

# MATERIAL SAFETY DATA SHEET

## Caliper Life Sciences

Prepared to U.S. OSHA, CMA, ANSI, Canadian WHMIS, European Union Standards, Australian WorkSafe, and the Japanese Industrial Standard JIS Z 7250: 2000

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

#### 1. PRODUCT IDENTIFICATION

<u>TRADE NAME (AS LABELED):</u>	<b>Diversilab Reagent Kit 25 Pack</b>
<u>CODE NUMBERS:</u>	PN 760244
<u>U.N. NUMBER:</u>	Not applicable
<u>U.N. DANGEROUS GOODS CLASS/SUBSIDIARY RISK:</u>	Not applicable
<u>HAZCHEM CODE (AUSTRALIA):</u>	Not applicable
<u>POISONS SCHEDULE NUMBER (AUSTRALIA):</u>	Not applicable
<u>PRODUCT USE:</u>	Laboratory Biological Research
<u>SUPPLIER/MANUFACTURER'S NAME:</u>	<b>Caliper Life Sciences</b>
<u>ADDRESS:</u>	68 Elm Street Hopkinton, MA 01748
<u>EMERGENCY PHONE:</u>	1-800-255-3924 (CHEM-TEL) in U.S., Canada, Puerto Rico, U.S. Virgin Islands
<u>INFORMATION NUMBER:</u>	+1-800-LAB-CHIP (toll-free) +1-800-522-2447 (toll-free) +1-508-435-3439 (outside North America)
<u>SUPPLIER/IMPORTER'S NAME (AUSTRALIA):</u>	
<u>ADDRESS:</u>	
<u>EMERGENCY PHONE:</u>	
<u>BUSINESS PHONE:</u>	
<u>DATE OF PREPARATION:</u>	June 5, 2007

#### 2. COMPOSITION AND INFORMATION ON INGREDIENTS

**EU LABELING/CLASSIFICATION:** This product does not meet the definition of any hazard class, as defined by the European Union Council Directives 67/548/EEC and 2001/59/EC. (See Section 15 for details on classification)

**TSCA Status:** Some components of this product contain ingredients not included in the TSCA Inventory. In accordance with the conditions listed in 40 CFR 720.36 and 721.47, this product must be used only for research and development, pharmaceutical manufacture, or export. It must be used by, or directly under the supervision of, a technically qualified individual. The manufacturer should be consulted prior to using this compound for other applications. Other requirements may apply.

This Material Safety Data sheet describes the Diversilab Reagent Kit 25 Pack. This product consists of four 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 of the following sections (Sections 3-16) of this document is pertinent to each solution. The components of this product are mixtures (preparations) of the following chemical components:

CHEMICAL NAME	CAS #	EINECS#	ENCS#	% v/v	EU CLASSIFICATION FOR COMPONENTS
---------------	-------	---------	-------	-------	----------------------------------

##### COMPONENT 1: DIVERSILAB DNA LADDER

3-(Tris(hydroxymethyl)-methylamino)propane-1-sulphonic acid	29915-38-6	249-954-1	Not Listed	1-5	HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable.
Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens).				Balance	None of the other constituents in this mixture contribute significantly to the hazards associated with this component. All hazard information relevant to this product is provided in this Material Safety Data Sheet, per the requirements of the US Federal Occupational Safety and Health Administration Standard (29 CFR 1910.1200), US State equivalent standards, and Canadian Workplace Hazardous Materials Identification System Standards (CPR 4).

##### COMPONENT 2: DIVERSILAB GEL MATRIX

Poly(N,N-dimethylacrylamide)				1-5	HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable.
3-(Tris(hydroxymethyl)-methylamino)propane-1-sulphonic acid	29915-38-6	249-954-1	Not Listed	1-5	HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable.
Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens).				Balance	None of the other constituents in this mixture contribute significantly to the hazards associated with this component. All hazard information relevant to this product is provided in this Material Safety Data Sheet, per the requirements of the US Federal Occupational Safety and Health Administration Standard (29 CFR 1910.1200), US State equivalent standards, and Canadian Workplace Hazardous Materials Identification System Standards (CPR 4).

NE = Not Established.

See Section 16 for Definitions of Terms Used.

NOTE: ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR, EU Directives, Australian Worksafe and the Japanese Industrial Standard JIS Z 7250: 2000.

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

CHEMICAL NAME	CAS #	EINECS#	ENCS#	% v/v	EU CLASSIFICATION FOR COMPONENTS
---------------	-------	---------	-------	-------	----------------------------------

### COMPONENT 3: DIVERSILAB INTERCALATING DYE

Dimethyl Sulfoxide	67-68-5	200-664-3	2-1553	90-99	HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable.
Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens).				Balance	None of the other constituents in this mixture contribute significantly to the hazards associated with this component. All hazard information relevant to this product is provided in this Material Safety Data Sheet, per the requirements of the US Federal Occupational Safety and Health Administration Standard (29 CFR 1910.1200), US State equivalent standards, and Canadian Workplace Hazardous Materials Identification System Standards (CPR 4).

### COMPONENT 4: DNA DIVERSILAB MARKER

3-(Tris(hydroxymethyl)-methylamino)propane-1-sulphonic acid	29915-38-6	249-954-1	Not Listed	1-5	HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable.
Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens).				Balance	None of the other constituents in this mixture contribute significantly to the hazards associated with this component. All hazard information relevant to this product is provided in this Material Safety Data Sheet, per the requirements of the US Federal Occupational Safety and Health Administration Standard (29 CFR 1910.1200), US State equivalent standards, and Canadian Workplace Hazardous Materials Identification System Standards (CPR 4).

NE = Not Established.

See Section 16 for Definitions of Terms Used.

NOTE (1): ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR, EU Directives, Australian Worksafe and the Japanese Industrial Standard JIS Z 7250: 2000.



