1. SECTION 1 – IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

IDENTIFICATION of the SUBSTANCE or PREPARATION:

PRODUCT NAME: HALON 1211
CHEMICAL NAME: BROMOCHLORODIFLUOROMETHANE
OTHER MEANS OF IDENTIFICATION/SYNONYMS: R 12B1; BCF; Chlorodifluoronomonobromomethane; Flugex 12B1;

Fluorocarbon 1211; Freon 12B1; Halon 1211; Methane, bromochlorodifluoro-

RELEVANT PRODUCT USE: Fire Extinguishing Material

USES ADVISED AGAINST: Other than Relevant Use

COMPANY/UNDERTAKING IDENTIFICATION:

U.S. MANUFACTURER: H3R Clean Agents
ADDRESS: 103 H Street
Petaluma, CA 94952
PHONE: 1-800/249-4289 (8:00 a.m. to 4:30 p.m. PST)
FAX: 1-707/765-3395

EUROPEAN SUPPLIER/MANUFACTURER’S NAME:
ADDRESS: BUSINESS PHONE:
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: September 21, 2006
DATE OF REVISION: August 28, 2015

This gas has been classified in accordance with the hazard criteria of the Canadian CPR and the SDS contains all the information required by the CPR. The compound is also classified per all applicable U.S. OSHA Hazcom, the European Union CLP EC 1272/2008 and the Global Harmonization Standard.

SECTION 2. HAZARD IDENTIFICATION


Classification: Gases Under Pressure/Liquefied Gas
Precautionary Statement Codes: P410 + P403
Signal Word: Warning
Hazard Statement Code: H280
Hazard Symbol/Pictogram: GHS04

See Section 16 for full classification information for this product.

EMERGENCY OVERVIEW: Product Description: Halon 1211 is a colorless, liquefied gas, with a sweet odor, shipped under 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. Reactivity Hazards: This gas is not reactive. Environmental Hazards: Release of this product to the environment is not expected to cause environmental harm. 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.

SECTION 3. COMPOSITION and INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Chemical Formula</th>
<th>CAS #</th>
<th>EINECS #</th>
<th>% Composition</th>
<th>LABEL ELEMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bromochlorodifluoromethane</td>
<td>CBrClF3</td>
<td>353-59-3</td>
<td>205-537-9</td>
<td>&gt; 99%</td>
<td>SELF-CATEGORIZATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GHS under U.S. OSHA &amp; EU Classification (1272/2008 EC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hazard Statement Codes</td>
</tr>
</tbody>
</table>

See Section 16 for full product classification information.

SECTION 4. FIRST AID MEASURES

PROTECTION OF FIRST AID RESPONDERS: RESCUEUS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS GAS WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. Self-Contained Breathing Apparatus should be worn if the level of oxygen cannot be determined. Rescuers should be taken for medical attention, if necessary. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary.
SECTION 4. FIRST AID MEASURES (Continued)

DESCRIPTION OF FIRST AID MEASURES: Remove victim(s) to fresh air, as quickly as possible. Take copy of label and SDS to physician or other health professional with victim(s).

Inhalation Exposure: If inhaled, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Seek medical attention if adverse effect occurs after removal to fresh air.

Skin Exposure: If this gas contaminates the skin, immediately begin decontamination with 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. Remove any clothing that may restrict circulation to any frozen area. Do not rub frozen parts as tissue damage may occur. As soon as practicable, place any affected area in warm water bath which has a temperature that does not exceed 105°F (40°C). NEVER USE HOT WATER. NEVER USE DRY HEAT. If area of frostbite is extensive, and if possible, remove clothing while showering with warm 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 of the body in the armpit. Encourage victim to gently exercise the affected part while being warmed. Frozen tissue is painless and appears waxy, with a possible yellow color. Frozen tissue will become swollen, painful and prone to infection when thawed. If the frozen part of the body has been thawed by the time medical attention has been obtained, cover the part with a dry sterile dressing and a large bulky protective covering.

Eye Exposure: If mechanical injury occurs, cover eye with bandage and seek appropriate medical attention. If rapid release has caused frostbite, cover injured eye; an ophthalmologist should be sought as soon as possible.

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

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 FIRE EXTINGUISHING MEDIA: None known.

SPECIFIC HAZARDS ARISING FROM THE CHEMICAL: 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. 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 481.7°C (900°F) include hydrogen bromide, hydrogen chloride, hydrogen fluoride, free halogens, and small amounts of carbonyl halides. 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.

