MATERIAL SAFETY DATA SHEET

Illumina, Inc.

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

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

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

PRODUCT IDENTIFIER

TRADE NAME (AS LABELED): **Illumina Cluster Generation Reagents**

CHEMICAL NAME/CLASS:

SYNONYMS:

DOCUMENT NUMBER: 15011656

PRODUCT USE: DNA Sequencing

SUPPLIER OF THE SAFETY DATA SHEET: **ILLUMINA, Inc.**

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AUSTRALIAN SUPPLIER/DISTRIBUTOR'S NAME:

Address:

Business Phone:

EUROPEAN SUPPLIER/ DISTRIBUTOR'S NAME:

Address:

Business Phone:

DATE OF PREPARATION: December 16, 2009

DATE OF REVISION: June 16, 2011

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

2. HAZARD IDENTIFICATION

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

GLOBAL HARMONIZATION AND EU CLP REGULATION (EC) 1272/2008 LABELING AND CLASSIFICATION: This product has been classified per CLP Regulation (EC) 1272/2008 and Japanese Industrial Standard Z 7251:2006.

Code GA#-HP3 Solution:

Classification: Skin Corrosive Cat. 1A. *Signal Word*: Danger *Hazard Statement Codes*: H314

Precautionary Statement Codes: P260, P264, P280, P301 + P330 + P331, P303 + P361 + P353, P363, P304 + P340, P310, P321, P305 + P351 + P338, P405, P501

Hazard Symbol/Pictogram:

Codes GA#-AT1 and GA#AT2, Code GA#-LS1, and GA#-LDR1 Solutions:

Classification: Reproductive Toxicant Category 1B. *Signal Word*: Danger *Hazard Statement Codes*: H360

Precautionary Statement Codes: P201, P202, P281, P308 + P313, P405, P501 *Hazard Symbol/Pictogram*:

All Other Solutions:

Classification: Not applicable. *Signal Word*: Not applicable. *Hazard Statement Codes*: Not applicable.

Precautionary Statement Codes: Not applicable. *Hazard Symbol/Pictogram*: Not applicable.

EU/AUSTRALIAN LABELING AND CLASSIFICATION: This product has been classified per European Union Council Directive 67/548/EEC and subsequent Directives and Australian National Occupational Health and Safety Commission [NOHSC(1008:2004)].

Code GA#-HP3 Solution:

Classification: Corrosive. *Risk Phrases*: R35 *Symbol*:

Codes GA#-AT1 and GA#AT2, Code GA#-LS1, and GA#-LDR1 Solution Solutions:

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

All Other Solutions:

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

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

2. HAZARD IDENTIFICATION (Continued)

EMERGENCY OVERVIEW: Product Description: Code GA#-EMX, Code GA#-AMX-1, Code GA#-AMX-2, Codes GA#-APM1 and GA#-APM2 Solutions: These solutions are clear, colorless liquids with a mild, garlic-like odor. Codes GA#-AT1 and GA#AT2, Code GA#-LS1 Solution, and GA#-LDR1 Solutions: These solutions are clear, colorless liquids with a mildly sulfurous odor. All Other Solutions: These solutions are clear, colorless, odorless liquids. **Health Hazards:** Code GA#-HP3 Solution: This solution is corrosive and can damage contaminated tissue by all routes of exposure. Ingestion of large quantities may be fatal. Codes GA#-AT1 and GA#AT2 and GA#-LDR1 Solutions: These liquids are considered toxic to reproduction. Code GA#-LS1 Solution Components: The Aliphatic Amine constituent of this component is considered toxic to reproduction. All Other Solutions: The chief hazard in event of overexposure is the potential for irritation of contaminated skin or eyes. **Flammability Hazards:** Codes GA#-AT1 and GA#AT2 and GA#-LDR1 Solutions: These liquids are combustible. All Other Solutions: These solutions present no significant fire hazards. **Reactivity Hazards:** These solutions are not reactive. **Environmental Hazards:** Negligible. **Emergency Recommendations:** Emergency responders must wear personal protective equipment suitable for the situation to which they are responding.

3. COMPOSITION AND INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	European EINECS#	Japanese ENCS#	% v/v	EU Classification (67/548/EEC) GHS & EU Classification (1272/2008 EC)
COMPONENT 1: Code GA#-EMX					
Aliphatic Sulfoxide	Proprietary			1–5	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Carbohydrate	Proprietary		NE	7–13	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Carboxymethyl Hydroxide	Proprietary		NE	20–30	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Water and other trace constituents.				Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 2: Code GA#-HT2					
Water and other trace constituents.				Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 3: Code GA#-AMX1					
Aliphatic Sulfoxide	Proprietary			1–5	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Carboxymethyl Hydroxide	Proprietary		NE	20–30	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Water and other trace constituents.				Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 4: Code GA#-AMX2					
Aliphatic Sulfoxide	Proprietary			1–5	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Carboxymethyl Hydroxide	Proprietary		NE	20–30	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Water and other trace constituents.				Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 5: Code GA#-LMX1					
Carbohydrate	Proprietary		NE	7–13	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Water and other trace constituents.				Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 6: Code GA#-LMX2					
Carbohydrate	Proprietary		NE	7–13	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Water and other trace constituents.				Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 7: Code GA#-BMX					
Carbohydrate	Proprietary		NE	7–13	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Water and other trace constituents.				Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 8: Code GA#-RMX					
Carbohydrate	Proprietary		NE	7–13	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Water and other trace constituents.				Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.

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

3. COMPOSITION AND INFORMATION ON INGREDIENTS (Continued)

CHEMICAL NAME	CAS #	European EINECS#	Japanese ENCS#	% v/v	EU Classification (67/548/EEC) GHS & EU Classification (1272/2008 EC)

COMPONENT 9: Code GA#-HP1

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

COMPONENT 10: Code GA#-HP2

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

COMPONENT 11: Code GA#-HP3

Alkali Hydroxide	Proprietary			5–10	EU 67/548 HAZARD Classification: Corrosive. Risk Phrases: R35 Symbol: C GHS & EU 1272/2008 Classification: Skin Corrosion Cat. 1A Hazard Statement Codes: H314 Pictogram(s): GHS05
Water	7732-18-5	231-791-2	Not Applicable	Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.

COMPONENT 12: Code GA#-HP5

Alkali Hydroxide	Proprietary			0.1–0.5	EU 67/548 HAZARD Classification: Corrosive. Risk Phrases: R35 Symbol: C GHS & EU 1272/2008 Classification: Skin Corrosion Cat. 1A Hazard Statement Codes: H314; Pictogram(s): GHS05
Water	7732-18-5	231-791-2	Not Applicable	Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.

COMPONENT 13: Code GA#-LS1

Iodide Salt	Proprietary			1–5	EU 67/548 HAZARD Classification: Oxidizer; Harmful. Risk Phrases: R8, R22, R36/37/38 Symbol: O, Xn GHS & EU 1272/2008 Classification: Oxidizing Solid Cat. 2, Acute Toxicity Cat 3, Skin Irritant Cat. 2, Eye Irritant Cat. 2, STOT Respiratory System SE Cat. 3 Hazard Statement Codes: H272, H301, H315, H319, H335; Pictogram(s): GHS03, GHS08
Aliphatic Amine	Proprietary			45–55	EU 67/548 HAZARD Classification: Toxic to Reproduction Cat. 2 Risk Phrases: R61 Symbol: T GHS & EU 1272/2008 Classification: Reproductive Toxicity Cat. 1B Hazard Statement Codes: H360D Pictogram(s): GHS08
Water and other trace constituents.				Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.

COMPONENT 14: Code GA#-HFE

Aliphatic Triol	Proprietary			30–55	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Water and other trace constituents.				Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.

