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. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

PRODUCT IDENTIFIER

TRADE NAME (AS LABELED): **TruSeq Small RNA Sample Prep**
CHEMICAL NAME/CLASS:
SYNONYMS:
DOCUMENT NUMBER: 15019892
PRODUCT USE: Sample Prep for Sequencing
SUPPLIER OF THE SAFETY DATA SHEET: **ILLUMINA, Inc.**
Address: 35861 Industrial Boulevard
Hayward, CA 94545
Business Phone: +1-800-809-ILMN (toll-free)
+1-800-809-4566 (toll-free)
+1-858-202-4566 (outside North America)
Emergency Phone: 1-858-202-4566 (North America)
+1-858-202-4566 (outside North America)
Email Address/Competent Person for MSDS: techsupport@illumina.com
AUSTRALIAN SUPPLIER/DISTRIBUTOR'S NAME:
Address:
Business Phone:
EUROPEAN SUPPLIER/ DISTRIBUTOR'S NAME:
Address:
Business Phone:
DATE OF PREPARATION: December 13, 2010
DATE OF REVISION: February 28, 2011

NOTE: ALL United States Occupational Safety and Health Administration Standard (29 CFR 1910.1200), U.S. State equivalent Standards, Canadian WHMIS [Controlled Products Regulations], EU Directives [67/548/EEC and subsequent amendments to the directive], European Union Regulations [(EC) 1272/2008 and subsequent amendments to the regulation], Global Harmonization Standard, Australian [NOHSC:2011 (2003)], and Japanese Industrial Standard (JIS Z 7250: 2005) required information is included in appropriate sections based on the U.S. ANSI Z400.1-2010 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 TruSeq Small RNA Sample Prep. This product consists of seventy-one 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.

GLOBAL HARMONIZATION AND EU CLP REGULATION (EC) 1272/2008 LABELING AND CLASSIFICATION: This product has been classified per CLP Regulation (EC) 1272/2008 and Japanese Industrial Standard Z 7251:2006.
Classification: Not applicable. Signal Word: Not applicable. Hazard Statement Codes: Not applicable.
Precautionary Statement Codes: Not applicable. Hazard Symbol/Pictogram: Not applicable.

EU/AUSTRALIAN LABELING AND CLASSIFICATION: This product has been classified per European Union Council Directive 67/548/EEC and subsequent Directives and 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/Precautionary Statements

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	EU Classification (67/548/EEC) GHS & EU Classification (1272/2008 EC)
COMPONENT 1: Code 1001913					
Water	7732-18-5	231-791-2	Not Applicable	Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.

See Section 16 for full text of Risk Phrases/Precautionary Statements

3. COMPOSITION AND INFORMATION ON INGREDIENTS (Continued)

CHEMICAL NAME	CAS #	EINECS#	ENCS#	% v/v	EU Classification (67/548/EEC) GHS & EU Classification (1272/2008 EC)
COMPONENT 2: Code 15003548					
Aliphatic Triol	Proprietary			45–55	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: 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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 3: Code LP#-ATP					
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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 4: Code LP#-HML					
Amino Hydroxymethyl Salt	Proprietary			1–5	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: 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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 5: Code 1000587					
Aliphatic Triol	Proprietary			45–55	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: 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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 6: Code 11318102					
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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 7: Code 1000585					
Water and Proprietary Constituents				Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 8: Code 1000584					
Aliphatic Triol	Proprietary			45–55	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: 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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 9: Code 1000571					
Sodium Salt	Proprietary			1–5	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Amino Hydroxymethyl Salt	Proprietary			1–5	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: 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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 10: Code LP#-STP					
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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 11: Code LP#-RSB					
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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 12: Code LP#-RTP					
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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 13: Code LP#-RA3					
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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 14: Code LP#-RA5					
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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.

See Section 16 for full text of Risk Phrases/Precautionary Statements

3. COMPOSITION AND INFORMATION ON INGREDIENTS (Continued)

CHEMICAL NAME	CAS #	EINECS#	ENCS#	% v/v	EU Classification (67/548/EEC) GHS & EU Classification (1272/2008 EC)
COMPONENT 15: Code LP#-RP1					
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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENTS 16–64: Codes LP#-RPI1–LP#-RPI48					
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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 65: Code GA#-GLY					
Starch	Proprietary		Not Listed	1–5	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: 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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 66: Code LP#-LAD					
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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 67: RESUSPENSION BUFFER					
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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 68: Code LP#-HRL					
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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 69: Code LP#-CRL					
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	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.

See Section 16 for full text of Risk Phrases/Precautionary Statements

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

4. FIRST-AID MEASURES

PROTECTION OF FIRST AID RESPONDERS: Rescuers should be taken for medical attention if necessary. Remove or cover gross contamination to avoid exposure to rescuers.

DESCRIPTION OF FIRST AID MEASURES: Contaminated individuals must seek medical attention if any adverse effect occurs. 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 20 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.

IMPORTANT SYMPTOMS AND EFFECTS: See Sections 3 (Hazard Identification) and 11 (Toxicological Information).

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

IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED: Treat symptoms and eliminate overexposure.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not flammable.

AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %): Not applicable.

5. FIRE-FIGHTING MEASURES (Continued)

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

UNSUITABLE EXTINGUISHING MEDIA: None known.

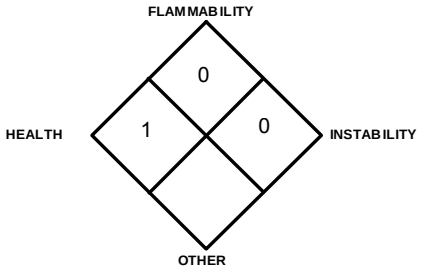
SPECIAL FIRE AND EXPLOSION HAZARDS: When involved in a fire, this product's components will decompose and produce irritating vapors and toxic gases (including carbon oxides, nitrogen oxides, sodium oxides, and hydrogen chloride).