SPECIAL PROTECTIVE ACTIONS FOR FIRE-FIGHTERS: Move fire-exposed containers if it can be done without risk to firefighters. Use water spray to cool fire-exposed cylinders. Take care not to block pressure relief valves. Stay away from ends of tanks (but realize that shrapnel may travel in any direction). Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire.

SECTION 6. ACCIDENTAL RELEASE MEASURES

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. Detection systems should be available to monitor for level of oxygen. The level of oxygen should above 19.5% before personnel can be allowed in the area without SCBA.

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.

All Releases: In the event of a release of this product, operator should close the gas source if possible to do so safely. Evacuate area in the event of a significant release. Locate and seal the source of the leaking gas. If leak is in user's gas handling equipment or system, close cylinder valve, and safely vent high pressure before attempting repairs. If leak is from the cylinder, cylinder valve or the valve pressure relief device (PRD), contact your supplier. 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 in Canada, call CANUTEC (613-996-6666).
SECTION 6. ACCIDENTAL RELEASE MEASURES (Continued)

ENVIRONMENTAL PRECAUTIONS: All release to the environment should be avoided as this gas has an ozone depletion potential and a global warming potential. 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 1211 can create an oxygen-deficient atmosphere. Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations could occur without any significant warning symptoms, due to oxygen-deficiency. All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a release. Wearing contact lenses is not recommended when handling this gas.

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

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

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 cylinders designed for compressed gas storage. Cylinders must not be recharged except by or with the consent of owner.

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA: Use the proper CGA connections, DO NOT USE ADAPTERS:

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:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS #</th>
<th>OSHA PELs ppm</th>
<th>ACGIH TLVs ppm</th>
<th>NIOSH RELs ppm</th>
<th>NIOSH IDLH ppm</th>
<th>DFG MAKs ppm</th>
<th>AIHA WEELs ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Halon 1211</td>
<td>353-59-3</td>
<td>NE</td>
<td>NE</td>
<td>NE</td>
<td>NE</td>
<td>NE</td>
<td>NE</td>
</tr>
</tbody>
</table>

NE = Not Established

International Exposure Limits: Currently, the following international exposure limits are in place for Halon 1211 (specific country limits may become available or change-consult individual countries for most current information).

Russia: STEL = 1000 mg/m³, JUNE 1993

PERSONAL PROTECTIVE EQUIPMENT:

The following information is 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), equivalent standards of Canada (including CSA Standard Z94.4-02 and CSA Standard Z94.3-02), 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 necessary, use only respiratory protection authorized under appropriate regulations. In the U.S., oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).

Eye Protection: Use approved safety goggles or safety glasses. If necessary, refer to appropriate regulations for further information.
PERSONAL PROTECTIVE EQUIPMENT (continued):

Hand Protection: Wear leather gloves when handling cylinders of this gas. Otherwise, wear glove protection appropriate to the specific operation for which this gas is used. If necessary, refer to appropriate regulations.

Body Protection: Use body protection appropriate for task. Safety shoes are recommended when handling cylinders. 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 country regulations and standards.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Halon 1211</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form</td>
<td>Liquefied gas under pressure</td>
</tr>
<tr>
<td>Color</td>
<td>Colorless</td>
</tr>
<tr>
<td>Odor</td>
<td>Sweet</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>165.36</td>
</tr>
<tr>
<td>Molecular Formula</td>
<td>CBrClF2</td>
</tr>
<tr>
<td>Boiling Point @ 1 atm</td>
<td>-4°C (26°F)</td>
</tr>
<tr>
<td>Freezing/Melting Point @ 1 atm</td>
<td>-159.5°C (319.1°F)</td>
</tr>
<tr>
<td>Specific Gravity [Relative Density] [water = 1]</td>
<td>1.83</td>
</tr>
<tr>
<td>Solubility in Water</td>
<td>Negligible</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>37.5 psi @ 70°F; 2,270 hPa @ 20°C</td>
</tr>
<tr>
<td>Vapor Density (air = 1)</td>
<td>5.7</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>Not determined</td>
</tr>
</tbody>
</table>

WARNING PROPERTIES FOR THIS GAS: The odor may be 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

CHEMICAL STABILITY: Stable.

