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EFFECTIVE:	6/29/08
SUPERSEDES:	New

# MATERIAL SAFETY DATA SHEET

Illumina, Inc.

Prepared to U.S. OSHA, CMA, ANSI, Canadian WHMIS, European Union, Australian NOHSC, and Japanese Industrial Standards

## PART I

*What is the material and what do I need to know in an emergency?*

### 1. PRODUCT IDENTIFICATION

<u>TRADE NAME (AS LABELED):</u>	<b>DGE GEX Kit</b>
<u>CODE NUMBERS:</u>	1002394
<u>U.N. NUMBER:</u>	Not Applicable
<u>U.N. DANGEROUS GOODS CLASS/SUBSIDIARY RISK:</u>	Not Applicable
<u>HAZCHEM CODE (AUSTRALIA):</u>	Not Applicable
<u>POISONS SCHEDULE NUMBER (AUSTRALIA):</u>	Not Applicable
<u>PRODUCT USE:</u>	DNA Sequencing
<u>U.S. SUPPLIER/MANUFACTURER'S NAME:</u>	<b>ILLUMINA, Inc.</b>
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<u>DATE OF PREPARATION:</u>	June 29, 2008

NOTE: ALL United States Occupational Safety and Health Administration Standard (29 CFR 1910.1200), U.S. State equivalent Standards, Canadian WHMIS [Controlled Products Regulations], European Union [Regulation (EC) 1907/2006 Annex II], Australian [NOHSC:2011 (2003)], and Japanese Industrial Standard (JIS Z 7250: 2000) required information is included in appropriate sections based on the U.S. ANSI Z400.1-2004 format. This product has been classified in accordance with the hazard criteria of the countries listed above.

### 2. HAZARD IDENTIFICATION

This Material Safety Data sheet describes the DGE GEX Kit. This product consists of eleven solutions. This Material Safety Data Sheet provides complete information on all the components described in the following tables. Unless otherwise specified, the information in each section of this document is pertinent to each solution. The solutions of this product are mixtures (preparations) of chemical compounds.

**EU/AUSTRALIAN LABELING AND CLASSIFICATION:** This product does not meet the definition of any hazard classification according to the European Union Council Directive 67/548/EEC and subsequent Directives and by the Australian National Occupational Health and Safety Commission [NOHSC(1008:2004)].

Classification: Not applicable.      Risk Phrases: Not applicable.      Symbol: Not applicable.

See Section 16 for full text of Risk Phrases

**EMERGENCY OVERVIEW: Product Description:** These solutions are clear, colorless, odorless liquids. **Health Hazards:** The chief hazard in event of overexposure is the potential for irritation of contaminated skin or eyes. **Flammability Hazards:** These solutions present no significant fire hazards. In the event of a fire, this product will not contribute significant additional hazards. **Reactivity Hazards:** This product is not reactive. **Environmental Hazards:** Negligible. **Emergency Recommendations:** Emergency responders must wear personal protective equipment suitable for the situation to which they are responding.

### 3. COMPOSITION AND INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	EINECS#	ENCS#	% v/v	CLASSIFICATION, RISK PHRASES, SYMBOL LETTERS
<b>COMPONENT 1: SERA-MAG; Code 1002545</b>					
Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens).				Balance	None of the other constituents in this mixture contribute significantly to the hazards associated with this component.
<b>COMPONENT 2: BINDING BUFFER; Code 1001671</b>					
Lithium Salt		Proprietary		1-5	HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable.
Alkanolamine		Proprietary		1-5	HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable.
Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens).				Balance	None of the other constituents in this mixture contribute significantly to the hazards associated with this component.
<b>COMPONENT 3: WASHING BUFFER; Code 1001672</b>					
Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens).				Balance	None of the other constituents in this mixture contribute significantly to the hazards associated with this component.
<b>COMPONENT 4: ULTRA PURE WATER; Code 1000467</b>					
Water	7732-18-5	231-791-2	NE	100	HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable.
<b>COMPONENT 5: BUFFER C; Code 1001667</b>					
Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens).				Balance	None of the other constituents in this mixture contribute significantly to the hazards associated with this component.
<b>COMPONENT 6: CLEANING SOLUTION; Code 1001668</b>					
Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens).				Balance	None of the other constituents in this mixture contribute significantly to the hazards associated with this component.
<b>COMPONENT 7: BUFFER D; Code 1001669</b>					
Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens).				Balance	None of the other constituents in this mixture contribute significantly to the hazards associated with this component.

See Section 16 for full text of Ingredient Risk Phrases

## PART II What should I do if a hazardous situation occurs?

### 4. FIRST-AID MEASURES

Contaminated individuals must seek medical attention if any adverse effect occurs. Rescuers should be taken for medical attention if necessary. Remove or cover gross contamination to avoid exposure to rescuers. Take a copy of label and MSDS to physician or health professional with the contaminated individual.

**SKIN EXPOSURE:** If this product contaminates the skin, begin decontamination with copious amounts of running water. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Contaminated clothing must be removed and laundered before re-use. The contaminated individual must seek medical attention if any adverse effect develops after the area is flushed.

**EYE EXPOSURE:** If this product contaminates the eyes, open victim's eyes while under gently running water. Use sufficient force to open eyelids. Have the contaminated individual "roll" eyes. Minimum flushing is for 15 minutes. The contaminated individual must seek medical attention if adverse effects occur after flushing.

**INHALATION:** If vapors, mists or sprays from this product are inhaled, remove contaminated individual to fresh air. If necessary, use artificial respiration to support vital functions. Seek medical attention if adverse effect continues after removal to fresh air.

**INGESTION:** If this product is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. DO NOT INDUCE VOMITING unless directed by medical personnel. Have contaminated individual rinse mouth with water. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or unable to swallow. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain an open airway and prevent aspiration. If contaminated individual is convulsing, maintain an open airway and obtain immediate medical attention.

**MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:** Pre-existing dermatitis and other skin conditions may be aggravated by overexposure to components of this product.