COMPONENTS 15–16: Codes GA#-AT1 and GA#-AT2

Aliphatic Amine	Proprietary			100	EU 67/548 HAZARD Classification: Toxic to Reproduction Cat. 2 Risk Phrases: R61 Symbol: T GHS & EU 1272/2008 Classification: Reproduction Toxicity Cat. 1B Hazard Statement Codes: H360D Pictogram(s): GHS08

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

3. COMPOSITION AND INFORMATION ON INGREDIENTS (Continued)

CHEMICAL NAME	CAS #	European EINECS#	Japanese ENCS#	% v/v	EU Classification (67/548/EEC) GHS & EU Classification (1272/2008 EC)
COMPONENTS 17–18: Codes GA#-APM1 and GA#-APM2					
Aliphatic Sulfoxide	Proprietary			1–5	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Carboxymethyl Hydroxide	Proprietary		NE	20–30	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Water and other trace constituents.				Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENTS 19–20: Codes GA#-HT1 and GA#-HP4					
Sodium Salt	Proprietary			1–5	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Water and other trace constituents.				Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENTS 21–23: Codes GA#-HP6, GA#-HP7, and GA#-HP8					
Sodium Salt	Proprietary			1–5	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Water and other trace constituents.				Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 24: Code GA#-LAM1					
Aliphatic Sulfoxide	Proprietary			1–5	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Carboxymethyl Hydroxide	Proprietary		NE	10–20	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
Water and other trace constituents.				Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 25: Code GA#-LDR1					
Aliphatic Amine	Proprietary			> 95	EU 67/548: Classification: Toxic to Reproductive Cat. 2 Risk Phrases: R61 Symbol: T GHS & EU 1272/2008: Classification: Reproductive Toxicity Cat. 1B Hazard Statement Codes: H360D Pictogram(s): GHS08
Water and other trace constituents.				Balance	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.
COMPONENT 26: Water; Code GA#-LPM1					
Water	7732-18-5	231-791-2	Not Applicable	100	EU 67/548 HAZARD CLASSIFICATION: Not Applicable. GHS & EU 1272/2008 CLASSIFICATION: Not Applicable.

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

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

4. FIRST-AID MEASURES

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

DESCRIPTION OF FIRST AID MEASURES: Contaminated individuals must seek medical attention if any adverse effect occurs. Take a copy of label and MSDS to physician or health professional with the contaminated individual.

Skin Exposure: If this product's components 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 this product's components 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 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.

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

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

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

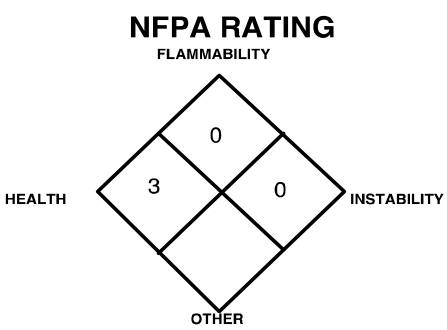
4. FIRST-AID MEASURES (Continued)

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate overexposure.

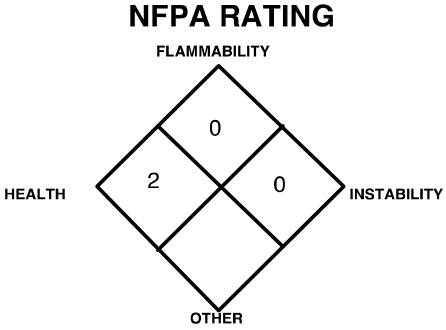
IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED: Treat symptoms and eliminate overexposure.

5. FIRE-FIGHTING MEASURES

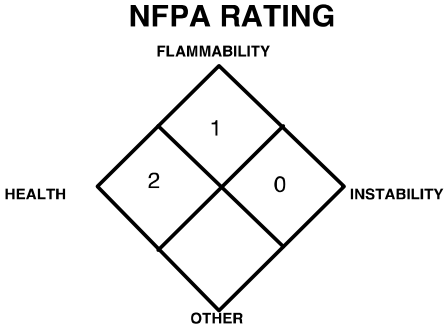
Code GA#-HP3 Solution



Codes GA#-AT1 and GA#AT2 Solutions and GA#-LDR1



Code GA#-LS1 Solution



FLASH POINT:

Codes GA#-AT1 and GA#AT2 Solutions: 154°C (310°F)

All Other Solutions: Not flammable.

AUTOIGNITION TEMPERATURE:

Codes GA#-AT1 and GA#AT2 Solutions: Not established.

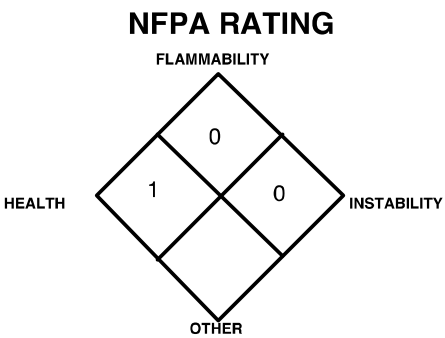
All Other Solutions: Not applicable.

FLAMMABLE LIMITS (in air by volume, %):

Codes GA#-AT1 and GA#AT2 Solutions: (LEL): Not established.
(UEL): Not established.

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

All Other Solutions



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

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

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

SPECIAL FIRE AND EXPLOSION HAZARDS: Code GA#-HP3 Solution: This component is corrosive and presents a significant contact hazard to firefighters. Codes GA#-AT1 and GA#AT2 Solutions: These components are combustible and considered toxic to reproduction. Code GA#-LS1 Solution: When involved in a fire, the liquid in this material may evaporate off and the remaining residue may cause fire when in contact with combustible materials and enhances combustion in combination with combustible materials. 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, phosphine, cyanides, hydrogen iodide, and phosphorous, sodium and nitrogen oxides).

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

ADVICE FOR FIREFIGHTERS: Do not use halogenated extinguishing media. Move containers from fire area if it can be done without risk to personnel. Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Chemical resistant clothing may be necessary. If possible, prevent runoff water from entering storm drains, bodies of water, or other environmentally sensitive areas.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS: In the event of a spill, clear the area and protect people. Trained personnel using pre-planned procedures should respond to uncontrolled releases. Avoid generating airborne dusts, mists, or sprays. Eliminate all sources of ignition before cleanup begins. Use non-sparking tools. The atmosphere must have levels of components lower than those listed in Section 8, (Exposure Controls and Personal Protective Equipment) if applicable, and have at least 19.5 percent oxygen before personnel can be allowed into the area without Self-Contained Breathing Apparatus (SCBA). Monitor area and confirm levels are bellow exposure limits given in Section 8 (Exposure Controls-Personal Protection), if applicable, before non-response personnel are allowed into the spill area.

PROTECTIVE EQUIPMENT:

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

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

METHODS FOR CLEANUP AND CONTAINMENT:

Small Spills: Absorb spilled liquid with polypads or other appropriate absorbent material.

6. ACCIDENTAL RELEASE MEASURES (Continued)

METHODS FOR CLEANUP AND CONTAINMENT (continued):

Large Spills: Absorb spilled liquid with polypads or other suitable absorbent materials. Dike or otherwise contain spill and remove with vacuum truck or pump to storage/salvage vessels.

All Spills: Decontaminate the area of the spill thoroughly using detergent and water. Place all spill residue in an appropriate container and seal. Code GA#-LS1 Solution: Test area with Starch-Iodide paper. If Starch-Iodide paper becomes discolored when in contact with an area moistened with water, neutralize area with 5% sodium thiosulfate solution. Do not mix with wastes from other materials. If necessary, discard contaminated response equipment or rinse with soapy water before returning such equipment to service. Dispose of in accordance with applicable international, national, state, and local procedures (see Section 13, Disposal Considerations).

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

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

7. HANDLING and STORAGE

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

CONDITIONS FOR SAFE STORAGE: Ensure containers of this product's components are properly labeled. Store vials as directed in the product insert. Store away from incompatible materials. Material should be stored in secondary containers, as appropriate. Containers should be separated from oxidizing materials by a minimum distance of 20 ft. or by a barrier of non-combustible material at least 5 ft. high having a fire-resistance rating of at least 0.5 hours. Storage areas should be made of fire resistant materials. Post warning and "NO SMOKING" signs in storage and use areas, as appropriate. Have appropriate extinguishing equipment in the storage area (i.e., sprinkler system, portable fire extinguishers). Keep vials tightly closed when not in use. Inspect vials containing this product's components for leaks or damage. Read instructions provided with the product prior to use. Refer to NFPA 30, *Flammable and Combustible Liquids Code,* for additional information on storage.

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

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

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

EXPOSURE LIMITS/CONTROL PARAMETERS:

Workplace/Occupational Exposure Limits: NOTE: Solutions not specifically listed are primarily water and trace constituents; no exposure limits are applicable.