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

MATERIALS WITH WHICH GAS IS INCOMPATIBLE: Metal halides. Contact with acids can evolve highly toxic hydrogen chloride.

HAZARDOUS DECOMPOSITION PRODUCTS: Combustion: Combustion or decomposition products above 900°F include hydrogen bromide, hydrogen chloride, hydrogen fluoride, free halogens, and small amounts of carbonyl halides. These by-products have a sharp irritating odor. Hydrolysis: None known.

POSSIBILITY OF HAZARDOUS REACTION OR 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 1211 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 high concentrations of this gas may lead to heart arrhythmias. 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 on the following page.

CONCENTRATION of OXYGEN

<table>
<thead>
<tr>
<th>Concentration</th>
<th>EXPOSURE SYMPTOM</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.9% Oxygen</td>
<td>Normal oxygen concentration in air.</td>
</tr>
<tr>
<td>15–19% Oxygen</td>
<td>Decreased ability to perform tasks. May impair coordination and may induce early symptoms in persons with heart, lung, or circulatory problems.</td>
</tr>
<tr>
<td>10–12% Oxygen</td>
<td>Breathing increases, especially in exertion. Pulse up. Impaired coordination, perception, and judgment.</td>
</tr>
<tr>
<td>8–10% Oxygen</td>
<td>Breathing further increases in rate and depth, poor coordination and judgment, lips slightly blue.</td>
</tr>
<tr>
<td>6–8% Oxygen</td>
<td>Mental failure, fainting, unconsciousness, ashen face, blueness of lips, nausea (upset stomach), and vomiting.</td>
</tr>
<tr>
<td>4–6% Oxygen</td>
<td>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.</td>
</tr>
</tbody>
</table>

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: In animal tests, rats were exposed by inhalation for 21 days, dosed 6 hours per day, 5 days per week, at 3,300 ppm and no adverse effects of toxicological significance (NOAEL) were observed. At 10,000 ppm, there were signs of central nervous system depression. However, there were no signs of toxicity or histopathological changes observed and no potentiation of cardiac sensitization potential. Other animal testing resulted in cardiac sensitization at various concentrations for varying exposure times. Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may affect the heart and nervous system.

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

Chronic Exposure Target Organs: Skin, cardiac system, central nervous system.

CARCINOGENIC POTENTIAL: Halon 1211 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 is no toxicology data currently available for Halon 1211.

BROMOCHLORODIFLUOROMETHANE:

TCL0 (Inhalation-Man) 4 pph/1 minute: Peripheral Nerve and Sensation: paresthesia; Behavioral: hallucinations, distorted perceptions; Cardiac: EKG changes not diagnostic of specific effects
TCL0 (Inhalation-Human) 265,200 mg/m³/10 minutes: Peripheral Nerve and Sensation: paresthesia
LC50 (Inhalation-Rat) 20 pph/15 minutes: Behavioral: tremor, convulsions or effect on seizure threshold; Lungs, Thorax, or Respiration: respiratory depression
LC50 (Inhalation-Rat) 2,140,000 mg/m³/5 minutes
LC0 (Inhalation-Dog) 5 pph/5 minutes: Behavioral: tremor, convulsions or effect on seizure threshold; Cardiac: other changes
LC0 (Inhalation-Guinea Pig) 30 pph/2 hours: Behavioral: convulsions or effect on seizure threshold
TCL0 (Inhalation-Rat) 396,000 mg/m³/10 minutes: Behavioral: general anesthetic
TCL0 (Inhalation-Rat) 210 µg/m³/14 hours/12 weeks-intermittent: Blood: pigmented or nucleated red blood cells, changes in erythrocyte (RBC) count, changes in platelet count
TCL0 (Inhalation-Rat) 1 pph/6 hours/3 weeks-intermittent: Behavioral: somnolence (general depressed activity)
TCL0 (Inhalation-Rat) 50,000 ppm: female 6-15 day(s) after conception: Reproductive: Maternal Effects: other effects

ADDITIONAL TOXICOLOGICAL DATA:

Acute: Inhalation-Rat: At 50,000 ppm, no effects were noted. At 75,000 ppm, slightly accelerated respiration was noted. At 100,000 ppm, mild excitement was seen. At 200,000 ppm, within 1 to 2 minutes marked excitation and some convulsions were noted. At 60 to 90 minutes, 2 of the 4 animals died. A concentration of 300,000 ppm immediately gave rise to convulsions and narcosis and all animals died within 50 min. Inhalation-Dog: At 25,000 to 75,000 ppm for 3.5 hours, there was reversible myocardial lesions and fatty degeneration of the liver.

