:* Materials that may form explosive reactions with water. *Organic Peroxides:* Materials that are capable of detonation or explosive reaction, but require a strong initiating source, or must be heated under confinement before initiation; or materials that react explosively with water. *Explosives:* Division 1.2 – Explosive substances that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but do not have a mass explosion hazard. *Compressed Gases:* Pressure ≥ 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics:* No Rating. *Oxidizers:* Packaging Group I *Solids:* any material that, in either concentration tested, exhibits a mean burning time less than the mean burning time of a 3:2 potassium bromate/cellulose mixture. *Liquids:* Any material that spontaneously ignites when mixed with cellulose in a 1:1 ratio, or which exhibits a mean pressure rise time less than the pressure rise time of a 1:1 perchloric acid (50%)/cellulose mixture.

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS

HEALTH HAZARD: 0 (materials that, under emergency conditions, would offer no hazard beyond that of ordinary combustible materials): Gases and vapors whose LC₅₀ for acute inhalation toxicity is greater than 10,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is greater than 200 mg/L. Materials whose LD₅₀ for acute dermal toxicity is greater than 2000 mg/kg. Materials whose LD₅₀ for acute oral toxicity is greater than 2000 mg/kg. Materials that are essentially non-irritating to the respiratory tract, eyes and skin. 1 (materials that, under emergency conditions, can cause significant irritation): Gases and vapors whose LC₅₀ for acute inhalation toxicity is greater than 5,000 ppm but less than or equal to 10,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is greater than 10 mg/L but less than or equal to 200 mg/L. Materials whose LD₅₀ for acute dermal toxicity is greater than 1000 mg/kg but less than or equal to 2000 mg/kg. Materials whose LD₅₀ for acute oral toxicity is greater than 500 mg/kg but less than or equal to 2000 mg/kg. Materials that cause slight to moderate irritation to the respiratory tract, eyes and skin. 2 (materials that, under emergency conditions, can cause temporary incapacitation or residual injury): Gases and vapors whose LC₅₀ for acute inhalation toxicity is greater than 3,000 ppm but less than or equal to 5,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is greater than 2 mg/L but less than or equal to 10 mg/L. Materials whose LD₅₀ for acute dermal toxicity is greater than 200 mg/kg but less than or equal to 1000 mg/kg. Materials whose LD₅₀ for acute oral toxicity is greater than 50 mg/kg but less than or equal to 500 mg/kg. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than one-fifth its LC₅₀ for acute inhalation toxicity, if its LC₅₀ is less than or equal to 5000 ppm and that does not meet the criteria for either degree of hazard 3 or degree of hazard 4. Compressed liquefied gases with boiling points between -30°C (-22°F) and -55°C (-66.5°F) that cause severe tissue damage, depending on duration of exposure. Materials that are respiratory irritants. Materials that cause severe, but reversible irritation to the eyes or are lachrymators. Materials that are primary skin irritants or sensitizers. 3 (materials that, under emergency conditions, can cause serious or permanent injury): Gases and vapors whose LC₅₀ for acute inhalation toxicity is greater than 1,000 ppm but less than or equal to 3,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is greater than 0.5 mg/L but less than or equal to 2 mg/L. Materials whose LD₅₀ for acute dermal toxicity is greater than 40 mg/kg but less than or equal to 200 mg/kg. Materials whose LD₅₀ for acute oral toxicity is greater than 5 mg/kg but less than or equal to 50 mg/kg. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than one-fifth its LC₅₀ for acute inhalation toxicity, if its LC₅₀ is less than or equal to 3000 ppm and that does not meet the criteria for degree of hazard 4. Compressed liquefied gases with boiling points between -30°C (-22°F) and -55°C (-66.5°F) that cause frostbite and irreversible tissue damage. Materials that are respiratory irritants. Cryogenic gases that cause frostbite and irreversible tissue damage. Materials that are corrosive to the respiratory tract. Materials that are corrosive to the eyes or cause irreversible corneal opacity. Materials that are corrosive to the skin. 4 (materials that, under emergency conditions, can be lethal): Gases and vapors whose LC₅₀ for acute inhalation toxicity less than or equal to 1,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is less than or equal to 0.5 mg/L. Materials whose LD₅₀ for acute dermal toxicity is less than or equal to 40 mg/kg. Materials whose LD₅₀ for acute oral toxicity is less than or equal to 5 mg/kg. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than one-fifth its LC₅₀ for acute inhalation toxicity, if its LC₅₀ is less than or equal to 1000 ppm.