CHEMICAL NAME	CAS #	EXPOSURE LIMITS IN AIR							
		ACGIH-TLVs		OSHA-PELs		NIOSH-RELs		NIOSH	OTHER
		TWA mg/m^3	STEL mg/m^3	TWA mg/m^3	STEL mg/m^3	TWA mg/m^3	STEL mg/m^3	IDLH mg/m^3	mg/m^3
COMPONENT 1: Code GA#-EMX									
Proprietary Aliphatic Sulfoxide		NE	NE	NE	NE	NE	NE	NE	DFG MAK: TWA = 160 PEAK = 2•MAK 15 min, average value, 1-hr interval, 4 per shift Pregnancy Risk Group D Danger of cutaneous absorption AIHA WEEL: TWA = 250 ppm
Proprietary Carbohydrate		10	NE	15 (total dust), 5 (resp. fraction)	NE	10 (total dust), 5 (resp. fraction)	NE	NE	NE
Proprietary Carboxymethyl Hydroxide		NE	NE	NE	NE	NE	NE	NE	NE
COMPONENT 3: Code GA#-AMX1									
Proprietary Aliphatic Sulfoxide		NE	NE	NE	NE	NE	NE	NE	DFG MAK: TWA = 160 PEAK = 2•MAK 15 min, average value, 1-hr interval, 4 per shift Pregnancy Risk Group D Danger of cutaneous absorption AIHA WEEL: TWA = 250 ppm

NE = Not Established. See Section 16 for Definitions of Other Terms Used

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

EXPOSURE LIMITS/CONTROL PARAMETERS (continued):

Workplace/Occupational Exposure Limits:

CHEMICAL NAME	CAS #	EXPOSURE LIMITS IN AIR							
		ACGIH-TLVs		OSHA-PELs		NIOSH-RELs		NIOSH	OTHER
		TWA mg/m^3	STEL mg/m^3	TWA mg/m^3	STEL mg/m^3	TWA mg/m^3	STEL mg/m^3	IDLH mg/m^3	mg/m^3
COMPONENT 3: Code GA#-AMX1									
Proprietary Aliphatic Sulfoxide		NE	NE	NE	NE	NE	NE	NE	DFG MAK: TWA = 160 PEAK = 2•MAK 15 min, average value, 1-hr interval, 4 per shift Pregnancy Risk Group D Danger of cutaneous absorption AIHA WEEL: TWA = 250 ppm
Proprietary Carboxymethyl Hydroxide		NE	NE	NE	NE	NE	NE	NE	NE
COMPONENT 4: Code GA#-AMX2									
Proprietary Aliphatic Sulfoxide		NE	NE	NE	NE	NE	NE	NE	DFG MAK: TWA = 160 PEAK = 2•MAK 15 min, average value, 1-hr interval, 4 per shift Pregnancy Risk Group D Danger of cutaneous absorption AIHA WEEL: TWA = 250 ppm
Proprietary Carboxymethyl Hydroxide		NE	NE	NE	NE	NE	NE	NE	NE
COMPONENT 5: Code GA#-LMX1									
Proprietary Carbohydrate		10	NE	15 (total dust), 5 (resp. fraction)	NE	10 (total dust), 5 (resp. fraction)	NE	NE	NE
COMPONENT 6: Code GA#-LMX2									
Proprietary Carbohydrate		10	NE	15 (total dust), 5 (resp. fraction)	NE	10 (total dust), 5 (resp. fraction)	NE	NE	NE
COMPONENT 7: Code GA#-BMX									
Proprietary Carbohydrate		10	NE	15 (total dust), 5 (resp. fraction)	NE	10 (total dust), 5 (resp. fraction)	NE	NE	NE
COMPONENT 8: Code GA#-RMX									
Proprietary Carbohydrate		10	NE	15 (total dust), 5 (resp. fraction)	NE	10 (total dust), 5 (resp. fraction)	NE	NE	NE
COMPONENT 9: Code GA#-HP1									
Proprietary Sodium Salt		NE	NE	NE	NE	NE	NE	NE	NE
COMPONENT 10: Code GA#-HP2									
Proprietary Sodium Salt		NE	NE	NE	NE	NE	NE	NE	NE
COMPONENT 11: Code GA#-HP3									
Proprietary Alkali Hydroxide		NE	2 ceiling	2	NE	NE	2 ceiling	NE	NE
COMPONENT 12: Code GA#-HP5									
Proprietary Alkali Hydroxide		NE	2 ceiling	2	NE	NE	2 ceiling	NE	NE
COMPONENT 13: Code GA#-LS1									
Proprietary Iodide Salt		NE	NE	NE	NE	NE	NE	NE	NE
Proprietary Aliphatic Amine		18 (skin)	NE	15 (skin)	NE	NE	NE	NE	DFG MAK: Danger of cutaneous absorption
COMPONENT 14: Code GA#-HFE									
Proprietary Aliphatic Triol		10 ppm (mist)	NE	15 (total dust) 5 (resp. frac.) Vacated 1989 PEL: 10 (total)	NE	NE	NE	NE	DFG MAKs: TWA = 50 (inhalable fraction) PEAK = 2•MAK 15 min. average value, 1-hr interval, 4 per shift Pregnancy Risk Group C
COMPONENTS 15–16: Codes GA#-AT1 and GA#-AT2									
Proprietary Aliphatic Amine		18 (skin)	NE	15 (skin)	NE	NE	NE	NE	DFG MAK: Danger of cutaneous absorption
COMPONENTS 17–18: Codes GA#-APM1 and GA#-APM2									
Proprietary Carboxymethyl Hydroxide		NE	NE	NE	NE	NE	NE	NE	NE

NE = Not Established. See Section 16 for Definitions of Other Terms Used

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

EXPOSURE LIMITS/CONTROL PARAMETERS (continued):

Workplace/Occupational Exposure Limits (continued):

CHEMICAL NAME	CAS #	EXPOSURE LIMITS IN AIR							
		ACGIH-TLVs		OSHA-PELs		NIOSH-RELs		NIOSH	OTHER
		TWA mg/m^3	STEL mg/m^3	TWA mg/m^3	STEL mg/m^3	TWA mg/m^3	STEL mg/m^3	IDLH mg/m^3	mg/m^3
COMPONENTS 17–18: Codes GA#-APM1 and GA#-APM2 (Continued)									
Proprietary Aliphatic Sulfoxide		NE	NE	NE	NE	NE	NE	NE	DFG MAK: TWA = 160 PEAK = 2•MAK 15 min, average value, 1-hr interval, 4 per shift Pregnancy Risk Group D Danger of cutaneous absorption AIHA WEEL: TWA = 250 ppm
COMPONENTS 19–20: Codes GA#-HT1 and GA#-HP4									
Proprietary Sodium Salt		NE	NE	NE	NE	NE	NE	NE	NE
COMPONENTS 21–23: Codes GA#-HP6, GA#-HP7, and GA#-HP8									
Proprietary Sodium Salt		NE	NE	NE	NE	NE	NE	NE	NE
COMPONENT 24: Code GA#-LAM1									
Proprietary Aliphatic Sulfoxide		NE	NE	NE	NE	NE	NE	NE	DFG MAK: TWA = 160 PEAK = 2•MAK 15 min, average value, 1-hr interval, 4 per shift Pregnancy Risk Group D Danger of cutaneous absorption AIHA WEEL: TWA = 250 ppm
Proprietary Carboxymethyl Hydroxide		NE	NE	NE	NE	NE	NE	NE	NE
COMPONENT 25: Code GA#-LDR1									
Proprietary Aliphatic Amine		18 (skin)	NE	15 (skin)	NE	NE	NE	NE	DFG MAK: Danger of cutaneous absorption

NE = Not Established. See Section 16 for Definitions of Other Terms Used

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

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

ALIPHATIC AMINE:
Australia: TWA = 10 ppm (18 mg/m^3), JUL 2008
Belgium: TWA = 10 ppm (18 mg/m^3), Skin, MAR 2002
Denmark: TWA = 10 ppm (18 mg/m^3), OCT 2002
Finland: TWA = 10 ppm (19 mg/m^3), STEL = 20 ppm (37 mg/m^3), Skin, SEP 2009
France: VME = 20 ppm (30 mg/m^3), FEB 2006
Korea: TWA = 10 ppm (15 mg/m^3), skin, 2006
Mexico: TWA = 20 ppm (30 mg/m^3); STEL = 30 ppm (45 mg/m^3), 2004
The Netherlands: MAC-TGG = 16 mg/m^3, 2003
New Zealand: TWA = 10 ppm (18 mg/m^3), skin, JAN 2002
Norway: TWA = 10 ppm (18 mg/m^3), JAN 1999
Russia: STEL = 3 mg/m^3, JUN 2003
Sweden: TWA = 10 ppm (20 mg/m^3); STEL = 15 ppm (30 mg/m^3), Skin, JUN 2005
Switzerland: MAK-W = 10 ppm (18 mg/m^3), Skin, DEC 2006

ALIPHATIC AMINE (continued):
United Kingdom: TWA = 20 ppm (37 mg/m^3); STEL = 30 ppm, 2005
In Argentina, Bulgaria, Colombia, Jordan, Singapore, Vietnam check ACGIH TLV