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

ADVICE FOR FIREFIGHTERS: 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.

NFPA RATING



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

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS: In the event of a spill, clear the area and protect people. Trained personnel using pre-planned procedures should respond to uncontrolled releases. The atmosphere must have levels of components 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). Monitor area and confirm levels are bellow exposure limits given in Section 8 (Exposure Controls-Personal Protection), if applicable, before non-response personnel are allowed into the spill area.

PROTECTIVE EQUIPMENT:

Small Spills: For incidental spills (e.g., 1 bottle), wear lightweight gloves, a lab coat, and eye protection.

Large Spills: For large spills (e.g., a case of bottles), protective apparel should be Level C: triple-gloves (rubber gloves and nitrile gloves over latex gloves), chemical resistant suit and boots, hardhat, and Air-Purifying respirator with organic vapor cartridge. Self-Contained Breathing Apparatus must be selected if release occurs in confined or poorly ventilated areas or in situations in which the level of oxygen is below 19.5%.

METHODS FOR CLEANUP AND CONTAINMENT:

Small Spills: Absorb spilled liquid with paper towels.

Large Spills: 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.

All Spills: Decontaminate the area of the spill thoroughly using detergent and water. Place all spill residue in an appropriate container and seal. Do not mix with wastes from other materials. If necessary, discard contaminated response equipment or rinse with soapy water before returning such equipment to service. Dispose of in accordance with applicable international, national, state, and local procedures (see Section 13, Disposal Considerations).

ENVIRONMENTAL PRECAUTIONS: Prevent material from entering sewer or confined spaces, waterways, soil or public waters. Do not flush to sewer. For spills on water, contain, minimize dispersion and collect.

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

7. HANDLING and STORAGE

PRECAUTIONS FOR SAFE HANDLING: All employees who handle this material should be trained to handle it safely. As with all chemicals, avoid getting this product's components ON YOU or IN YOU. Open containers slowly on a stable surface. Avoid splashing or spraying this product's components. Avoid breathing vapors, mists, or sprays generated by this product's components. Do not eat or drink while handling this product's components. Wash thoroughly after handling this product's components.

CONDITIONS FOR SAFE STORAGE: Ensure containers of this product's components are properly labeled. Store vials as directed in the product insert. Store away from incompatible materials. Material should be stored in secondary containers, as appropriate. Post warning and "NO SMOKING" signs in storage and use areas, as appropriate. Have appropriate extinguishing equipment in the storage area (i.e., sprinkler system, portable fire extinguishers). Keep vials tightly closed when not in use. Inspect vials containing this product's components for leaks or damage. Read instructions provided with the product prior to use.

SPECIFIC END 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

EXPOSURE LIMITS/CONTROL PARAMETERS:

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^3	STEL mg/m^3	TWA mg/m^3	STEL mg/m^3	TWA mg/m^3	STEL mg/m^3	IDLH mg/m^3	mg/m^3
COMPONENT 2: Code 15003548									
Aliphatic Triol		10 (mist)	NE	15 (total dust) 5 (resp. frac.) Vacated 1989 PEL: 10 (total)	NE	NE	NE	NE	DFG MAKs: TWA = 50 (inhalable fraction) PEAK = 2•MAK 15 min. average value, 1-hr interval, 4 per shift Pregnancy Risk Group C
COMPONENT 4: Code LP#-HML									
Amino Hydroxymethyl Salt		NE	NE	NE	NE	NE	NE	NE	NE
COMPONENT 5: Code 1000587									
Aliphatic Triol	56-81-5	10 (mist)	NE	15 (total dust) 5 (resp. frac.) Vacated 1989 PEL: 10 (total)	NE	NE	NE	NE	DFG MAKs: TWA = 50 (inhalable fraction) PEAK = 2•MAK 15 min. average value, 1-hr interval, 4 per shift Pregnancy Risk Group C
COMPONENT 8: Code 1000584									
Aliphatic Triol		10 (mist)	NE	15 (total dust) 5 (resp. frac.) Vacated 1989 PEL: 10 (total)	NE	NE	NE	NE	DFG MAKs: TWA = 50 (inhalable fraction) PEAK = 2•MAK 15 min. average value, 1-hr interval, 4 per shift Pregnancy Risk Group C
COMPONENT 9: Code 1000571									
Sodium Salt		NE	NE	NE	NE	NE	NE	NE	NE
Amino Hydroxymethyl Salt		NE	NE	NE	NE	NE	NE	NE	NE
COMPONENT 66: Code GA#-GLY									
Starch		NE	NE	NE	NE	NE	NE	NE	NE

NE = Not Established. DSEN = May Cause Dermal Sensitization See Section 16 for Definitions of Other Terms Used

International Occupational Exposure Limits: Currently the following international exposure limits are in place for the some constituents of this product. Values given may not be the most current; individual country lists should be consulted to determine most current values available.

