

Illumina Doc. #15029301, Rev. A	Page 1 of 15
EFFECTIVE:	10/12/2011
SUPERSEDES:	N/A

# MATERIAL SAFETY DATA SHEET

## Illumina, Inc.

Prepared to U.S. OSHA, CMA, ANSI, Canadian WHMIS, European Union, Australian NOHSC, Japanese Industrial, and Global Harmonization 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):

CHEMICAL NAME/CLASS:

SYNONYMS:

DOCUMENT NUMBER:

PRODUCT USE:

**MiSeq Sequencing System**

Mixture

None

15029301

DNA Sequencing

##### SUPPLIER OF THE SAFETY DATA SHEET

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DATE OF PREPARATION:

September 1, 2011

DATE OF REVISION:

New

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 Illumina Sequencing Reagents. This product consists of fifteen 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.

MS#-LDR1 Solution:

Classification: Reproductive Toxicant Category 1B. Signal Word: Danger

Hazard Statement Codes: H360

Precautionary Statement Codes: P201, P202, P281, P308 + P313, P405, P501

Hazard Symbol/Pictogram: GHS08



All Other Solutions:

Classification: Not applicable.

Signal Word: Not applicable.

Hazard Statement Codes: Not applicable.

Precautionary Statement Codes: Not applicable.

Hazard Symbol/Pictogram: Not applicable.

**EU 67/548/EEC /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)].

MS#-LDR1 Solution:

Classification: Toxic to Reproduction, Category 2. Risk Phrases: R61

Symbol:



All Other Solutions:

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:** MS#-LDR1 Solution: This solution is a clear, colorless liquid with a mildly sulfurous odor. All Other Solutions: These solutions are clear, colorless, odorless liquids. **Health Hazards:** MS#-LDR1 Solution: The Aliphatic Amide constituent of this component is considered toxic to reproduction. All Other Solutions: The chief hazard in event of overexposure is the potential for irritation of contaminated skin or eyes. **Flammability Hazards:** All Other Solutions: These solutions present no significant fire hazards.

## 2. HAZARD IDENTIFICATION (Continued)

**EMERGENCY OVERVIEW (continued):** **Reactivity Hazards:** These solutions are 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 #	European EINECS#	Japanese ENCS#	Australian AICS	% v/v	EU Classification (67/548/EEC) GHS & EU Classification (1272/2008 EC)
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### COMPONENTS 1–3: Codes MS#-HP10, MS#-HP11, and MS#-HP12

Sodium Salt	Proprietary	Listed	Listed	Listed	1–5	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable
Water and other trace constituents.					Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable

### COMPONENT 4: Code MS#-LPM

Water and other trace constituents.					Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable
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### COMPONENT 5: Code MS#-LDR1

Aliphatic Amide	Proprietary	Listed	Listed	Listed	90–100	EU 67/548 Classification: Toxic to Reproduction Cat. 2 Risk Phrases: R61 Symbol: T GHS & EU 1272/2008 Classification: Reproduction Toxicity Cat. 1B Hazard Statement Codes: H360D Pictogram(s): GHS08
Other trace constituents.					Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable

### COMPONENT 6: Code MS#-SRE

Aliphatic Triol Hydrochloride	Proprietary	Listed	Listed	Listed	10–20	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable
Sodium Salt	Proprietary	Listed	Listed	Listed	1–5	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable
Water and other constituents.					Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable

### COMPONENT 7: Code MS#-PR2

Water and other trace constituents.					Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable
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### COMPONENT 8: Code MS#-HT1

Sodium Salt	Proprietary	Listed	Listed	Listed	1–5	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable
Water and other trace constituents.					Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable

### COMPONENT 9: Code MS#-RMF

Disaccharide	Proprietary	Listed	NE	Listed	7–13	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable
Water and other trace constituents.					Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable

### COMPONENTS 10–11: Codes MS#-LMX1 and MS#-LMX2

Disaccharide	Proprietary	Listed	NE	Listed	7–13	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable
Water and other trace constituents.					Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable

### COMPONENT 12: Code MS#-AMX1

Water and other trace constituents.					Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable
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### COMPONENT 13: Code MS#-AMX2

Carboxymethyl Hydroxide Monohydrate	Proprietary	Listed	NE	Listed	20–30	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable
Aliphatic Sulfoxide	Proprietary	Listed	Listed	Listed	1–5	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable
Water and other trace constituents.					Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable

### COMPONENT 14: Code MS#-CMF

Aliphatic Triol	Proprietary	Listed	Listed	Listed	1–5	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable
Water and other trace constituents.					Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable

See Section 16 for full text of Ingredient Risk Phrases and Hazard Statements. All trace constituents present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens).

### 3. COMPOSITION AND INFORMATION ON INGREDIENTS (Continued)

CHEMICAL NAME	CAS #	European EINECS#	Japanese ENCS#	Australian AICS	% v/v	EU Classification (67/548/EEC) GHS & EU Classification (1272/2008 EC)
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#### COMPONENT 15: Code MS#-IMF

Water and other trace constituents.	Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable GHS & EU 1272/2008 CLASSIFICATION: Not Applicable
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See Section 16 for full text of Ingredient Risk Phrases and Hazard Statements. All trace constituents present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens).

## 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.

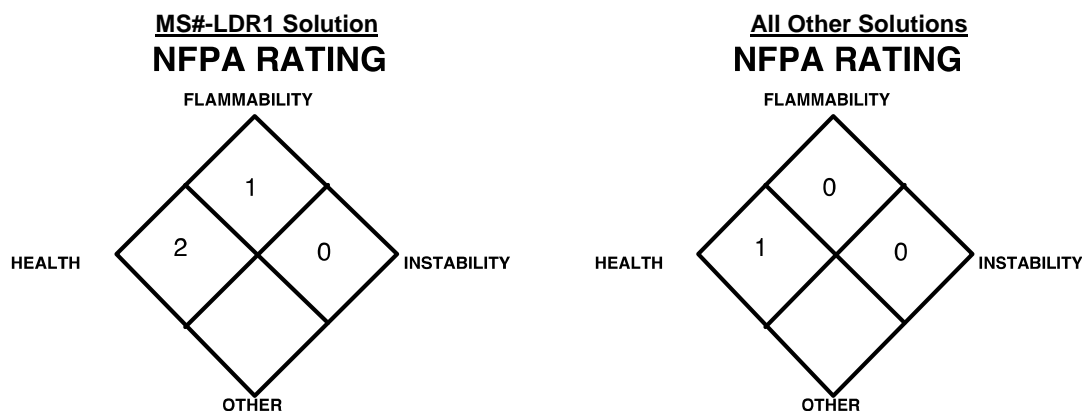
**Ingestion:** If this product is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. DO NOT INDUCE VOMITING unless directed by medical personnel. Have contaminated individual rinse mouth with water. Never induce vomiting or give diluents (milk or water) to someone who is 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



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

#### FLASH POINT:

Aliphatic Amide Solution: 154°C (310°F)

All Other Solutions: Not flammable.

#### AUTOIGNITION TEMPERATURE:

Aliphatic Amide Solution: Not established.

All Other Solutions: Not applicable.

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

Aliphatic Amide Solution: (LEL): Not established. (UEL): Not established.

All Other Solutions: (LEL): Not applicable. (UEL): Not applicable.

**FIRE EXTINGUISHING MEDIA:** 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:** Halon extinguishers should not be used for fires involving this product.

## 5. FIRE-FIGHTING MEASURES (Continued)

### SPECIAL FIRE AND EXPLOSION HAZARDS:

Aliphatic Amide Solution: This component is combustible and considered toxic to reproduction. When involved in a fire, this component will decompose and produce irritating vapors and toxic gases (including carbon oxides, dimethyl amine, hydrogen sulfide, phosphine, cyanides, hydrogen chloride, and phosphorous, sodium and nitrogen oxides).