ALIPHATIC TRIOL:
Belgium: TWA = 10 mg/m^3, MAR 2002
Finland: TWA = 20 mg/m^3, SEP 2009
France: VME = 10 mg/m^3, FEB 2006
Korea: TWA = 10 mg/m^3 (mist), 2006
Mexico: TWA = 10 mg/m^3 (inhalable), 2004
The Netherlands: MAC-TGG = 10 mg/m^3, 2003
New Zealand: TWA = 10 mg/m^3 (mist), JAN 2002
Switzerland: MAK-W = 50 mg/m^3, KZG-W = 100 mg/m^3, DEC 2006
United Kingdom: TWA = 10 mg/m^3, 2005
In Argentina, Bulgaria, Colombia, Jordan, Singapore, Vietnam check ACGIH TLV

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

ALKALI HYDROXIDE:
Australia: CL = 2 mg/m^3, JUL 2008
Belgium: TWA = 2 mg/m^3, MAR 2002
Denmark: CL = 2 mg/m^3, OCT 2002
Finland: TWA = 2 mg/m^3, JAN 1999
France: VME = 2 mg/m^3, FEB 2006
Hungary: TWA = 2 mg/m^3, STEL = 2 mg/m^3, SEP 2000
Japan: OEL-C = 2 mg/m^3, APR 2007
Korea: CL = 2 mg/m^3, 2006

ALKALI HYDROXIDE (continued):
Mexico: Peak 2 mg/m^3, 2004
The Netherlands: MAC-TGG = 2 mg/m^3, 2003
New Zealand: CL = 2 mg/m^3, JAN 2002
Norway: TWA = 2 mg/m^3, JAN 1999
The Philippines: TWA = 2 mg/m^3, JAN 1993
Poland: MAC(TWA) = 0.5 mg/m^3, MAC(STEL) = 1 mg/m^3, JAN 1999
Sweden: TWA = 1 mg/m^3, CL = 2 mg/m^3 (inhalable dust), JUN 2005
Switzerland: MAK-W = 2 mg/m^3, KZG-W = 2 mg/m^3, DEC 2006
Thailand: TWA = 2 mg/m^3, JAN 1993
Turkey: TWA = 2 mg/m^3, JAN 1993
United Kingdom: STEL = 2 mg/m^3, 2005
In Argentina, Bulgaria, Colombia, Jordan, Singapore, Vietnam check ACGIH TLV

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

ENGINEERING CONTROLS:

Ventilation And Engineering: Use with adequate ventilation to ensure exposure levels are maintained below the limits provided in this section, if applicable. Ensure eyewash/safety shower stations are available near areas where this product is used.

PERSONAL PROTECTIVE EQUIPMENT:

The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132), equivalent standards of Canada (including CSA Standard Z94.4-02 and CSA Standard Z94.3-07), standards of EU member states (including EN 529:2005 for respiratory PPE, CEN/TR 15419:2006 for hand/body protection, and CR 13464:1999 for face/eye protection), standards of Australia (including AS/NZS 1715:1994 for respiratory PPE, AS/NZS 4501.2:2006 for protective clothing, AS/NZS 2161.1:2000 for glove selection, and AS/NZS 1336:1997 for eye protection), or standards of Japan (including JIS T 8116:2005 for glove selection, JIS T 8150:2006 for respiratory PPE, JIS T 8147:2003 for eye protectors, and JIS T 8030:2005 for protective clothing). Please reference applicable regulations and standards for relevant details.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

PERSONAL PROTECTIVE EQUIPMENT (continued):

Respiratory Protection: Respiratory protection is not generally needed when using this product. Maintain airborne contaminant concentrations below limits listed in Section 3 (Composition and Information on Ingredients). 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 Z94.4-93, the European Standard EN149, 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). Specific NIOSH recommendations on personal protective equipment for the Alkali Hydroxide constituent in air are presented below:

ALKALI HYDROXIDE

CONCENTRATION	**RESPIRATORY PROTECTION**
Up to 10 mg/m^3:	Supplied Air Respirator (SAR) operated in a continuous flow mode; full facepiece respirator with high-efficiency particulate filter(s); powered air-purifying respirator with dust and mist filter(s); full-facepiece Self-Contained Breathing Apparatus (SCBA); or full-facepiece SAR.
Emergency or Planned Entry into Unknown Concentrations or IDLH Conditions:	Positive pressure, full-facepiece SCBA or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.
Escape:	Full-facepiece respirator with high-efficiency particulate filter(s); or escape-type SCBA.

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, Canadian Standards, or the European Standard EN166, 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, the European Standard DIN EN 374, appropriate Standards of Canada, 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 DIN EN 465, the Australian Standard 3765-Clothing for Protection Against Hazardous Chemicals, or Standards of 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.

9. PHYSICAL and CHEMICAL PROPERTIES

The following information is component solution specific.

pH:
- Code GA#-HP3 Solution: 14
- Codes GA#-AT1 and GA#AT2 and GA#-LDR1 Solutions: 7.1
- All Other Solutions: 6–10

ODOR:
- Codes GA#-AT1 and GA#AT2, Code GA#-LS1 Solution, and GA#-LDR1: Mildly sulfurous odor.
- Code GA#-EMX, Code GA#-AMX-1, Code GA#-AMX-2, Codes GA#-APM1 and GA#-APM2 Solutions: Mildly garlic-like odor.
- All Other Solutions: Odorless.

FLASH POINT:
- Codes GA#-AT1 and GA#AT2 and GA#-LDR1 Solutions: 154°C (310°F)
- All Other Solutions: Not applicable.

FLAMMABILITY:
- Codes GA#-AT1 and GA#AT2 and GA#-LDR1 Solutions: Combustible Liquids
- All Other Solutions: Not flammable.

BOILING POINT:
- Codes GA#-AT1 and GA#AT2 and GA#-LDR1 Solutions: 210°C (410°F)
- All Other Solutions: Not established.

MELTING/FREEZING POINT:
- Codes GA#-AT1 and GA#AT2 and GA#-LDR1 Solutions: 2-3°C (36-37°F)
- All Other Solutions: Not established.

EVAPORATION RATE (*n*-BuAc = 1):
- Codes GA#-AT1 and GA#AT2 Solutions: < 1
- All Other Solutions: Similar to water.

HOW TO DETECT THESE SUBSTANCES:
- Code GA#-HP3 Solution: Litmus paper will turn blue when in contact with this solution.
- Codes GA#-AT1 and GA#AT2, Code GA#-LS1 Solution, and GA#-LDR1 Solutions: The odor may act as a warning property associated with these liquids.
- Code GA#-EMX, Code GA#-AMX-1, Code GA#-AMX-2, Codes GA#-APM1 and GA#-APM2 Solutions: The odor may act as a warning property associated with these solutions.
- All Other Solutions: There are no unusual warning properties associated with these components.

9. PHYSICAL and CHEMICAL PROPERTIES (Continued)

The following information applies to all components, in general.

MOLECULAR WEIGHT (single entity only): Not applicable.

COLOR: Colorless.
APPEARANCE: Clear.
RELATIVE VAPOR DENSITY (air = 1): Not established.
UPPER EXPLOSIVE LIMIT: Not established.
AUTOIGNITION TEMPERATURE: Not established.
EXPLOSIVE PROPERTIES: Not explosive.
EVAPORATION RATE (*n*-BuAc = 1): Not established.
DENSITY/SPECIFIC GRAVITY: Not established.
SOLUBILITY: Miscible in some organic solvents.

VISCOSITY: Not established.
PHYSICAL STATE: Liquids.
VAPOR PRESSURE: Not established.
LOWER EXPLOSIVE LIMIT: Not established.
DECOMPOSITION TEMPERATURE: Not established.
OXIDIZING PROPERTIES: Not oxidizers.
% VOLATILITY: Not established.
ODOR THRESHOLD: Not established.
SOLUBILITY IN WATER: Completely soluble.

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

10. STABILITY AND REACTIVITY

REACTIVITY/CHEMICAL STABILITY: All solutions are stable at room temperature in sealed containers. No solutions are expected to be reactive.

POSSIBILITY OF HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID:

Codes GA#-AT1 and GA#AT2 Solutions: Sparks, flame, mixing this component with incompatible chemicals.
All Other Solutions: Mixing with incompatible chemicals or as given above.

INCOMPATIBLE MATERIALS:

Code GA#-HP3 Solution: Aluminum and other metals, acid solutions, acidic chemicals, amines, ammonia, urea, ammonium compounds, cellulose, methanol, aziridine, phenyl acetonitrile, ethylene imine, and bisulfates.

Codes GA#-AT1 and GA#AT2, Code GA#-LS1 Solution, and GA#-LDR1 Solutions: Karl Fischer reagent (mixture of toluene, pyridine and sulfur trioxide), strong oxidizers, strong acids, some metals, substances that are incompatible with water.

