

# MATERIAL SAFETY DATA SHEET

## Caliper Life Sciences

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

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

#### 1. PRODUCT IDENTIFICATION

TRADE NAMES (AS LABELED):

**XenoLight Rediject D-Luciferin**  
**XenoLight Rediject D-Luciferin Ultra**  
**XenoLight Rediject Coelenterazine**

CODE NUMBERS:

PN 760504, PN 760505, PN 760506

U.N. NUMBER:

Not Applicable

U.N. DANGEROUS GOODS CLASS/SUBSIDIARY RISK:

Not Applicable

HAZCHEM CODE (AUSTRALIA):

Not Applicable

POISONS SCHEDULE NUMBER (AUSTRALIA):

Not Applicable

PRODUCT USE:

Laboratory Biological Research

U.S. SUPPLIER/MANUFACTURER'S NAME:

**Caliper Life Sciences**

Address:

68 Elm Street  
Hopkinton, MA 01748

Business Phone:

1-800-LAB-CHIP (toll-free)  
1-800-522-2447 (toll-free)  
+1-508-435-3439 (outside North America)

AUSTRALIAN SUPPLIER/DISTRIBUTOR'S NAME:

Address:

Business Phone:

EUROPEAN SUPPLIER/ DISTRIBUTOR'S NAME:

Address:

Business Phone:

EMERGENCY PHONE: CHEM-TEL: 1-800-255-3924 (U.S., Canada, Puerto Rico, U.S. Virgin Islands) 24 hrs  
+1-813-248-0585 (Worldwide Intl.) 24 hrs

EMAIL ADDRESS/COMPETENT PERSON FOR MSDS:

Techsupport@caliperls.com

DATE OF PREPARATION:

August 25, 2009

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

#### 2. HAZARD IDENTIFICATION

EU/AUSTRALIAN LABELING AND CLASSIFICATION: These products do not meet the definition of any hazard class as defined by the European Union Council Directive 67/548/EEC and subsequent Directives and by the Australian National Occupational Health and Safety Commission [NOHSC(1008:2004)].

THIS MSDS PROVIDES INFORMATION ON THREE SEPARATE PRODUCTS.

**EMERGENCY OVERVIEW: Product Description:** These products are clear, off-white to yellow, odorless liquids.

**Health Hazards:** The toxicological properties of the main component of the For XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra products described in this MSDS (D-LUCIFERIN, POTASSIUM SALT) has not been fully investigated. FOR RESEARCH USE ONLY. ALL EXPOSURE MUST BE MINIMIZED. Due to the presence of the Citric Acid, Monohydrate component in XenoLight Rediject Coelenterazine, prolonged or repeated overexposure may cause allergic skin reaction in sensitive individuals. For Other Products, the chief health hazard anticipated during normal use and handling is the potential for mild irritation of contaminated eyes or skin.

**Flammability Hazards:** The XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra products are not flammable. The XenoLight Rediject Coelenterazine product is combustible. If involved in a fire, these products will release smoke, acrid vapors, and toxic gases (e.g., carbon oxides, nitrogen oxides, sulfur oxides, and potassium oxides).

**Reactivity Hazards:** These products 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

This Material Safety Data sheet describes three products: XenoLight Rediject D-Luciferin, XenoLight Rediject D-Luciferin Ultra, and XenoLight Rediject Coelenterazine. This Material Safety Data Sheet provides complete information on all the products 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 product. These products are mixtures (preparations) of the following chemical components:

| CHEMICAL NAME | CAS # | EU EINECS# | JAPANESE ENCS# | AUSTRALIA N AICS | % v/v | EU CLASSIFICATION FOR COMPONENTS |
|---------------|-------|------------|----------------|------------------|-------|----------------------------------|
|---------------|-------|------------|----------------|------------------|-------|----------------------------------|

#### PRODUCTS 1 and 2: XENOLIGHT REDIJECT D-LUCIFERIN and XENOLIGHT REDIJECT D-LUCIFERIN ULTRA

|  |             |          |          |          |           |   |
|--|-------------|----------|----------|----------|-----------|---|
| D-Luciferin, Potassium Salt  | 115144-35-9 | Unlisted | Unlisted | Unlisted | 1.00–5.00 | HAZARD CLASSIFICATION: Not applicable.<br>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   | HAZARD CLASSIFICATION: Not applicable.<br>RISK PHRASES: Not applicable. |

#### PRODUCT 3: XENOLIGHT REDIJECT COELENTERAZINE

|                         |            |           |          |          |              |   |
|-------------------------|------------|-----------|----------|----------|--------------|---|
| 1,2-Propanediol         | 57-55-6    | 200-338-0 | 2-234    | Listed   | 90.00–100.00 | HAZARD CLASSIFICATION: Not applicable.<br>RISK PHRASES: Not applicable. |
| Citric Acid Monohydrate | 5949-29-1  | 201-069-1 | Unlisted | Listed   | 0.50–1.50    | HAZARD CLASSIFICATION: Not applicable.<br>RISK PHRASES: Not applicable. |
| Coelenterazine H        | 50909-86-9 | Unlisted  | Unlisted | Unlisted | 0.05–0.50    | HAZARD CLASSIFICATION: Not applicable.<br>RISK PHRASES: Not applicable. |

See Section 16 for full text of Ingredient Risk Phrases

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

### 4. FIRST-AID MEASURES

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

**SKIN EXPOSURE:** If these products contaminate 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 these products contaminate 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 mists or sprays of these products 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.