ALIPHATIC TRIOL:
Belgium: TWA = 10 mg/m^3, MAR 2002
Finland: TWA = 20 mg/m^3, SEP 2009
France: VME = 10 mg/m^3, FEB 2006
Korea: TWA = 10 mg/m^3 (mist), 2006

ALIPHATIC TRIOL (continued):
Mexico: TWA = 10 mg/m^3 (inhalable), 2004
The Netherlands: MAC-TGG = 10 mg/m^3, 2003
New Zealand: TWA = 10 mg/m^3 (mist), JAN 2002
Switzerland: MAK-W = 50 mg/m^3, KZG-W = 100 mg/m^3, DEC 2006

ALIPHATIC TRIOL (continued):
United Kingdom: TWA = 10 mg/m^3, 2005
In Argentina, Bulgaria, Colombia, Jordan, Singapore, Vietnam check ACGIH TLV

SODIUM SALT:
Russia: STEL = 5 mg/m^3, JUN 2003

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/body protection, and CR 13464:1999 for face/eye protection), 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), or standards of Japan (including JIS T 8116:2005 for glove selection, JIS T 8150:2006 for respiratory PPE, JIS T 8147:2003 for eye protectors, and JIS T 8030:2005 for protective clothing). Please reference applicable regulations and standards for relevant details.

EXPOSURE CONTROLS:

Ventilation and Engineering: 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.

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, Canadian CSA Standard Z94.4-02, European Standard EN 529:2005, EU member state standards, Australian Standard 1716-Respiratory Protective Devices and Australian Standard 1715-Selection, Use, and Maintenance of Respiratory Protective Devices, or Japanese Standard JIS T 8150:2006. 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.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

EXPOSURE CONTROLS (continued):

Eye Protection (continued): If necessary, refer to U.S. OSHA 29 CFR 1910.133, Canadian CSA Standard Z94.3-07, European Standard CR 13464:1999, Australian Standard 1337-Eye Protection for Industrial Applications and Australian Standard 1336-Recommended Practices for Eye Protection in the Industrial Environment, or Japanese Standard JIS T 8147:2003.

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 Australian Standard 2161-Industrial Safety Gloves and Mittens, European Standard CEN/TR 15419:2006, or Japanese Standard JIS T 8116:2005.

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 to OSHA Technical Manual (Section VII: Personal Protective Equipment), appropriate Canadian Standards, the European Standard CEN/TR 15419:2006, Australian Standard 3765-Clothing for Protection Against Hazardous Chemicals, or Japanese Standard JIS T 8030:2005. 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*.

9. PHYSICAL and CHEMICAL PROPERTIES

MOLECULAR WEIGHT (single entity only): Not applicable.
pH: 5.0–8.1
COLOR: Colorless.
ODOR: Odorless.
APPEARANCE: All components are clear.
PHYSICAL STATE: All components are liquids.
RELATIVE VAPOR DENSITY (air = 1): Not established.
VAPOR PRESSURE: Not established.
FLASH POINT: Not applicable.
FLAMMABILITY: Not flammable.
UPPER EXPLOSIVE LIMIT: Not established.
LOWER EXPLOSIVE LIMIT: Not established.
AUTOIGNITION TEMPERATURE: Not established.
DECOMPOSITION TEMPERATURE: Not established.
EXPLOSIVE PROPERTIES: Not explosive.
OXIDIZING PROPERTIES: Not oxidizers.
BOILING POINT: Not established.
EVAPORATION RATE (*n*-BuAc = 1): Not established.
MELTING/FREEZING POINT: Not established.
% VOLATILITY: Not established.
DENSITY/SPECIFIC GRAVITY: Not established.
ODOR THRESHOLD: Not established.
VISCOSITY: Not established.
SOLUBILITY: Not established.
PARTITION COEFFICIENT (*n*-octanol/water): Not established
HOW TO DETECT THIS SUBSTANCE: There are no unusual warning properties associated with these components.

10. STABILITY AND REACTIVITY

REACTIVITY/CHEMICAL STABILITY: No data available on reactivity. Stable at room temperature in sealed containers.

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

INCOMPATIBLE MATERIALS: Strong oxidizers, strong acids, some metals, substances that are incompatible with water.

POSSIBILITY OF HAZARDOUS POLYMERIZATION: No data available.

CONDITIONS TO AVOID: Contact with incompatible materials and excessive temperatures.

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.

SKIN CONTACT: Contact with the skin may cause mild irritation, which is alleviated upon rinsing.

EYE CONTACT: Contact with the 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 ingested, symptoms of such overexposure are described below. 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.

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.

11. TOXICOLOGICAL INFORMATION (Continued)

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

ALIPHATIC TRIOL:

TDLo (skin, pig) = 4698 mL/kg/58 weeks/intermittent; Sense Organs and Special Senses (Eye): changes in refraction; Behavioral: fluid intake
Skin Irritancy (rabbit) = 500 mg/24 hours; mild
Eye Irritancy (rabbit) = 126 mg; mild
Eye Irritancy (rabbit) = 500 mg/24 hours; mild
LC_{50} (inhalation, rat) > 570 mg/m^3/1 hour
LD_{50} (oral, rat) = 12600 mg/kg; general anesthetic, muscle weakness, Liver: other changes
LD_{50} (oral, mouse) = 4090 mg/kg
LD_{50} (oral, rabbit) = 27 g/kg
LD_{50} (oral, guinea pig) = 7750 mg/kg
LD_{50} (skin, rabbit) > 10 g/kg
LD_{50} (intraperitoneal, rat) = 4420 mg/kg; toxic psychosis; Cardiac; other changes; Kidney, Urethra, Bladder: other changes
LD_{50} (intraperitoneal, mouse) = 8700 mg/kg
LD_{50} (intravenous, rat) = 5566 mg/kg
LD_{50} (intravenous, mouse) = 4250 mg/kg
LD_{50} (intravenous, rabbit) = 53 g/kg
LD_{50} (subcutaneous, rat) = 100 mg/kg
LD_{50} (subcutaneous, mouse) = 91 mg/kg
TDLo (oral, rat) = 16800 mg/kg/28 days/continuous; Changes in adrenal weight
TDLo (oral, rat) = 100 mg/kg/male 1 day pre-mating; Reproductive: Fertility: post-implantation mortality
TDLo (oral, rat) = 96 g/kg/30 days/intermittent; Blood: changes in leukocyte (WBC) count, changes in serum composition (e.g. TP, bilirubin, cholesterol); Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: true cholinesterase
TDLo (oral, mouse) = 560 g/kg/8 weeks/continuous; Structural or functional change in trachea or bronchi
TDLo (intratesticular, rat) = 280 mg/kg/male 2 days pre-mating; Reproductive Effects: spermato-genesis, testes, epididymis, sperm duct
TDLo (intratesticular, rat) = 1600 mg/kg/male 1 day pre-mating; Reproductive: Male fertility index
TDLo (intratesticular, rat) = 862 mg/kg/male 1 day pre-mating; Reproductive: Paternal Effects: spermatogenesis
TDLo (intratesticular, monkey) = 119 mg/kg/male 1 day pre-mating; Reproductive: Paternal Effects: spermatogenesis, testes, epididymis, sperm duct
DNA Inhibition (human, lymphocyte) = 200 mmol/L
Cytogenetic Analysis (oral, rat) = 1 g/kg