Code GA#-EMX, Code GA#-AMX-1, Code GA#-AMX-2, Codes GA#-APM1 and GA#-APM2 Solutions: Strong oxidizers, acetyl chloride, cyanuric chloride, acid chlorides, phosphorus halides, strong acids, strong reducers, substances that are incompatible with water.

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

HAZARDOUS DECOMPOSITION PRODUCTS:

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

Hydrolysis: None known.

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

11. TOXICOLOGICAL INFORMATION

Code GA#-HP3 Solution

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH HAZARD	(BLUE)	3
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

Codes GA#-AT1 and GA#AT2 and GA#-LDR1 Solutions

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH HAZARD	(BLUE)	2
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

11. TOXICOLOGICAL INFORMATION (Continued)

Code GA#-LS1 Solution

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH HAZARD	(BLUE)	2
FLAMMABILITY HAZARD	(RED)	1
PHYSICAL HAZARD	(YELLOW)	0

PROTECTIVE EQUIPMENT

EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8

For Routine Industrial Use and Handling Applications

All Other Solutions

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

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

PROTECTIVE EQUIPMENT

EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8

For Routine Industrial Use and Handling Applications

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

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

INHALATION:

Code GA#-HP3 Solution: Inhalation of mists or sprays of this component can cause difficulty breathing, irritation of the mucus membranes, coughing, nasal congestion, and a sore throat. Prolonged inhalation exposures or exposures to high concentrations of this component can damage the tissues of the respiratory system. The effects of inhalation exposure may be delayed up to 48 hours. Severe inhalation overexposures can cause chemical pneumonitis, pulmonary edema, and death. Repeated, low level exposure can damage the respiratory system, including emphysema.

Codes GA#-AT1 and GA#AT2, Code GA#-LS1 and GA#-LDR1 Solutions: Inhalation of vapors, mists, or sprays of these components will irritate the nose, throat, and lungs. Symptoms may include nausea, headache, and vomiting.

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

SKIN CONTACT:

Code GA#-HP3 Solution: This component is extremely corrosive and capable of causing severe burns with deep ulceration and permanent scarring. This component can penetrate to deeper layers of skin and corrosion will continue until removed. The severity of injury depends on the duration of exposure. Burns may not be immediately painful; onset of pain may be delayed minutes to hours.

Codes GA#-AT1 and GA#AT2, Code GA#-LS1 and GA#-LDR1 Solutions: Depending on the duration and concentration of overexposure, skin contact can irritate contaminated tissue. Symptoms of skin overexposure may include redness and discomfort.

All Other Solutions: Contact with the skin may cause mild irritation, which is alleviated upon rinsing.

EYE CONTACT:

Code GA#-HP3 Solution: Eye contact will cause severe irritation or burns. The severity of injury increases with the duration of exposure and the speed of penetration into the eye. Damage can range from mild scarring to blistering, disintegration, ulceration, severe scarring, and clouding. Glaucoma and cataracts are possible late developments. In severe cases, there is progressive ulceration and clouding of eye tissue, which may cause permanent blindness.

Codes GA#-AT1 and GA#AT2, Code GA#-LS1 and GA#-LDR1 Solutions: Depending on the duration and concentration of overexposure, eye contact can irritate contaminated tissue. Symptoms of eye overexposure may include redness, tearing, and pain.

All Other Solutions: Contact with the eyes may cause mild irritation, which is alleviated upon rinsing.

SKIN ABSORPTION:

Code GA#-HP3 Solution: Alkali Hydroxide solutions can penetrate the skin and burn deep tissue layers. Burns may not be immediately visible or painful.

Codes GA#-AT1 and GA#AT2, Code GA#-LS1 and GA#-LDR1 Solutions: The Aliphatic Amine constituent of these components can be absorbed through the skin and may cause adverse reproductive effects.

11. TOXICOLOGICAL INFORMATION (Continued)

SKIN ABSORPTION (continued):

Code GA#-EMX, Code GA#-AMX-1, Code GA#-AMX-2, Codes GA#-APM1 and GA#-APM2 Solutions: The Aliphatic Sulfoxide constituent in these solutions 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 Solutions: No constituents in these components are known to be absorbed via intact skin.

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

Code GA#-HP3 Solution: If this component is swallowed, gastric discomfort and can burn the mouth, throat, and digestive system can occur. Symptoms of such overexposure can include pain, nausea, vomiting, and diarrhea. Ingestion of large amounts may cause gastrointestinal ulceration, increased thirst, decreased appetite, and internal bleeding. Severe ingestion overexposures can be fatal.

Codes GA#-AT1 and GA#AT2 and GA#-LDR1 Solutions: If these liquids are swallowed, irritation of the mouth, throat, and other tissues of the digestive system may occur. Ingestion may cause adverse reproductive effects.

Code GA#-EMX, Code GA#-AMX-1, Code GA#-AMX-2, Codes GA#-APM1 and GA#-APM2 Solutions: If these solutions are swallowed, they may cause gastric distress. Large doses may cause nausea, vomiting, chills, cramps, and lethargy.

Code GA#-LS1 Solution: Ingestion may cause irritation, nausea, vomiting, and diarrhea. The Iodide Salt constituent in this component may produce quantities of oxygen gas, which can cause severe damage by physical pressure.

All Other Solutions: If these solutions are swallowed they may cause gastric distress. Large doses may cause nausea, vomiting, and diarrhea.

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

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

Acute:

Code GA#-HP3 Solution: Depending on the duration of contact, overexposures can severely irritate or burn the eyes, skin, mucous membranes, and any other exposed tissue. Skin contact can cause blisters and scars. Eye contact can cause blindness. Severe inhalation and ingestion overexposures may be fatal.

Codes GA#-AT1 and GA#AT2, Code GA#-LS1 and GA#-LDR1 Solutions: Inhalation of vapors, mists, or sprays of the Aliphatic Amine constituent of these components may cause nausea, headache, and vomiting. Depending on the duration and concentration of overexposure, skin and eye contact can irritate contaminated tissue. The Aliphatic Amine constituent can be absorbed through the skin and may cause adverse reproductive effects. Ingestion may cause adverse reproductive effects.

Code GA#-EMX, Code GA#-AMX-1, Code GA#-AMX-2, Codes GA#-APM1 and GA#-APM2 Solutions: Large oral doses may cause nausea, vomiting, chills, cramps, and lethargy.

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

Chronic:

Code GA#-HP3 Solution: Prolonged inhalation of mists or sprays may cause respiratory disorders (e.g., bronchitis).

Code GA#-EMX, Code GA#-AMX-1, Code GA#-AMX-2, Codes GA#-APM1 and GA#-APM2 Solutions: Chronic ingestion of the Aliphatic Sulfoxide constituent of these components may affect the liver and kidneys.

All Other Solutions: These components are not known to cause any significant chronic health effects.

TARGET ORGANS:

Acute:

Code GA#-HP3 Solution: Skin, eyes, respiratory system.

Codes GA#-AT1 and GA#AT2 and Code GA#-LS1 Solution: Eyes, skin, reproductive system.

Code GA#-EMX, Code GA#-AMX-1, Code GA#-AMX-2, Codes GA#-APM1 and GA#-APM2 Solutions: Eyes, gastrointestinal tract.

All Other Solutions: Eyes, gastrointestinal tract.

Chronic:

Code GA#-HP3 Solution: Skin, respiratory system.

Code GA#-EMX, Code GA#-AMX-1, Code GA#-AMX-2, Codes GA#-APM1 and GA#-APM2 Solutions: Liver, kidneys.

All Other Solutions: None known.

TOXICITY DATA: The following information is available for the constituents in components of this product present in greater that 1 percent concentration.