Chronic: A case of occupational rhabdomyolysis in an individual susceptible to malignant hyperthermia was described. A 43 year old man was found to have a serum creatine-kinase activity of 650 international units per liter, normal range 10 to 200 international units/liter, suggesting that he was susceptible to malignant hyperthermia. His susceptibility was confirmed by in vitro testing of a muscle specimen with halothane and caffeine. The subject was subsequently employed in a factory that made fire extinguishers where one of his jobs consisted of discharging Bromochlorodifluoromethane from fire extinguishers before refilling them. Although discharging was done in open air, some gas was commonly inhaled. Eighteen months after beginning this work, he was examined for complaints of malaise and stiffness and weakness in the forearms and hands. The symptoms progressively worsened during the week and improved the weekend. Serum creatine-kinase activity was 1056 IU/l on one Saturday and 444 IU/l the following Monday. Because of the similarity in structure between Bromochlorodifluoromethane and halothane, the effects of the former on contractions of a muscle specimen were examined. Bromochlorodifluoromethane induced contractions identical to those of halothane. The patient was advised to change jobs. After he did so his symptoms immediately improved. It was concluded that the patient's rhabdomyolysis is due to recurring exposures to Bromochlorodifluoromethane. They recommended that persons susceptible to malignant hyperthermia avoid exposure to similar halogenated hydrocarbons. Inhalation-Human: At 4 to 5% for 1 minute using face mask, subjects at 30 seconds became slightly dizzy and light-headed. Over the next few seconds, these symptoms rapidly increased in severity until at 1 minute the subjects felt as though they were about to lose consciousness and exposure was stopped. Paresthesia of the fingers and other parts of the body was sometimes noted towards the end of the experiment. Heart rate rose by approximately 30% during the early stages of exposure and remained at that level throughout the experiment. Depression of the T wave was consistently observed on the ECG tracings. The subjects recovered rapidly on cessation of exposure and felt perfectly normal again within 5 minutes. The heart rate and the ECG reverted to normal within 1 minute. There were no delayed effects. Inhalation-Dog: At 5,000 to 100,000 ppm resulted in cardiac sensitization above 20,000 ppm and in 10 to 0.5 minutes, depending on concentration.

IRRITACY OF PRODUCT: Not applicable.

SENSITIZATION OF PRODUCT: Halon 1211 is not a human skin or respiratory sensitizer, but has been shown to be a cardiac sensitizer in animal studies.

REPRODUCTIVE TOXICITY INFORMATION: Halon 1211 is not reported to cause mutagenic, embryotoxic, teratogenic or reproductive toxicity effects in humans. No animal data are available.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) have not been determined for Halon 1211.
SECTION 12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

MOBILITY: Using a structure estimation method based on molecular connectivity indices, the Koc for Halon 1211 can be estimated to be about 49. According to a classification scheme, this estimated Koc value suggests that Halon 1211 is expected to have very high mobility in soil.

PERSISTENCE AND BIODEGRADABILITY: Photodegradation: > 50% after 14 years. If released to air, a vapor pressure of 2.07X10^3 mm Hg at 25°C indicates Halon 1211 will exist solely in the gas phase in the ambient atmosphere. Gas phase Bromochlorodifluoromethane will slowly be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be greater than 44 years. Halon 1211 absorbs very little UV radiation above 290 nm and is not expected to photolysese at a significant rate in the ambient atmosphere. Volatilization from moist soil surfaces is expected to be an important fate process based upon an estimated Henry's Law constant of 9.4X10^-2 atm-cu/mole. Halon 1211 will volatilize rapidly from dry soil surfaces since it exists as a gas in the ambient atmosphere. If released into water, Halon 1211 is not expected to absorb to suspended solids and sediment based upon the estimated Koc. Volatilization from water surfaces is expected to be an important fate process based upon this compound's estimated Henry's Law constant. Estimated volatilization half-lives for a model river and model lake are 1.3 hrs and 5.1 days, respectively. Given its high degree of halogenation, it is not expected to be an important degradation pathway for Halon 1211.

POTENTIAL TO BIOACCUMULATE: An estimated BCF of 5.8 was calculated for Halon 1211, using an estimated log Kow of 1.9 and a regression-derived equation. According to a classification scheme, this BCF suggests the potential for bioconcentration in aquatic organisms is low.