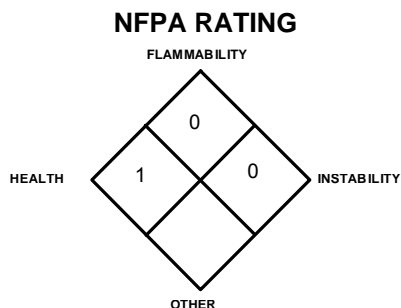
**INGESTION:** If these products are swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. DO NOT INDUCE VOMITING unless directed by medical personnel. Have contaminated individual rinse mouth with water. Never induce vomiting or give diluents (milk or water) to someone who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

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

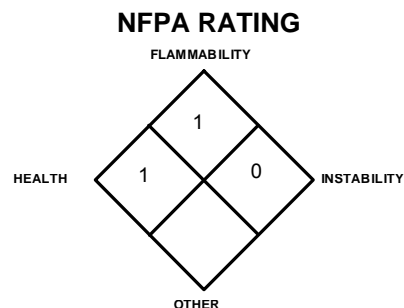
**RECOMMENDATIONS TO PHYSICIANS:** Treat symptoms and eliminate overexposure.

### 5. FIRE-FIGHTING MEASURES

#### XENOLIGHT REDIJECT D-LUCIFERIN and XENOLIGHT REDIJECT D-LUCIFERIN ULTRA



#### XENOLIGHT REDIJECT COELENTERAZINE



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

## 5. FIRE-FIGHTING MEASURES (Continued)

### FLASH POINT:

XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra: Not flammable.

XenoLight Rediject Coelenterazine: 98.9°C (210°F) [for 1,2-Propanediol]

### AUTOIGNITION TEMPERATURE:

XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra: Not applicable.

XenoLight Rediject Coelenterazine: 371°C (700°F) [for 1,2-Propanediol]

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

XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra: Not applicable.

XenoLight Rediject Coelenterazine: LEL: 2.6% UEL: 12.6% [for 1,2-Propanediol]

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

FIRE EXTINGUISHING MATERIALS NOT BE USED: None known.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Due to the limited information currently available for the main component (D-Luciferin, Potassium Salt) in XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra, these products must be viewed as potentially capable of causing temporary incapacitation. The XenoLight Rediject Coelenterazine product is combustible, it must be substantially heated to ignite. When involved in a fire, these products will release smoke, acrid vapors, and toxic gases (e.g., carbon oxides, nitrogen oxides, sulfur oxides, and potassium oxides).

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. If protective equipment is contaminated by these products, it should be thoroughly washed with running water prior to removal of SCBA respiratory protection. Firefighters whose protective equipment becomes contaminated should thoroughly shower with warm, soapy water and should receive medical evaluation if they experience any adverse effects. Move fire-exposed containers, if it can be done without risk to firefighters. 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: Trained personnel using pre-planned procedures should respond to uncontrolled releases. Proper protective equipment should be used. In case of a spill, clear the affected area and protect people. Eliminate all sources of ignition before cleanup begins. Use non-sparking tools. The atmosphere must have levels of constituents lower than those listed in Section 8, (Exposure Controls and Personal Protective Equipment), if applicable, and have at least 19.5 percent oxygen before personnel can be allowed into the area without Self-Contained Breathing Apparatus (SCBA).

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

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

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

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

### 7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting these products ON YOU or IN YOU. Wash thoroughly after handling these products. Do not eat, drink, smoke, or apply cosmetics while handling these products. Use in a well-ventilated location. Remove contaminated clothing immediately.

STORAGE AND HANDLING PRACTICES: All employees who handle these materials should be trained to handle them safely. Avoid breathing vapors or mists generated by these products. Ensure containers of these products 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. Use non-sparking tools. Store away from incompatible materials. Inspect vials containing these products for leaks or damage. Read instructions provided with the product prior to use.

SPECIFIC USE(S): These products are for use in laboratory biological research. Follow all industry standards for use.

## 7. HANDLING and STORAGE (Continued)

**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 International, National, and local hazardous waste disposal regulations.

## 8. EXPOSURE CONTROLS - PERSONAL PROTECTION

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

**EXPOSURE LIMITS/GUIDELINES:**

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

### PRODUCTS 1 and 2: XENOLIGHT REDIJECT D-LUCIFERIN and XENOLIGHT REDIJECT D-LUCIFERIN ULTRA

| D-Luciferin, Potassium Salt | 115144-35-9 | NE | NE | NE | NE | NE | NE | NE | NE |
|-----------------------------|-------------|----|----|----|----|----|----|----|----|
|-----------------------------|-------------|----|----|----|----|----|----|----|----|

### PRODUCT 3: XENOLIGHT REDIJECT COELENTERAZINE

| 1,2-Propanediol         | 57-55-6    | NE | NE | NE | NE | NE | NE | NE | AIHA WEEL:<br>TWA = 10 |
|-------------------------|------------|----|----|----|----|----|----|----|------------------------|
| Citric Acid Monohydrate | 5949-29-1  | NE | NE | NE | NE | NE | NE | NE | NE                     |
| Coelenterazine H        | 50909-86-9 | NE | NE | NE | NE | NE | NE | NE | NE                     |

NE = Not Established.