**RECOMMENDATIONS TO PHYSICIANS:** Treat symptoms and eliminate overexposure.

## 5. FIRE-FIGHTING MEASURES

**FLASH POINT:** Not flammable.

**AUTOIGNITION TEMPERATURE:** Not applicable.

**FLAMMABLE LIMITS (in air by volume, %):**

(LEL): Not applicable. (UEL): Not applicable.

**FIRE EXTINGUISHING MATERIALS:** In the event of a fire, use suppression methods for surrounding materials (e.g., water spray, dry chemical, carbon dioxide, foam, Halon, any "ABC" class extinguisher).

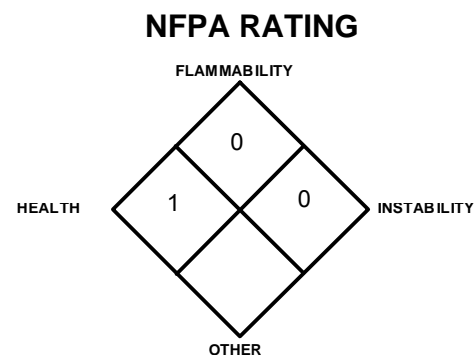
**FIRE EXTINGUISHING MATERIALS NOT BE USED:** None known.

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** When involved in a fire, this product's components will decompose and produce irritating vapors and toxic gases (including carbon oxides, nitrogen oxides, lithium oxides, and hydrogen chloride).

**Explosion Sensitivity to Mechanical Impact:** Not sensitive.

**Explosion Sensitivity to Static Discharge:** Not sensitive.

**SPECIAL FIRE-FIGHTING PROCEDURES:** Move containers from fire area if it can be done without risk to personnel. Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Chemical resistant clothing may be necessary. If possible, prevent runoff water from entering storm drains, bodies of water, or other environmentally sensitive areas.



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

## 6. ACCIDENTAL RELEASE MEASURES

**SPILL AND LEAK RESPONSE:** Trained personnel using pre-planned procedures should respond to uncontrolled releases. Proper protective equipment should be used. In case of a spill, clear the affected area and protect people. The atmosphere must have levels of constituents lower than those listed in Section 8, (Exposure Controls and Personal Protective Equipment), if applicable, and have at least 19.5 percent oxygen before personnel can be allowed into the area without Self-Contained Breathing Apparatus (SCBA).

**Small Spills:** Lightweight gloves, a lab coat, and eye protection should be worn. Absorb spilled liquid with paper towels. Wash contaminated area with soap and water, absorb with paper towels, and rinse with water.

**Large Spills:** Minimum Personal Protective Equipment should be **Level D: lab-gloves, chemical resistant apron, boots, and splash goggles. Respiratory protection should not be necessary.** Absorb spilled liquid with polypads or other suitable absorbent materials. Dike or otherwise contain spill and remove with vacuum truck or pump to storage/salvage vessels. Decontaminate the area thoroughly. Prevent material from entering sewer or confined spaces, waterways, soil or public waters. Monitor area and confirm levels are below exposure limits given in Section 8 (Exposure Controls-Personal Protection), if applicable, before non-response personnel are allowed into the spill area.

Place all spill residue in a double plastic bag or other containment and seal. Decontaminate the area thoroughly. Do not mix with wastes from other materials. Dispose of in accordance with applicable Federal, State, and local procedures (see Section 13, Disposal Considerations). For spills on water, contain, minimize dispersion and collect. Dispose of recovered material and report spill per regulatory requirements.

## PART III *How can I prevent hazardous situations from occurring?*

### 7. HANDLING and STORAGE

**SAFE WORK AND HYGIENE PRACTICES:** As with all chemicals, avoid getting this product's components ON YOU or IN YOU. Wash thoroughly after handling this product's components. Avoid splashing or spraying this product's components. Do not eat or drink while handling this product's components.

**STORAGE AND HANDLING PRACTICES:** All employees who handle this material should be trained to handle it safely. Avoid breathing vapors or mists generated by this product's components. Ensure containers of this product's components are properly labeled. Open containers slowly on a stable surface. Store vials as directed in the product insert. Keep vials tightly closed when not in use. Store away from incompatible materials. Inspect vials containing this product's components for leaks or damage. Read instructions provided with the product prior to use.

**SPECIFIC USE(S):** This product is for use in laboratory biological research. Follow all industry standards for use.

**PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT:** Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely, as applicable. Collect all rinsates and dispose of according to applicable Federal, State, and local procedures standards.

### 8. EXPOSURE CONTROLS - PERSONAL PROTECTION

**VENTILATION, ENGINEERING, AND OCCUPATIONAL EXPOSURE CONTROLS:** Use with adequate ventilation to ensure exposure levels are maintained below the limits provided below, if applicable. If necessary, refer to Australian National Code of Practice for the Control of Workplace Hazardous Substances [NOHSC: 2007 (1994)] for further information. As with all products that contain chemicals, ensure proper decontamination equipment (e.g., eyewash/safety shower stations) are available near areas where this product is used as necessary.

## 8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

### EXPOSURE LIMITS/GUIDELINES:

NOTE: Solutions not specifically listed are primarily water and trace constituents; no exposure limits are applicable.

CHEMICAL NAME	CAS #	EXPOSURE LIMITS IN AIR							
		ACGIH-TLVs		OSHA-PELs		NIOSH-RELS		NIOSH	OTHER
		TWA mg/m <sup>3</sup>	STEL mg/m <sup>3</sup>	TWA mg/m <sup>3</sup>	STEL mg/m <sup>3</sup>	TWA mg/m <sup>3</sup>	STEL mg/m <sup>3</sup>	IDLH mg/m <sup>3</sup>	mg/m <sup>3</sup>

#### COMPONENT 2: BINDING BUFFER; Code 1001671

Lithium Salt	Proprietary	NE	NE	NE	NE	NE	NE	NE	NE
Alkanolamine	Proprietary	NE	NE	NE	NE	NE	NE	NE	NE

NE = Not Established.