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

ADVICE FOR FIREFIGHTERS: Do not use halogenated extinguishing media. 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.

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## 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. Avoid generating airborne dusts, mists, or sprays. Eliminate all sources of ignition before cleanup begins. Use non-sparking tools. 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 below 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 polypads or other suitable absorbent material.

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.

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## 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. Containers should be separated from oxidizing materials by a minimum distance of 20 ft. or by a barrier of non-combustible material at least 5 ft. high having a fire-resistance rating of at least 0.5 hours. Storage areas should be made of fire resistant materials. 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. Refer to NFPA 30, *Flammable and Combustible Liquids Code*, for additional information on storage.

SPECIFIC END USE(S): This product is for use in laboratory biological research. Follow 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:

**Workplace/Occupational Exposure Limits:** 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>

#### COMPONENTS 1–3: Codes MS#-HP10, MS#-HP11, and MS#-HP12

Sodium Salt	Proprietary	NE	NE	NE	NE	NE	NE	NE	NE
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#### COMPONENT 5: Code MS#-LDR1

Aliphatic Amide	Proprietary	10 (skin)	NE	10 (skin)	NE	NE	NE	NE	DFG MAK: Skin
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#### COMPONENT 6: Code MS#-SRE

Aliphatic Triol Hydrochloride	Proprietary	NE	NE	NE	NE	NE	NE	NE	NE
Sodium Salt	Proprietary	NE	NE	NE	NE	NE	NE	NE	NE

#### COMPONENT 8: Code MS#-HT1

Sodium Salt	Proprietary	NE	NE	NE	NE	NE	NE	NE	NE
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#### COMPONENT 9: Code MS#-RMF

Disaccharide	Proprietary	NE	NE	NE	NE	NE	NE	NE	NE
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#### COMPONENTS 10–11: Codes MS#-LMX1 and MS#-LMX2

Disaccharide	Proprietary	NE	NE	NE	NE	NE	NE	NE	NE
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#### COMPONENT 13: Code MS#-AMX2

Carboxymethyl Hydroxide Monohydrate	Proprietary	NE	NE	NE	NE	NE	NE	NE	NE
Aliphatic Sulfoxide	Proprietary	NE	NE	NE	NE	NE	NE	NE	DFG MAK: TWA = 160 PEAK = 2•MAK 15 min, average value, 1-hr interval, 4 per shift Pregnancy Risk Group D Danger of cutaneous absorption AIHA WEEL: TWA = 250 ppm

#### COMPONENT 14: Code MS#-CMF

Aliphatic Triol	Proprietary	NE	NE	NE	NE	NE	NE	NE	NE
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NE = Not Established.

See Section 16 for Definitions of Other Terms Used

**International Occupational Exposure Limits:** In addition to the exposure limit values cited in this section, other exposure limits have been established by various countries for the components of this product. The exposure limits given may not be the most current; individual country authorities should be contacted to check on more current limits.

#### ALIPHATIC SULFOXIDE:

Denmark: TWA = 100 ppm (tentative), OCT 2002  
Finland: TWA = 50 ppm, Skin, SEP 2009  
The Netherlands: MAC-TGG = 150 mg/m<sup>3</sup>, Skin, 2003  
Russia: STEL = 20 mg/m<sup>3</sup>, JUN 2003  
Sweden: TWA = 50 ppm (150 mg/m<sup>3</sup>); STEL = 150 ppm (500 mg/m<sup>3</sup>), Skin, JUN 2005  
Switzerland: MAK-W = 50 ppm (160 mg/m<sup>3</sup>), Skin, DEC 2006

#### ALIPHATIC AMIDE:

Australia: TWA = 10 ppm (18 mg/m<sup>3</sup>), JUL 2008  
Belgium: TWA = 10 ppm (18 mg/m<sup>3</sup>), Skin, MAR 2002  
Denmark: TWA = 10 ppm (18 mg/m<sup>3</sup>), OCT 2002  
Finland: TWA = 10 ppm (19 mg/m<sup>3</sup>), STEL = 20 ppm (37 mg/m<sup>3</sup>), Skin, SEP 2009  
France: VME = 20 ppm (30 mg/m<sup>3</sup>), FEB 2006

#### ALIPHATIC AMIDE (continued):

Korea: TWA = 10 ppm (15 mg/m<sup>3</sup>), skin, 2006  
Mexico: TWA = 20 ppm (30 mg/m<sup>3</sup>); STEL = 30 ppm (45 mg/m<sup>3</sup>), 2004  
The Netherlands: MAC-TGG = 16 mg/m<sup>3</sup>, 2003  
New Zealand: TWA = 10 ppm (18 mg/m<sup>3</sup>), skin, JAN 2002  
Norway: TWA = 10 ppm (18 mg/m<sup>3</sup>), JAN 1999  
Russia: STEL = 3 mg/m<sup>3</sup>, JUN 2003  
Sweden: TWA = 10 ppm (20 mg/m<sup>3</sup>); STEL = 15 ppm (30 mg/m<sup>3</sup>), Skin, JUN 2005  
Switzerland: MAK-W = 10 ppm (18 mg/m<sup>3</sup>), Skin, DEC 2006  
United Kingdom: TWA = 20 ppm (37 mg/m<sup>3</sup>); STEL = 30 ppm, 2005  
In Argentina, Bulgaria, Colombia, Jordan, Singapore, Vietnam check ACGIH TLV

#### SODIUM SALT:

Russia: STEL = 5 mg/m<sup>3</sup>, JUN 2003

#### DISACCHARIDE:

Belgium: TWA = 10 mg/m<sup>3</sup>, MAR 2002  
France: VME = 10 mg/m<sup>3</sup>, FEB 2006  
Korea: TWA = 10 mg/m<sup>3</sup>, 2006  
Mexico: TWA = 10 mg/m<sup>3</sup>; STEL = 20 mg/m<sup>3</sup>, 2004  
The Netherlands: MAC-TGG = 10 mg/m<sup>3</sup>, 2003  
New Zealand: TWA = 10 mg/m<sup>3</sup> (inspirable dust), JAN 2002  
United Kingdom: TWA = 10 mg/m<sup>3</sup>; STEL = 20 mg/m<sup>3</sup>, 2005  
In Argentina, Bulgaria, Colombia, Jordan, Singapore, Singapore, Vietnam check ACGIH TLV

#### ALIPHATIC TRIOL:

Russia: STEL = 5 mg/m<sup>3</sup>, JUN 2003

### ENGINEERING CONTROLS:

**Ventilation:** 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.

**PERSONAL PROTECTIVE EQUIPMENT:** The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132), 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.



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

### PERSONAL PROTECTIVE EQUIPMENT (continued):

**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 per regulatory authorities. 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, appropriate country regulations for eye protective equipment.

**Hand Protection:** Wear butyl rubber, neoprene, or nitrile rubber or latex gloves for routine use. If necessary, refer to appropriate country regulations for hand protection.

**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 U.S. OSHA Technical Manual (Section VII: Personal Protective Equipment), appropriate individual country standards. 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* and appropriate individual country standards.

## 9. PHYSICAL and CHEMICAL PROPERTIES

The following information is component specific.

### ODOR:

**MS#-LDR1 Solution:** Mildly sulfurous odor.

**All Other Solutions:** Odorless.

### HOW TO DETECT THESE SUBSTANCES:

**MS#-LDR1 Solution:** The odor may act as a warning property associated with these liquids.

**All Other Solutions:** There are no unusual warning properties associated with these components.

The following information applies to all components, in general.