NOTE (2): Unless otherwise indicated, the hazard assessments in the following sections are pertinent to all component reagents.

## 3. HAZARD IDENTIFICATION



**EU LABELING/CLASSIFICATION:** This product does not meet the definition of any hazard class, as defined by the European Union Council Directives 67/548/EEC and 2001/59/EC. (See Section 15 for details on classification)

**EMERGENCY OVERVIEW:** The INTERCALATING DYE is a clear, dark blue solution with a mild, garlic-like odor. ALL OTHER COMPONENTS are clear, colorless, odorless liquids. **Health Hazards:** Chronic ingestion of the Dimethyl Sulfoxide constituent of the INTERCALATING DYE may affect the liver and kidneys. For ALL OTHER COMPONENTS the chief hazard in event of overexposure is the potential for irritation of contaminated skin or eyes. **Flammability Hazards:** The components of this product present no significant fire hazards. In the event of a fire, this product will not contribute significant additional hazards. **Reactivity Hazards:** This product is not reactive. **Environmental Hazards:** Negligible. **Emergency Recommendations:** Emergency responders must wear personal protective equipment suitable for the situation to which they are responding.

### INTERCALATING DYE

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

### 3. HAZARD IDENTIFICATION (Continued)

**SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE:** No adverse health effects should occur from routine, occupational use of this product's components in the manner specified by the manufacturer's instructions. The potential health effects of this product's components, via route of exposure, are described on the following pages.

**INHALATION:**

**INTERCALATING DYE:** Inhalation of vapors, mists, or sprays of this component may irritate the nose, throat, and lungs. Symptoms may include nausea, headache, and vomiting.

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

**CONTACT WITH SKIN or EYES:**

**INTERCALATING DYE:** Depending on the duration and concentration of overexposure, skin and eye contact may irritate contaminated tissue. Symptoms of skin overexposure may include redness and discomfort. Symptoms of eye overexposure may include redness, tearing, and pain.

**ALL OTHER COMPONENTS:** Contact with the skin or eyes may cause mild irritation, which is alleviated upon rinsing.

**SKIN ABSORPTION:**

**INTERCALATING DYE:** The Dimethyl Sulfoxide constituent of this component can be absorbed through the skin and may carry dissolved chemicals with it into the body. Symptoms of overexposure for a prolonged period of time and a large area of skin may include redness, burning, itching, scaling, vision disturbance, photophobia, headache, and diarrhea.

**ALL OTHER COMPONENTS:** No constituents of 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 solutions. If ingested, symptoms of such overexposure are described below.

**INTERCALATING DYE:** If this component is swallowed, it may cause gastric distress. Large doses may cause nausea, vomiting, chills, cramps, and lethargy.

**ALL OTHER COMPONENTS:** If these components are swallowed they may cause gastric distress. Large doses may cause nausea, vomiting, and diarrhea.

**INJECTION:** Accidental injection of this product's components, 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:**

**INTERCALATING DYE:** Large oral doses may cause nausea, vomiting, chills, cramps, and lethargy.

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

**CHRONIC:**

**INTERCALATING DYE:** The Dimethyl Sulfoxide component of this product can cause anaphylactic reaction by unspecified exposure routes; symptoms may include rash, abdominal cramps, nausea, chills, and chest pain.

Chronic ingestion of the Dimethyl Sulfoxide constituent of these components may affect the liver and kidneys.

**ALL OTHER COMPONENTS:** These components are not known to cause any significant chronic health effects.

**TARGET ORGANS:**

**INTERCALATING DYE:**

**ACUTE:** Eyes, gastrointestinal tract.

**CHRONIC:** Liver, kidneys.

**ALL OTHER SOLUTIONS**

**ACUTE:** Eyes, gastrointestinal tract.

**CHRONIC:** None known.

---

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

---

### 4. FIRST-AID MEASURES

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

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

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

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

#### 4. FIRST-AID MEASURES (Continued)

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

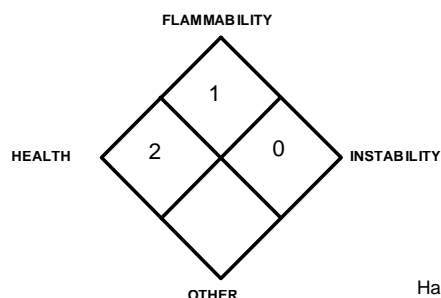
**MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:** Pre-existing dermatitis, other skin conditions, respiratory conditions, and liver disorders may be aggravated by overexposure to components of this product.

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

#### 5. FIRE-FIGHTING MEASURES

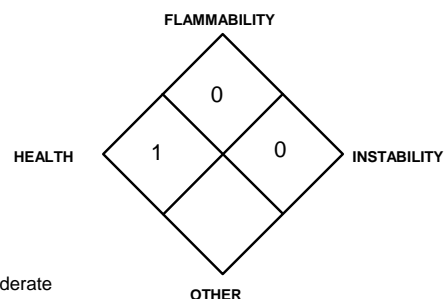
##### Intercalating Dye

##### NFPA RATING



##### All Other Reagents

##### NFPA RATING



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

**FLASH POINT:** Not flammable.

**AUTOIGNITION TEMPERATURE:** Not applicable.

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

(LEL): Not applicable.

(UEL): Not applicable.

**FIRE EXTINGUISHING MATERIALS:** In the event of a fire, use suppression methods for surrounding materials.

Water Spray: YES

Carbon Dioxide: YES

Dry Chemical: YES

Halon: NO

Other: Any "ABC" Class.