DSEN = May Cause Dermal Sensitization

See Section 16 for Definitions of Terms Used

**INTERNATIONAL OCCUPATIONAL EXPOSURE LIMITS:** Currently there are no international exposure limits in place for the constituents of this product.

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), equivalent standards of Canada (including CSA Standard Z94.4-02 and CSA Standard Z94.3-07), 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), or standards of Australia (including AS/NZS 1715:1994 for respiratory PPE, AS/NZS 4501.2:2006 for protective clothing, AS/NZS 2161.1:2000 for glove selection, and AS/NZS 1336:1997 for eye protection). Please reference applicable regulations and standards for relevant details.

**RESPIRATORY PROTECTION:** Respiratory protection is not generally needed when using this product. Maintain airborne contaminant concentrations below limits listed above. In instances where inhalable mists or sprays of product may be generated and respiratory protection is necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), equivalent U.S. State standards, the Canadian CSA Standard Z94.4-02, the European Standard EN 529:2005, the Australian Standard 1716-Respiratory Protective Devices, the Australian Standard 1715-Selection, Use, and Maintenance of Respiratory Protective Devices, or the requirements of Japan. 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, SAR with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).

**EYE PROTECTION:** Depending on the use of this product, splash goggles or safety glasses may be worn. Use goggles or safety glasses for spill response, as stated in Section 6 (Accidental Release Measures) of this MSDS. If necessary, refer to U.S. OSHA 29 CFR 1910.133, the European Standard CR 13464:1999 and the Canadian CSA Standard Z94.3-07, *Industrial Eye and Face Protectors*, the Australian Standard 1337-Eye Protection for Industrial Applications and Australian Standard 1336-Recommended Practices for Eye Protection in the Industrial Environment, as well as requirements of Japan for further information.

**HAND PROTECTION:** Wear butyl rubber, neoprene, or nitrile rubber or latex gloves for routine use. If necessary, refer to U.S. OSHA 29 CFR 1910.138 appropriate Standards of Canada, the European Standard CEN/TR 15419:2006 or the Australian Standard 2161-Industrial Safety Gloves and Mittens, and applicable Standards of Japan, for further information.

**BODY PROTECTION:** Use body protection appropriate for task, such as a lab coat. If necessary, use body protection appropriate for task (e.g., Tyvek suit, rubber apron). If necessary, refer appropriate Standards of Canada, the European Standard CEN/TR 15419:2006, the to Australian Standard 3765-Clothing for Protection Against Hazardous Chemicals, or Japan for further information. 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 U.S. OSHA 29 CFR 1910.136 and the Canadian CSA Standard Z195-02, *Protective Footwear*.

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

## 9. PHYSICAL and CHEMICAL PROPERTIES

**APPEARANCE, ODOR and COLOR:** These solutions are clear, colorless liquids.

**HOW TO DETECT THESE SUBSTANCES:** There are no unusual warning properties associated with these components.

pH: 6-10

**FLASH POINT:** Not established.

**EXPLOSIVE PROPERTIES:** Not explosive

**VAPOR PRESSURE:** Not established.

**SOLUBILITY:** Miscible in some organic solvents.

**BOILING POINT:** Not established.

**VISCOSITY:** Not established.

**EVAPORATION RATE:** Similar to water.

**COEFFICIENT OF OIL/WATER DISTRIBUTION (PARTITION COEFFICIENT):** Not established.

**FLAMMABILITY:** Not flammable.

**OXIDIZING PROPERTIES:** Not an oxidizer.

**SPECIFIC GRAVITY:** Not established.

**SOLUBILITY IN WATER:** Completely soluble.

**MELTING/FREEZING POINT:** Not established.

**RELATIVE VAPOR DENSITY (air = 1):** Not established.

**ODOR THRESHOLD:** Not established.

## 10. STABILITY AND REACTIVITY

**DECOMPOSITION CONDITIONS/STABILITY:** Stable.

**DECOMPOSITION PRODUCTS:** Combustion: Carbon oxides, nitrogen oxides, lithium oxides, and hydrogen chloride. Hydrolysis: None known.

**MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE:** Strong oxidizers, strong acids, some metals and substances that are incompatible with water.

**HAZARDOUS POLYMERIZATION:** Will not occur.

**CONDITIONS TO AVOID:** Any conditions that are incompatible with water, mixing this product with incompatible chemicals.

## PART IV *Is there any other useful information about this material?*

### 11. TOXICOLOGICAL INFORMATION

#### **SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE:**

No adverse health effects should occur from routine, occupational use of this product's solutions in the manner specified by the manufacturer's instructions. The potential health effects of this product's solutions, via route of exposure, are described below.

**INHALATION:** Inhalation of vapors, mists, or sprays of these solutions may slightly irritate the nose, throat, and lungs. Symptoms are generally alleviated upon breathing fresh air.

**CONTACT WITH SKIN or EYES:** Contact with the skin or eyes may cause mild irritation, which is alleviated upon rinsing.

**SKIN ABSORPTION:** No constituents in these solutions are known to be absorbed via intact skin.

**INGESTION:** Ingestion is not anticipated to be a significant route of exposure for the product's solutions. If these solutions are swallowed they may cause gastric distress. Large doses may cause nausea, vomiting, and diarrhea.

**INJECTION:** Accidental injection of this product's solutions, via laceration or puncture by a contaminated object, may cause local reddening, tissue swelling, and discomfort in addition to the wound.

**INJECTION:** Accidental injection of this product's solutions, via laceration or puncture by a contaminated object, may cause local reddening, tissue swelling, and discomfort in addition to the wound.

#### **HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms.**

**ACUTE:** Beyond mild irritation of the skin or eyes, contact with these components does not usually cause acute health effects.

**CHRONIC:** These components are not known to cause any significant chronic health effects.

**TARGET ORGANS:** ACUTE: Eyes, gastrointestinal tract. CHRONIC: None known.

**TOXICITY DATA:** The following information is available for the constituents in components of this product present in greater than 1 percent concentration and listed in Section 3 (Composition and Information on Ingredients).