**MOLECULAR WEIGHT (single entity only):** Not applicable.

**COLOR:** Colorless.

**VISCOSITY:** Not established.

**APPEARANCE:** Clear.

**PHYSICAL STATE:** Liquid.

**BOILING POINT:** Not established.

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

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

**VAPOR PRESSURE:** Not established.

**FLASH POINT:**

**FLAMMABILITY:**

**Aliphatic Amide Solution:** 154°C (310°F)

**All Other Solutions:** Not flammable.

**Aliphatic Amide Solution:** Combustible.

**All Other Solutions:** Not flammable.

**UPPER EXPLOSIVE LIMIT:** Not established.

**LOWER EXPLOSIVE LIMIT:** Not established.

**AUTOIGNITION TEMPERATURE:** Not established.

**DECOMPOSITION TEMPERATURE:** Not established.

**EXPLOSIVE PROPERTIES:** Not applicable.

**OXIDIZING PROPERTIES:** Not applicable.

**EVAPORATION RATE (n-BuAc = 1):** Not established.

**% VOLATILITY:** Not established.

**DENSITY/SPECIFIC GRAVITY:** Not established.

**ODOR THRESHOLD:** Not established.

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

**SOLUBILITY IN WATER:** Completely soluble.

**pH:** 6-10

**PARTITION COEFFICIENT (n-octanol/water):** Not established.

## 10. STABILITY AND REACTIVITY

**REACTIVITY/CHEMICAL STABILITY:** Stable at room temperature in sealed containers. This product is not expected to be reactive.

**POSSIBILITY OF HAZARDOUS POLYMERIZATION:** Will not occur.

**CONDITIONS TO AVOID:** Mixing with incompatible chemicals or as given above.

### INCOMPATIBLE MATERIALS:

**MS#-LDR1 Solution:** Karl Fischer reagent (mixture of toluene, pyridine and sulfur trioxide), strong oxidizers, strong acids, some metals, substances that are incompatible with water.

**All Other Solutions:** Strong oxidizers, strong acids, some metals and substances which are incompatible with water.

### HAZARDOUS DECOMPOSITION PRODUCTS:

**Combustion:** Carbon oxides, dimethyl amine, hydrogen sulfide, phosphine, cyanides, hydrogen chloride, and phosphorous, sodium and nitrogen oxides.

**Hydrolysis:** None known.



## 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, in this section.

## 11. TOXICOLOGICAL INFORMATION (Continued)

### MS#-LDR1 SOLUTION

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM			
HEALTH HAZARD		(BLUE)	2
FLAMMABILITY HAZARD		(RED)	1
PHYSICAL HAZARD		(YELLOW)	0
PROTECTIVE EQUIPMENT			
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8
For Routine Industrial Use and Handling Applications			

### ALL OTHER SOLUTIONS

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 Industrial Use and Handling Applications			

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

#### INHALATION:

**MS#-LDR1 Solution:** Inhalation of vapors, mists, or sprays of these components will irritate the nose, throat, and lungs. Symptoms may include nausea, headache, and vomiting.

**All Other Solutions:** 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:

**MS#-LDR1 Solution:** Depending on the duration and concentration of overexposure, skin contact can irritate contaminated tissue. Symptoms of skin overexposure may include redness and discomfort.

**All Other Solutions:** Skin contact may cause mild irritation, which is alleviated upon rinsing.

#### EYE CONTACT:

**MS#-LDR1 Solution:** Depending on the duration and concentration of overexposure, eye contact can irritate contaminated tissue. Symptoms of eye overexposure may include redness, tearing, and pain.

**All Other Solutions:** Eye contact may cause mild irritation, which is alleviated upon rinsing.

#### SKIN ABSORPTION:

**MS#-LDR1 Solution:** The Aliphatic Amide constituent of these components can be absorbed through the skin and may cause adverse reproductive effects.

**All Other Solutions:** No constituents in these components are known to be absorbed via intact skin.

#### INGESTION:

Ingestion is not anticipated to be a significant route of exposure for the product's components.

**MS#-LDR1 Solution:** Ingestion may cause irritation, nausea, vomiting, and diarrhea.

**All Other 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.

#### HEALTH EFFECTS OR RISKS FROM EXPOSURE:

An Explanation in Lay Terms.

##### Acute:

**MS#-LDR1 Solution:** Inhalation of vapors, mists, or sprays of the Aliphatic Amide constituent of these components may cause nausea, headache, and vomiting. Depending on the duration and concentration of overexposure, skin and eye contact can irritate contaminated tissue. Aliphatic Amide can be absorbed through the skin and may cause adverse reproductive effects. Ingestion may cause adverse reproductive effects.

**All Other Solutions:** 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.

# 11. TOXICOLOGICAL INFORMATION (Continued)

## TARGET ORGANS:

### Acute:

**MS#-LDR1 Solution:** Eyes, skin, reproductive system.

**All Other Solutions:** 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).

### ALIPHATIC SULFOXIDE:

TDLo (Skin-Human) 1800 mg/kg: Lungs, Thorax, or Respiration: dyspnea, cyanosis; Blood: other changes  
 TDLo (Intravenous-Man) 606 mg/kg: Gastrointestinal: nausea or vomiting; Liver: jaundice, other or unclassified  
 Open Irritation Test (Skin-Rabbit) 10 mg/24 hours: Mild  
 Standard Draize Test (Skin-Rabbit) 500 mg/24 hours: Mild  
 Standard Draize Test (Skin-Rabbit) 100 mg: Mild  
 Standard Draize Test (Eye-Rabbit) 0.1 mL: Mild  
 Standard Draize Test (Eye-Rabbit) 100 mg: Mild  
 Standard Draize Test (Eye-Rabbit) 100 mg: Mild  
 Standard Draize Test (Eye-Rabbit) 500 mg/24 hours: Mild  
 LC<sub>50</sub> (Inhalation-Rat) > 1600 mg/m<sup>3</sup>/4 hours  
 LC<sub>50</sub> (Inhalation-Rat) > 2000 mg/m<sup>3</sup>/40 hours  
 LD<sub>50</sub> (Oral-Rat) 14,500 mg/kg: Sense Organs and Special Senses (Eye): hemorrhage, conjunctive irritation  
 LD<sub>50</sub> (Oral-Rat) 28,300 mg/kg: Behavioral: ataxia; Lungs, Thorax, or Respiration: respiratory depression  
 LD<sub>50</sub> (Oral-Rat) 14.5 g/kg: Sense Organs and Special Senses (Eye): effect, not otherwise specified; Vascular: regional or general arteriolar or venous dilation  
 LD<sub>50</sub> (Oral-Rat) 17,400 mg/kg  
 LD<sub>50</sub> (Oral-Mouse) 7920 mg/kg  
 LD<sub>50</sub> (Oral-Mouse) 21.4 g/kg: Behavioral: ataxia Lungs, Thorax, or Respiration: respiratory depression  
 LD<sub>50</sub> (Oral-Dog) > 10 g/kg  
 LD<sub>50</sub> (Oral-Chicken) 12 g/kg  
 LD<sub>50</sub> (Oral-Wild Bird Species) 100 mg/kg  
 LD<sub>50</sub> (Oral-Mammal-Species Unspecified) 21,400 mg/kg  
 LD<sub>50</sub> (Skin-Rat) 40,000 mg/kg  
 LD<sub>50</sub> (Skin-Mouse) 50,000 mg/kg  
 LD<sub>50</sub> (Intraperitoneal-Rat) 8200 mg/kg  
 LD<sub>50</sub> (Intraperitoneal-Mouse) 2500 mg/kg  
 LD<sub>50</sub> (Subcutaneous-Rat) 12 g/kg: Behavioral: changes in motor activity (specific assay); Lungs, Thorax, or Respiration: dyspnea  
 LD<sub>50</sub> (Subcutaneous-Mouse) 14 g/kg: Behavioral: changes in motor activity (specific assay); Lungs, Thorax, or Respiration: other changes; Kidney/Ureter/Bladder: hematuria  
 LD<sub>50</sub> (Intravenous-Rat) 5360 mg/kg: Behavioral: tremor, muscle weakness: Lungs, Thorax, or Respiration: dyspnea  
 LD<sub>50</sub> (Intravenous-Rat) 5360 mg/kg: Behavioral: tremor, convulsions or effect on seizure threshold; Lungs, Thorax, or Respiration: dyspnea  
 LD<sub>50</sub> (Intravenous-Mouse) 5750 mg/kg: Behavioral: tremor, convulsions or effect on seizure threshold; Lungs, Thorax, or Respiration: dyspnea  
 LD<sub>50</sub> (Intravenous-Mouse) 3100 mg/kg  
 LD<sub>50</sub> (Intravenous-Mouse) 3100 mg/kg: Sense Organs and Special Senses (Eye): hemorrhage, conjunctive irritation  
 LD<sub>50</sub> (Intravenous-Dog) 2500 mg/kg: Cardiac: other changes; Kidney/Ureter/Bladder: hematuria, other changes  
 LD<sub>50</sub> (Unreported-Rat) 1300 mg/kg  
 LD<sub>50</sub> (Unreported-Mouse) 12 g/kg  
 LDLo (Oral-Guinea Pig) > 11 g/kg  
 LDLo (Intravenous-Cat) 200 mg/kg: Behavioral: altered sleep time (including change in righting reflex)  
 LDLo (Intraperitoneal-Guinea Pig) > 5500 mg/kg  
 TDLo (Oral-Rat) 1070 g/kg/13 weeks-intermittent: Blood: other changes; Nutritional and Gross Metabolic: weight loss or decreased weight gain; Related to Chronic Data: death  
 TDLo (Oral-Rat) 3,564,000 mg/kg/72 weeks-intermittent: Sense Organs and Special Senses (Eye): changes in refraction; Blood: normocytic anemia; Nutritional and Gross Metabolic: weight loss or decreased weight gain  
 TDLo (Oral-Rat) 59 g/kg/81 weeks-intermittent: Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Skin and Appendages: tumors  
 TDLo (Oral-Rat) 50,000 mg/kg: female 6-15 day(s) after conception: Reproductive: Maternal Effects: other effects; Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)