Foam: YES

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

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

**SPECIAL FIRE-FIGHTING PROCEDURES:** 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.

#### 6. ACCIDENTAL RELEASE MEASURES

**SPILL AND LEAK RESPONSE:** For small releases take basic hygiene precautions. Lightweight gloves, a lab coat, and eye protection should be worn. Absorb spilled liquid with paper towels. Wash contaminated area with soap and water, absorb with paper towels, and rinse with water. Trained personnel using pre-planned procedures should respond to large releases that are not immediately controlled. Proper protective equipment should be used. In case of a spill, clear the affected area, protect people, and respond with trained personnel. In the event of a non-incident release, minimum Personal Protective Equipment should be **Level D: lab-gloves, chemical resistant apron, boots, and splash goggles. Respiratory protection should not be necessary.** Absorb spilled liquid with polypads or other suitable absorbent materials. Decontaminate the area thoroughly. Place all spill residue in a suitable container and seal. Dispose of in accordance with U.S. Federal, State, and local hazardous waste disposal regulations, those of Canada, European EU Member States, Australia and its Provinces and those of Japan (see Section 13, Disposal Considerations).

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

### 7. HANDLING and STORAGE

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

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

**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 U.S. Federal, State, and local hazardous waste disposal regulations, those of Canada, European EU Member States, Australia and its provinces and those of Japan.

### 8. EXPOSURE CONTROLS - PERSONAL PROTECTION

**VENTILATION AND ENGINEERING CONTROLS:** Use with adequate ventilation to ensure exposure levels are maintained below the limits provided below, if applicable. Ensure eyewash/safety shower stations are available near areas where this product is used.

**EXPOSURE LIMITS/GUIDELINES:**

**NOTE:** For components not specifically listed, those components 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	AIHA WEELs		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>	TWA mg/m <sup>3</sup>	STEL mg/m <sup>3</sup>	mg/m <sup>3</sup>

#### COMPONENT 1: DIVERSILAB DNA LADDER

3-(Tris(hydroxymethyl)-methylamino)propane-1-sulphonic Acid	29915-38-6	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
---	------------	----	----	----	----	----	----	----	----	----	----	----

#### COMPONENT 2: DIVERSILAB GEL MATRIX

Poly(N,N-dimethylacrylamide)		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
3-(Tris(hydroxymethyl)-methylamino)propane-1-sulphonic Acid	29915-38-6	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

#### COMPONENT 3: DIVERSILAB INTERCALATING DYE

Dimethyl Sulfoxide	67-68-5	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
--------------------	---------	----	----	----	----	----	----	----	----	----	----	----

#### COMPONENT 4: DNA DIVERSILAB MARKER

3-(Tris(hydroxymethyl)-methylamino)propane-1-sulphonic Acid	29915-38-6	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
---	------------	----	----	----	----	----	----	----	----	----	----	----

NE = Not Established.

See Section 16 for Definitions of Terms Used.

**INTERNATIONAL OCCUPATIONAL EXPOSURE LIMITS:** Currently the following international exposure limits are in place for the some constituents of this product. Values given may not be the most current; individual country lists should be consulted to determine most current values available.

#### DIMETHYL SULFOXIDE:

Germany: No MAK Established, JAN 1999  
Russia: STEL = 20 mg/m<sup>3</sup>, JUN 2003

#### DIMETHYL SULFOXIDE (continued):

Sweden: TWA = 50 ppm (150 mg/m<sup>3</sup>), KTV = 150 ppm (500 mg/m<sup>3</sup>), Skin, JAN 1999

#### DIMETHYL SULFOXIDE (continued):

Switzerland: MAK-W = 50 ppm (160 mg/m<sup>3</sup>), Skin, JAN 1999  
The Netherlands: MAC-TGG = 150 mg/m<sup>3</sup>, Skin, 2003

*The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132), equivalent standards of Canada (including CSA Standard Z94.4-02 and CSA Standard Z94.3-02), standards of EU member states (including EN 529:2005 for respiratory PPE, CEN/TR 15419:2006 for hand protection, and CR 13464:1999 for face/eye protection), or standards of Australia (including AS/NZS 1715:1994 for respiratory PPE, AS/NZS 4501.2:2006 for protective clothing, AS/NZS 2161.1:2000 for glove selection, and AS/NZS 1336:1997 for eye protection). Please reference applicable regulations and standards for relevant details.*

**RESPIRATORY PROTECTION:** Respiratory protection is not generally needed when using this product. Maintain airborne contaminant concentrations below limits listed in this section.

(section continued on next page)

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

**RESPIRATORY PROTECTION (continued):** In instances where inhalable mists or sprays of product may be generated, and respiratory protection is necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent U.S. State standards, Canadian CSA Standard Z94.4-02, the European Standard EN 529:2005, and EU member states, or the Australian Standard 1716-Respiratory Protective Devices, the Australian Standard 1715-Selection, Use, and Maintenance of Respiratory Protective Devices, as well as requirements of Japan. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, SAR with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).

**EYE PROTECTION:** Depending on the use of this product, splash goggles or safety glasses may be worn. Use goggles or safety glasses for spill response, as stated in Section 6 (Accidental Release Measures) of this MSDS. If necessary, refer to U.S. OSHA 29 CFR 1910.133, the European Standard CR 13464:1999 and the Canadian CSA Standard Z94.3-02, *Industrial Eye and Face Protectors*, the Australian Standard 1337-Eye Protection for Industrial Applications and Australian Standard 1336-Recommended Practices for Eye Protection in the Industrial Environment, as well as requirements of Japan for further information.

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

**BODY PROTECTION:** Use body protection appropriate for task, such as a lab coat. If necessary, use body protection appropriate for task (e.g., Tyvek suit, rubber apron). If necessary, refer appropriate Standards of Canada, the European Standard CEN/TR 15419:2006 the to Australian Standard 3765-Clothing for Protection Against Hazardous Chemicals, or Japan for further information. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR 1910.136 and the Canadian CSA Standard Z195-02, *Protective Footwear*.