#### **LITHIUM SALT:**

Skin Irritancy (rabbit) = 500 mg/24 hours; Severe  
 Eye Irritancy (rabbit) = 100 mg/24 hours; Moderate  
 Gene Conversion and Mitotic Recombination (*Saccharomyces cerevisiae*) = 9 mmol/L  
 Sex chromosome loss and non-disjunction (Yeast, *Saccharomyces cerevisiae*) = 3 mmol/L  
 DNA Inhibition (HeLa cell, human) = 70 mmol/L  
 DNA Inhibition (lymphocyte, human) = 50 mg/L  
 Cytogenetic Analysis (lymphocyte, human) = 50 mg/L  
 Cytogenetic Analysis (oral, mouse) = 212 µg/kg/3 days/intermittent.  
 Sister Chromatid Exchange (oral, mouse) = 21 mg/kg/3 days/intermittent  
 LDLo (oral, human) = 200 mg/kg/3 days  
 TDLo (oral, human) = 243 mg/kg/13 days; Central nervous system and Gastrointestinal effects  
 LD<sub>50</sub> (oral, rat) = 526 mg/kg  
 LD<sub>50</sub> (oral, mouse) = 1165 mg/kg  
 LD<sub>50</sub> (oral, rabbit) = 850 mg/kg  
 LD<sub>50</sub> (oral, quail) = 422 mg/kg  
 LD<sub>50</sub> (oral, wild bird species) = 422 mg/kg  
 LD<sub>50</sub> (intraperitoneal, rat) = 514 mg/kg

#### **LITHIUM SALT (continued):**

LD<sub>50</sub> (intraperitoneal, mouse) = 600 mg/kg  
 LD<sub>50</sub> (intraperitoneal, cat) = 492 mg/kg  
 LD<sub>50</sub> (intravenous, mouse) = 363 mg/kg  
 LD<sub>50</sub> (intracerebral, rat) = 4800 mg/kg  
 LD<sub>50</sub> (subcutaneous, rat) = 499 mg/kg  
 LD<sub>50</sub> (subcutaneous, mouse) = 828 mg/kg  
 LD<sub>50</sub> (subcutaneous, mouse) = 738 mg/kg; Behavioral: tremor; Musculoskeletal changes  
 LD<sub>50</sub> (intracerebral, mouse) = 14040 µg/kg; Eye: ptosis; Behavioral: somnolence (general depressed activity)  
 TDLo (oral, rat) = 712 mg/kg/1 week/continuous; Behavioral: fluid intake; Weight loss or decreased weight gain  
 TDLo (oral, rat) = 66 g/kg/female 1–21 days after conception/lactating female 21 days post-birth; Specific Developmental Abnormalities: Central Nervous System; Effects on Newborn: biochemical and metabolic, physical  
 TDLo (oral, mouse) = 475 mg/kg/male 7 days pre-mating/female 7 days pre-mating, 21 days post-birth; Reproductive: Effects on Newborn: growth statistics (e.g. %, reduced weight gain); biochemical and metabolic; physical

#### **LITHIUM SALT (continued):**

TDLo (oral, dog) = 4200 mg/kg/42 days/intermittent; Behavioral: coma; Nutritional and Gross Metabolic: weight loss or decreased weight gain; Related to Chronic Data: death  
 TDLo (intraperitoneal, rat) = 1 g/kg/female 7–11 days post; Teratogenic effects  
 TDLo (intraperitoneal, rat) = 500 mg/kg/10 days/intermittent; Liver: changes in liver weight; Urine volume increased; Endocrine: changes in spleen weight  
 TDLo (intraperitoneal, rat) = 41360 mg/kg/male 1 day pre-mating; Fertility: mating performance (e.g. # sperm positive females per # females mated; # copulations per # estrus cycles)  
 TDLo (intraperitoneal, rat) = 809 mg/kg/female 9–16 days after conception; Reproductive: Specific Developmental Abnormalities: eye/ear, craniofacial (including nose and tongue); Effects on Embryo: other effects to embryo  
 LDLo (subcutaneous, rabbit) = 531 mg/kg  
 LDLo (subcutaneous, cat) = 450 mg/kg  
 LDLo (subcutaneous, guinea pig) = 620 mg/kg  
 LDLo (subcutaneous, pigeon) = 513 mg/kg  
 LDLo (subcutaneous, frog) = 885 mg/kg



#### HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

<b>HEALTH HAZARD</b>	(BLUE)	1
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<b>FLAMMABILITY HAZARD</b>	(RED)	0
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<b>PHYSICAL HAZARD</b>	(YELLOW)	0
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#### PROTECTIVE EQUIPMENT

EYES	RESPIRATORY	HANDS	BODY
	SEE SECTION 8		SEE SECTION 8

For Routine Use and Handling Applications

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

## 11. TOXICOLOGICAL INFORMATION (Continued)

### TOXICITY DATA (continued):

#### LITHIUM SALT (continued):

LDLo (intravenous, dog) = 500 mg/kg; Behavioral: food intake (animal); Gastrointestinal: changes in structure or function of salivary glands; Musculoskeletal: other changes  
 TDLo (intraperitoneal, rat) = 1250 mg/kg/female 7–11 days after conception; Reproductive: Fertility: litter size (e.g. # fetuses per litter; measured before birth)  
 TDLo (intraperitoneal, rat) = 979 mg/kg; female 7–16 days after conception; Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants)  
 TDLo (intraperitoneal, mouse) = 882 mg/kg/7 days/intermittent; Neoplastic effects