ECOTOXICITY: There is currently no evidence of adverse effects from exposure to Halon 1211 on aquatic life. Immediate adverse effect on plants would be related to oxygen-deficient environments or frost from rapidly expanding gases.

OZONE-DEPLETION POTENTIAL: Halon 1211 is rated as 3 (compared to trichlorofluoromethane nominally 1). Halon 1211 is a Class I ozone depleting chemical (40 CFR Part 82). Halon 1211 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

PRECAUTIONS TO BE FOLLOWED DURING WASTE HANDLING: Wear proper protective equipment when handling waste materials.

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

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.

U.S. EPA WASTE NUMBER: Not applicable.

EUROPEAN (EWC) WASTE CODES: 16 05 04* gases in pressure containers (including halons) containing dangerous substances

SECTION 14. TRANSPORT INFORMATION

The following classification applies when this product is supplied as a fire extinguisher.

U.S. SHIPPING INFORMATION: This gas is classified as dangerous goods, per U.S. DOT regulations, under 49 CFR 172.101.

UN Identification Number: UN 1044
U.S. DOT Proper Shipping Name: Fire extinguisher with compressed or liquefied gas
Hazard Class Number and Description: 2.2 (Non-Flammable Gas)
U.S. DOT Shipping Label(s) Required: Class 2.2 (Non-Flammable Gas)
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.

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 is valid for shipments originating within the Canadi. For shipments via ground vehicle or rail that originate in Canada, the following information is applicable.

UN Identification Number: UN 1044
Proper Shipping Name: Fire extinguisher with compressed or liquefied gas
Hazard Class Number and Description: 2.2 (Non-Flammable Gas)
Packing Group: Not Applicable
**SECTION 14. TRANSPORT INFORMATION (Continued)**

The following classification applies when this product is supplied as a fire extinguisher.

**TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS (continued):**

<table>
<thead>
<tr>
<th>Excepted Quantities:</th>
<th>E0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazard Shipping Label(s) Required:</td>
<td>Class 2.2 (Non-Flammable Gas)</td>
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<tr>
<td>Special Provisions:</td>
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<tr>
<td>Explosive Limit &amp; Limited Quantity Index:</td>
<td>0.125 L</td>
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<tr>
<td>ERAP Index:</td>
<td>None</td>
</tr>
<tr>
<td>Passenger Carrying Ship Index:</td>
<td>None</td>
</tr>
<tr>
<td>Passenger Carrying Road Or Rail Vehicle Index:</td>
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</tr>
</tbody>
</table>

**INTERNATIONAL AIR TRANSPORT ASSOCIATION SHIPPING INFORMATION (IATA):** This gas is classified as dangerous goods, per the International Air Transport Association.

| 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: | None |
| 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):** This gas is classified as dangerous goods, per the International Maritime Organization.

| UN No.: | 1044 |
| Proper Shipping Name: | Fire extinguisher with compressed or liquefied gas |
| Hazard Class Number: | 2.2 |
| Packing Group: | None |
| Special Provisions: | None |
| Limited Quantities: | 120 mL |
| Excepted Quantities: | E0 |
| Packing: | Instructions: P200; Provisions: None |
| IBCs: | Instructions: None; Provisions: None |
| Tanks: | Instructions: None; Provisions: None |
| EmS: | F-C, S-V |
| Stowage Category: | Category A. |
| Marine Pollutant: | This gas does not meet the criteria of a Marine Pollutant. |

**EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR):** This gas is classified by the Economic Commission for Europe to be dangerous goods.

| UN No.: | 1044 |
| Name and Description: | Fire extinguisher with compressed or liquefied gas |
| Class: | 2 |
| Classification Code: | 6A |
| Packing Group: | None |
| Labels: | 2.2 |
| Special Provisions: | 225, 594 |
| Limited Quantities: | 120 mL |
| Excepted Quantities: | E0 |
| Packing Instructions: | P200 |
| Special Packing Instructions: | PP91 |
| Mixed Packing Provisions: | MP9 |
| Portable Tank and Bulk Container: | Instructions: None; Special Provisions: None |
| Hazard Identification No.: | None |
The following classification applies when this product is charged with nitrogen, carbon dioxide or air.