STARCH:

TDLo (Intrauterine–mouse) 20 mg/kg/female 2 days after conception; Reproductive: Maternal Effects: uterus, cervix, vagina; Fertility: pre-implantation mortality (e.g. reduction in number of implants per female; total number of implants per corpora lutea)

SODIUM SALT:

TDLo (Oral-Human) 12,357 mg/kg/23 days-continuous: Vascular: BP elevation not characterized in autonomic section
TDLo (Oral-Man) 1 gm/kg: Sense Organs and Special Senses (Eye): effect, not otherwise specified; Behavioral: changes in motor activity (specific assay); Nutritional and Gross Metabolic: changes in sodium
TDLo (Intraplacental-Woman) 27 mg/kg: female 15 week(s) after conception: Reproductive: Fertility: abortion
LD_{50} (Oral-Rat) 3000 mg/kg
LD_{50} (Oral-Mouse) 4 gm/kg
LD_{50} (Intraperitoneal-Rat) 2600 mg/kg
LD_{50} (Intraperitoneal-Mouse) 2602 mg/kg
LD_{50} (Subcutaneous-Mouse) 3 gm/kg
LD_{50} (Intravenous-Mouse) 645 mg/kg
LD_{50} (Intracervical-Mouse) 131 mg/kg
LDLo (Oral-Rabbit) 8 gm/kg
LDLo (Subcutaneous-Rat) 3500 mg/kg: Behavioral: irritability
LDLo (Subcutaneous-Guinea Pig) 2160 mg/kg
LDLo (Intraperitoneal-Rat) 3.72 gm/kg: Behavioral: tremor, convulsions or effect on seizure threshold
LDLo (Intravenous-Rabbit) 1.5 mg/kg

SODIUM SALT (continued):

LDLo (Intravenous-Rabbit) 1100 mg/kg: Behavioral: convulsions or effect on seizure threshold, muscle contraction or spasticity; Cardiac: other changes
LDLo (Intravenous-Guinea Pig) 300 mg/kg
LDLo (Intravenous-Dog) 2 gm/kg: Behavioral: somnolence (general depressed activity)
LDLo (Parenteral-Guinea Pig) 300 mg/kg
LDLo (Intraarterial-Guinea Pig) 300 mg/kg
TDLo (Oral-Rat) 1 mg/kg/24 hours: Biochemical: Metabolism (Intermediary): effect on Sodium-Potassium pump
TDLo (Oral-Rat) 1.43 mg/kg: Gastrointestinal: ulceration or bleeding from stomach
TDLo (Oral-Rat) 37,500 mg/kg/30 days-continuous: Vascular: BP elevation not characterized in autonomic section; Kidney/Ureter/Bladder: urine volume increased
TDLo (Oral-Rat) 12,500 mg/kg/10 days-continuous: Kidney/Ureter/Bladder: urine volume decreased, other changes in urine composition
TDLo (Oral-Rat) 37.5 gm/kg/10 days-continuous: Vascular: BP elevation not characterized in autonomic section Kidney/Ureter/Bladder: other, changes in urine composition
TDLo (Oral-Rat) 201.6 gm/kg/6 weeks-intermittent: Vascular: BP elevation not characterized in autonomic section
TDLo (Oral-Rat) 145 gm/kg: female 7 day(s) pre-mating 1-22 day(s) after conception: Reproductive: Effects on Newborn: delayed effects
TDLo (Oral-Rat) 56,400 mg/kg: female 5 day(s) pre-mating: 21 day(s) post-birth: Reproductive: Maternal Effects: postpartum; Effects on Newborn: biochemical and metabolic
TDLo (Intraperitoneal-Rat) 1710 mg/kg: female 13 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus), fetal death; Specific Developmental Abnormalities: musculoskeletal system
TDLo (Intraperitoneal-Rat) 10 gm/kg: female 17-20 day(s) after conception: Reproductive: Effects on Newborn: behavioral
TDLo (Subcutaneous-Mouse) 1900 mg/kg: female 11 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetal death
TDLo (Subcutaneous-Mouse) 1900 mg/kg: female 10 day(s) after conception: Reproductive: Specific Developmental Abnormalities: musculoskeletal system
TDLo (Subcutaneous-Mouse) 2500 mg/kg: female 10 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)
TDLo (Subcutaneous-Mouse) 13,440 mg/kg: female 2-6 day(s) after conception: Reproductive: Fertility: abortion
TDLo (Subcutaneous-Rabbit) 0.04 mg/kg: Vascular: other changes; Skin and Appendages: dermatitis, irritative (after systemic exposure)
TDLo (Intravenous-Mouse) 2.1 mg/kg: Vascular: other changes; Blood: hemorrhage; Skin and Appendages: dermatitis, irritative (after systemic exposure)
TDLo (Intravenous-Rabbit) 0.04 mg/kg: Vascular: other changes; Blood: hemorrhage; Skin and Appendages: dermatitis, irritative (after systemic exposure)
TDLo (Intravenous-Dog) 375 mg/kg: Cardiac: EKG changes not diagnostic of specified effects