## 9. PHYSICAL and CHEMICAL PROPERTIES

### FOR ALL COMPONENTS UNLESS OTHERWISE INDICATED:

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

**EVAPORATION RATE (nBuAc = 1):** Similar to water.

**SPECIFIC GRAVITY (water = 1):** Not established.

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

**BOILING POINT:** Not established.

**SOLUBILITY IN WATER:** Completely soluble.

### FOR INTERCALATING DYE:

**VAPOR PRESSURE, mm Hg @ 20°C:** Not established.

**LOG WATER/OIL DISTRIBUTION COEFFICIENT:** Not available.

**APPEARANCE AND COLOR:** Clear, dark blue solution with a mild garlic-like odor.

**HOW TO DETECT THIS SUBSTANCE:** The odor may act as a warning property associated with this component.

**pH:** Not established.

**ODOR THRESHOLD:** Not available.

### FOR ALL OTHER COMPONENTS:

**VAPOR PRESSURE, mm Hg @ 20°C:** Not established.

**LOG WATER/OIL DISTRIBUTION COEFFICIENT:** Not available.

**APPEARANCE, ODOR and COLOR:** Clear, odorless, colorless liquids.

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

**pH:** 6.0–10.7

**ODOR THRESHOLD:** Not available.

## 10. STABILITY AND REACTIVITY

**STABILITY:** Stable.

**DECOMPOSITION PRODUCTS:** Thermal decomposition of this product's components may produce carbon oxides, dimethyl amine, hydrogen sulfide, cyanides, sodium oxides, and nitrogen oxides.

### MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE:

**INTERCALATING DYE:** Strong oxidizers, acetyl chloride, cyanuric chloride, acid chlorides, phosphorus halides, strong acids, strong reducers, substances that are incompatible with water.

**ALL OTHER COMPONENTS:** Strong oxidizers, strong acids, some metals, substances that are incompatible with water.

**HAZARDOUS POLYMERIZATION:** Will not occur.

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

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

## 11. TOXICOLOGICAL INFORMATION

**TOXICITY DATA:** The following toxicity data is available for the constituents in constituents in this product present in greater than 1 percent concentration and listed in Section 2 (Composition and Information on Ingredients).

### DIMETHYL SULFOXIDE:

TDL<sub>0</sub> (intravenous, man) = 606 mg/kg;  
Gastrointestinal: nausea or vomiting; Liver: jaundice, other or unclassified

### DIMETHYL SULFOXIDE (continued):

LD<sub>50</sub> (oral, rat) = 14500 mg/kg; Sense Organs and Special Senses (Eye): hemorrhage; Sense Organs and Special Senses (Eye): conjunctive irritation

### DIMETHYL SULFOXIDE (continued):

LD<sub>50</sub> (oral, mouse) = 7920 mg/kg  
LD<sub>50</sub> (oral, dog) > 10 g/kg  
LD<sub>50</sub> (oral, chicken) = 12 g/kg  
LD<sub>50</sub> (intraperitoneal, rat) = 8200 mg/kg

## 11. TOXICOLOGICAL INFORMATION (Continued)

### TOXICITY DATA (continued):

#### DIMETHYL SULFOXIDE (continued):

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, mouse) = 3100 mg/kg; Sense Organs and Special Senses (Eye): hemorrhage; conjunctive irritation  
 LD<sub>50</sub> (skin, mouse) = 50 g/kg  
 LD<sub>50</sub> (skin, rat) = 40 g/kg  
 TDLo (oral, rat) = 1070 g/kg/13 weeks/intermittent; Blood changes; 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, mouse) = 65340 mg/kg/66 weeks/intermittent; Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Blood: leukemia; Skin and Appendages: tumors

#### DIMETHYL SULFOXIDE (continued):

TDLo (oral, mouse) = 16 mg/kg/female 5–9 days after conception; Reproductive: Fertility: pre-implantation mortality; Effects on Embryo or Fetus: fetotoxicity; Specific Developmental Abnormalities: musculoskeletal system  
 TDLo (oral, hamster) = 11 g/kg/female 7 days after conception; Reproductive: Specific Developmental Abnormalities: Central Nervous System, musculoskeletal system  
 TDLo (oral, monkey) = 4864 g/kg/78 weeks/intermittent  
 TDLo (intraperitoneal, rat) = 56 g/kg/female 6–12 days after conception; Reproductive: Fertility: abortion  
 TDLo (intraperitoneal, rat) = 192 g/kg/4 weeks/intermittent; Blood: normocytic anemia; weight loss or decreased weight gain  
 TDLo (intraperitoneal, mouse) = 210 g/kg/female 6–12 days after conception; Reproductive: Specific Developmental Abnormalities: Central Nervous System, musculoskeletal system  
 TDLo (intraperitoneal, hamster) = 5500 mg/kg/female 8 days after conception; Reproductive: Specific Developmental Abnormalities: musculoskeletal system, Central Nervous System, craniofacial

#### DIMETHYL SULFOXIDE (continued):

TDLo (subcutaneous, rat) = 220 g/kg/82 weeks/intermittent; Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Skin and Appendages: tumors  
 TDLo (ocular, rabbit) = 250 µg/kg/30 days/intermittent; Sense Organs and Special Senses (Eye): 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  
 Mutation in Microorganisms (*Salmonella typhimurium*) = 25 pph  
 Mutation in Microorganisms (*Escherichia coli*) = 551 g/L  
 Mutation Test Systems (*Salmonella typhimurium*) = 70 g/L  
 Open Irritation Test (skin, rabbit) = 10 mg/24 hours  
 Standard Draize Test (skin, rabbit) = 500 mg/24 hours; mild  
 Standard Draize Test (eye, rabbit) = 100 mg  
 Standard Draize Test (eye, rabbit) = 500 mg/24 hours; mild  
**3-(TRIS(HYDROXYMETHYL)-METHYLAMINO)PROPANE-1-SULPHONIC ACID:**  
 Currently, there are no toxicological data available for this component.