#### LITHIUM SALT (continued):

TDLo (intraperitoneal, mouse) = 320 mg/kg/female 6–7 days post; Reproductive effects  
 TDLo (subcutaneous, rat) = 678 mg/kg/8 days/intermittent; Behavioral: fluid intake; Kidney, Urethra, Bladder: urine volume increased; other changes in urine composition  
 TDLo (subcutaneous, rat) = 28 mg/kg/male 14 days pre-mating; Reproductive: Paternal Effects: other effects on male; Endocrine: changes in luteinizing hormone, androgenic  
 TDLo (subcutaneous, rat) = 42 mg/kg/male 21 days pre-mating; Reproductive: Paternal Effects: spermatogenesis (incl. genetic material, sperm morphology, motility, and count)

#### LITHIUM SALT (continued):

TDLo (subcutaneous, mouse) = 5440 mg/kg/17 days/intermittent; Kidney, Urethra, Bladder: other changes in urine composition; Nutritional and Gross Metabolic: weight loss or decreased weight gain; Related to Chronic Data: death  
 TDLo (subcutaneous, mouse) = 1240 mg/kg/female 12–13 days after conception; Specific Developmental Abnormalities: craniofacial (including nose and tongue)  
**ALKANOLAMINE:**  
 LD<sub>50</sub> (oral, rat) = 5900 mg/kg  
 LD<sub>50</sub> (intravenous, rat) = 1800 mg/kg  
 LD<sub>50</sub> (intravenous, mouse) = 1210 mg/kg  
 LDLo (oral, rabbit) = 1 g/kg; Behavioral: somnolence (general depressed activity), muscle weakness, coma

**CARCINOGENIC POTENTIAL OF COMPONENTS:** The constituents in the solutions of this product are not found on the following lists: U.S. EPA, U.S. NTP, U.S. OSHA, U.S. NIOSH, GERMAN MAK, IARC, or ACGIH and therefore are neither considered to be nor suspected to be cancer causing agents by these agencies.

**IRRITANCY OF PRODUCT:** Contact with the skin or eyes may cause mild irritation, which is alleviated upon rinsing.

**SENSITIZATION TO THE PRODUCT:** These solutions are not known to cause skin or respiratory sensitization.

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

**Mutagenicity:** The constituents in the solutions in this product are not reported to produce mutagenic effects in humans. Human mutation data are available for the Lithium Salt constituent in this product's solutions; these data were obtained during clinical studies on specific human tissues exposed to high doses of these compounds.

**Embryotoxicity:** The constituents in the solutions in this product are not reported to cause human embryotoxic effects.

**Teratogenicity:** The constituents in the solutions in this product are reported to cause teratogenic effects in humans. Clinical studies on test animals exposed to relatively high doses of the Lithium Salt constituent in this product's solutions indicate teratogenic effects.

**Reproductive Toxicity:** The constituents in the solutions in this product are not reported to cause adverse reproductive effects in humans. Clinical studies on test animals exposed to relatively high doses of the Lithium Salt constituent in this product's solutions indicate adverse reproductive effects.

*A **mutagen** is a chemical that causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An **embryotoxin** is a chemical that causes damage to a developing embryo (i.e., within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A **teratogen** is a chemical that causes damage to a developing fetus, but the damage does not propagate across generational lines. A **reproductive toxin** is any substance that interferes in any way with the reproductive process.*

**BIOLOGICAL EXPOSURE INDICES:** Currently, there are no Biological Exposure Indices (BEIs) determined for the constituents in this product's solutions.

## 12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

**MOBILITY:** This product has not been tested for mobility in soil.

**PERSISTENCE AND BIODEGRADABILITY:** This product has not been tested for persistence or biodegradability. It is expected that the constituents of this product will slowly degrade in the environment and form a variety of organic and inorganic materials; however, no specific information is known.

**BIO-ACCUMULATION POTENTIAL:** This product has not been tested for bio-accumulation potential. No information is available for constituents.

#### LITHIUM SALT:

Log Kow = -2.66; Water solubility = 1 g/ 1.3 mL (cold water), 1 g/ 0.8 mL (boiling water)

**ECOTOXICITY:** This product has not been tested for aquatic or animal toxicity. All releases to terrestrial, atmospheric and aquatic environments should be avoided. The following aquatic toxicity data for some constituents of this product are available as follows:

#### LITHIUM SALT:

Toxicity Critical Limit (fish: unspecified species) = 100 mg/L

#### LITHIUM SALT (continued):

Mortality (goldfish) 22-27 hours = 3750 mg/L  
 LC (Fish: unspecified species) 24 hours = 2600 mg/L

#### LITHIUM SALT (continued):

Total Mortality (pike-perch fry) several hours = 50 µg/L

**OTHER ADVERSE EFFECTS:** This product does not contain any constituents with known ozone depletion potential.

## 13. DISPOSAL CONSIDERATIONS

**DISPOSAL METHODS:** Do NOT dispose of any solution of this product by pouring down the drain. It is the responsibility of the generator to determine at the time of disposal whether the product meets the criteria of a hazardous waste per regulations of the area in which the waste is generated and/or disposed of. Waste disposal must be in accordance with appropriate Federal, State, and local regulations. This product, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local hazardous waste regulatory authority. Shipment of wastes must be done with appropriately permitted and registered transporters.

### 13. DISPOSAL CONSIDERATIONS (Continued)

DISPOSAL CONTAINERS: Waste materials must be placed in and shipped in appropriate 5-gallon or 55-gallon poly or metal waste pails or drums. Permeable cardboard containers are not appropriate and should not be used. Ensure that any required marking or labeling of the containers be done to all applicable regulations.

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

U.S. EPA WASTE NUMBER: Not applicable.

EWG WASTE CODE: Wastes from research, diagnoses, treatment, or preventions of disease involving animals: chemicals other than containing dangerous substances: 18-02-06

### 14. TRANSPORTATION INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION REGULATIONS: This product is NOT classified as dangerous goods, per U.S. DOT regulations, under 49 CFR 172.101.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This product is NOT classified as Dangerous Goods, per regulations of Transport Canada.

INTERNATIONAL AIR TRANSPORT ASSOCIATION/ICAO (IATA/ICAO): This product is NOT classified as dangerous goods, per rules of IATA.