See Section 16 for Definitions of Other Terms Used

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

**PROPYLENE GLYCOL:**

New Zealand: TWA = 10 mg/m<sup>3</sup> (particulates only),  
JAN 2002

**PROPYLENE GLYCOL (continued):**

New Zealand: TWA = 150 ppm (474 mg/m<sup>3</sup>)  
(vapour and particulates), JAN 2002  
Russia: STEL = 7 mg/m<sup>3</sup>, JUN 2003

**PROPYLENE GLYCOL (continued):**

United Kingdom: TWA = 10 mg/m<sup>3</sup> (particulate),  
2005  
United Kingdom: TWA = 150 ppm (474 mg/m<sup>3</sup>)  
(total vapor), 2005

*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.*

**RESPIRATORY PROTECTION:** Respiratory protection is not generally needed when using these products. Maintain airborne contaminant concentrations below limits listed above. In instances where inhalable mists or sprays of product may be generated and respiratory protection is necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), equivalent U.S. State standards, Canadian CSA Standard Z94.4-02, European Standard EN 529:2005, EU member state standards, Australian Standard 1716-Respiratory Protective Devices and Australian Standard 1715-Selection, Use, and Maintenance of Respiratory Protective Devices, or Japanese Standard JIS T 8150:2006. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under U.S. Federal OSHA's Respiratory Protection Standard (1910.134-1998).

**EYE PROTECTION:** Depending on the use of these products, 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, Canadian CSA Standard Z94.3-07, European Standard CR 13464:1999, Australian Standard 1337-Eye Protection for Industrial Applications and Australian Standard 1336-Recommended Practices for Eye Protection in the Industrial Environment, or Japanese Standard JIS T 8147:2003.

**HAND PROTECTION:** Wear butyl rubber, neoprene, or nitrile rubber or latex gloves for routine use. Use triple gloves for spill response. If necessary, refer to U.S. OSHA 29 CFR 1910.138, Australian Standard 2161-Industrial Safety Gloves and Mittens, European Standard CEN/TR 15419:2006, or Japanese Standard JIS T 8116:2005.

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

**BODY PROTECTION:** Use body protection appropriate for task, such as a lab coat. If necessary, refer to OSHA Technical Manual (Section VII: Personal Protective Equipment), European Standard CEN/TR 15419:2006, Australian Standard 3765-Clothing for Protection Against Hazardous Chemicals, or Japanese Standard JIS T 8030:2005. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR 1910.136, Canadian CSA Standard Z195.1-02, *Guideline on Selection, Care, and Use of Protective Footwear*, or European Standard CEN ISO/TR 18690:2006.

## 9. PHYSICAL and CHEMICAL PROPERTIES

**APPEARANCE AND COLOR:** Clear, off-white to yellow, odorless liquids

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

**pH:** Not established.

**BOILING POINT:**

XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra: Not established.

XenoLight Rediject Coelenterazine: 188.2°C (370.8°F) [for 1,2-Propanediol]

**MELTING/FREEZING POINT:**

XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra: Not established.

XenoLight Rediject Coelenterazine: -59°C (-74°F) [for 1,2-Propanediol]

**FLASH POINT:**

XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra: Not applicable.

XenoLight Rediject Coelenterazine: 98.9°C (210°F) [for 1,2-Propanediol]

**FLAMMABILITY:**

XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra: Not flammable.

XenoLight Rediject Coelenterazine: Class IIIB Combustible Liquid.

**EXPLOSIVE PROPERTIES:** Not explosive

**OXIDIZING PROPERTIES:** Not an oxidizer.

**VAPOR PRESSURE:**

XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra: Not established.

XenoLight Rediject Coelenterazine: 0.08 mmHg @ 20°C [for 1,2-Propanediol]

**SPECIFIC GRAVITY:**

XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra: Not established.

XenoLight Rediject Coelenterazine: 0.0361 @ 20°C [for 1,2-Propanediol]

**SOLUBILITY:** Miscible in methanol and ethanol.

**SOLUBILITY IN WATER:** Completely soluble.

**VISCOSITY:**

XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra: Not established.

XenoLight Rediject Coelenterazine: 0.581 poise @ 20°C [for 1,2-Propanediol]

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

XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra: Not established.

XenoLight Rediject Coelenterazine: 2.62

**EVAPORATION RATE:** Similar to water.

**ODOR THRESHOLD:** Not established.

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

## 10. STABILITY AND REACTIVITY

**STABILITY:** Stable.

**DECOMPOSITION PRODUCTS:** *Combustion:* carbon oxides, nitrogen oxides, sulfur oxides, and potassium oxides.

*Hydrolysis:* None known.

**MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE:** Strong oxidizers, substances that are incompatible with water.

**HAZARDOUS POLYMERIZATION:** Will not occur.

**CONDITIONS TO AVOID:** High temperatures, mixing these products with incompatible chemicals.

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

### 11. TOXICOLOGICAL INFORMATION

**SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE:** The toxicological properties of these products have not been fully investigated; all exposure must be minimized. The potential health effects of these products, via route of exposure, are described as follows.



**INHALATION:**

XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra: Inhalation of mists or sprays of these products may mildly irritate the nose, throat, and lungs. Symptoms may include coughing and sneezing. The toxicological properties of the D-Luciferin, Potassium Salt component of these products have not been fully investigated, all exposures must be minimized.



XenoLight Rediject Coelenterazine: Inhalation of mists or sprays of this product may mildly irritate the nose, throat, and lungs. Symptoms may include coughing and sneezing.