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH HAZARD	(BLUE)	1
FLAMMABILITY HAZARD	(RED)	0
PHYSICAL HAZARD	(YELLOW)	0

PROTECTIVE EQUIPMENT

EYES	RESPIRATORY	HANDS	BODY
	SEE SECTION 8		SEE SECTION 8

For Routine Use and Handling Applications

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

SODIUM SALT (continued):

TDLo (Parenteral-Rat) 10 mg/kg: female 1 day(s) pre-mating: Reproductive: Maternal Effects: ovaries, fallopian tubes
TDLo (Intrauterine-Rat) 500 mg/kg: female 4 day(s) after conception: Reproductive: Fertility: pre-implantation mortality (e.g. reduction in number of implants per female; total number of implants per corpora lutea)
TDLo (Intrauterine-Rat) 50 mg/kg: female 6 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants)
TDLo (Intrauterine-Monkey) 6 gm/kg: female 18 week(s) after conception: Reproductive: Fertility: abortion
TDLo (Intraplacental-Horse, Donkey) 480 mg/kg: female 45 day(s) after conception: Reproductive: Maternal Effects: other effects; Endocrine: estrogenic; Reproductive: Effects on Embryo or Fetus: fetal death
DNA Inhibition (Human Fibroblast) 125 mmol/L
Mutation Test Systems-Not Otherwise Specified (Bacteria-*Escherichia coli*) 150 mmol/L
Mutation Test Systems-Not Otherwise Specified (Oral-Rat) 400 mg/kg
Unscheduled DNA Synthesis (Oral-Rat) 16,800 mg/kg/4 weeks-continuous
Cytogenetic Analysis (Intraperitoneal-Rat) 2338 mg/kg
Cytogenetic Analysis (Hamster Ovary) 160 mmol/L
Cytogenetic Analysis (Hamster Lung) 7500 mg/L
Mutation in Microorganisms (Yeast-*Saccharomyces cerevisiae*) 2 mol/L
DNA Damage (Bacteria-*Salmonella typhimurium*) 10 gm/L/120 minutes
DNA Damage (Mouse Lymphocyte) 101 mmol/L
DNA Damage (Hamster Ovary) 275 mmol/L
Mutation in Mammalian Somatic Cells (Mouse Lymphocyte) 57,200 µmol/L
Mutation in Mammalian Somatic Cells (Mouse Cells-Not Otherwise Specified) 5000 mg/L/4 hours
DNA Repair (Bacteria-*Salmonella typhimurium*) 10 gm/L/120 minutes
Micronucleus Test (Hamster-Lung) 4 gm/L
Micronucleus Test (Oral-Rat) 2 pph/14 days
Micronucleus Test (Mouse Cells-Not Otherwise Specified) 0.5 pph/4 hours

CARCINOGENIC POTENTIAL OF COMPONENTS: The constituents in the solutions of this product listed by CAS# in Section 3 (Composition and Information on Ingredients) 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.

11. TOXICOLOGICAL INFORMATION (Continued)

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 Aliphatic Triol 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.

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 Aliphatic Triol 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 IN SOIL: This product has not been tested for mobility in soil. Data for some constituents of this product are available as follows:

ALIPHATIC TRIOL:

Based on an experimental log octanol/water partition coefficient of -1.76 and its water solubility, 1,220,000 mg/L at 5°C, soil adsorption coefficients for Aliphatic Triol can be estimated at 3 and 2, respectively, using regression-derived equations. The magnitude of these values indicate that Aliphatic Triol will display very high mobility in soil.

SODIUM SALT:

Water solubility = 37 g/ 100 mL @ 0°C; 39.12 g/100 ml of water @ 100°C; Log Kow = -3.0

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. Data for some constituents of this product are available as follows:

ALIPHATIC TRIOL:

If released to soil, Aliphatic Triol is expected to undergo rapid biodegradation under aerobic conditions. It is expected to display very high mobility in soil and it is not expected to significantly volatilize to the atmosphere. If released to water, Aliphatic Triol is expected to rapidly degrade under aerobic conditions. Biodegradation in seawater and under anaerobic conditions is also expected. Aliphatic Triol is not expected to bioconcentrate is fish and aquatic organisms nor is it expected to adsorb to sediment and suspended organic matter. Volatilization to the atmosphere is expected to be slower then for water itself. If released to the atmosphere, Aliphatic Triol may undergo a gas-phase oxidation with photochemically produced hydroxyl radicals with a half-life of 33 hrs. It may also undergo atmospheric removal by wet deposition processes.

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

ALIPHATIC TRIOL:

Based on an experimental log octanol/water partition coefficient of -1.76 and its water solubility, 1,220,000 mg/L at 5°C, bioconcentration factors for Aliphatic Triol can be estimated at 3 and 0.2, respectively, using regression-derived equations. The magnitude of these values indicate that bioconcentration of Aliphatic Triol in fish and aquatic organisms will not be significant. Log K_{OW} = -1.76.