### ALIPHATIC SULFOXIDE (continued):

TDLo (Oral-Mouse) 10.91 mL/kg: Endocrine: hypoglycemia; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: phosphatases, Metabolism (Intermediary): other  
 TDLo (Oral-Mouse) 10 mL/kg: Behavioral: changes in motor activity (specific assay), analgesia; Biochemical: Metabolism (Intermediary): effect on inflammation or mediation of inflammation  
 TDLo (Oral-Mouse) 140 g/kg/10 weeks-intermittent: Nutritional and Gross Metabolic: weight loss or decreased weight gain; Related to Chronic Data: death  
 TDLo (Oral-Mouse) 65,340 mg/kg/66 weeks-intermittent: Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Blood: leukemia; Skin and Appendages: tumors  
 TDLo (Oral-Mouse) 16 mg/kg: female 5-9 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); Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus); Specific Developmental Abnormalities: musculoskeletal system  
 TDLo (Oral-Dog) 6570 mL/kg/2 years-intermittent: Sense Organs and Special Senses (Eye): effect, not otherwise specified; Blood: changes in erythrocyte (RBC) count; Biochemical: Metabolism (Intermediary): other proteins  
 TDLo (Oral-Dog) 528,000 mg/kg/2 years-intermittent: Sense Organs and Special Senses (Eye): changes in refraction; Gastrointestinal: nausea or vomiting; Kidney/Ureter/Bladder: urine volume increased  
 TDLo (Oral-Dog) 34 mL/kg/68 days-intermittent: Sense Organs and Special Senses (Eye): effect, not otherwise specified  
 TDLo (Oral-Monkey) 4864 g/kg/78 weeks-intermittent: Related to Chronic Data: death  
 TDLo (Oral-Monkey) 5,346,000 mg/kg/72 weeks-intermittent: Gastrointestinal: nausea or vomiting; Nutritional and Gross Metabolic: weight loss or decreased weight gain; Related to Chronic Data: death  
 TDLo (Oral-Hamster) 11 g/kg: female 7 day(s) after conception: Reproductive: Specific Developmental Abnormalities: Central Nervous System, musculoskeletal system  
 TDLo (Intraperitoneal-Rat) 200 mg/kg: Endocrine: other changes  
 TDLo (Intraperitoneal-Rat) 1000 mg/kg: Endocrine: other changes; Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol); Biochemical: Metabolism (Intermediary): other proteins  
 TDLo (Intraperitoneal-Rat) 750 mg/kg: Brain and Coverings: changes in surface EEG; Behavioral: changes in REM sleep (human)  
 TDLo (Intraperitoneal-Rat) 750 mg/kg: Brain and Coverings: changes in surface EEG  
 TDLo (Intraperitoneal-Rat) 3.5 mg/kg: Brain and Coverings: recordings from specific areas of CNS; Biochemical: Metabolism (Intermediary): other  
 TDLo (Intraperitoneal-Rat) 192 g/kg/4 weeks-intermittent: Blood: normocytic anemia; Nutritional and Gross Metabolic: weight loss or decreased weight gain; Related to Chronic Data: death  
 TDLo (Intraperitoneal-Rat) 3600 mg/kg/10 days-intermittent: Peripheral Nerve and Sensation: sensory change involving peripheral nerve  
 TDLo (Intraperitoneal-Rat) 12 mL/kg/3 days-intermittent: Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: hepatic microsomal mixed oxidase (dealkylation, hydroxylation, etc.)  
 TDLo (Intraperitoneal-Rat) 20 mL/kg/10 days-intermittent: Related to Chronic Data: death  
 TDLo (Intraperitoneal-Rat) 70 g/kg/7 days-intermittent: Related to Chronic Data: death  
 TDLo (Intraperitoneal-Rat) 56 g/kg: female 6-12 day(s) after conception: Reproductive: Fertility: abortion  
 TDLo (Intraperitoneal-Rat) 6600 mg/kg: female 7-15 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants)

### ALIPHATIC SULFOXIDE (continued):

TDLo (Intraperitoneal-Rat) 20 mL/kg: female 6-15 day(s) after conception: Reproductive: Maternal Effects: other effects; Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants)  
 TDLo (Intraperitoneal-Rat) 70 g/kg: female 6-12 day(s) after conception: Reproductive: Maternal Effects: other effects; Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants); Specific Developmental Abnormalities: musculoskeletal system  
 TDLo (Intraperitoneal-Mouse) 0.4 mL/kg: Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: transaminases, Enzyme inhibition, induction, or change in blood or tissue levels: dehydrogenases  
 TDLo (Intraperitoneal-Mouse) 2.5 mL/kg: Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: hepatic microsomal mixed oxidase (dealkylation, hydroxylation, etc.)  
 TDLo (Intraperitoneal-Mouse) 2.5 mL/kg: Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: hepatic microsomal mixed oxidase (dealkylation, hydroxylation, etc.)  
 TDLo (Intraperitoneal-Mouse) 87.5 g/kg/5 weeks-intermittent: Kidney/Ureter/Bladder: changes in tubules (including acute renal failure, acute tubular necrosis)  
 TDLo (Intraperitoneal-Mouse) 210 g/kg: female 6-12 day(s) after conception: Reproductive: Specific Developmental Abnormalities: Central Nervous System, musculoskeletal system  
 TDLo (Intraperitoneal-Mouse) 5500 mg/kg: female 10 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus); Specific Developmental Abnormalities: musculoskeletal system  
 TDLo (Intraperitoneal-Mouse) 8250 mg/kg: female 10 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants)  
 TDLo (Intraperitoneal-Hamster) 5500 mg/kg: female 8 day(s) after conception: Reproductive: Specific Developmental Abnormalities: musculoskeletal system, Central Nervous System, craniofacial (including nose and tongue)  
 TDLo (Intraperitoneal-Hamster) 4400 mg/kg: female 8 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetal death; Specific Developmental Abnormalities: Central Nervous System  
 TDLo (Intraperitoneal-Hamster) 5500 mg/kg: female 8 day(s) after conception: Reproductive: Maternal Effects: other effects; Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants); Specific Developmental Abnormalities: Central Nervous System  
 TDLo (Skin-Rabbit) 150,000 mg/kg/30 days-intermittent: Sense Organs and Special Senses (Eye): effect, not otherwise specified; Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol); Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: dehydrogenases  
 TDLo (Skin-Dog) 389 g/kg/17 weeks-continuous: Sense Organs and Special Senses (Eye): changes in refraction, effect, not otherwise specified  
 TDLo (Skin-Pig) 4698 mL/kg/58 weeks-intermittent: Sense Organs and Special Senses (Eye): changes in refraction; Behavioral: fluid intake  
 TDLo (Skin-Pig) 133,650 mg/kg/90 days-intermittent: Sense Organs and Special Senses (Eye): effect, not otherwise specified  
 TDLo (Subcutaneous-Rat) 220 g/kg/82 weeks-intermittent: Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Skin and Appendages: tumors  
 TDLo (Subcutaneous-Rat) 30,750 mg/kg: female 8-10 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants), litter size (e.g. # fetuses per litter; measured before birth)