## 11. TOXICOLOGICAL INFORMATION (Continued)

### XENOLIGHT REDIJECT D-LUCIFERIN and XENOLIGHT REDIJECT D-LUCIFERIN ULTRA

| HAZARDOUS MATERIAL IDENTIFICATION SYSTEM  |               |   |               |
|---|---------------|---|---------------|
| <b>HEALTH HAZARD</b>  | (BLUE)        | 1   |               |
| <b>FLAMMABILITY HAZARD</b>  | (RED)         | 0   |               |
| <b>PHYSICAL HAZARD</b>  | (YELLOW)      | 0   |               |
| PROTECTIVE EQUIPMENT  |               |   |               |
| EYES  | RESPIRATORY   | HANDS   | BODY          |
|  | SEE SECTION 8 |  | SEE SECTION 8 |
| For Routine Industrial Use and Handling Applications                              |               |   |               |

### XENOLIGHT REDIJECT COELENTERAZINE

| HAZARDOUS MATERIAL IDENTIFICATION SYSTEM  |               |   |               |
|---|---------------|---|---------------|
| <b>HEALTH HAZARD</b>  | (BLUE)        | 1   |               |
| <b>FLAMMABILITY HAZARD</b>  | (RED)         | 0   |               |
| <b>PHYSICAL HAZARD</b>  | (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

**CONTACT WITH SKIN or EYES:** Skin and eye contact may mildly irritate contaminated tissue. Symptoms of skin overexposure may include redness and discomfort. Prolonged or repeated skin contact may cause dermatitis (dry, red skin).

**XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra:** The toxicological properties of the D-Luciferin, Potassium Salt component of these products have not been fully investigated, all exposures must be minimized.

**XenoLight Rediject Coelenterazine:** Due to the presence of Citric Acid, Monohydrate (a suspect skin sensitizer) in this product, prolonged or repeated overexposure may cause allergic reaction in sensitive individuals.

#### SKIN ABSORPTION:

**XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra:** It is not known whether some components of these products can be absorbed via intact skin. Skin contact should be minimized.

**XenoLight Rediject Coelenterazine:** The components of this product are not known to be absorbed through intact skin.

**INGESTION:** Ingestion is not anticipated to be a significant route of exposure for these products.

**XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra:** If these products are swallowed, they may cause gastric distress. Large doses may cause nausea, vomiting, and diarrhea. The toxicological properties of the D-Luciferin, Potassium Salt component of these products have not been fully investigated, all exposures must be minimized.

**XenoLight Rediject Coelenterazine:** If this product is swallowed, it may cause gastric distress. Large doses may cause nausea, vomiting, and diarrhea.

#### INJECTION:

**XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra:** Accidental injection of these products, via laceration or puncture by a contaminated object, may cause local reddening, tissue swelling, and discomfort in addition to the wound. The toxicological properties of the D-Luciferin, Potassium Salt component of these products have not been fully investigated, all exposures must be minimized.

**XenoLight Rediject Coelenterazine:** Accidental injection of this product, 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:

**XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra:** Large oral doses may cause nausea, vomiting, and diarrhea. The toxicological properties of the D-Luciferin, Potassium Salt component of these products have not been fully investigated, all exposures must be minimized.

**XenoLight Rediject Coelenterazine:** Large oral doses may cause nausea, vomiting, and diarrhea.

#### Chronic:

**XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra:** Prolonged or repeated skin contact may cause dermatitis (dry, red skin).

**XenoLight Rediject Coelenterazine:** Due to the presence of Citric Acid, Monohydrate (a suspect skin sensitizer) in this product, prolonged or repeated overexposure may cause allergic reaction in sensitive individuals.

## 11. TOXICOLOGICAL INFORMATION (Continued)

**TARGET ORGANS:** Acute: Eyes, gastrointestinal tract. Chronic: Skin.

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

### CITRIC ACID MONOHYDRATE:

Eye Irritancy (rabbit) = 5 mg/30 seconds; mild  
LD<sub>50</sub> (intraperitoneal, rat) = 375 mg/kg

### D-LUCIFERIN, POTASSIUM SALT:

Currently, there are no toxicological data available for this compound.

### PROPYLENE GLYCOL:

Skin Irritancy (human) = 500 mg/7 days; mild  
Skin Irritancy (human) = 104 mg/3 days/intermittent; moderate  
Skin Irritancy (man) = 10%/2 days  
TDLo (oral, child) = 79 g/kg/56 weeks/intermittent;  
Central nervous system effects, BRN  
TDLo (parenteral, infant) = 10 g/kg/3 days/continuous; Systemic effects  
LD<sub>50</sub> (oral, rat) = 20 g/kg  
LD<sub>50</sub> (oral, mouse) = 22 g/kg  
LD<sub>50</sub> (oral, rabbit) 18500 mg/kg  
LD<sub>50</sub> (oral, dog) = 22 g/kg

### PROPYLENE GLYCOL (continued):

LD<sub>50</sub> (oral, guinea pig) = 18350 mg/kg  
LD<sub>50</sub> (oral, quail) > 2080 mg/kg  
LD<sub>50</sub> (intraperitoneal, rat) = 6660 mg/kg  
LD<sub>50</sub> (intraperitoneal, mouse) = 9718 mg/kg  
LD<sub>50</sub> (subcutaneous, rat) = 22,500 mg/kg  
LD<sub>50</sub> (intravenous, rat) = 6423 mg/kg  
LD<sub>50</sub> (intravenous, mouse) = 6630 mg/kg  
LD<sub>50</sub> (intravenous, rabbit) = 6500 mg/kg  
LD<sub>50</sub> (intravenous, dog) = 26 g/kg  
LDLo (intravenous, chicken) = 27 g/kg; Vascular: other changes  
LD<sub>50</sub> (intramuscular, rat) = 14 g/kg  
LD<sub>50</sub> (subcutaneous, mouse) = 17,370 mg/kg  
LDLo (subcutaneous, guinea pig) = 15500 mg/kg  
LD<sub>50</sub> (skin, rabbit) = 20800 mg/kg  
LDLo (intramuscular, rabbit) = 6300 mg/kg;  
Behavioral: somnolence (general depressed activity); Behavioral: coma; Lungs, Thorax, or Respiration: respiratory stimulation