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:

SODIUM SALT:

EC_{50} (*Daphnia magna* Water flea) 21 days = 1,480,000 µg/L (95% confidence limit: 1,180,000 to 1,840,000 µg/L); Conditions: freshwater; renewal; Effect: intoxication, immobile

EC_{50} (*Daphnia magna* Water flea) 21 days = 1,020,000 µg/L; Conditions: freshwater; renewal; Effect: reproduction, reproduction, general

EC_{50} (*Daphnia magna* Water flea) 48 hours = 402,600 µg/L (95% confidence limit: 340,700 to 469,200 µg/L); Conditions: freshwater; static; Effect: intoxication, immobile

EC_{50} (*Daphnia magna* Water flea) 24 hours = 402,600 µg/L (95% confidence limit: 340,700 to 469,200 µg/L); Conditions: freshwater; static; Effect: intoxication, immobile

EC_{50} (*Daphnia magna* Water flea) 64 hours = 3,680,000 µg/L; Conditions: freshwater; static; Effect: intoxication, immobile

EC_{50} (*Daphnia pulex* Water flea) 24 hr = 56.4 mM; Conditions: freshwater; static; Effect: intoxication, immobile

EC_{50} (*Lemna minor* Duckweed) 7 days = 4,880,000 µg/L (95% confidence limit: 3,950,000 to 6,020,000 µg/L); Conditions: freshwater; renewal; Effect: population, biomass

EC_{50} (*Ceriodaphnia dubia* Water flea) 48 hours = 2122.55 mg/L (95% confidence limit: 1493 to 2644 mg/L); Conditions: freshwater; Effect: intoxication, immobile

SODIUM SALT (continued):

EC_{50} (*Ceriodaphnia dubia* Water flea) 192 hours = (95% confidence limit: > 1500 to < 2000 mg/L); Conditions: freshwater; renewal; Effect: reproduction, progeny

LC_{50} (*Ceriodaphnia dubia* Water flea) 7 days = 280,000 µg/L; Conditions: freshwater; renewal

LC_{50} (*Ceriodaphnia dubia* Water flea) 192 hours = ~ 2000 mg/L; Conditions: freshwater; renewal; temp 25.6-26.8°C, pH 8.4 (8.3-8.5), hardness 102 mg/L CaCO3 (94-104 mg/L), salinity <1 ppt, alkalinity 80 mg/L CaCO3 (75-87 mg/L), conductivity 493 µmhos/cm (460-550 µmhos/cm), dissolved oxygen 8.6 mg/L (8.3-9.6 mg/L); Effect: mortality, survival

LC_{50} (*Ceriodaphnia dubia* Water flea) 48 hours = 1,960,000 µg/L (95% confidence limit: 1,770,000 to 2,330,000 µg/L); Conditions: freshwater; static

LC_{50} (*Ceriodaphnia dubia* Water flea) 24 hours = 3,380,000 µg/L (95% confidence limit: 3,080,000 to 3,540,000 µg/L); Conditions: freshwater; static

EC_{50} (*Danio rerio* Zebra danio, fertilized eggs) 205.5 mmol/L; Conditions: freshwater; static; Effect: Developmental endpoints: coagulation of the eggs, development of gastrulation, number of somites, development of organs, circulation, heartbeat, otolithanlage and pigmentation

LC_{50} (*Cyprinus carpio* common carp, fry) 0.5 hour = 21,500,000 µg/L; Conditions: static

LC_{50} (*Daphnia magna* Water flea) 48 hours = 81.19799 mmol/L; Conditions: freshwater; renewal

SODIUM SALT (continued):

LC_{50} (*Daphnia magna* Water flea) 4.2 days = 3,114,000 µg/L; Conditions: freshwater; static, temp 21-25°C

LC_{50} (*Daphnia magna* Water flea) 48 hours = 3,310,000 µg/L; Conditions: freshwater; static, temp 21-25°C

LC_{50} (*Daphnia magna* Water flea, 4th instar or adult) 24 hours = 3,412,000 µg/L; Conditions: freshwater; static

LC_{50} (*Daphnia magna*, age < 24 hr) 48 hours = 4,770,000 µg/L (95% confidence limit: 3,790,000 to 5,740,000 µg/L); Conditions: freshwater; static, pH 7.5-9.0, dissolved oxygen > 40%

LC_{50} (*Daphnia magna* Water flea) 50 hours = 5,874,000 µg/L; Conditions: freshwater; static, temp 21-25°C

LC_{50} (*Daphnia magna* Water flea, age < 24 hr) 24 hours = 6,380,000 µg/L (95% confidence limit: 6,160,000 to 6,600,000 µg/L); Conditions: freshwater; static, pH 7.5-9.0, dissolved oxygen >4 0%

LC_{50} (*Daphnia magna* Water flea) 25 hours = 6,447,000 µg/L; Conditions: freshwater; static, temp 21-25°C

LC_{50} (*Daphnia pulex* Water flea) 48 hours = 1.47 g/L (95% confidence limit: 1.38 to 1.57 g/L); Conditions: freshwater; static, pH 7.83, hardness 92.8 mg/L CaCO3, alkalinity 60.8 mg/L CaCO3, conductivity 314 µmhos/cm, dissolved oxygen 8.7 mg/L

12. ECOLOGICAL INFORMATION (Continued)

ECOTOXICITY (continued):

SODIUM SALT (continued):