ALIPHATIC SULFOXIDE:

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 hr
Standard Draize Test (skin, rabbit) = 500 mg/24 hr; mild
Standard Draize Test (eye, rabbit) = 100 mg
Standard Draize Test (eye, rabbit) = 500 mg/24 hr; mild
TDLo (intravenous, man) = 606 mg/kg: Gastrointestinal: nausea or vomiting; Liver: jaundice, other or unclassified
LD_{50} (oral, rat) = 14500 mg/kg: Eye: hemorrhage, conjunctive irritation
LD_{50} (oral, mouse) = 7920 mg/kg
LD_{50} (oral, dog) > 10 g/kg
LD_{50} (oral, chicken) = 12 g/kg
LD_{50} (skin, rat) = 40 g/kg
LD_{50} (skin, mouse) = 50 g/kg
LD_{50} (intraperitoneal, rat) = 8200 mg/kg

ALIPHATIC SULFOXIDE (continued):

LD_{50} (intraperitoneal, mouse) = 2500 mg/kg
LD_{50} (subcutaneous, rat) = 12 g/kg; Behavioral: changes in motor activity (specific assay); Lungs, Thorax, or Respiration: dyspnea
LD_{50} (subcutaneous, mouse) = 14 g/kg; Behavioral: changes in motor activity (specific assay); Lungs, Thorax, or Respiration: other changes; Kidney, Ureter, Bladder: hematuria
LD_{50} (intravenous, rat) = 5360 mg/kg; Behavioral: tremor; muscle weakness; Lungs, Thorax, or Respiration: dyspnea
LD_{50} (intravenous, mouse) = 3100 mg/kg; Eye: hemorrhage; conjunctive irritation
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
TDLo (oral, mouse) = 16 mg/kg/female 5–9 days after conception; Reproductive: Fertility: pre-implantation mortality; Effects on 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) = 192 g/kg/4 weeks/intermittent; Blood: normocytic anemia; weight loss or decreased weight gain
TDLo (intraperitoneal, rat) = 56 g/kg/female 6–12 days after conception; Reproductive: Fertility: abortion

11. TOXICOLOGICAL INFORMATION (Continued)

TOXICITY DATA (continued):

ALIPHATIC SULFOXIDE (continued):

TDLo (intraperitoneal, mouse) = 210 g/kg/female 6–12 days after conception; Reproductive: Specific Developmental Abnormalities: Central Nervous System, musculoskeletal system

TDLo (subcutaneous, rat) = 220 g/kg/82 weeks/intermittent; Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Skin and Appendages: tumors

TDLo (intraperitoneal, hamster) = 5500 mg/kg/female 8 days after conception; Reproductive: Specific Developmental Abnormalities: musculoskeletal system, Central Nervous System, craniofacial

TDLo (ocular, rabbit) = 250 µg/kg/30 days/intermittent; Eye: effect, not otherwise specified

TDLo (skin, pig) = 4698 mL/kg/58 weeks/intermittent; Eye: changes in refraction; Behavioral: fluid intake

ALIPHATIC AMINE:

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

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

LD_{50} (oral, rat) = 5577 mg/kg; Autonomic Nervous System: other (direct) parasympathomimetic; Behavioral: ataxia Incontinence

LD_{50} (oral, mouse) > 3150 mg/kg

LD_{50} (oral, mammal) = 3150 mg/kg

LD_{50} (intraperitoneal, rat) = 5700 mg/kg

LD_{50} (subcutaneous, rat) > 4 g/kg

LD_{50} (intraperitoneal, mouse) = 2450 mg/kg

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

LDLo (subcutaneous, frog) = 30 mg/kg

LDLo (skin, rabbit) = 6 g/kg

LDLo (intravenous, dog)= 1500 mg/kg

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

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

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

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

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

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

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

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

ALIPHATIC TRIOL:

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

Eye Irritancy (rabbit) = 126 mg; mild

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

LD_{50} (oral, rat) = 12600 mg/kg; general anesthetic, muscle weakness, Liver: other changes

LD_{50} (oral, mouse) = 4090 mg/kg

LD_{50} (oral, rabbit) = 27 g/kg

LD_{50} (oral, guinea pig) = 7750 mg/kg

LD_{50} (skin, rabbit) > 10 g/kg

LD_{50} (intraperitoneal, rat) = 4420 mg/kg; toxic psychosis; Cardiac; other changes; Kidney, Urethra, Bladder: other changes

LD_{50} (intraperitoneal, mouse) = 8700 mg/kg

LD_{50} (subcutaneous, rat) = 100 mg/kg

LD_{50} (subcutaneous, mouse) = 91 mg/kg

LD_{50} (intravenous, rat) = 5566 mg/kg

LD_{50} (intravenous, mouse) = 4250 mg/kg

LD_{50} (intravenous, rabbit) = 53 g/kg

LC_{50} (inhalation, rat) > 570 mg/m^3/1 hour

TDLo (oral, rat) = 96 g/kg/30 days/intermittent; Blood: changes in leukocyte (WBC) count, changes in serum composition (e.g. TP, bilirubin, cholesterol); Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: true cholinesterase

ALIPHATIC TRIOL (continued):

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

TDLo (oral, rat) = 100 mg/kg/male 1 day pre-mating; Reproductive: Fertility: post-implantation mortality

TDLo (intratesticular, rat) = 280 mg/kg/male 2 days pre-mating; Reproductive: Paternal Effects: spermatogenesis, testes, epididymis, sperm duct

TDLo (intratesticular, rat) = 1600 mg/kg/male 1 day pre-mating; Reproductive: Fertility: male fertility index

TDLo (intratesticular, rat) = 862 mg/kg/male 1 day pre-mating; Reproductive: Paternal Effects: spermatogenesis

TDLo (intratesticular, monkey) = 119 mg/kg/male 1 day pre-mating; Reproductive: Paternal Effects: spermatogenesis, testes, epididymis, sperm duct

TDLo (oral, mouse) = 560 g/kg/8 weeks/continuous; Lungs, Thorax, or Respiration: structural or functional change in trachea or bronchi

DNA Inhibition (human, lymphocyte) = 200 mmol/L

Cytogenetic Analysis (oral, rat) = 1 g/kg

SODIUM SALT:

TDLo (Oral-Human) 12,357 mg/kg/23 days-continuous: Vascular: BP elevation not characterized in autonomic section

TDLo (Oral-Man) 1 gm/kg: Sense Organs and Special Senses (Eye): effect, not otherwise specified; Behavioral: changes in motor activity (specific assay); Nutritional and Gross Metabolic: changes in sodium

TDLo (Intraplacental-Woman) 27 mg/kg: female 15 week(s) after conception: Reproductive: Fertility: abortion

LD_{50} (Oral-Rat) 3000 mg/kg

LD_{50} (Oral-Mouse) 4 gm/kg

LD_{50} (Intraperitoneal-Rat) 2600 mg/kg

LD_{50} (Intraperitoneal-Mouse) 2602 mg/kg

LD_{50} (Subcutaneous-Mouse) 3 gm/kg

LD_{50} (Intravenous-Mouse) 645 mg/kg

LD_{50} (Intracervical-Mouse) 131 mg/kg

LDLo (Oral-Rabbit) 8 gm/kg

LDLo (Subcutaneous-Rat) 3500 mg/kg: Behavioral: irritability

LDLo (Subcutaneous-Guinea Pig) 2160 mg/kg

LDLo (Intraperitoneal-Rat) 3.72 gm/kg: Behavioral: tremor, convulsions or effect on seizure threshold

LDLo (Intravenous-Rabbit) 1.5 mg/kg

LDLo (Intravenous-Rabbit) 1100 mg/kg: Behavioral: convulsions or effect on seizure threshold, muscle contraction or spasticity; Cardiac: other changes

LDLo (Intravenous-Guinea Pig) 300 mg/kg

LDLo (Intravenous-Dog) 2 gm/kg: Behavioral: somnolence (general depressed activity)

LDLo (Parenteral-Guinea Pig) 300 mg/kg

LDLo (Intraarterial-Guinea Pig) 300 mg/kg

TDLo (Oral-Rat) 1 mg/kg/24 hours: Biochemical: Metabolism (Intermediary): effect on Sodium-Potassium pump

TDLo (Oral-Rat) 1.43 mg/kg: Gastrointestinal: ulceration or bleeding from stomach

TDLo (Oral-Rat) 37,500 mg/kg/30 days-continuous: Vascular: BP elevation not characterized in autonomic section; Kidney/Ureter/Bladder: urine volume increased

TDLo (Oral-Rat) 12,500 mg/kg/10 days-continuous: Kidney/Ureter/Bladder: urine volume decreased, other changes in urine composition

TDLo (Oral-Rat) 37.5 gm/kg/10 days-continuous: Vascular: BP elevation not characterized in autonomic section Kidney/Ureter/Bladder: other, changes in urine composition

TDLo (Oral-Rat) 201.6 gm/kg/6 weeks-intermittent: Vascular: BP elevation not characterized in autonomic section

TDLo (Oral-Rat) 145 gm/kg: female 7 day(s) pre-mating 1-22 day(s) after conception: Reproductive: Effects on Newborn: delayed effects

TDLo (Oral-Rat) 56,400 mg/kg: female 5 day(s) pre-mating - 21 day(s) post-birth: Reproductive: Maternal Effects: postpartum; Effects on Newborn: biochemical and metabolic

TDLo (Intraperitoneal-Rat) 1710 mg/kg: female 13 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus), fetal death; Specific Developmental Abnormalities: musculoskeletal system

TDLo (Intraperitoneal-Rat) 10 gm/kg: female 17-20 day(s) after conception: Reproductive: Effects on Newborn: behavioral