### PROPYLENE GLYCOL (continued):

TCLo (inhalation, rat) = 2180 mg/m<sup>3</sup>/6 hours/90 days/intermittent; Behavioral: food intake (animal); Endocrine: changes in spleen weight; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: dehydrogenases  
TDLo (intraperitoneal, mouse) = 100 mg/kg/15 days preg; Teratogenic effects  
TDLo (intraperitoneal, mouse) = 100 mg/kg/11 days preg; Reproductive effects  
Eye Irritancy (rabbit) = 100 mg; mild  
Eye Irritancy (rabbit) = 500 mg/24 hours; mild  
DNA Inhibition (subcutaneous, mouse) = 8000 mg/kg  
Cytogenetic Analysis (subcutaneous, mouse) = 8000 mg/kg  
Cytogenetic Analysis (fibroblast, hamster) = 32 g/L

**IRRITANCY OF PRODUCT:** It is anticipated that these products may irritate the respiratory system, skin, and eyes.

### SENSITIZATION TO THE PRODUCT:

XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra: The components in these products are not known to be human skin or respiratory sensitizers.

XenoLight Rediject Coelenterazine: Due to the presence of Citric Acid, Monohydrate (a suspect skin sensitizer) in this product, overexposure may cause allergic reaction in sensitive individuals.

**CARCINOGENIC POTENTIAL:** The components of these products 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.

**REPRODUCTIVE TOXICITY INFORMATION:** Listed below is information concerning the effects of these products on the human reproductive system.

**Mutagenicity:** These products are not reported to produce mutagenic effects in humans. Animal mutation data are available for the 1,2-Propanediol component of XenoLight Rediject Coelenterazine; these data were obtained during clinical studies on specific animal tissues exposed to high doses of this compound.

**Embryotoxicity:** The components of these products are not reported to cause human embryotoxic effects.

**Teratogenicity:** These products are not reported to cause teratogenic effects in humans. Clinical studies on test animals exposed to relatively high doses of the 1,2-Propanediol component of XenoLight Rediject Coelenterazine provided teratogenic data.

**Reproductive Toxicity:** These products are not reported to cause adverse reproductive effects in humans. Clinical studies on test animals exposed to relatively high doses of the 1,2-Propanediol component of XenoLight Rediject Coelenterazine provided reproductive toxicity data.

*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 components of these products.

## 12. ECOLOGICAL INFORMATION

**MOBILITY:** These products have not been tested for mobility in soil. Additional data for components are available as follows:

### 1,2-PROPANEDIOL:

The Koc of Propylene Glycol is estimated as 8, using a log Kow of -0.92 and a regression-derived equation. According to a classification scheme, this estimated Koc value suggests that Propylene Glycol is expected to have very high mobility in soil.

**PERSISTENCE AND BIODEGRADABILITY:** These products have not been tested for persistence or biodegradability. It is expected that the components of these products will slowly degrade in the environment and form a variety of organic and inorganic materials; however, no specific information is known. Additional data for components are available as follows:

### 1,2-PROPANEDIOL:

Based on a classification scheme, an estimated Koc value of 8, determined from a log Kow of -0.92 and a regression-derived equation, indicates that Propylene Glycol is expected to have very high mobility in soil. Volatilization of Propylene Glycol from moist soil surfaces is not expected to be an important fate process given an estimated Henry's Law constant of 1.3X10<sup>-8</sup> atm-cu m/mole, derived from its vapor pressure, 0.13 mmHg, and water solubility, 1X10<sup>+6</sup> mg/liter. Propylene Glycol is not expected to volatilize from dry soil surfaces based upon its vapor pressure. Laboratory experiments using agricultural soils from South Carolina conducted at 22 deg C and a fortification of 1,000 ppm Propylene Glycol, yielded 73-78% mineralization during a 51 day incubation period, suggesting that biodegradation will be an important fate process in soils. Based on a classification scheme, an estimated Koc value of 8, determined from a log Kow of -0.92 and a regression-derived equation, indicates that Propylene Glycol is not expected to adsorb to suspended solids and sediment. Volatilization from water surfaces is not expected based upon an estimated Henry's Law constant of 1.3X10<sup>-8</sup> atm-cu m/mole, derived from its vapor pressure, 0.13 mmHg, and water solubility, 1X10<sup>+6</sup> mg/L. Numerous screening studies using wastewater or sewage inoculum as seed, suggests that Propylene Glycol will be degraded readily under aqueous environments. According to a model of gas/particle partitioning of semi-volatile organic compounds in the atmosphere, Propylene Glycol, which has a vapor pressure of 0.13 mmHg at 25°C, is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase Propylene Glycol is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 32 hours, calculated from its rate constant of 1.2X10<sup>-11</sup> cu cm/molecule-sec at 25°C

## 12. ECOLOGICAL INFORMATION (Continued)

**BIO-ACCUMULATION POTENTIAL:** These products have not been tested for bio-accumulation potential. Additional data for components are available as follows:

### 1,2-PROPANEDIOL:

An estimated BCF of 3 was calculated for Propylene Glycol, using a log Kow of -0.92 and a regression-derived equation. According to a classification scheme, this BCF suggests the potential for bioconcentration in aquatic organisms is low.