- LC_{50} (*Daphnia pulex* Water flea) 48 hours = 3.05 g/L (95% confidence limit: 2.06 to 5.91 g/L); Conditions: freshwater; static, pH 7.47, alkalinity 74 mg/L CaCO3, conductivity 10001 µmhos/cm, dissolved oxygen 8.7 mg/L, organic carbon 27 mg/L
- LC_{50} (*Gambusia affinis* Western mosquitofish) 96 hours = 17,550,000 µg/L; Conditions: freshwater; static
- LC_{50} (*Gambusia affinis* Western mosquitofish) 24 hours = 18,100,000 µg/L; Conditions: freshwater; static
- LC_{50} (*Gambusia affinis* Western mosquitofish) 48 hours = 18,100,000 µg/L; Conditions: freshwater; static
- LC_{50} (*Gambusia holbrooki* Eastern mosquitofish) 96 hours = 11,540,000 µg/L (95% confidence limit: 11,290,000 to 11,800,000 µg/L); Conditions: freshwater; flow-through
- LC_{50} (*Lepomis macrochirus* Bluegill, wt 0.260 g wwgt) 96 hours = 5.84 g/L (95% confidence limit: 5.56 to 6.08 g/L); Conditions: freshwater; flow-through
- LC_{50} (*Lepomis macrochirus* Bluegill, size 5-9 cm, wt 1-9 g) 96 hours = 12,94,600 µg/L; Conditions: freshwater; static

SODIUM SALT (continued):

- LC_{50} (*Lepomis macrochirus* Bluegill, size 5.3-7.2 cm, wt 3.5-3.9 g) 96 hours = 12,946,000 µg/L; Conditions: freshwater; static
- LC_{50} (*Oncorhynchus mykiss* Rainbow trout, eggs) 96 hours = 6094 mg/L (95% confidence limit: 4747 to 7824 mg/L); Conditions: freshwater; flow-through, pH 7.65, hardness 46 mg/L CaCO3, alkalinity 42 mg/L CaCO3, conductivity 91 µS/cm, dissolved oxygen 10.8 mg/L
- LC_{50} (*Oncorhynchus mykiss* Rainbow trout, size 15-20 cm tl) 24 hours = 175 mOsm; Conditions: freshwater; static
- LC_{50} (*Pimephales promelas* Fathead minnow, wt 0.217 g wwgt) 96 hours = 6.57 g/L (95% confidence limit: 6.42 to 6.7 g/L); Conditions: freshwater; flow-through; Concentration: for 96 hr; Effect: mortality, survival
- LC_{50} (*Pimephales promelas* Fathead minnow) 96 hours = 6,390,000 µg/L (95% confidence limit: 6,020,000 to 7,070,000 µg/L); Conditions: freshwater; static
- LC_{50} (*Pimephales promelas* Fathead minnow) 48 hours = 6,510,000 µg/L (95% confidence limit: 6,090,000 to 7,070,000 µg/L); Conditions: freshwater; static

SODIUM SALT (continued):

- LC_{50} (*Lepomis macrochirus* Bluegill) 24 hours = 14,125,000 µg/L; Conditions: freshwater; static
- LC_{50} (*Pimephales promelas* Fathead minnow, size 27.2 mm tl, wt 0.24 g) 96 hours = 7,050,000 µg/L; Conditions: freshwater; renewal
- LC_{50} (*Pimephales promelas* Fathead minnow, size 27.2 mm tl, wt 0.24 g) 48 hours = 7,050,000 µg/L; Conditions: freshwater; renewal
- LC_{50} (*Pimephales promelas* Fathead minnow, size 27.6 mm tl, wt 0.26 g) 24 hours = 7,100,000 µg/L; Conditions: freshwater; renewal
- LC_{50} (*Pimephales promelas* Fathead minnow, size 22.8 mm tl, wt 0.19 g) 48 hours = 7,300,000 µg/L; Conditions: freshwater; renewal
- LC_{50} (*Pimephales promelas* Fathead minnow, size 24.2 mm tl, wt 0.21 g) 24 hours = 7,400,000 µg/L; Conditions: freshwater; renewal
- LC_{50} (*Pimephales promelas* Fathead minnow, size 26.4 mm tl, wt 0.24 g) 96 hours = 7,450,000 µg/L; Conditions: freshwater; renewal
- LC_{50} (*Pimephales promelas* Fathead minnow, size 22.8 mm tl, wt 0.19 g) 24 hours = 7,500,000 µg/L; Conditions: freshwater; renewal

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.

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

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

13. DISPOSAL CONSIDERATIONS

WASTE TREATMENT/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.

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.

EWC 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

This product is not classified under any jurisdiction as Dangerous Goods and has no UN Number, Hazard Class or Packing Group or Special Precautions for User.

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

TRANSPORT CANADA: This product is NOT classified as Dangerous Goods, per the Transportation of Dangerous Goods regulations.

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.

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE (UNECE): This product is NOT classified as dangerous goods, per the European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR).

AUSTRALIAN FEDERAL OFFICE OF ROAD SAFETY: This product is NOT dangerous goods, per the Code for the Transportation of Dangerous Goods by Road or Rail.

ENVIRONMENTAL HAZARDS: This product is neither environmentally hazardous according to the criteria of the UN Model Regulations (as reflected in the IMDG Code, ADR, RID, and ADN) nor a marine pollutant according to the IMDG Code.

TRANSPORT IN BULK ACCORDING TO ANNEX II OF MARPOL 73/78 AND THE IBC CODE: Not applicable.

15. REGULATORY INFORMATION

ADDITIONAL UNITED STATES REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The constituents in this product's solutions of 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: The constituents in the solutions of this product listed by CAS# in Section 3 (Composition and Information on Ingredients) are on the TSCA Inventory.