## 11. TOXICOLOGICAL INFORMATION (Continued)

### TOXICITY DATA (continued):

#### ALIPHATIC SULFOXIDE (continued):

TDLo (Subcutaneous-Mouse) 800 µL/kg: Behavioral: analgesia; Biochemical: Metabolism (Intermediary): effect on inflammation or mediation of inflammation

TDLo (Subcutaneous-Mouse) 66 g/kg/66 weeks-intermittent: Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Lungs, Thorax, or Respiration: tumors; Skin and Appendages: tumors

TDLo (Intravenous-Mouse) 240 g/kg: female 1-20 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants)

TDLo (Intravenous-Hamster) 2500 mg/kg: female 8 day(s) after conception: Reproductive: Specific Developmental Abnormalities: Central Nervous System, craniofacial (including nose and tongue), musculoskeletal system

TDLo (Intravenous-Hamster) 2500 mg/kg: female 8 day(s) after conception: Reproductive: Specific Developmental Abnormalities: other developmental abnormalities

TDLo (Intravenous-Dog) 57,600 mg/kg/4 weeks-intermittent: Kidney/Ureter/Bladder: hematuria; Blood: normocytic anemia; Related to Chronic Data: death

TDLo (Intravenous-Monkey) 18 g/kg/9 days-intermittent: Lungs, Thorax, or Respiration: respiratory stimulation; Kidney/Ureter/Bladder: urine volume increased; Blood: other hemolysis with or without anemia

TDLo (Intracerebral-Rat) 2234.8 mg/kg: Brain and Coverings: other degenerative changes

TDLo (Intracerebral-Mouse) 200 µL/kg: Behavioral: changes in motor activity (specific assay), analgesia

TDLo (Ocular-Rabbit) 250 µg/kg/30 days-intermittent: Sense Organs and Special Senses (Eye): effect, not otherwise specified

TCLo (Inhalation-Rat) 0.964 g/m<sup>3</sup>/90 days-intermittent: Skin and Appendages: dermatitis, irritative (after systemic exposure)

TCLo (Inhalation-Rat) 2.783 g/m<sup>3</sup>/90 days-intermittent: Sense Organs and Special Senses (Olfaction): effect, not otherwise specified

TCLo (Inhalation-Rat) 0.310 g/m<sup>3</sup>/28 days-intermittent: Blood: changes in spleen

Mutation Test Systems-Not Otherwise Specified (Human Lymphocyte) 140 mmol/L

Mutation Test Systems-Not Otherwise Specified (Bacteria-*Salmonella Typhimurium*) 70 g/L

Mutation in Microorganisms (Yeast-*Saccharomyces cerevisiae*) 8 pph

Mutation in Microorganisms (Yeast-*Saccharomyces cerevisiae*) 1400 mmol/L

Mutation in Microorganisms (Bacteria-*Salmonella Typhimurium*) 25 pph

Mutation in Microorganisms (Bacteria-*Escherichia coli*) 551 g/L

Mutation in Microorganisms (Microorganism-Not Otherwise Specified) 111 g/L

Phage Inhibition Capacity (Bacteria-*Escherichia coli*) 6200 ppm

Sex Chromosome Loss and Non-Disjunction (Yeast-*Saccharomyces cerevisiae*) 118 g/L

Sex Chromosome Loss and Non-Disjunction (Insect-*Drosophila melanogaster*) 700 ppm

DNA Damage (Intraperitoneal-Mouse) 75 mmol/kg

Mutation in Mammalian Somatic Cells (Mouse Lymphocyte) 1 mol/L

Cytogenetic Analysis (Intraperitoneal-Rat) 25 g/kg/5 days

Cytogenetic Analysis (Intraperitoneal-Rat) 25 mL/kg/5 days-intermittent

Cytogenetic Analysis (Mouse Lymphocyte) 93 g/L

Cytogenetic Analysis (Hamster Ovary) 19 pph

Cytogenetic Analysis (Hamster-Lung) 1 pph

#### ALIPHATIC AMIDE:

Standard Draize Test (eye, rabbit) = 100 mg; severe

LD (skin, rat) > 13,500 mg/kg

LD<sub>50</sub> (oral, rat) = 5577 mg/kg; Autonomic Nervous System: other (direct) parasympathomimetic; Behavioral: ataxia Incontinence

LD<sub>50</sub> (oral, mouse) > 3150 mg/kg

LD<sub>50</sub> (oral, mammal) = 3150 mg/kg

LD<sub>50</sub> (intraperitoneal, rat) = 5700 mg/kg

LD<sub>50</sub> (subcutaneous, rat) > 4 g/kg

LD<sub>50</sub> (intraperitoneal, mouse) = 2450 mg/kg

LD<sub>50</sub> (intraperitoneal, guinea pig) = 1250 mg/kg; Autonomic Nervous System: other (direct) parasympathomimetic; Behavioral: somnolence (general depressed activity), convulsions or effect on seizure threshold

#### ALIPHATIC AMIDE (continued):

LDLo (subcutaneous, frog) = 30 mg/kg

LDLo (skin, rabbit) = 6 g/kg

LDLo (intravenous, dog) = 1500 mg/kg

TDLo (oral, rat) = 910 mg/kg/26 weeks/intermittent; Brain and Coverings: recordings from specific areas of CNS; Liver: liver function tests impaired Kidney, Ureter, Bladder: proteinuria

TDLo (oral, rat) = 7980 mg/kg/female 7-12 days after conception; Reproductive: Specific Developmental Abnormalities: craniofacial (including nose and tongue); musculoskeletal system

TDLo (oral, rat) = 2 g/kg/female 7 days after conception; Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants); Reproductive: Effects on Fetus: fetotoxicity (except death, e.g., stunted fetus)

TDLo (skin, rat) = 1200 mg/kg/female 10-11 days after conception; Reproductive: Effects on Fetus: fetal death

TDLo (skin, rabbit) = 910 mg/kg/female 6-18 days after conception; Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants); Effects on Fetus: fetotoxicity (except death, e.g., stunted fetus); Specific Developmental Abnormalities: musculoskeletal system

TCLo (inhalation, rat) = 1500 ppm/6 hours/2 weeks/intermittent; Blood: changes in leukocyte (WBC) count; Blood: changes in platelet count; Nutritional and Gross Metabolic: weight loss or decreased weight gain