**SUSPECTED CANCER AGENT:** The constituents in the components of this product are not found on the following lists: NTP, IARC, FEDERAL OSHA Z-List, and CAL-OSHA and therefore are neither considered to be nor suspected to be cancer causing agents by these agencies.

### IRRITANCY OF PRODUCT:

**INTERCALATING DYE:** Depending on the duration and concentration of overexposure, skin and eye contact can irritate contaminated tissue.

**ALL OTHER COMPONENTS:** Contact with the skin or eyes may cause mild irritation, which is alleviated upon rinsing.

**SENSITIZATION TO THE PRODUCT:** The components of this product are not known to cause skin or respiratory sensitization.

**INTERCALATING DYE:** The Dimethyl Sulfoxide component of this product can cause anaphylactic reaction by unspecified exposure routes; symptoms may include rash, abdominal cramps, nausea, chills, and chest pain.

**ALL OTHER COMPONENTS:** All other components of this product are not known to cause skin or respiratory sensitization.

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

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

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

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

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

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

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

## 12. ECOLOGICAL INFORMATION

**ENVIRONMENTAL STABILITY:** The components of this product will degrade in the environment into smaller organic and inorganic constituents. Additional environmental data for components are available as follows:

**DIMETHYL SULFOXIDE:**

Biological Half-Life: Dermal application resulted in 50-60 mg % in blood in 4-8 hr; half-life 11-14 hr. 220-340 mg % reported following oral admin of 1,000 mg/kg; half-life 20 hours.

Biodegradation: No degradation of Dimethyl Sulfoxide (%) was noted in a screening test using an activated sludge inoculum. Dimethyl Sulfoxide is considered to be very difficult to degrade in water, based on available data. The data used to make this classification were not indicated. A variety of microorganisms, including some that are found in anaerobic lake mud, have the ability to transform Dimethyl Sulfoxide to dimethyl sulfide.

**EFFECT OF MATERIAL ON PLANTS or ANIMALS:** Release of large quantities of this product's components into the environment may have adverse effects on plants or animals.

**EFFECT OF CHEMICAL ON AQUATIC LIFE:** Release of large quantities of this product's components into an aquatic environment may have adverse effects on aquatic plants or animals. Additional aquatic toxicity data are available as follows:

**DIMETHYL SULFOXIDE:**

TLm (bluegill) 48 hours = 33,500 ppm; fresh water

## 13. DISPOSAL CONSIDERATIONS

**PREPARING WASTES FOR DISPOSAL:** Do NOT dispose of any component of this product by pouring down the drain. Waste disposal must be in accordance with appropriate Federal, State, and local regulations. This product, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local hazardous waste regulatory authority.

**U.S. EPA WASTE NUMBER:** Not applicable.

## 14. TRANSPORTATION INFORMATION

**THIS PRODUCT IS NOT HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.**

<b>PROPER SHIPPING NAME:</b>	Not Regulated
<b>HAZARD CLASS NUMBER and DESCRIPTION:</b>	Not Applicable
<b>UN IDENTIFICATION NUMBER:</b>	Not Applicable
<b>PACKING GROUP:</b>	Not Applicable
<b>DOT LABEL(S) REQUIRED:</b>	Not Applicable
<b>EMERGENCY RESPONSE GUIDEBOOK NUMBER (2004):</b>	Not Applicable
<b>MARINE POLLUTANT:</b>	Not applicable (49 CFR 172.101, Appendix B).

**TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:** This product is not classified as dangerous goods, per regulations of Transport Canada.

**INTERNATIONAL AIR TRANSPORT ASSOCIATION DESIGNATION:** This product is not classified as dangerous goods, per rules of IATA.

**INTERNATIONAL MARITIME ORGANIZATION (IMO):** This product is not classified as dangerous goods, per rules of the IMO. **Marine Pollutant:** No component of this product is designated by the IMO to be a Marine Pollutant.

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

**AUSTRALIAN CODE FOR THE TRANSPORTATION OF DANGEROUS GOODS BY ROAD AND RAIL (ADG CODE):** This product is not classified by the National Road Transport Commission (NRTC) to be dangerous goods.

## 15. REGULATORY INFORMATION

**ADDITIONAL U.S. REGULATIONS:**

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

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

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

**U.S. TSCA INVENTORY STATUS:** Some components of this product contain ingredients not included in the TSCA Inventory. In accordance with the conditions listed in 40 CFR 720.36 and 721.47, this product must be used only for research and development, pharmaceutical manufacture, or export. It must be used by, or directly under the supervision of, a technically qualified individual. The manufacturer should be consulted prior to using this product for other applications. Other requirements may apply.

**OTHER U.S. FEDERAL REGULATIONS:** Not applicable.

## 15. REGULATORY INFORMATION (Continued)

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

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

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

**FOR INTERCALATING DYE: CAUTION! MAY CAUSE SENSITIZATION BY UNSPECIFIED ROUTE OF EXPOSURE. MAY CAUSE SKIN, EYE, AND RESPIRATORY TRACT IRRITATION. MAY CAUSE DISCOMFORT IF SWALLOWED.** 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.

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

### ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL/NDSL INVENTORY STATUS: Some components of this product contain ingredients not included in the DSL/NDSL Inventory. This product must be used only for research and development purposes. The manufacturer should be consulted prior to using this product for other applications. Other requirements may apply.

OTHER CANADIAN REGULATIONS: Not applicable.