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.

ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL/NDSL INVENTORY STATUS: The constituents in the solutions of this product listed by CAS# in Section 3 (Composition and Information on Ingredients) are on the DSL Inventory.

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:

SAFETY, HEALTH, AND ENVIRONMENTAL REGULATIONS/LEGISLATION SPECIFIC FOR THE PRODUCT: Currently, there is no specific legislation pertaining to this product.

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

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.

STANDARD FOR THE UNIFORM SCHEDULING OF MEDICINES AND POISONS: 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

U.S. 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_2, or "alcohol" foam. IN CASE OF SPILL: Absorb spill with polypads and place in suitable container. Consult Material Safety Data Sheet for additional information.

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

Classification: Not applicable. Hazard Statements: Not applicable. Precautionary Statements: Not applicable.

EU LABELING/CLASSIFICATION FULL TEXT UNDER 67/548/EEC AND 2001/59/EC AUSTRALIAN NATIONAL OCCUPATION HEALTH AND SAFETY COMMISSION LABELING/CLASSIFICATION FULL TEXT:

Classification: Not applicable. Risk Phrases: Not applicable. Safety Phrases: Not applicable.

16. OTHER INFORMATION (Continued)

REVISION DETAILS: Three components added to Section 3. Entire MSDS updated to 2010 ANSI Standard and REACH requirements.

REFERENCES AND DATA SOURCES: Contact the supplier for information.

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

PREPARED BY: CHEMICAL SAFETY ASSOCIATES, Inc.
PO Box 1961, Hilo, HI 96721 • 800/441-3365 • 808/969-4846

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 of animals, or which produce mutagenic effects in somatic cells of mammals *in vivo* and have been shown to reach the germ cells in an active form. **3B:** Substances 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.

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 a 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.

WEEL: Workplace Environmental Exposure Limits from the AIHA.

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_{50} Rat*: > 5000 mg/kg. *Dermal Toxicity LD_{50} Rat or Rabbit*: > 2000 mg/kg. *Inhalation Toxicity 4-hrs LC_{50} 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.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

HEALTH HAZARD (continued): **1 (continued):** *Oral Toxicity LD_{50} Rat*: > 500–5000 mg/kg. *Dermal Toxicity LD_{50} Rat or Rabbit*: > 1000–2000 mg/kg. *Inhalation Toxicity LC_{50} 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_{50} Rat*: > 50–500 mg/kg. *Dermal Toxicity LD_{50} Rat or Rabbit*: > 200–1000 mg/kg. *Inhalation Toxicity LC_{50} 4-hrs Rat*: > 0.5–2 mg/L. **3** Serious Hazard: Major injury likely unless prompt action is taken and medical treatment is given; high level of toxicity; corrosive. *Skin Irritation*: Severely irritating and/or corrosive; may 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_{50} Rat*: > 1–50 mg/kg. *Dermal Toxicity LD_{50} Rat or Rabbit*: > 20–200 mg/kg. *Inhalation Toxicity LC_{50} 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_{50} Rat*: ≤ 1 mg/kg. *Dermal Toxicity LD_{50} Rat or Rabbit*: ≤ 20 mg/kg. *Inhalation Toxicity LC_{50} 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.

DEFINITIONS OF TERMS (Continued)

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

PHYSICAL HAZARD (continued): **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. *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_{50} for acute inhalation toxicity greater than 10,000 ppm. Dusts and mists with an LC_{50} for acute inhalation toxicity greater than 200 mg/L. Materials with an LD_{50} for acute dermal toxicity greater than 2000 mg/kg. Materials with an LD_{50} 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_{50} for acute inhalation toxicity greater than 5,000 ppm but less than or equal to 10,000 ppm. Dusts and mists with an LC_{50} for acute inhalation toxicity greater than 10 mg/L but less than or equal to 200 mg/L. Materials with an LD_{50} 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_{50} 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_{50} 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_{50} for acute inhalation toxicity, if its LC_{50} 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_{50} for acute inhalation toxicity greater than 2 mg/L but less than or equal to 10 mg/L. Materials with an LD_{50} 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_{50} 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_{50} 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_{50} for acute inhalation toxicity, if its LC_{50} 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_{50} for acute inhalation toxicity greater than 0.5 mg/L but less than or equal to 2 mg/L. Materials with an LD_{50} 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_{50} 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. Gases with an LC_{50} 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_{50} for acute inhalation toxicity, if its LC_{50} is less than or equal to 1000 ppm. Dusts and mists whose LC_{50} for acute inhalation toxicity is less than or equal to 0.5 mg/L.

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

HEALTH HAZARD (continued): **4 (continued):** Materials whose LD_{50} for acute dermal toxicity is less than or equal to 40 mg/kg. Materials whose LD_{50} 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 according 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 according 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. **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.

DEFINITIONS OF TERMS (Continued)

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_{50}: Lethal Dose (solids & liquids) that kills 50% of the exposed animals. LC_{50}: 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^3: 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. TDo, LDLo, and LDo, or TC, TCo, LCLo, and LCo: 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. $\log K_{OW}$ or $\log K_{OC}$: Coefficient of Oil/Water Distribution is used to assess a substance's behavior in the environment.

REGULATORY INFORMATION: This section explains the impact of various laws and regulations on the material.

U.S.:

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. DOT: U.S. Department of Transportation. TC: Transport Canada. SARA: Superfund Amendments and Reauthorization Act. 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.

CANADA:

WHMIS: Canadian Workplace Hazardous Materials Information System. TC: Transport Canada. DSL/NDSL: Canadian Domestic/Non-Domestic Substances List.

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.