**ECOTOXICITY:** These products have not been tested for aquatic or animal toxicity. All releases to terrestrial, atmospheric and aquatic environments should be avoided. Additional data for components are available as follows:

### 1,2-PROPANEDIOL:

EC<sub>50</sub> (*Photobacterium phosphoreum*, bacteria) 30 minutes = 26,800 mg/L

TD (*Chlorella pyrenoidosa*, algae) = 92,000 mg/L

EC<sub>0</sub> (*Daphnia magna*, crustacean) 48 hours = < 4,295 mg/L

EC<sub>50</sub> (*Daphnia magna*, crustacean) 48 hours = 34,400 mg/L

EC<sub>100</sub> (*Daphnia magna*, crustacean) 48 hours = 50,000 mg/L

### 1,2-PROPANEDIOL (continued):

EC<sub>50</sub> (*Daphnia magna*, crustacean) 24 hours = > 10,000 mg/L

EC<sub>100</sub> (*Daphnia magna*, crustacean) 24 hours = > 10,000 mg/L

EC<sub>50</sub> (*Nitocra spinipes*, crustacean) 96 hours = > 10,000 mg/L

LC<sub>50</sub> (*Lebistes reticulatus*, guppy) 48 hours > 10,000 mg/L

LC<sub>50</sub> (*Carassius auratus*) 24 hours = > 5,000 mg/L

LC<sub>50</sub> (*Salmo gairdneri*) 24 hours = 50,000 mg/L

### 1,2-PROPANEDIOL (continued):

LC<sub>50</sub> (*Pimephales promelas*) 96 hours = 54,900 mg/L

LC<sub>50</sub> (*Artemia salina*) 24 hours = >10,000 mg/L

LC<sub>100</sub> (*Pimephales promelas*) 96 hours = 65,610 mg/L

NOEC (*Pimephales promelas*) 96 hours < 47,829 mg/L

fingering trout: at 50,000 mg/l at 10°C: no mortality or apparent signs of stress were produced during a 25-hr exposure period (static bioassay)

**OTHER ADVERSE EFFECTS:** These products do not contain any component 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

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

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

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

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

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

## 14. TRANSPORTATION INFORMATION

**U.S. DEPARTMENT OF TRANSPORTATION REGULATIONS:** These products are NOT classified as dangerous goods, per U.S. DOT regulations, under 49 CFR 172.101.

**TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:** These products are NOT classified as Dangerous Goods, per regulations of Transport Canada.

**INTERNATIONAL AIR TRANSPORT ASSOCIATION/ICAO (IATA/ICAO):** These products are NOT classified as dangerous goods, per rules of IATA.

**INTERNATIONAL MARITIME ORGANIZATION (IMO):** These products are NOT classified as dangerous goods, per the rules of IMO.

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

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

## 15. REGULATORY INFORMATION

### ADDITIONAL U.S. REGULATIONS:

**U.S. SARA REPORTING REQUIREMENTS:** The components of these products 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 components of these products. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) therefore applies, per 40 CFR 370.20.

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

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

## 15. REGULATORY INFORMATION (Continued)

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

OTHER U.S. FEDERAL REGULATIONS: Not applicable.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): The components of these products are not on the California Proposition 65 lists.

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

XenoLight Rediject D-Luciferin and XenoLight Rediject D-Luciferin Ultra: **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.

XenoLight Rediject Coelenterazine: **CAUTION!** CONTAINS A SUSPECT SKIN SENSITIZER. 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/NDL INVENTORY STATUS: Some components of these products are not included in the DSL/NDL Inventory. These products must be used only for research and development purposes. The manufacturer should be consulted prior to using these products for other applications. Other requirements may apply.

OTHER CANADIAN REGULATIONS: Not applicable.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITY SUBSTANCES LISTS: These products are not on the CEPA Priority Substances Lists.

CANADIAN WHMIS CLASSIFICATION AND SYMBOLS: Not applicable.

### EUROPEAN UNION INFORMATION:

LABELING/CLASSIFICATION: These products do not meet the definition of any hazard class, as defined by EU Council Directive 67/548/EEC and subsequent directives. Caution; this preparation has not been fully tested.

### FOR CONSTITUENTS:

#### All Constituents:

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

### AUSTRALIAN INFORMATION FOR PRODUCT:

AUSTRALIAN INVENTORY OF CHEMICAL SUBSTANCES (AICS) STATUS: Some components of these products are not included in the AICS. 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 components of these products are not listed in the HSIS.

CLASSIFICATION: These products do not meet the definition of any hazard class, as defined by the Australian National Occupational Health and Safety Commission [NOHSC (1008:2004)].

POISONS SCHEDULE NUMBER: Not applicable.

### JAPANESE INFORMATION FOR PRODUCT:

JAPANESE ENCS: Some components of these products are not included in the ENCS Inventory.

POISONOUS AND DELETERIOUS SUBSTANCES CONTROL LAW: The components of these products are not listed as a Specified Poisonous Substance under the Poisonous and Deleterious Substances Control Law.

---

## 16. OTHER INFORMATION

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.  
PO Box 1961, Hilo, HI 96921  
800/441-3365 • 808/969-4846

## DEFINITIONS OF TERMS

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

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

### EXPOSURE LIMITS IN AIR:

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

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

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

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

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

**LOQ:** Limit of Quantitation.

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

**NIC:** Notice of Intended Change.

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

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

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

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

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

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

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

**WEEL:** Workplace Environmental Exposure Limits from the AIHA.

### HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS:

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

**HEALTH HAZARD: 0 Minimal Hazard:** No significant health risk, irritation of skin or eyes not anticipated. *Skin Irritation:* Essentially non-irritating. Mechanical irritation may occur. PII or Draize = 0. *Eye Irritation:* Essentially non-irritating, minimal effects clearing in < 24 hours. Mechanical irritation may occur. Draize = 0. *Oral Toxicity LD<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.