TDLo (Subcutaneous-Mouse) 1900 mg/kg: female 11 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetal death

SODIUM SALT (continued):

TDLo (Subcutaneous-Mouse) 1900 mg/kg: female 10 day(s) after conception: Reproductive: Specific Developmental Abnormalities: musculoskeletal system

TDLo (Subcutaneous-Mouse) 2500 mg/kg: female 10 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)

TDLo (Subcutaneous-Mouse) 13,440 mg/kg: female 2-6 day(s) after conception: Reproductive: Fertility: abortion

TDLo (Subcutaneous-Rabbit) 0.04 mg/kg: Vascular: other changes; Skin and Appendages: dermatitis, irritative (after systemic exposure)

TDLo (Intravenous-Mouse) 2.1 mg/kg: Vascular: other changes; Blood: hemorrhage; Skin and Appendages: dermatitis, irritative (after systemic exposure)

TDLo (Intravenous-Rabbit) 0.04 mg/kg: Vascular: other changes; Blood: hemorrhage; Skin and Appendages: dermatitis, irritative (after systemic exposure)

TDLo (Intravenous-Dog) 375 mg/kg: Cardiac: EKG changes not diagnostic of specified effects

TDLo (Parenteral-Rat) 10 mg/kg: female 1 day(s) pre-mating: Reproductive: Maternal Effects: ovaries, fallopian tubes

TDLo (Intrauterine-Rat) 500 mg/kg: female 4 day(s) after conception: Reproductive: Fertility: pre-implantation mortality (e.g. reduction in number of implants per female; total number of implants per corpora lutea)

TDLo (Intrauterine-Rat) 50 mg/kg: female 6 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants)

TDLo (Intrauterine-Monkey) 6 gm/kg: female 18 week(s) after conception: Reproductive: Fertility: abortion

TDLo (Intraplacental-Horse, Donkey) 480 mg/kg: female 45 day(s) after conception: Reproductive: Maternal Effects: other effects; Endocrine: estrogenic; Reproductive: Effects on Embryo or Fetus: fetal death

DNA Inhibition (Human Fibroblast) 125 mmol/L

Mutation Test Systems-Not Otherwise Specified (Bacteria-*Escherichia coli*) 150 mmol/L

Mutation Test Systems-Not Otherwise Specified (Oral-Rat) 400 mg/kg

Unscheduled DNA Synthesis (Oral-Rat) 16,800 mg/kg/4 weeks-continuous

Cytogenetic Analysis (Intraperitoneal-Rat) 2338 mg/kg

Cytogenetic Analysis (Hamster Ovary) 160 mmol/L

Cytogenetic Analysis (Hamster Lung) 7500 mg/L

Mutation in Microorganisms (Yeast-*Saccharomyces cerevisiae*) 2 mol/L

DNA Damage (Bacteria-*Salmonella typhimurium*) 10 gm/L/120 minutes

DNA Damage (Mouse Lymphocyte) 101 mmol/L

DNA Damage (Hamster Ovary) 275 mmol/L

Mutation in Mammalian Somatic Cells (Mouse Lymphocyte) 57,200 µmol/L

Mutation in Mammalian Somatic Cells (Mouse Cells-Not Otherwise Specified) 5000 mg/L/4 hours

DNA Repair (Bacteria-*Salmonella typhimurium*) 10 gm/L/120 minutes

Micronucleus Test (Hamster-Lung) 4 gm/L

Micronucleus Test (Oral-Rat) 2 pph/14 days

Micronucleus Test (Mouse Cells-Not Otherwise Specified) 0.5 pph/4 hours

ALKALI HYDROXIDE:

LD_{50} (intraperitoneal, mouse) = 40 mg/kg

LDLo (oral, rabbit) = 500 mg/kg

Eye Irritancy (monkey) = 1%/24 hours; severe

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

Eye Irritancy (rabbit) = 400 µg; mild

Eye Irritancy (rabbit) = 1%; severe

Eye Irritancy (rabbit) = 50 µg/24 hours; severe

Eye Irritancy (rabbit) = 1 mg/24 hours; severe

Eye Irritancy (rabbit) = 1 mg/30 sec/rinsed; severe

Cytogenetic Analysis (parenteral, grasshopper) = 20 mg

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

Cytogenetic Analysis (hamster) = 16 mmol/L

IODIDE SALT

LD_{50} (oral-rat) = 264 mg/kg

LD_{50} (Intraperitoneal-mouse) 58 mg/kg

CARBOHYDRATE:

LD_{50} (oral, rat) = 29,700 mg/kg; Behavioral: somnolence (general depressed activity); Lungs, Thorax, or Respiration: cyanosis; Gastrointestinal: hypermotility, diarrhea

LD_{50} (intraperitoneal, mouse) = 14,000 mg/kg

11. TOXICOLOGICAL INFORMATION (Continued)

TOXICITY DATA (continued):

CARBOHYDRATE (continued):

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

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

CARBOHYDRATE (continued):

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

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

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

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

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

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

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

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

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

Code GA#-HP3 Solution: This component can severely irritate and burn contaminated tissue.

Codes GA-AT1 and GA-AT2, Code GA#-LS1, and GA#-LDR1 Solutions: Depending on the duration and concentration of overexposure, skin and eye contact can irritate contaminated tissue.

All Other Solutions: Contact with the skin or eyes may cause mild irritation, which is alleviated upon rinsing.

SENSITIZATION TO THE PRODUCT:

Code GA#-EMX, Code GA#-AMX-1, Code GA#-AMX-2, Codes GA#-APM1 and GA#-APM2 Solutions: The Aliphatic Sulfoxide constituent in these solutions can cause anaphylactic reaction by unspecified exposure routes; symptoms may include rash, abdominal cramps, nausea, chills, and chest pain.

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

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

Mutagenicity: The constituents in the solutions in this product are not reported to produce mutagenic effects in humans. Human mutation data are available for the Aliphatic Sulfoxide constituent in this product's solutions; these data were obtained during clinical studies on specific human tissues exposed to high doses of this compound. Animal mutation data are available for the Aliphatic Amine and Carbohydrate constituents in this product's solutions; these data were obtained during clinical studies on specific animal tissues exposed to high doses of this compound.

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

Teratogenicity: The constituents in the solutions in this product are reported to cause teratogenic effects in humans. Clinical studies on test animals exposed to relatively high doses of the Aliphatic Sulfoxide, Aliphatic Amine, and Carbohydrate constituents in this product's solutions, indicate teratogenic effects.

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

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

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

MOBILITY IN SOIL: This product has not been tested for mobility in soil. The following information is available for some constituents.

ALIPHATIC SULFOXIDE:

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

ALIPHATIC AMINE:

The Koc of this compound is 3.6. According to a classification scheme, this Koc value suggests that Aliphatic Amine is expected to have very high mobility in soil.

ALIPHATIC TRIOL:

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

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

ALIPHATIC SULFOXIDE:

If released to air, a vapor pressure of 6.1X10-1 mm Hg at 25°C indicates this compound will exist solely as a vapor phase in the atmosphere. Vapor-phase material will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 6.2-6.6 hours. This compound does not absorb light at wavelengths > 290 nm and therefore is not expected to be susceptible to direct photolysis by sunlight. If released to soil, this material is expected to have very high mobility based upon an estimated Koc of 4. Volatilization from water and moist soil surfaces is not expected to be an important fate process based upon a Henry's Law constant of 1.5X10-9 atm-cu m/mole. This compound is expected to slowly volatilize from dry soil surfaces based upon its vapor pressure. A 3% theoretical BOD after 2 weeks in activated sludge indicates that biodegradation is not expected to be an important environmental fate process. If released into water, this material is not expected to adsorb to suspended solids and sediment based upon the estimated Koc. A low experimental BCF of <1 suggests that bioconcentration in aquatic organisms is low. Hydrolysis is not expected to be an important environmental fate process since this compound lacks functional groups that hydrolyze under environmental conditions.

ALIPHATIC AMINE:

If released to air, a vapor pressure of 6.1X10-2 mm Hg at 25°C indicates this compound will exist solely as a vapor in the ambient atmosphere. Vapor-phase material will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 8.0 days. If released to soil, this compound is expected to have very high mobility based upon a Koc of 3.6. Volatilization from moist soil surfaces is not expected to be an important fate process based upon an estimated Henry's Law constant of 1.4X10-9 atm-cu m/mole. If released into water, this material is not expected to adsorb to suspended solids and sediment based upon the Koc. Several biodegradation screening studies have observed significant biodegradation of this material which suggests that biodegradation may be important. Volatilization from water surfaces is not expected to be an important fate process based upon this compound's estimated Henry's Law constant. Hydrolysis is expected to be slow.