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

CANADIAN WHMIS CLASSIFICATION AND SYMBOLS:

**INTERCALATING DYE:** D2B Materials Causing Other Toxic Effects (Contains sensitizer in greater than 1%)



**ALL OTHER COMPONENTS:** Not applicable.

### EUROPEAN UNION INFORMATION:

EU LABELING/CLASSIFICATION: This product does not meet the definition of any hazard class, as defined by the European Union Council Directives 67/548/EEC and 2001/59/EC. (See Section 15 for details on classification)

FOR CONSTITUENTS:

#### Dimethyl Sulfoxide:

An official classification for this substance has not been published in Commission Directives 93/72EEC, 94/69/EC, 96/56/EC, or 98/98/EC.

### AUSTRALIAN INFORMATION FOR PRODUCT:

AUSTRALIAN INVENTORY OF CHEMICAL SUBSTANCES (AICS) STATUS: The constituents in components of this product are on the AICS as indicated in composition tables in Section 2 (Composition and Information on Ingredients).

LIST OF DESIGNATED SUBSTANCES: Not applicable.

STANDARD FOR THE UNIFORM SCHEDULING OF DRUGS AND POISONS: Not applicable.

LABELING AND CLASSIFICATION: The components of this product do not meet the definition of any hazard class.

### JAPANESE INFORMATION FOR PRODUCT:

JAPANESE ENCS: The constituents in components of this product are on the ENCS Inventory as indicated in composition tables in Section 2 (Composition and Information on Ingredients).

POISONOUS AND DELETERIOUS SUBSTANCES CONTROL LAW: No constituent in the components of this product is a listed Specified Poisonous Substance under the Poisonous and Deleterious Substances Control Law.

## 16. OTHER INFORMATION

PREPARED BY:

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

## DEFINITIONS OF TERMS

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

**CAS #:** This is the Chemical Abstract Service Number that uniquely identifies each constituent.

### EXPOSURE LIMITS IN AIR:

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

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

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

**IDLH-Immediately Dangerous to Life and Health:** This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury.

**LOQ:** Limit of Quantitation.

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

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

**NIC:** Notice of Intended Change.

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

**NIOSH RELs:** NIOSH's Recommended Exposure Limits.

**PEL-Permissible Exposure Limit:** OSHA's Permissible Exposure Limits. This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule ([Federal Register](#); 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL that was vacated by Court Order.

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

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

**TLV-Threshold Limit Value:** An airborne concentration of a substance that represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour.

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

## HAZARDOUS MATERIALS IDENTIFICATION SYSTEM

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

### HEALTH HAZARD:

**0 (Minimal Hazard):** No significant health risk, irritation of skin or eyes not anticipated. *Skin Irritation:* Essentially non-irritating. PII or Draize = "0". *Eye Irritation:* Essentially non-irritating, or minimal effects which clear in < 24 hours [e.g. mechanical irritation]. Draize = "0". *Oral Toxicity 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; slightly or mildly irritating. *Skin Irritation:* Slightly or mildly irritating. *Eye Irritation:* Slightly or mildly irritating. *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);

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

### HEALTH HAZARD (continued):

**2 (Moderate Hazard):** Temporary or transitory injury may occur. *Skin Irritation:* Moderately irritating; primary irritant; sensitizer. PII or Draize > 0, < 5. *Eye Irritation:* Moderately to severely irritating and/or corrosive; reversible corneal opacity; corneal involvement or irritation clearing in 8-21 days. Draize > 0, ≤ 25. *Oral Toxicity 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 destroy dermal tissue, cause skin burns, dermal necrosis. PII or Draize > 5-8 with destruction of tissue. *Eye Irritation:* Corrosive, irreversible destruction of ocular tissue; corneal involvement or irritation persisting for more than 21 days. Draize > 80 with effects irreversible in 21 days. *Oral Toxicity 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 exposure. *Skin Irritation:* Not appropriate. Do not rate as a "4", based on skin irritation alone. *Eye Irritation:* Not appropriate. Do not rate as a "4", based on eye irritation alone. *Oral Toxicity LD<sub>50</sub> Rat:* ≤ 1 mg/kg. *Dermal Toxicity LD<sub>50</sub>Rat or Rabbit:* ≤ 20 mg/kg. *Inhalation Toxicity LC<sub>50</sub> 4-hrs Rat:* ≤ 0.05 mg/L).

### FLAMMABILITY HAZARD:

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

### PHYSICAL HAZARD:

**0 (Water Reactivity):** Materials that do not react with water. *Organic Peroxides:* Materials that are normally stable, even under fire conditions and will not react with water. *Explosives:* Substances that are Non-Explosive. Unstable *Compressed Gases:* No Rating. *Pyrophorics:* No Rating. *Oxidizers:* No "0" rating allowed. *Unstable Reactives:* Substances that will not polymerize, decompose, condense or self-react.; **1 (Water Reactivity):** Materials that change or decompose upon exposure to moisture. *Organic Peroxides:* Materials that are normally stable, but can become unstable at high temperatures and pressures. These materials may react with water, but will not release energy. *Explosives:* Division 1.5 & 1.6 substances that are very insensitive explosives or that do not have a mass explosion hazard. *Compressed Gases:* Pressure below OSHA definition. *Pyrophorics:* No Rating. *Oxidizers:* Packaging Group III; *Solids:* any material that in either concentration tested, exhibits a mean burning time less than or equal to the mean burning time of a 3:7 potassium bromate/cellulose mixture and the criteria for Packing Group I and II are not met. *Liquids:* any material that exhibits a mean pressure rise time less than or equal to the pressure rise time of a 1:1 nitric acid (65%)/cellulose mixture and the criteria for Packing Group I and II are not met. *Unstable Reactives:* Substances that may decompose, condense or self-react, but only under conditions of high temperature and/or pressure and have little or no potential to cause significant heat generation or explosive hazard. Substances that readily undergo hazardous polymerization in the absence of inhibitors.; **2 (Water Reactivity):** Materials that may react violently with water. *Organic Peroxides:* Materials that, in themselves, are normally unstable and will readily undergo violent chemical change, but will not detonate. These materials may also react violently with water.