INTERNATIONAL MARITIME ORGANIZATION (IMO): This product is NOT dangerous goods, per the rules of IMO.

EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR): This product is NOT classified by the United Nations Economic Commission for Europe to be dangerous goods.

AUSTRALIAN FEDERAL OFFICE OF ROAD SAFETY CODE FOR THE TRANSPORTATION OF DANGEROUS GOODS BY ROAD OR RAIL: This product is NOT dangerous goods, per regulations of the Office of Road Safety.

### 15. REGULATORY INFORMATION

#### ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The constituents in this product's solutions are not subject to Sections 302, 304, and 313 reporting requirements under the Superfund Amendment and Reauthorization Act.

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for the constituents in this product's solutions. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) therefore applies, per 40 CFR 370.20.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

U.S. TSCA INVENTORY STATUS: This product is regulated by the Food and Drug Administration; it is exempt from the requirements of TSCA.

OTHER U.S. FEDERAL REGULATIONS: Not applicable.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): No constituent in the solutions of this product is on the California Proposition 65 lists.

ANSI LABELING (Z129.1; Provided to Summarize Occupational Hazard Information): **CAUTION! MAY CAUSE SKIN AND EYE IRRITATION. MAY CAUSE DISCOMFORT IF SWALLOWED OR INHALED.** Do not taste or swallow. Avoid skin or eye contact. Avoid prolonged or repeated skin contact. Avoid breathing mists or sprays. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Wear gloves and goggles. **FIRST-AID**: In case of contact, immediately flush skin or eyes with plenty of water. If inhaled, remove to fresh air. If ingested, do not induce vomiting. Get medical attention if necessary. **IN CASE OF FIRE**: Use water fog, dry chemical, CO<sub>2</sub>, or "alcohol" foam. **IN CASE OF SPILL**: Absorb spill with polypads and place in suitable container. Consult Material Safety Data Sheet for additional information.

#### ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL/NDL INVENTORY STATUS: The constituents in this product's solutions are listed on the DSL Inventory or are exempt.

OTHER CANADIAN REGULATIONS: Not applicable.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITY SUBSTANCES LISTS: The constituents in this product's solutions are not on the CEPA Priority Substances Lists.

CANADIAN WHMIS CLASSIFICATION AND SYMBOLS: Not applicable.

#### ADDITIONAL EUROPEAN UNION REGULATIONS:

LABELING AND CLASSIFICATION: This product does not meet the definition of any hazard classification according to the European Union Council Directive 67/548/EEC and subsequent Directives.

Classification: Not applicable.

Risk Phrases: Not applicable.

Safety Phrases: Not applicable.

Symbol: Not applicable.

LABELING AND CLASSIFICATION FOR CONSTITUENTS: Official classifications for these substances have not been published in Commission Directives 93/72/EEC, 94/69/EC, 96/56/EC, or 98/98/EC.

## 15. REGULATORY INFORMATION (Continued)

### ADDITIONAL AUSTRALIAN REGULATIONS:

**AUSTRALIAN INVENTORY OF CHEMICAL SUBSTANCES (AICS) STATUS:** The constituents in the solutions of this product which are listed in Section 3 (Composition and Information on Ingredients) are on the AICS. Hydrates of listed compounds and biological materials are exempt from listing. Any chemical not included in AICS is regarded as a new industrial chemical unless it is outside the scope of the Industrial Chemicals (Notification and Assessment) Act 1989 OR is otherwise exempt from notification. New industrial chemicals must be notified and assessed before being manufactured or imported into Australia.

**HAZARDOUS SUBSTANCES INFORMATION SYSTEM (HSIS):** No constituents in this product's solutions are listed in the HSIS.

**LABELING AND CLASSIFICATION:** This product does not meet the definition of any hazard classification according to the Australian National Occupational Health and Safety Commission [NOHSC(1008:2004)].

**Classification:** Not applicable.

**Risk Phrases:** Not applicable.

**Safety Phrases:** Not applicable.

**Symbol:** Not applicable.

**POISONS SCHEDULE NUMBER:** Not applicable.

### ADDITIONAL JAPANESE REGULATIONS:

**JAPANESE ENCS:** The constituents in this product's solutions are on the ENCS Inventory as indicated in composition tables in Section 3 (Composition and Information on Ingredients).

**POISONOUS AND DELETERIOUS SUBSTANCES CONTROL LAW:** No constituent in this product's solutions is listed under the Poisonous and Deleterious Substances Control Law.

## 16. OTHER INFORMATION

**PREPARED BY:**

CHEMICAL SAFETY ASSOCIATES, Inc.  
PO Box 3519, La Mesa, CA 91944-3519  
800/441-3365 • 619/670-0609

**REVISION INFORMATION:** New

## 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 MAKs:** Federal Republic of Germany Maximum Concentration Values in the workplace. Exposure limits are given as TWA (Time-Weighted Average) or PEAK (short-term exposure) values.

**DFG MAK Germ Cell Mutagen Categories:** **1:** Germ cell mutagens that have been shown to increase the mutant frequency in the progeny of exposed humans. **2:** Germ cell mutagens that have been shown to increase the mutant frequency in the progeny of exposed mammals. **3A:** Substances that 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 that 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 that 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.