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

**HEALTH HAZARD (continued): 3 Serious Hazard:** Major injury likely unless prompt action is taken and medical treatment is given; high level of toxicity; corrosive. *Skin Irritation:* Severely irritating and/or corrosive; may cause destruction of dermal tissue, skin burns, and dermal necrosis. PII or Draize > 5–8, with destruction of tissue. *Eye Irritation:* Corrosive, irreversible destruction of ocular tissue; corneal involvement or irritation persisting for more than 21 days. Draize > 80 with effects irreversible in 21 days. *Oral Toxicity LD<sub>50</sub> Rat:* > 1–50 mg/kg. *Dermal Toxicity LD<sub>50</sub> Rat or Rabbit:* > 20–200 mg/kg. *Inhalation Toxicity LC<sub>50</sub> 4-hrs Rat:* > 0.05–0.5 mg/L. **4 Severe Hazard:** Life-threatening; major or permanent damage may result from single or repeated exposures; extremely toxic; irreversible injury may result from brief contact. *Skin Irritation:* Not appropriate. Do not rate as a 4, based on skin irritation alone. *Eye Irritation:* Not appropriate. Do not rate as a 4, based on eye irritation alone. *Oral Toxicity LD<sub>50</sub> Rat:* ≤ 1 mg/kg. *Dermal Toxicity LD<sub>50</sub> Rat or Rabbit:* ≤ 20 mg/kg. *Inhalation Toxicity LC<sub>50</sub> 4-hrs Rat:* ≤ 0.05 mg/L.

**FLAMMABILITY HAZARD: 0 Minimal Hazard:** Materials that will not burn in air when 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 coarse 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 0 rating. *Oxidizers:* No 0 rating. *Unstable Reactives:* Substances that will not polymerize, decompose, condense, or self-react. **1 Water Reactivity:** Materials that change or decompose upon exposure to moisture. *Organic Peroxides:* Materials that are normally stable, but can become unstable at high temperatures and pressures. These materials may react with water, but will not release energy violently. *Explosives:* Division 1.5 & 1.6 explosives. Substances that are very insensitive explosives or that do not have a mass explosion hazard. *Compressed Gases:* Pressure below OSHA definition. *Pyrophorics:* No Rating. *Oxidizers:* Packaging Group III oxidizers; Solids: any material that in either concentration tested, exhibits a mean burning time less than or equal to the mean burning time of a 3:7 potassium bromate/cellulose mixture and the criteria for Packing Group I and II are not met. Liquids: any material that exhibits a mean pressure rise time less than or equal to the pressure rise time of a 1:1 nitric acid (65%)/cellulose mixture and the criteria for Packing Group I and II are not met. *Unstable Reactives:* Substances that may decompose condense, or self-react, but only under conditions of high temperature and/or pressure and have little or no potential to cause significant heat generation or explosion hazard. Substances that readily undergo hazardous polymerization in the absence of inhibitors. **2 Water Reactivity:** Materials that may react violently with water. *Organic Peroxides:* Materials that, in themselves, are normally unstable and will readily undergo violent chemical change, but will not detonate. These materials may also react violently with water. *Explosives:* Division 1.4 explosives. Explosive substances where the explosive effects are largely confined to the package and no projection of fragments of appreciable size or range are expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package. *Compressed Gases:* Pressurized and meet OSHA definition but < 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics:* No Rating. *Oxidizers:* Packing Group II oxidizers. Solids: any material that, either in concentration tested, exhibits a mean burning time of less than or equal to the mean burning time of a 2:3 potassium bromate/cellulose mixture and the criteria for Packing Group I are not met. Liquids: any material that exhibits a mean pressure rise time less than or equal to the pressure rise of a 1:1 aqueous sodium chlorate solution (40%)/cellulose mixture and the criteria for Packing Group I are not met. *Reactives:* Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure, but have a low potential (or low risk) for significant heat generation or explosion. Substances that readily form peroxides upon exposure to air or oxygen at room temperature.

## DEFINITIONS OF TERMS (Continued)

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

**PHYSICAL HAZARD (continued):** **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  $\geq$  514.7 psi absolute at 21.1°C (70°F) [500 psig]. **Pyrophorics:** No Rating. **Oxidizers:** Packing Group I oxidizers. Solids: any material that, in either concentration tested, exhibits a mean burning time less than the mean burning time of a 3:2 potassium bromate/cellulose mixture. Liquids: any material that spontaneously ignites when mixed with cellulose in a 1:1 ratio, or which exhibits a mean pressure rise time less than the pressure rise time of a 1:1 perchloric acid (50%)/cellulose mixture. **Unstable Reactives:** Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure and have a moderate potential (or moderate risk) to cause significant heat generation or explosion. **4 Water Reactivity:** Materials that react explosively with water without requiring heat or confinement. **Organic Peroxides:** Materials that are readily capable of detonation or explosive decomposition at normal temperature and pressures. **Explosives:** Division 1.1 & 1.2 explosives. Explosive substances that have a mass explosion hazard or have a projection hazard. A mass explosion is one that affects almost the entire load instantaneously. **Compressed Gases:** No Rating. **Pyrophorics:** Add to the definition of Flammability 4. **Oxidizers:** No 4 rating. **Unstable Reactives:** Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure and have a high potential (or high risk) to cause significant heat generation or explosion.

### NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS:

**HEALTH HAZARD: 0** Materials that, under emergency conditions, would offer no hazard beyond that of ordinary combustible materials. Gases and vapors with an LC<sub>50</sub> for acute inhalation toxicity greater than 10,000 ppm. Dusts and mists with an LC<sub>50</sub> for acute inhalation toxicity greater than 200 mg/L. Materials with an LD<sub>50</sub> for acute dermal toxicity greater than 2000 mg/kg. Materials with an LD<sub>50</sub> for acute oral toxicity greater than 2000 mg/kg. Materials essentially non-irritating to the respiratory tract, eyes, and skin. **1** Materials that, under emergency conditions, can cause significant irritation. Gases and vapors with an LC<sub>50</sub> for acute inhalation toxicity greater than 5,000 ppm but less than or equal to 10,000 ppm. Dusts and mists with an LC<sub>50</sub> for acute inhalation toxicity greater than 10 mg/L but less than or equal to 200 mg/L. Materials with an LD<sub>50</sub> for acute dermal toxicity greater than 1000 mg/kg but less than or equal to 2000 mg/kg. Materials that slightly to moderately irritate the respiratory tract, eyes and skin. Materials with an LD<sub>50</sub> for acute oral toxicity greater than 500 mg/kg but less than or equal to 2000 mg/kg. **2** Materials that, under emergency conditions, can cause temporary incapacitation or residual injury. Gases with an LC<sub>50</sub> for acute inhalation toxicity greater than 3,000 ppm but less than or equal to 5,000 ppm. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than one-fifth its LC<sub>50</sub> for acute inhalation toxicity, if its LC<sub>50</sub> is less than or equal to 5000 ppm and that does not meet the criteria for either degree of hazard 3 or degree of hazard 4. Dusts and mists with an LC<sub>50</sub> for acute inhalation toxicity greater than 2 mg/L but less than or equal to 10 mg/L. Materials with an LD<sub>50</sub> for acute dermal toxicity greater than 200 mg/kg but less than or equal to 1000 mg/kg. Compressed liquefied gases with boiling points between -30°C (-22°F) and -55°C (-66.5°F) that cause severe tissue damage, depending on duration of exposure. Materials that are respiratory irritants. Materials that cause severe, but reversible irritation to the eyes or are lachrymators. Materials that are primary skin irritants or sensitizers. Materials whose LD<sub>50</sub> for acute oral toxicity is greater than 50 mg/kg but less than or equal to 500 mg/kg. **3** Materials that, under emergency conditions, can cause serious or permanent injury. Gases with an LC<sub>50</sub> for acute inhalation toxicity greater than 1,000 ppm but less than or equal to 3,000 ppm. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater its LC<sub>50</sub> for acute inhalation toxicity, if its LC<sub>50</sub> is less than or equal to 3000 ppm and that does not meet the criteria for degree of hazard 4. Dusts and mists with an LC<sub>50</sub> for acute inhalation toxicity greater than 0.5 mg/L but less than or equal to 2 mg/L. Materials with an LD<sub>50</sub> for acute dermal toxicity greater than 40 mg/kg but less than or equal to 200 mg/kg. Materials that are corrosive to the respiratory tract. Materials that are corrosive to the eyes or cause irreversible corneal opacity. Materials corrosive to the skin. Cryogenic gases that cause frostbite and irreversible tissue damage. Compressed liquefied gases with boiling points below -55°C (-66.5°F) that cause frostbite and irreversible tissue damage. Materials with an LD<sub>50</sub> for acute oral toxicity greater than 5 mg/kg but less than or equal to 50 mg/kg. **4** Materials that, under emergency conditions, can be lethal. Gases with an LC<sub>50</sub> for acute inhalation toxicity less than or equal to 1,000 ppm. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than ten times its LC<sub>50</sub> for acute inhalation toxicity, if its LC<sub>50</sub> is less than or equal to 1000 ppm. Dusts and mists whose LC<sub>50</sub> for acute inhalation toxicity is less than or equal to 0.5 mg/L. Materials whose LD<sub>50</sub> for acute dermal toxicity is less than or equal to 40 mg/kg. Materials whose LD<sub>50</sub> for acute oral toxicity is less than or equal to 5 mg/kg.

**FLAMMABILITY HAZARD: 0** Materials that will not burn under typical fire conditions, including intrinsically noncombustible materials such as concrete, stone, and sand. Materials that will not burn in air when exposed to a temperature of 816°C (1500°F) for a period of 5 minutes in accordance with Annex D of NFPA 704. **1** Materials that must be preheated before ignition can occur. Materials in this degree require considerable preheating, under all ambient temperature conditions, before ignition and combustion can occur. Materials that will burn in air when exposed to a temperature of 816°C (1500°F) for a period of 5 minutes in accordance with Annex D of NFPA 704. Liquids, solids, and semisolids having a flash point at or above 93.4°C (200°F) (i.e. Class IIIB liquids). Liquids with a flash point greater than 35°C (95°F) that do not sustain combustion when tested using the *Method of Testing for Sustained Combustibility*, per 49 CFR 173, Appendix H or the UN *Recommendations on the Transport of Dangerous Goods, Model Regulations* (current edition) and the related *Manual of Tests and Criteria* (current edition).

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

**FLAMMABILITY HAZARD (continued): 1 (continued):** 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 100 W/mL. **3** Materials that in themselves are capable of detonation or explosive decomposition or explosive reaction, but that require a strong initiating source or that must be heated under confinement before initiation. Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) 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 LDo, or TC, TC<sub>0</sub>, 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.

## DEFINITIONS OF TERMS (Continued)

### ECOLOGICAL INFORMATION:

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

### REGULATORY INFORMATION:

#### U.S.:

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

### REGULATORY INFORMATION (continued):

#### CANADA:

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

#### EUROPE:

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

#### AUSTRALIA:

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

#### JAPAN:

METI: Ministry of Economy, Trade and Industry.