Mutation Test Systems (Non-Mammalian Species Cells) = 500 mmol/L

Cytogenetic Analysis (Non-Mammalian Species Cells) = 500 mmol/L

#### SODIUM SALT:

TDLo (oral, human) = 12,357 mg/kg/23 days/continuous; Cardiovascular effects

TDLo (intraplacental, woman) = 27 mg/kg/15 weeks pregnant; Reproductive effects

Skin Irritancy (rabbit) = 50 mg/24 hours; mild

Skin Irritancy (rabbit) = 500 mg/24 hours; mild

Eye Irritancy (rabbit) = 100 mg; mild

Eye Irritancy (rabbit) = 100 mg/24 hours; moderate

Eye Irritancy (rabbit) = 10 mg; moderate

LC<sub>50</sub> (inhalation, rat) > 42 g/m<sup>3</sup>/1 hour

LD<sub>50</sub> (oral, rat) = 3000 mg/kg

LD<sub>50</sub> (oral, mouse) = 4000 mg/kg

LD<sub>50</sub> (skin, rabbit) > 10 g/kg

LD<sub>50</sub> (intraperitoneal, mouse) = 6614 mg/kg

LD<sub>50</sub> (subcutaneous, mouse) = 3 g/kg

LD<sub>50</sub> (intravenous, mouse) = 645 mg/kg

LD<sub>50</sub> (intracervical, mouse) = 131 mg/kg

TDLo (oral, rat) = 145 g/kg/female 7 days pre-mating/female 1-22 days after conception; Reproductive: Delayed Effects on Newborn

TDLo (oral, rat) = 56400 mg/kg/female 5 days pre-mating/21 days post-birth; Reproductive: Maternal Effects: postpartum, Effects on Newborn: biochemical and metabolic

TDLo (oral, rat) = 16800 mg/kg/28 days/continuous; Endocrine: changes in adrenal weight

TDLo (intrauterine, rat) = 500 mg/kg/female 4 days after conception; Reproductive: Fertility: pre-implantation mortality (e.g., reduction in number of implants per female; total number of implants per corpora lutea)

TDLo (parenteral, rat) = 10 mg/kg/female 1 day pre-mating; Reproductive: Maternal Effects: ovaries, fallopian tubes

TDLo (subcutaneous, mouse) = 2500 mg/kg/female 10 days after conception; Reproductive: Effects on Fetus: fetotoxicity (except death, e.g., stunted fetus)

TDLo (subcutaneous, mouse) = 1900 mg/kg/female 10-11 days after conception; Reproductive: Effects on Fetus: fetal death, Specific Developmental Abnormalities: musculoskeletal system

TDLo (intraperitoneal, rat) = 1710 mg/kg/female 13 days post; Teratogenic effects

LDLo (oral, rabbit) = 8 g/kg

LDLo (subcutaneous, rat) = 3500 mg/kg

LDLo (subcutaneous, guinea pig) = 2160 mg/kg

LDLo (intraperitoneal, dog) = 364 mg/kg

LDLo (intravenous, dog) = 2 g/kg

LDLo (intravenous, rabbit) = 1100 mg/kg

LDLo (intravenous, guinea pig) = 2910 mg/kg

LDLo (parenteral, guinea pig) = 300 mg/kg

LDLo (intraarterial, guinea pig) = 300 mg/kg

Mutation in Microorganisms (yeast, *Saccharomyces cerevisiae*) = 2 mol/L

#### SODIUM SALT (continued):

DNA Inhibition (fibroblast, human) = 125 mmol/L

Unscheduled DNA Synthesis (oral, rat) = 16800 mg/kg/4 weeks/continuous

Cytogenetic Analysis (intraperitoneal, rat) = 2338 mg/kg

Cytogenetic Analysis (ovary, hamster) = 160 mmol/L

Cytogenetic Analysis (lung, hamster) = 7500 mg/L

DNA Damage (lymphocyte, mouse) = 101 mmol/L

DNA Damage (ovary, hamster) = 275 mmol/L

Mutation in Mammalian Somatic Cells (lymphocyte, mouse) = 57200 µmol/L

Micronucleus Test (lung, hamster) = 4 g/L

#### DISACCHARIDE:

LD<sub>50</sub> (oral, rat) = 29,700 mg/kg; Behavioral: somnolence (general depressed activity); Lungs, Thorax, or Respiration: cyanosis; Gastrointestinal: hypermotility, diarrhea

LD<sub>50</sub> (intraperitoneal, mouse) = 14,000 mg/kg

LDLo (oral, mammal) = 40 g/kg; Behavioral: somnolence (general depressed activity); Lungs, Thorax, or Respiration: respiratory stimulation; Gastrointestinal: hypermotility, diarrhea

TDLo (oral, rat) = 1548 g/kg/female 21 days pre-mating/female 1-22 days after conception; Reproductive: Specific Developmental Abnormalities: Central Nervous System

TDLo (oral, rat) = 683 g/kg/female 1-21 days after conception; Reproductive: Specific Developmental Abnormalities: hepatobiliary system; Reproductive: Effects on Newborn: growth statistics (e.g., reduced weight gain)

TDLo (oral, rat) = 683 g/kg/lactating female 21 days post-birth; Reproductive: Effects on Newborn: growth statistics (e.g., reduced weight gain)

TDLo (oral, mammal) = 54,810 mg/kg/female 15-35 days after conception; Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)

Mutation in Microorganisms (bacteria, *Salmonella typhimurium*) = 600 µg/plate

DNA Repair (yeast, *Saccharomyces cerevisiae*) = 300 mg/L

Cytogenetic Analysis (lung, hamster) = 10 g/L

Cytogenetic Analysis (ovary, hamster) = 275 mmol/L

#### ALIPHATIC TRIOL:

Standard Draize Test (Skin-Rat) 100 mg

Standard Draize Test (Skin-Rabbit) 25%: Moderate

Standard Draize Test (Eye-Rabbit) 500 mg: Severe

LD<sub>50</sub> (Oral-Rat) > 3000 mg/kg

LD<sub>50</sub> (Oral-Mouse) 5500 mg/kg

LD<sub>50</sub> (Intravenous-Rat) 1800 mg/kg

LD<sub>50</sub> (Intravenous-Rat) 3.28 g/kg; Liver: hepatitis (hepatocellular necrosis), diffuse; Kidney/Ureter/Bladder: changes in tubules (including acute renal failure, acute tubular necrosis)

LD<sub>50</sub> (Intravenous-Mouse) 1210 mg/kg

LD<sub>50</sub> (Intravenous-Mouse) 6100 mg/kg; Behavioral: muscle weakness; Lungs, Thorax, or Respiration: respiratory depression

LD<sub>50</sub> (Intraperitoneal-Mouse) 3350 mg/kg

LDLo (Oral-Mouse) 1 g/kg; Behavioral: somnolence (general depressed activity), muscle weakness, coma

TDLo (Oral-Rat) 3000 mg/kg; Kidney/Ureter/Bladder: urine volume increased

TDLo (Oral-Rat) 12,000 mg/kg; female 14 day(s) pre-mating: 4 day(s) post-birth: Reproductive: Maternal Effects: other effects; Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants); Sense Organs and Special Senses (Ear): effect, not otherwise specified

TDLo (Oral-Mouse) 3000 mg/kg; Kidney/Ureter/Bladder: urine volume increased

TDLo (Intravenous-Rat) 6000 mg/kg/20 days-intermittent: Gastrointestinal: ulceration or bleeding from stomach; Kidney/Ureter/Bladder: changes in both tubules and glomeruli

TDLo (Intravenous-Rabbit) 500 mg/kg; Lungs, Thorax, or Respiration: dyspnea

TDLo (Intravenous-Rabbit) 10,000 mg/kg/4 weeks-intermittent: Sense Organs and Special Senses (Ear): effect, not otherwise specified; Blood: changes in leukocyte (WBC) count; Biochemical: Metabolism (Intermediary): effect on inflammation or mediation of inflammation

TDLo (Intravenous-Dog) 125 mg/kg; Lungs, Thorax, or Respiration: dyspnea

**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.

## 11. TOXICOLOGICAL INFORMATION (Continued)

### IRRITANCY OF PRODUCT:

**MS#-LDR1 Solution:** Depending on the duration and concentration of overexposure, skin and eye contact can irritate contaminated tissue.