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

**NIC:** Notice of Intended Change.

### EXPOSURE LIMITS IN AIR (continued):

**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.

**PEL:** 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, 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 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. Mechanical irritation may occur. PII or Draize = 0. *Eye Irritation:* Essentially non-irritating, minimal effects clearing in < 24 hours. Mechanical irritation may occur. Draize = 0. *Oral Toxicity LD<sub>50</sub> Rat:* > 5000 mg/kg. *Dermal Toxicity LD<sub>50</sub> Rat or Rabbit:* > 2000 mg/kg. *Inhalation Toxicity 4-hrs LC<sub>50</sub> Rat:* > 20 mg/L. **1 Slight Hazard:** Minor reversible injury may occur; may irritate the stomach if swallowed; may defat the skin and exacerbate existing dermatitis. *Skin Irritation:* Slightly or mildly irritating. PII or Draize > 0 < 5. *Eye Irritation:* Slightly to mildly irritating, but reversible within 7 days. Draize > 0 ≤ 25. *Oral Toxicity LD<sub>50</sub> Rat:* > 500–5000 mg/kg. *Dermal Toxicity LD<sub>50</sub> Rat or Rabbit:* > 1000–2000 mg/kg. *Inhalation Toxicity LC<sub>50</sub> 4-hrs Rat:* > 2–20 mg/L. **2 Moderate Hazard:** Temporary or transitory injury may occur; prolonged exposure may affect the CNS. *Skin Irritation:* Moderately irritating; primary irritant; sensitizer. PII or Draize ≥ 5, with no destruction of dermal tissue. *Eye Irritation:* Moderately to severely irritating; reversible corneal opacity; corneal involvement or irritation clearing in 8–21 days. Draize = 26–100, with reversible effects. *Oral Toxicity LD<sub>50</sub> Rat:* > 50–500 mg/kg. *Dermal Toxicity LD<sub>50</sub> Rat or Rabbit:* > 200–1000 mg/kg. *Inhalation Toxicity LC<sub>50</sub> 4-hrs Rat:* > 0.5–2 mg/L.

## DEFINITIONS OF TERMS (Continued)

### HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

**HEALTH HAZARD (continued): 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 cause destruction of dermal tissue, skin burns, and 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 LD<sub>50</sub> Rat:* > 1–50 mg/kg. *Dermal Toxicity LD<sub>50</sub> Rat or Rabbit:* > 20–200 mg/kg. *Inhalation Toxicity LC<sub>50</sub> 4-hrs Rat:* > 0.05–0.5 mg/L. **4 Severe Hazard:** Life-threatening; major or permanent damage may result from single or repeated exposures; extremely toxic; irreversible injury may result from brief contact. *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 LD<sub>50</sub> Rat:* ≤ 1 mg/kg. *Dermal Toxicity LD<sub>50</sub> Rat or Rabbit:* ≤ 20 mg/kg. *Inhalation Toxicity LC<sub>50</sub> 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 requires considerable pre-heating, under all ambient temperature conditions before ignition and combustion can occur. This usually includes the following: 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) (i.e. OSHA Class IIIb); and 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 with air. This usually includes the following: Liquids having a flash-point at or above 37.8°C (100°F); Solid materials in the form of course 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); and Solids and semisolids (e.g. viscous and slow flowing as asphalt) 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. This usually includes the following: Liquids having a flash point below 22.8°C (73°F) and having a boiling point at or above 38°C (100°F) and those liquids having a flash point at or above 22.8°C (73°F) and below 37.8°C (100°F) (i.e. 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); and 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 that will burn readily. This usually includes the following: 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) (i.e. OSHA Class IA); and Materials that ignite spontaneously when exposed to air at a temperature of 54.4°C (130°F) or below (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. *Compressed Gases:* No Rating. *Pyrophorics:* No Rating. *Oxidizers:* No 0 rating. *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 violently. *Explosives:* Division 1.5 & 1.6 explosives. 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 oxidizers; 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 explosion 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 explosives. Explosive substances where the explosive effects 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.

### HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

**PHYSICAL HAZARD (continued): 2 (continued) Compressed Gases:** Pressurized and meet OSHA definition but < 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics:* No Rating. *Oxidizers:* Packing Group II oxidizers. 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. *Reactives:* Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure, but have a low potential (or low risk) 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 1.3 explosives. 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:* Packing Group I oxidizers. 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. *Unstable Reactives:* Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure and have a moderate potential (or moderate risk) to cause significant heat generation or explosion. **4 Water Reactivity:** Materials that react explosively with water without requiring heat or confinement. *Organic Peroxides:* Materials that are readily capable of detonation or explosive decomposition at normal temperature and pressures. *Explosives:* Division 1.1 & 1.2 explosives. Explosive substances that have a mass explosion hazard or have a projection hazard. A mass explosion is one that affects almost the entire load instantaneously. *Compressed Gases:* No Rating. *Pyrophorics:* Add to the definition of Flammability 4. *Oxidizers:* No 4 rating. *Unstable Reactives:* Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure and have a high potential (or high risk) to cause significant heat generation or explosion.

### 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 with an LC<sub>50</sub> for acute inhalation toxicity greater than 10,000 ppm. Dusts and mists with an LC<sub>50</sub> for acute inhalation toxicity greater than 200 mg/L. Materials with an LD<sub>50</sub> for acute dermal toxicity greater than 2000 mg/kg. Materials with an LD<sub>50</sub> for acute oral toxicity greater than 2000 mg/kg. Materials essentially non-irritating to the respiratory tract, eyes, and skin. **1** Materials that, under emergency conditions, can cause significant irritation. Gases and vapors with an LC<sub>50</sub> for acute inhalation toxicity greater than 5,000 ppm but less than or equal to 10,000 ppm. Dusts and mists with an LC<sub>50</sub> for acute inhalation toxicity greater than 10 mg/L but less than or equal to 200 mg/L. Materials with an LD<sub>50</sub> for acute dermal toxicity greater than 1000 mg/kg but less than or equal to 2000 mg/kg. Materials that slightly to moderately irritate the respiratory tract, eyes and skin. Materials with an LD<sub>50</sub> for acute oral toxicity greater than 500 mg/kg but less than or equal to 2000 mg/kg. **2** Materials that, under emergency conditions, can cause temporary incapacitation or residual injury. Gases with an LC<sub>50</sub> for acute inhalation toxicity greater than 3,000 ppm but less than or equal to 5,000 ppm. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than one-fifth its LC<sub>50</sub> for acute inhalation toxicity, if its LC<sub>50</sub> 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. Dusts and mists with an LC<sub>50</sub> for acute inhalation toxicity greater than 2 mg/L but less than or equal to 10 mg/L. Materials with an LD<sub>50</sub> for acute dermal toxicity greater than 200 mg/kg but less than or equal to 1000 mg/kg. 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. Materials whose LD<sub>50</sub> for acute oral toxicity is greater than 50 mg/kg but less than or equal to 500 mg/kg. **3** Materials that, under emergency conditions, can cause serious or permanent injury. Gases with an LC<sub>50</sub> for acute inhalation toxicity greater than 1,000 ppm but less than or equal to 3,000 ppm. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater its LC<sub>50</sub> for acute inhalation toxicity, if its LC<sub>50</sub> is less than or equal to 3000 ppm and that does not meet the criteria for degree of hazard 4. Dusts and mists with an LC<sub>50</sub> for acute inhalation toxicity greater than 0.5 mg/L but less than or equal to 2 mg/L. Materials with an LD<sub>50</sub> for acute dermal toxicity greater than 40 mg/kg but less than or equal to 200 mg/kg. Materials that are corrosive to the respiratory tract. Materials that are corrosive to the eyes or cause irreversible corneal opacity. Materials corrosive to the skin. Cryogenic gases that cause frostbite and irreversible tissue damage. Compressed liquefied gases with boiling points below -55°C (-66.5°F) that cause frostbite and irreversible tissue damage. Materials with an LD<sub>50</sub> for acute oral toxicity greater than 5 mg/kg but less than or equal to 50 mg/kg. **4** Materials that, under emergency conditions, can be lethal.