FLAMMABILITY HAZARD: 0 Materials that will not burn under typical fire conditions, including intrinsically noncombustible materials such as concrete, stone, and sand: Materials that will not burn in air when exposed to a temperature of 816°C (1500°F) for a period of 5 minutes in accordance with Annex D. 1 Materials that must be preheated before ignition can occur. Materials in this degree require considerable preheating, under all ambient temperature conditions, before ignition and combustion can occur: Materials that will burn in air when exposed to a temperature of 816°C (1500°F) for a period of 5 minutes in accordance with Annex D. Liquids, solids and semisolids having a flash point at or above 93.4°C (200°F) (i.e. Class IIIB liquids). Liquids with a flash point greater than 35°C (95°F) that do not sustain combustion when tested using the *Method of Testing for Sustained Combustibility*, per 49 CFR 173, Appendix H or the UN *Recommendation on the Transport of Dangerous Goods, Model Regulations* (current edition) and the related *Manual of Tests and Criteria* (current edition). Liquids with a flash point greater than 35°C (95°F) in a water-miscible solution or dispersion with a water non-combustible liquid/solid content of more than 85 percent by weight. Liquids that have no fire point when tested by ASTM D 92 Standard Test Method for Flash and Fire Points by Cleveland Open Cup, up to a boiling point of the liquid or up to a temperature at which the sample being tested shows an obvious physical change. Combustible pellets with a representative diameter of greater than 2 mm (10 mesh). Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed up flash point of the solvent. Most ordinary combustible materials.

2 Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not under normal conditions form hazardous atmospheres with air, but under high ambient temperatures or under moderate heating could release vapor in sufficient quantities to produce hazardous atmospheres with air: Liquids having a flash point at or above 37.8°C (100°F) and below 93.4°C (200°F) (i.e. Class II and Class IIIA liquids.) Solid materials in the form of powders or coarse dusts of representative diameter between 420 microns (40 mesh) and 2 mm (10 mesh) that burn rapidly but that generally do not form explosive mixtures in air. Solid materials in fibrous or shredded form that burn rapidly and create flash fire hazards, such as cotton, sisal and hemp. Solids and semisolids that readily give off flammable vapors. Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent.

DEFINITIONS OF TERMS (Continued)

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

FLAMMABILITY HAZARD (continued): 3 Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures or, though unaffected by ambient temperatures, are readily ignited under almost all conditions. Liquids having a flash point below 22.8°C (73°F) and having a boiling point at or above 37.8°C (100°F) and those liquids having a flash point at or above 22.8°C (73°F) and below 37.8°C (73°F) and below 37.8°C (100°F) (i.e. Class IB and IC liquids). Materials that, on account of their physical form or environmental conditions, can form explosive mixtures with air and are readily dispersed in air. Flammable or combustible dusts with a representative diameter less than 420 microns (40 mesh). Materials that burn with extreme rapidity, usually by reason of self-contained oxygen (e.g. dry nitrocellulose and many organic peroxides). Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent. **4** Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air and will burn readily. Flammable gases. Flammable cryogenic materials. Any liquid or gaseous materials that is liquid while under pressure and has a flash point below 22.8°C (73°F) and a boiling point below 37.8°C (100°F) (i.e. Class IA liquids). Materials that ignite when exposed to air. Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent.

INSTABILITY HAZARD: 0 Materials that in themselves are normally stable, even under fire conditions: Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) below 0.01 W/mL. Materials that do not exhibit an exotherm at temperatures less than or equal to 500°C (932°F) when tested by differential scanning calorimetry. **1** Materials that in themselves are normally stable, but that can become unstable at elevated temperatures and pressures: Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) at or above 0.01 W/mL and below 10 W/mL. **2** Materials that readily undergo violent chemical change at elevated temperatures and pressures: Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) at or above 10 W/mL and below 100W/mL. **3** Materials that in themselves are capable of detonation or explosive decomposition or explosive reaction, but that require a strong initiating source or that must be heated under confinement before initiation: Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) at or above 100 W/mL and below 1000 W/mL. Materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures. **4** Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures: Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) of 1000 W/mL or greater. Materials that are sensitive to localized thermal or mechanical shock at normal temperatures and pressures.

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:

Human and Animal Toxicology: 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. 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. **Cancer Information:** 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 Information:** **BEI** - ACGIH 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.

REPRODUCTIVE TOXICITY INFORMATION:

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.

ECOLOGICAL INFORMATION:

EC is the effect concentration in water. **BCF** = Bioconcentration Factor, which is used to determine if a substance will concentrate in lifeforms which consume contaminated plant or animal matter. **TL_m** = median threshold limit; Coefficient of Oil/Water Distribution is represented by **log K_{ow}** or **log K_{oc}** and is used to assess a substance's behavior in the environment.

REGULATORY INFORMATION:**U.S. and CANADA:**

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

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