**U.S. SHIPPING INFORMATION:** This gas is classified as dangerous goods, per U.S. DOT regulations, under 49 CFR 172.101.

- **UN Identification Number:** UN 1058
- **Hazard Class Number and Description:** 2.2 (Non-Flammable Gas)
- **Excepted Quantities:** E1
- **Proper Shipping Name:** Liquid gas, non-flammable, charged with nitrogen, carbon dioxide or air
- **Packaging Group:** Not Applicable
- **UN Label(s) Required:** 2.2 (Non-Flammable Gas)

**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.

- **UN Identification Number:** UN 1058
- **Proper Shipping Name:** Liquid gas, non-flammable, charged with nitrogen, carbon dioxide or air
- **Packaging Group:** Not Applicable
- **Excepted Quantities:** E1
- **Hazard Class 2.2 (Non-Flammable Gas)**
- **Provisions:** None

**INTERNATIONAL AIR TRANSPORT ASSOCIATION SHIPPING INFORMATION (IATA):** This gas is classified as dangerous goods, per the International Air Transport Association.

- **UN Identification Number:** UN 1058
- **Proper Shipping Name/Description:** Liquid gas, non-flammable, charged with nitrogen, carbon dioxide or air
- **Packaging Group:** None
- **Excepted Quantities:** E1
- **Cargo Aircraft Maximum Net Quantity per Pkg.:** 75 Kg
- **Provisions:** A19
- **ERG CODE:** 2L

**INTERNATIONAL MARITIME ORGANIZATION SHIPPING INFORMATION (IMO):** This gas is classified as dangerous goods, per the International Maritime Organization.

- **UN No.:** 1058
- **Proper Shipping Name:** Liquid gas, non-flammable, charged with nitrogen, carbon dioxide or air
- **Packaging Group:** None
- **Special Provisions:** 225
- **Limited Quantities:** 120 mL
- **Excepted Quantities:** E1
- **Stowage Category:** Category A
- **Marine Pollutant:** This gas does not meet the criteria of a Marine Pollutant.
EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR): This gas is classified by the Economic Commission for Europe to be dangerous goods.

UN No.: 1058
Name and Description: Liquefied gas, non-flammable, charged with nitrogen, carbon dioxide or air
Class: 2
Classification Code: 2A
Packing Group: None
Labels: 2.2
Special Provisions: 662
Limited Quantities: 120 mL
Excepted Quantities: E1
Packing Instructions: P200
Special Packing Instructions: None
Mixed Packing Provisions: MP9
Portable Tank and Bulk Container: Instructions: (M); Special Provisions: None
Hazard Identification No.: None

The following shipping classification applies when the product is supplied in types of cylinders other than fire extinguishers:

U.S. SHIPPING INFORMATION:
UN Identification Number: UN 1974
U.S. DOT Proper Shipping Name: Chlorodifluorobromomethane or Refrigerant gas R12B1
Hazard Class Number and Description: 2.2 (Non-Flammable Gas)
U.S. DOT Shipping Label(s) Required: Class 2.2 (Non-Flammable Gas)
Packing Group: Not Applicable
Placard (When required): Class 2.2 (Non-Flammable Gas)
ERG (Emergency Response Guidebook) #: 126

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).

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.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:
UN Identification Number: UN 1974
Proper Shipping Name: Chlorodifluorobromomethane or Refrigerant gas R12B1
Hazard Class Number and Description: 2.2 (Non-Flammable Gas)
Packing Group: Not Applicable
Excepted Quantities: E1
Hazard Shipping Label(s) Required: Class 2.2 (Non-Flammable Gas)
Special Provisions: None
Explosive Limit & Limited Quantity Index: 0.125 L
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 1974
Proper Shipping Name/Description: Chlorodifluorobromomethane or Refrigerant gas R12B1
Hazard Class or Division: 2.2 (Non-Flammable Gas)
Hazard Label(s) Required: Class 2.2 (Non-Flammable Gas)
Packing Group: None
Excepted Quantities: E1
Passenger and Cargo Aircraft Packing Instruction: 200
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.: 75 kg
Cargo Aircraft Only Packing Instruction: 200
Cargo Aircraft Only Maximum Net Quantity per Pkg.: 150 kg
Special Provisions: None
ERG Code: 2L
SECTION 14. TRANSPORT INFORMATION (Continued)

INTERNATIONAL MARITIME ORGANIZATION SHIPPING INFORMATION (IMO):