**All Other Solutions:** 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 in humans.

**MS#-AMX2 Solution:** The Aliphatic Sulfoxide constituent in this solution can cause anaphylactic reaction by unspecified exposure routes; symptoms may include rash, abdominal cramps, nausea, chills, and chest pain.

**All Other Solutions:** These solutions are not known to cause skin or respiratory sensitization.

**REPRODUCTIVE TOXICITY INFORMATION:** The constituents in the solutions in this product are not reported to produce mutagenic, embryotoxic, teratogenic, and adverse reproductive effects in humans.

**Mutagenicity:** Negative results have been obtained in tests using cultured human cells for the Aliphatic Sulfoxide constituent and negative results have been obtained in tests using cultured mammalian cells and bacteria. The available information from short-term tests does not indicate that the Aliphatic Amide constituent is mutagenic; it was not found to be mutagenic in a dominant lethal test in mice or in tests using bacteria or *Drosophila* (fruit flies); positive results (bone marrow micronuclei induction) were reported in mice exposed by intraperitoneal injection, which is not a relevant route of occupational exposure.

**Embryotoxicity:** The Aliphatic Amide constituent caused reduced fetal weight (fetotoxicity) in the offspring of rats and mice exposed to Aliphatic Amide orally, in the absence of maternal toxicity. In rabbits, rats, and mice exposed orally, embryotoxicity (fetal deaths) was observed in the presence of maternal toxicity. Aliphatic Amide has caused reduced fetal weight in rats, in the absence of maternal toxicity. Embryotoxicity was observed in rabbits, in the presence of severe maternal toxicity.

**Teratogenicity:** In one study involving the Aliphatic Sulfoxide constituent given orally, embryotoxicity in the presence of maternal toxicity in mice was observed.

**Reproductive Toxicity:** There is insufficient animal information available to conclude that the Aliphatic Amide constituent is a reproductive toxin. In a continuous breeding study using mice, female reproductive toxicity (decreased fertility, decreased litter size, increased days to litter and changes in the reproductive cycle) was observed in the presence of modest changes in body weight (both generations) and increases in food consumption.

**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. The following information is available for some constituents:

#### ALIPHATIC SULFOXIDE:

The Koc of this compound is estimated as 4, using a log Kow of -1.35 and a regression-derived equation. According to a classification scheme, this estimated Koc value suggests that this compound is expected to have very high mobility in soil.

#### ALIPHATIC AMIDE:

The Koc of Aliphatic Amide is 3.6. According to a classification scheme, this Koc value suggests that Aliphatic Amide is expected to have very high 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. Data for some constituents of this product are available as follows:

#### ALIPHATIC SULFOXIDE:

If released to air, a vapor pressure of  $6.1 \times 10^{-1}$  mm Hg at 25°C indicates this material will exist solely as a vapor phase in the atmosphere. Vapor-phase material will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 6.2-6.6 hours. The compound does not absorb light at wavelengths > 290 nm and therefore is not expected to be susceptible to direct photolysis by sunlight. If released to soil, this compound is expected to have very high mobility based upon an estimated Koc of 4. Volatilization from water and moist soil surfaces is not expected to be an important fate process based upon a Henry's Law constant of  $1.5 \times 10^{-9}$  atm-cu m/mole. This material is expected to slowly volatilize from dry soil surfaces based upon its vapor pressure. A 3% theoretical BOD after 2 weeks in activated sludge indicates that biodegradation is not expected to be an important environmental fate process. If released into water, Aliphatic Sulfoxide is not expected to adsorb to suspended solids and sediment based upon the estimated Koc. A low experimental BCF of < 1 suggests that bioconcentration in aquatic organisms is low. Hydrolysis is not expected to be an important environmental fate process since this compound lacks functional groups that hydrolyze under environmental conditions.

#### ALIPHATIC AMIDE:

If released to air, a vapor pressure of  $6.1 \times 10^{-2}$  mm Hg at 25°C indicates Aliphatic Amide will exist solely as a vapor in the ambient atmosphere. Vapor-phase Aliphatic Amide will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 8.0 days. If released to soil, Aliphatic Amide is expected to have very high mobility based upon a Koc of 3.6. Volatilization from moist soil surfaces is not expected to be an important fate process based upon an estimated Henry's Law constant of  $1.4 \times 10^{-9}$  atm-cu m/mole. If released into water, Aliphatic Amide is not expected to adsorb to suspended solids and sediment based upon the Koc. Several biodegradation screening studies have observed significant biodegradation of Aliphatic Amide which suggests that biodegradation may be important. Volatilization from water surfaces is not expected to be an important fate process based upon this compound's estimated Henry's Law constant. Hydrolysis is expected to be slow.

#### SODIUM SALT:

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

**ALIPHATIC TRIOL:** Water solubility = 55-80 g/ 100 mL (20°C)

**BIO-ACCUMULATION POTENTIAL:** This product has not been tested for bio-accumulation potential. The following information is available for some constituents.

#### ALIPHATIC SULFOXIDE:

A BCF of < 1 was observed for this material, using orange-red killifish (*Oryzias latipes*) which were exposed over an 8-week period. According to a classification scheme, this BCF suggests that bioconcentration in aquatic organisms is low.

#### ALIPHATIC AMIDE:

An estimated BCF of 3 was calculated for Aliphatic Amide, using a log Kow of -1.51 and a regression-derived equation. According to a classification scheme, this BCF suggests the potential for bioconcentration in aquatic organisms is low.

## 12. ECOLOGICAL INFORMATION (Continued)

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

**ALIPHATIC SULFOXIDE:**

TLm (bluegill) 48 hours = 33,500 ppm; fresh water  
LC<sub>50</sub> (*Salvelinus fontinalis* Brook trout) 24 hours = 54 g/L; static; 95% CI (50.9-58.3)  
LC<sub>50</sub> (*Salvelinus namaycush* Lake trout) 24 hours = 47.8 g/L; static; 95% CI (42.3-54.0)  
LC<sub>50</sub> (*Oncorhynchus mykiss* Rainbow trout) 24 hours = 53.0 g/L; static; 95% CI (48.6-57.8)  
LC<sub>50</sub> (*Cyprinus carpio* Carp) 24 hours = 44.0 g/L; static; 95% CI (48.6-57.8)  
LC<sub>50</sub> (*Ictalurus melas* Black bullhead) 24 hours = 42.5 g/L; static; 95% CI (37.9-47.6)  
LC<sub>50</sub> (*Ictalurus punctatus* Channel catfish) 24 hours = 39.0 g/L; static; 95% CI (36.1-42.1)  
LC<sub>50</sub> (*Lepomis cyanellus* Green sunfish) 24 hours = 65.0 g/L; static; 95% CI (61.3-68.9)

**ALIPHATIC SULFOXIDE (continued):**

LC<sub>50</sub> (*Lepomis macrochirus* Bluegill) 24 hours = 72.0 g/L; static; 95% CI (63.2-82.1)  
LC<sub>50</sub> (*Perca flavescens* Yellow perch) 24 hours = 65.0 g/L; static; 95% CI (61.3-68.9)  
LC<sub>50</sub> (*Salvelinus fontinalis* Brook trout) 24 hours = 54.5 g/L; static; 95% CI (50.9-58.3)  
LC<sub>50</sub> (*Salvelinus fontinalis* Brook trout) 48 hours = 46.0 g/L; static; 95% CI (42.2-50.1)  
LC<sub>50</sub> (*Pimephales promelas* Fathead minnow) 96 hours = 34 g/L; static  
LC<sub>50</sub> (*Lepomis macrochirus* Bluegill) 96 hours = > 40 g/L; static  
LC<sub>50</sub> (*Salvelinus fontinalis* Brook trout) 96 hours = 36.5 g/L; static; 95% CI (33.2-40.2)  
EC<sub>50</sub> (*Daphnia magna* water flea) 24 hours = 7000 mg/L; toxic effect: inhibition of mobility