## DEFINITIONS OF TERMS (Continued)

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

#### PHYSICAL HAZARD (continued):

**2 (continued) Explosives:** Division 1.4 – Explosive substances where the explosive effect are largely confined to the package and no projection of fragments of appreciable size or range are expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package. **Compressed Gases:** Pressurized and meet OSHA definition but < 514.7 psi absolute at 21.1°C (70°F) [500 psig]. **Pyrophorics:** No Rating. **Oxidizers:** Packing Group II **Solids:** any material that, either in concentration tested, exhibits a mean burning time of less than or equal to the mean burning time of a 2:3 potassium bromate/cellulose mixture and the criteria for Packing Group I are not met. **Liquids:** any material that exhibits a mean pressure rise time less than or equal to the pressure rise of a 1:1 aqueous sodium chlorate solution (40%)/cellulose mixture and the criteria for Packing Group I are not met. **Unstable Reactives:** Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure, but have a low potential for significant heat generation or explosion. Substances that readily form peroxides upon exposure to air or oxygen at room temperature); **3 (Water Reactivity):** Materials that may form explosive reactions with water. **Organic Peroxides:** Materials that are capable of detonation or explosive reaction, but require a strong initiating source, or must be heated under confinement before initiation; or materials that react explosively with water. **Explosives:** Division 1.2 – Explosive substances that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but do not have a mass explosion hazard. **Compressed Gases:** Pressure ≥ 514.7 psi absolute at 21.1°C (70°F) [500 psig]. **Pyrophorics:** No Rating. **Oxidizers:** Packing Group I **Solids:** any material that, in either concentration tested, exhibits a mean burning time less than the mean burning time of a 3.:2 potassium bromate/cellulose mixture. **Liquids:** Any material that spontaneously ignites when mixed with cellulose in a 1:1 ratio, or which exhibits a mean pressure rise time less than the pressure rise time of a 1:1 perchloric acid (50%)/cellulose mixture. **Unstable Reactives:** Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a moderate potential 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-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 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 whose LC<sub>50</sub> for acute inhalation toxicity is greater than 10,000 ppm. Dusts and mists whose LC<sub>50</sub> for acute inhalation toxicity is greater than 200 mg/L. Materials whose LD<sub>50</sub> for acute dermal toxicity is greater than 2000 mg/kg. Materials whose LD<sub>50</sub> for acute oral toxicity is greater than 2000 mg/kg. Materials that are essentially non-irritating to the respiratory tract, eyes and skin. **1** (materials that, under emergency conditions, can cause significant irritation): Gases and vapors whose LC<sub>50</sub> for acute inhalation toxicity is greater than 5,000 ppm but less than or equal to 10,000 ppm. Dusts and mists whose LC<sub>50</sub> for acute inhalation toxicity is greater than 10 mg/L but less than or equal to 200 mg/L. Materials whose LD<sub>50</sub> for acute dermal toxicity is greater than 1000 mg/kg but less than or equal to 2000 mg/kg. Materials whose LD<sub>50</sub> for acute oral toxicity is greater than 500 mg/kg but less than or equal to 2000 mg/kg. Materials that cause slight to moderate irritation to the respiratory tract, eyes and skin. **2** (materials that, under emergency conditions, can cause temporary incapacitation or residual injury): Gases and vapors whose LC<sub>50</sub> for acute inhalation toxicity is greater than 3,000 ppm but less than or equal to 5,000 ppm. Dusts and mists whose LC<sub>50</sub> for acute inhalation toxicity is greater than 2 mg/L but less than or equal to 10 mg/L. Materials whose LD<sub>50</sub> for acute dermal toxicity is greater than 200 mg/kg but less than or equal to 1000 mg/kg. 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. 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. Compressed liquefied gases with boiling points between -30°C (-22°F) and -55°C (-66.5°F) that cause severe tissue damage, depending on duration of exposure. Materials that are respiratory irritants. Materials that cause severe, but reversible irritation to the eyes or are lachrymators. Materials that are primary skin irritants or sensitizers. **3** (materials that, under emergency conditions, can cause serious or permanent injury): Gases and vapors whose LC<sub>50</sub> for acute inhalation toxicity is greater than 1,000 ppm but less than or equal to 3,000 ppm. Dusts and mists whose LC<sub>50</sub> for acute inhalation toxicity is greater than 0.5 mg/L but less than or equal to 2 mg/L. Materials whose LD<sub>50</sub> for acute dermal toxicity is greater than 40 mg/kg but less than or equal to 200 mg/kg. Materials whose LD<sub>50</sub> for acute oral toxicity is greater than 5 mg/kg but less than or equal to 50 mg/kg. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than one-fifth its 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.

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

**HEALTH HAZARD: 3 (continued)** Compressed liquefied gases with boiling points between -30°C (-22°F) and -55°C (-66.5°F) that cause frostbite and irreversible tissue damage. Materials that are respiratory irritants. Cryogenic gases that cause frostbite and irreversible tissue damage. Materials that are corrosive to the respiratory tract. Materials that are corrosive to the eyes or cause irreversible corneal opacity. Materials that are corrosive to the skin. **4** (materials that, under emergency conditions, can be lethal): Gases and vapors whose LC<sub>50</sub> for acute inhalation toxicity less than or equal to 1,000 ppm. Dusts and mists whose LC<sub>50</sub> for acute inhalation toxicity is less than or equal to 0.5 mg/L. Materials whose LD<sub>50</sub> for acute dermal toxicity is less than or equal to 40 mg/kg. Materials whose LD<sub>50</sub> for acute oral toxicity is less than or equal to 5 mg/kg. 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 1000 ppm.