## DEFINITIONS OF TERMS (Continued)

### NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

**HEALTH HAZARD (continued): 4 (continued)** Gases with an LC<sub>50</sub> for acute inhalation toxicity less than or equal to 1,000 ppm. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than ten times its LC<sub>50</sub> for acute inhalation toxicity, if its LC<sub>50</sub> is less than or equal to 1000 ppm. Dusts and mists whose LC<sub>50</sub> for acute inhalation toxicity is less than or equal to 0.5 mg/L. Materials whose LD<sub>50</sub> for acute dermal toxicity is less than or equal to 40 mg/kg. Materials whose LD<sub>50</sub> for acute oral toxicity is less than or equal to 5 mg/kg.

**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 of NFPA 704. **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 of NFPA 704. 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 *Recommendations 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% 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 the 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). Most ordinary combustible materials. Solids containing greater than 0.5% by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent. **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 with 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% 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 (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 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% 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% 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 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.

### NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

**INSTABILITY HAZARD (continued): 1** Materials that in themselves are normally stable, but that can become unstable at elevated temperatures and pressures. Materials that have an 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 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 are sensitive to localized thermal or mechanical shock 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.

#### 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 vapor to form an ignitable mixture with air near the surface of the liquid or within the test vessel used. **Autoignition Temperature:** Minimum temperature of a solid, liquid, or gas required to initiate or cause self-sustained combustion in air with no other source of ignition. **LEL:** Lowest concentration of a flammable vapor or gas/air mixture that will ignite and burn with a flame. **UEL:** Highest concentration of a flammable vapor or gas/air mixture that will ignite and burn with a flame.

#### 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. **LD<sub>50</sub>:** Lethal Dose (solids & liquids) that kills 50% of the exposed animals. **LC<sub>50</sub>:** Lethal Concentration (gases) that kills 50% of the exposed animals. **ppm:** Concentration expressed in parts of material per million parts of air or water. **mg/m<sup>3</sup>:** Concentration expressed in weight of substance per volume of air. **mg/kg:** Quantity of material, by weight, administered to a test subject, based on their body weight in kg. **TDLo:** Lowest dose to cause a symptom. **TCLo:** Lowest concentration to cause a symptom. **TD<sub>0</sub>, LDLo, and LD<sub>0</sub>, or TC, TC<sub>0</sub>, LCLo, and LC<sub>0</sub>:** Lowest dose (or concentration) to cause lethal or toxic effects. **Cancer Information: IARC:** International Agency for Research on Cancer. **NTP:** National Toxicology Program. **RTECS:** Registry of Toxic Effects of Chemical Substances. 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.

#### ECOLOGICAL INFORMATION:

**EC:** Effect concentration in water. **BCF:** Bioconcentration Factor, which is used to determine if a substance will concentrate in life forms that consume contaminated plant or animal matter. **TLm:** Median threshold limit. **log K<sub>ow</sub> or log K<sub>oc</sub>:** Coefficient of Oil/Water Distribution is used to assess a substance's behavior in the environment.

#### REGULATORY INFORMATION:

##### U.S. and CANADA:

This section explains the impact of various laws and regulations on the material. **EPA:** U.S. Environmental Protection Agency. **ACGIH:** American Conference of Governmental Industrial Hygienists, a professional association that establishes exposure limits. **OSHA:** U.S. Occupational Safety and Health Administration. **NIOSH:** National Institute of Occupational Safety and Health, which is the research arm of OSHA. **WHMIS:** Canadian Workplace Hazardous Materials Information System. **DOT:** U.S. Department of Transportation. **TC:** Transport Canada. **SARA:** Superfund Amendments and Reauthorization Act. **DSL/NDL:** Canadian Domestic/Non-Domestic Substances List. **TSCA:** U.S. Toxic Substance Control Act. **CERCLA:** Comprehensive Environmental Response, Compensation, and Liability Act. Marine Pollutant status according to the DOT; CERCLA or Superfund; and various state regulations. This section also includes information on the precautionary warnings that appear on the material's package label.

##### EUROPE:

**EU:** European Union (formerly known as the EEC, European Economic Community). **EINECS:** European Inventory of Now-Existing Chemical Substances. **ARD:** European Agreement Concerning the International Carriage of Dangerous Goods by Road. **RID:** International Regulations Concerning the Carriage of Dangerous Goods by Rail.

##### AUSTRALIA:

**AICS:** Australian Inventory of Chemical Substances. **NOHSC:** National Occupational Health & Safety Code.

##### JAPAN:

**METI:** Ministry of Economy, Trade and Industry.