- UN No.: 1974
- Proper Shipping Name: Chlorodifluorobromomethane or Refrigerant gas R12B1
- Hazard Class Number: 2.2
- Packing Group: None
- Special Provisions: None
- Limited Quantities: 120 mL
- Excepted Quantities: E1
- Instructions: P200; Provisions: None
- IBCs: Instructions: None; Provisions: None
- Tanks: Instructions: T50; Provisions: None
- EmS: MP9
- Stowage Category: None

**Marine Pollutant:** This gas does not meet the criteria of a Marine Pollutant.

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

- UN NO.: 1974
- Name and Description: Chlorodifluorobromomethane or Refrigerant gas R12B1
- Class: 2
- Classification Code: 2A
- Packing Group: None
- Special Provisions: None
- Limited Quantities: 120 mL
- Excepted Quantities: E1
- Packing Instructions: P200
- Special Packing Instructions: None
- Mixed Packing Provisions: MP9
- Portable Tank and Bulk Container: Instructions: (M) T50; Special Provisions: None
- Hazard Identification No.: 20

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.

SECTION 15. REGULATORY INFORMATION

U.S. FEDERAL REGULATIONS:

**EPA - ENVIRONMENTAL PROTECTION AGENCY:**

- SARA TITLE III: Superfund Amendment and Reauthorization Act
  - 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 1211 require reporting under Section 313.

**CLEAN AIR ACT:**

- TSCA: Toxic Substances Control Act Halon 1211 is listed in the TSCA Inventory

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


**Other U.S. Federal Regulations:** Requirements under (40 CFR Part 82) may be applicable as Halon 1211 is designated as an ozone-depleting compound.

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

- California Proposition 65: Halon 1211 is NOT listed on the California Proposition 65 lists.
SECTION 15. REGULATORY INFORMATION

CANADIAN FEDERAL REGULATIONS:
Canadian DSL Inventory Status: Halon 1211 is listed on the DSL Inventory.
Other Canadian Regulations: Halon 1211 is not on the CEPA Priorities Substances Lists.
Canadian WHMIS Classification and Symbols: Halon 1211 is categorized as a Controlled Product, Hazard Class A, as per the Controlled Product Regulations. Class A: Compressed Gas

EUROPEAN REGULATIONS:
Safety, Health, and Environmental Regulations/Legislation Specific for the Product: Currently, there is no specific legislation pertaining to this product.

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.
Classification: Gas under Pressure/Liquefied Gas
Signal Word: Warning
Hazard Statement: 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.
Disposal: P501: Dispose of contents/container in accordance with all local, regional, national and international regulations.
Hazard Symbol: GHS04

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 or 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 if 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.
EXPOSURE LIMITS IN AIR (continued):
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.
LOG: 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.
MOSH 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.
MOsh RELs: MOSH’s Recommended Exposure Limits.
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.

**HAZARD RATING: 0 (Minimal Hazard)**
- No significant health risk, irritation of skin or eyes not anticipated. Skin irritation is expected.
- Substances that are not Explosive, Unstable Compressed Gases, Pressurized and meet OSHA definition.
- Essentially non-irritating, or minimal effects which clear in < 24 hours (e.g. mechanical irritation).

**HAZARD RATING: 1 (Slight Hazard)**
- Minor reversible injury may occur, slightly or mildly irritating. Skin irritation.
- Eye irritation: Slightly or mildly irritating. Oral Toxicity LD₅₀: < 5000 mg/kg. Dermal Toxicity LD₅₀ or Rabbit or Rabbit: > 20 mg/L. (1) Slight Hazard:generally safe to handle.

**HAZARD RATING: 2 (Moderate Hazard)**
- Lung irritation, moderate primary irritant, sensitizers.
- Pulmonary irritation: may irritate, Dermal irritation: irritates, Eye irritation: moderately severe and corrosive, reversible.
- Oral Toxicity LD₅₀: 500-5000 mg/kg. Dermal Toxicity LD₅₀ or Rabbit or Rabbit: > 20-200 mg/L. Inhalation Toxicity LC₅₀ or 4-hrs Rat: > 20-50 mg/L.