**FLAMMABILITY HAZARD: 0** Materials that will not burn under typical fire conditions, including intrinsically noncombustible materials such as concrete, stone, and sand: Materials that will not burn in air when exposed to a temperature of 816°C (1500°F) for a period of 5 minutes in accordance with Annex D. **1** Materials that must be preheated before ignition can occur. Materials in this degree require considerable preheating, under all ambient temperature conditions, before ignition and combustion can occur: Materials that will burn in air when exposed to a temperature of 816°C (1500°F) for a period of 5 minutes in accordance with Annex D. Liquids, solids and semisolids having a flash point at or above 93.4°C (200°F) (i.e. Class IIIB liquids). Liquids with a flash point greater than 35°C (95°F) that do not sustain combustion when tested using the Method of Testing for Sustained Combustibility, per 49 CFR 173, Appendix H or the UN Recommendation on the Transport of Dangerous Goods, Model Regulations (current edition) and the related Manual of Tests and Criteria (current edition). Liquids with a flash point greater than 35°C (95°F) in a water-miscible solution or dispersion with a water non-combustible liquid/solid content of more than 85 percent by weight. Liquids that have no fire point when tested by ASTM D 92 Standard Test Method for Flash and Fire Points by Cleveland Open Cup, up to a boiling point of the liquid or up to a temperature at which the sample being tested shows an obvious physical change. Combustible pellets with a representative diameter of greater than 2 mm (10 mesh). Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed up flash point of the solvent. Most ordinary combustible materials. **2** Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not under normal conditions form hazardous atmospheres with air, but under high ambient temperatures or under moderate heating could release vapor in sufficient quantities to produce hazardous atmospheres with air: Liquids having a flash point at or above 37.8°C (100°F) and below 93.4°C (200°F) (i.e. Class II and Class IIIA liquids.) Solid materials in the form of powders or coarse dusts of representative diameter between 420 microns (40 mesh) and 2 mm (10 mesh) that burn rapidly but that generally do not form explosive mixtures in air. Solid materials in fibrous or shredded form that burn rapidly and create flash fire hazards, such as cotton, sisal and hemp. Solids and semisolids that readily give off flammable vapors. Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent. **3** Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures or, though unaffected by ambient temperatures, are readily ignited under almost all conditions: Liquids having a flash point below 22.8°C (73°F) and having a boiling point at or above 37.8°C (100°F) and those liquids having a flash point at or above 22.8°C (73°F) and below 37.8°C (73°F) and below 37.8°C (100°F) (i.e. Class IB and IC liquids). Materials that, on account of their physical form or environmental conditions, can form explosive mixtures with air and are readily dispersed in air. Flammable or combustible dusts with a representative diameter less than 420 microns (40 mesh). Materials that burn with extreme rapidity, usually by reason of self-contained oxygen (e.g. dry nitrocellulose and many organic peroxides). Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent. **4** Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air and will burn readily: Flammable gases. Flammable cryogenic materials. Any liquid or gaseous materials that is liquid while under pressure and has a flash point below 22.8°C (73°F) and a boiling point below 37.8°C (100°F) (i.e. Class IA liquids). Materials that ignite when exposed to air, Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent.

**INSTABILITY HAZARD: 0** Materials that in themselves are normally stable, even under fire conditions: Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) below 0.01 W/mL. Materials that do not exhibit an exotherm at temperatures less than or equal to 500°C (932°F) when tested by differential scanning calorimetry. **1** Materials that in themselves are normally stable, but that can become unstable at elevated temperatures and pressures: Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) at or above 0.01 W/mL and below 10 W/mL.

## DEFINITIONS OF TERMS (Continued)

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

**INSTABILITY HAZARD (continued):** **2** Materials that readily undergo violent chemical change at elevated temperatures and pressures: Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) at or above 10 W/mL and below 100W/mL. **3** Materials that in themselves are capable of detonation or explosive decomposition or explosive reaction, but that require a strong initiating source or that must be heated under confinement before initiation: Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) at or above 100 W/mL and below 1000 W/mL. Materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures. **4** Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures: Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) of 1000 W/mL or greater. Materials that are sensitive to localized thermal or mechanical shock at normal temperatures and pressures.

### FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the **National Fire Protection Association (NFPA)**. **Flash Point** - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. **Autoignition Temperature**: The minimum temperature required to initiate combustion in air with no other source of ignition. **LEL** - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. **UEL** - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

### TOXICOLOGICAL INFORMATION:

**Human and Animal Toxicology:** Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD<sub>50</sub>** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC<sub>50</sub>** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/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. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **Cancer Information:** The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. **Other Information:** **BEI** - ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV.

### ECOLOGICAL INFORMATION:

EC is the effect concentration in water. **BCF** = Bioconcentration Factor, which is used to determine if a substance will concentrate in lifeforms which consume contaminated plant or animal matter. **TL<sub>m</sub>** = median threshold limit; Coefficient of Oil/Water Distribution is represented by **log K<sub>ow</sub>** or **log K<sub>oc</sub>** and 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. **ACGIH:** American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **EPA** is the U.S. Environmental Protection Agency. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (**SARA**); the Canadian Domestic/Non-Domestic Substances List (**DSL/NDSL**); the U.S. Toxic Substance Control Act (**TSCA**); Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA** or **Superfund**); and various state regulations. This section also includes information on the precautionary warnings which appear on the material's package label. **OSHA** - U.S. Occupational Safety and Health Administration.

#### REGULATORY INFORMATION (continued):

#### EUROPEAN:

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

**AUSTRALIAN:** **AICS** is the Australian Inventory of Chemical Substances.

**NOHSC:** National Occupational Health & Safety Code.

**MITI** is the Japanese Minister of International Trade and Industry.