**ALIPHATIC AMIDE:**

LC<sub>50</sub> (minnow) > 500 mg/L/ 48 hours

**SODIUM SALT:**

LC<sub>50</sub> (*Tinca tinca* tench) 12 hours = 112 mg/L @ 25°C, freshwater, static bioassay  
LC<sub>50</sub> (*Carassius auratus* goldfish) 240 hr = 11,764.3 mg/L (@ 23.5°C, tap water, static bioassay)  
LC<sub>50</sub> (*Tinca tinca* tench) 12 hours = 1142 mg/L @ 20°C, freshwater, static bioassay  
LC<sub>50</sub> (*Tinca tinca* tench) 24 hours = 119 mg/L @ 25°C, freshwater, static bioassay  
LC<sub>50</sub> (*Tinca tinca* tench) 24 hours = 104 mg/L @ 20°C, freshwater, static bioassay  
EC<sub>50</sub> (*Daphnia magna* water flea) 48 hr = 340.7-469.2 mg/L s.c. (11.5-14.5°C, well water, static bioassay)

**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 international, national, 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:**

**MS#-AMX2 Solution:** Wastes of this solution should be tested for D001 (Waste Characteristic Ignitability).

**All Other Solutions:** 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.

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

**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.

## 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.



## 15. REGULATORY INFORMATION (Continued)

### ADDITIONAL U.S. REGULATIONS (continued):

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

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

### CANADIAN WHMIS CLASSIFICATION AND SYMBOLS:

MS#-AMX2 Solution: Class B3 Combustible Material



MS#-LDR1 Solution: D2A Teratogenicity and embryotoxicity



All Other Solutions: 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 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): The constituents in this product's solutions are not listed in the HSIS.

### STANDARD FOR THE UNIFORM SCHEDULING OF MEDICINES AND POISONS:

MS#-LDR1 Solution: Schedule 6

All Other Solutions: Not applicable.

### ADDITIONAL LABELING:

MS#-LDR1 Solution: Avoid contact with eyes. Avoid contact with skin. Avoid breathing vapour or spray mist. For advice, contact a Poisons Information Centre (Phone e.g. Australia 131 126; New Zealand 03 4747 000) or a doctor (at once). If in eyes, wash out immediately with water. If inhaled, remove from contaminated area. Apply artificial respiration if not breathing. If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with running water.

All Other Solutions: 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).

JAPANESE MINISTRY OF ECONOMY, TRADE, AND INDUSTRY (METI) STATUS: There is Biodegradation and Bioconcentration information from tests conducted according to the Chemical Substances Control Law on the following components: Aliphatic Sulfoxide, Aliphatic Amide. There is Mutagenicity information from tests conducted according to the Industrial Safety and Health Law on the following components: Aliphatic Amide.

## 16. OTHER INFORMATION

### U.S. ANSI LABELING (Z129.1; Provided to Summarize Occupational Hazard Information):

MS#-LDR1 Solution: **CAUTION!** POSSIBLE BIRTH DEFECT HAZARD. MAY CAUSE BIRTH DEFECTS BASED ON ANIMAL DATA. 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.



## 16. OTHER INFORMATION (Continued)

U.S. ANSI LABELING (Z129.1; Provided to Summarize Occupational Hazard Information) [continued]:

**All Other Solutions:** **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.

**GLOBAL HARMONIZATION, EU CLP REGULATION (EC) 1272/2008, AND JAPAN JIS Z7250:2005 FULL TEXT:**

**MS#-LDR1 Solution:**

**Classification:** Reproductive Toxicant Category 1B.

**Hazard Statements:** H360D: May damage fertility or the unborn child.

**Precautionary Statements:**

**Prevention:** P201: Obtain special instructions before use. P202: Do not handle until all safety precautions have been read and understood. P281: Use personal protective equipment as required.

**Response:** P308 + P313: IF exposed or concerned: Get medical advice/attention.

**Storage:** P405: Store locked up.

**Disposal:** P501: Dispose of contents/container to a properly permitted hazardous waste facility using a licensed waste carrier and according to all local, national, and international regulations.

**All Other Solutions:**

**Classification:** Not applicable.

**Hazard Statements:** Not applicable.

**Precautionary Statements:** Not applicable.

**EU 67/548/EEC AND 2001/59/EC AUSTRALIAN NOHSC FULL TEXT:**

**MS#-LDR1 Solution:**

**Classification:** Toxic to Reproduction Development, Category 2.

**Risk Phrases:** R61: May cause harm to the unborn child.

**Safety Phrases:** S45: In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S53: Avoid exposure—obtain special instructions before use.

**All Other Solutions:**

**Classification:** Not applicable.

**Risk Phrases:** Not applicable.

**Safety Phrases:** Not applicable.

**COMPONENT GLOBAL HARMONIZATION, EU CLP REGULATION (EC) 1272/2008 AND JAPAN JIS Z7250:2005 FULL TEXT:**

**Aliphatic Amide:**

**Classification:** Reproductive Toxin Category 1B

**Hazard Statements:** H360D: May damage fertility or the unborn child.

**COMPONENT EU 67/548/EEC AND AUSTRALIA NOHSC FULL TEXT:**

**Aliphatic Amide:**

**Classification:** Toxic to Reproduction, Category 2

**Risk Phrases:** R61: May cause harm to the unborn child.

**REVISION DETAILS:** New.

**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.

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## DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these, which are commonly used, include the following:

**CAS #:** This is the Chemical Abstract Service Number 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. 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.

### EXPOSURE LIMITS IN AIR (continued):

**DFG MAK Pregnancy Risk Group Classification (continued):** **Group B (continued):** 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 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.

## DEFINITIONS OF TERMS (Continued)

### EXPOSURE LIMITS IN AIR (continued):

**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. **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 exposed 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.

**HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):** **PHYSICAL HAZARD (continued): 1 (continued): 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. **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.

**PHYSICAL HAZARD (continued): 2 (continued): 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. **Reactivities:** 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.

**HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):** **PHYSICAL HAZARD (continued): 2 (continued): 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. **Reactivities:** 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.

**HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):** **PHYSICAL HAZARD (continued): 2 (continued): 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. **Reactivities:** 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.

**HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):** **PHYSICAL HAZARD (continued): 2 (continued): 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. **Reactivities:** 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.

**HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):** **PHYSICAL HAZARD (continued): 2 (continued): 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. **Reactivities:** 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.

**HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):** **PHYSICAL HAZARD (continued): 2 (continued): 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. **Reactivities:** 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

## DEFINITIONS OF TERMS (Continued)

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

**HEALTH HAZARD (continued): 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. 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 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. **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.

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

**INSTABILITY HAZARD (continued): 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 IC, 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.

#### REPRODUCTIVE TOXICITY INFORMATION:

**Mutagen:** A chemical that causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. **Embryotoxin:** 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. **Teratogen:** A chemical that causes damage to a developing fetus, but the damage does not propagate across generational lines. **Reproductive toxin:** Any substance that interferes in any way with the reproductive process.

#### ECOLOGICAL INFORMATION:

**EC:** Effect concentration in water. **BCE:** 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. **IC:** Transport Canada. **SARA:** Superfund Amendments and Reauthorization Act. **DSL/NDSL:** 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.