**HAZARD RATING: 3 (Serious Hazard)**
- Major irreversible injury may occur, severe irritant, sensitizers.
- Lung irritation: may cause irreversible injury, Dermal irritation: mildly irritating, Eye irritation: severe and irreversible.
- Oral Toxicity LD₅₀: > 5000 mg/kg. Dermal Toxicity LD₅₀ or Rabbit or Rabbit: < 20 mg/L. Inhalation Toxicity LC₅₀ or 4-hrs Rat: > 20-50 mg/L.

**HAZARD RATING: 4 (Severe Hazard)**
- Major or permanent injury may result from single or repeated exposure. Culture skin irritation.
- Lung irritation: severe irreversible injury, Dermal irritation: very irritating, Eye irritation: severe.
- Oral Toxicity LD₅₀: > 5000 mg/kg. Dermal Toxicity LD₅₀ or Rabbit or Rabbit: < 20 mg/L. Inhalation Toxicity LC₅₀ or 4-hrs Rat: > 20-50 mg/L.

**HAZARD RATING: 5 (DANGEROUS)**
- Causes major irreversible injury or death or great permanent injury.
- Lung irritation: may cause death or irreversible injury, Dermal irritation: very irritating, Eye irritation: severe.
- Oral Toxicity LD₅₀: > 5000 mg/kg. Dermal Toxicity LD₅₀ or Rabbit or Rabbit: < 20 mg/L. Inhalation Toxicity LC₅₀ or 4-hrs Rat: > 20-50 mg/L.

**PHYSICAL HAZARD (continued): 2 (Liquid):** Any material that exhibits a mean pressure rise time less than or equal to the pressure rise of 1.1 aqeous sodium chloride solution (40%)/cellulose mixture and the criteria for Packing Group I are not met. Materials that are not Explosive, Unstable Compressed Gases, Pressurized and meet OSHA definition, but at least one of the following conditions are anticipated. Pressure Test 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 begins to show an obvious chemical change. Combustible pellets with a representative diameter of greater than 2 mm (10 mesh).

**NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS**

**HAZARD RATING: 0 (that materials, 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 1 mg/L.

**HAZARD RATING: 1 (Slight Hazard):**
- Materials that, under emergency conditions, can cause significant irritation or temporary incapacitation or trivial injury. Inhalation LC₅₀ for acute toxicity; LD₅₀ for acute oral toxicity; LC₅₀ for acute dermal toxicity; LD₅₀ for acute dermal toxicity.

**HAZARD RATING: 2 (Moderate Hazard):**
- Liquids that have no autoignition temperature at room temperature; or if tested using Method 92 Standard, a non-combustible liquid/solid content of more than 38°C (100°F) and a boiling point below 37.8°C (100°F).

**HAZARD RATING: 3 (Serious Hazard):**
- Materials that, under emergency conditions, can cause severe temporary incapacitation or trivial injury. Inhalation LC₅₀ for acute toxicity; LD₅₀ for acute oral toxicity; LC₅₀ for acute dermal toxicity.

**HAZARD RATING: 4 (Severe Hazard):**
- Materials that, under emergency conditions, can cause severe or permanent injury. Inhalation LC₅₀ for acute toxicity; LD₅₀ for acute oral toxicity; LC₅₀ for acute dermal toxicity.

**HAZARD RATING: 5 (DANGEROUS):**
- Materials that, under emergency conditions, can cause serious or permanent injury. Inhalation LC₅₀ for acute toxicity; LD₅₀ for acute oral toxicity; LC₅₀ for acute dermal toxicity.

**HAZARD RATING: 6 (DANGEROUS):**
- Materials that, under emergency conditions, can cause irreversible or death or great permanent injury. Inhalation LC₅₀ for acute toxicity; LD₅₀ for acute oral toxicity; LC₅₀ for acute dermal toxicity.
NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

FLAMMABILITY HAZARD (continued): 1 (continued): 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 fibrinous 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. 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 II and IO 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: 9. 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) or at or above 10 W/ml and below 100 W/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) or 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 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 LDo, Lethal Dose (solids & liquids) which kills 50% of the exposed animals; LCLo, 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 TLID, the lowest dose to cause a symptom and TCLo, the lowest concentration to cause a symptom; TDo, TDLo, and LDLo, or TC, TGo, 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 increasing potential to cause human cancer with rankings from 1 to 4. Sub rankings (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 fish as which consume contaminated plant or animal matter. TLM = median threshold limit. Coefficient of Oil/Water Distribution is represented by log Kow or log Koc 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/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. OSHA - U.S. Occupational Safety and Health Administration.