ALIPHATIC TRIOL:

If released to soil, this compound is expected to undergo rapid biodegradation under aerobic conditions. It is expected to display very high mobility in soil and it is not expected to significantly volatilize to the atmosphere. If released to water, this material is expected to rapidly degrade under aerobic conditions. Biodegradation in seawater and under anaerobic conditions is also expected.

12. ECOLOGICAL INFORMATION (Continued)

PERSISTENCE AND BIODEGRADABILITY (continued):

ALIPHATIC TRIOL (continued):

This material is not expected to bioconcentrate is fish and aquatic organisms nor is it expected to adsorb to sediment and suspended organic matter. Volatilization to the atmosphere is expected to be slower then for water itself. If released to the atmosphere, this material may undergo a gas-phase oxidation with photochemically produced hydroxyl radicals with a half-life of 33 hrs. It may also undergo atmospheric removal by wet deposition processes.

SODIUM SALT:

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

ALKALI HYDROXIDE:

Water solubility = 9 g/0.9 ml water. BOD: None. Octanol/Water Partition Coefficient: SRP4: Too low to be measured (or possibly virtually 0); Persistence: Can persist for extended periods of time.

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

ALIPHATIC SULFOXIDE:

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

ALIPHATIC AMINE:

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

ALIPHATIC TRIOL:

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

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

ALIPHATIC SULFOXIDE:

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

LC_{50} (*Salvelinus fontinalis* Brook trout) 24 hours = 54 g/L; static; 95% CI (50.9-58.3)

LC_{50} (*Salvenilus namaycush* Lake trout) 24 hours = 47.8 g/L; static; 95% CI (42.3-54.0)

LC_{50} (*Oncorhynchus mykis* Rainbow trout) 24 hours = 53.0 g/L; static; 95%CI (48.6-57.8)

LC_{50} (*Cyprinus carpio* Carp) 24 hours = 44.0 g/L; static; 95% CI (48.6-57.8)

LC_{50} (*Ictalurus melas* Black bullhead) 24 hours = 42.5 g/L; static; 95% CI (37.9-47.6)

LC_{50} (*Ictalurus punctatus* Channel catfish) 24 hours = 39.0 g/L; static; 95% CI (36.1-42.1)

LC_{50} (*Lepomis cyanellus* Green sunfish) 24 hours = 65.0 g/L; static; 95% CI (61.3-68.9)

LC_{50} (*Lepomis macrochirus* Bluegill) 24 hours = 72.0 g/L; static; 95% CI (63.2-82.1)

LC_{50} (*Perca flavascens* Yellow perch) 24 hours = 65.0 g/L; static; 95% CI (61.3-68.9)

LC_{50} (*Salvenilus fontinales* Brook trout) 24 hours = 54.5 g/L; static; 95%CI (50.9-58.3)

LC_{50} (*Salvenilus fontinales* Brook trout 48 hours = 46.0 g/L; static; 95%CI (42.2-50.1)

LC_{50} (*Pimephales promelas* Fathead minnow) 96 hours = 34 g/L; static

LC_{50} (*Lepomis macrochirus* Bluegill) 96 hours = > 40 g/L; static

LC_{50} (*Salvenilus fontinales* Brook trout) 96 hours = 36.5 g/L; static; 95%CI (33.2-40.2)

EC_{50} (*Daphnia magna* water flea) 24 hours = 7000 mg/L; toxic effect: inhibition of mobility

ALIPHATIC AMINE:

LC_{50} (minnow) > 500 mg/L/ 48 hours

ALIPHATIC TRIOL:

EC_0 (*Pseudomonas putida* bacteria) 16 hours = >10,000 mg/L

EC_0 (*Microcystis aeruginosa* algae) 8 days = 2,900 mg/L

EC_0 (*Scenedesmus quadricauda* green algae) 7 days = > 10,000 mg/L

EC_0 (*Entosiphon sulcatum* protozoa) 72 hours = 3,200 mg/L

EC_0 (*Uronema parduczi* Chatton-Lwoff protozoa) = > 10,000 mg/L

LC_{50} (goldfish) 24 hours = > 5,000 mg/L

SODIUM SALT:

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

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

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

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

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

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

SODIUM SALT (continued):

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

LC_{50} (*Daphnia pulex* Water flea) 48 hours = 3.05 g/L (95% confidence limit: 2.06 to 5.91 g/L); Conditions: freshwater; static, pH 7.47, alkalinity 74 mg/L CaCO3, conductivity 10001 µmhos/cm, dissolved oxygen 8.7 mg/L, organic carbon 27 mg/L

SODIUM SALT (continued):

LC_{50} (*Gambusia affinis* Western mosquitofish) 96 hours = 17,550,000 µg/L; Conditions: freshwater; static

LC_{50} (*Gambusia affinis* Western mosquitofish) 24 hours = 18,100,000 µg/L; Conditions: freshwater; static

LC_{50} (*Gambusia affinis* Western mosquitofish) 48 hours = 18,100,000 µg/L; Conditions: freshwater; static

LC_{50} (*Gambusia holbrooki* Eastern mosquitofish) 96 hours = 11,540,000 µg/L (95% confidence limit: 11,290,000 to 11,800,000 µg/L); Conditions: freshwater; flow-through

LC_{50} (*Lepomis macrochirus* Bluegill, wt 0.260 g wwgt) 96 hours = 5.84 g/L (95% confidence limit: 5.56 to 6.08 g/L); Conditions: freshwater; flow-through

LC_{50} (*Lepomis macrochirus* Bluegill, size 5-9 cm, wt 1-9 g) 96 hours = 12,94,600 µg/L; Conditions: freshwater; static

LC_{50} (*Lepomis macrochirus* Bluegill, size 5.3-7.2 cm, wt 3.5-3.9 g) 96 hours = 12,946,000 µg/L; Conditions: freshwater; static

LC_{50} (*Lepomis macrochirus* Bluegill) 24 hours = 14,125,000 µg/L; Conditions: freshwater; static

LC_{50} (*Oncorhynchus mykiss* Rainbow trout, size 15-20 cm tl) 24 hours = 175 mOsm; Conditions: freshwater; static

LC_{50} (*Oncorhynchus mykiss* Rainbow trout, eggs) 96 hours = 6094 mg/L (95% confidence limit: 4747 to 7824 mg/L); Conditions: freshwater; flow-through, pH 7.65, hardness 46 mg/L CaCO3, alkalinity 42 mg/L CaCO3, conductivity 91 uS/cm, dissolved oxygen 10.8 mg/L

LC_{50} (*Pimephales promelas* Fathead minnow, wt 0.217 g wwgt) 96 hours = 6.57 g/L (95% confidence limit: 6.42 to 6.7 g/L); Conditions: freshwater; flow-through; Concentration: for 96 hr; Effect: mortality, survival

LC_{50} (*Pimephales promelas* Fathead minnow) 96 hours = 6,390,000 µg/L (95% confidence limit: 6,020,000 to 7,070,000 µg/L); Conditions: freshwater; static

LC_{50} (*Pimephales promelas* Fathead minnow) 48 hours = 6,510,000 µg/L (95% confidence limit: 6,090,000 to 7,070,000 µg/L); Conditions: freshwater; static

LC_{50} (*Pimephales promelas* Fathead minnow, size 27.2 mm tl, wt 0.24 g) 96 hours = 7,050,000 µg/L; Conditions: freshwater; renewal

LC_{50} (*Pimephales promelas* Fathead minnow, size 27.2 mm tl, wt 0.24 g) 48 hours = 7,050,000 µg/L; Conditions: freshwater; renewal

LC_{50} (*Pimephales promelas* Fathead minnow, size 27.6 mm tl, wt 0.26 g) 24 hours = 7,100,000 µg/L; Conditions: freshwater; renewal

LC_{50} (*Pimephales promelas* Fathead minnow, size 22.8 mm tl, wt 0.19 g) 48 hours = 7,300,000 µg/L; Conditions: freshwater; renewal

LC_{50} (*Pimephales promelas* Fathead minnow, size 24.2 mm tl, wt 0.21 g) 24 hours = 7,400,000 µg/L; Conditions: freshwater; renewal

LC_{50} (*Pimephales promelas* Fathead minnow, size 26.4 mm tl, wt 0.24 g) 96 hours = 7,450,000 µg/L; Conditions: freshwater; renewal

LC_{50} (*Pimephales promelas* Fathead minnow, size 22.8 mm tl, wt 0.19 g) 24 hours = 7,500,000 µg/L; Conditions: freshwater; renewal

ALKALI HYDROXIDE:

LC_{100} (*cyprinus carpio*) 24 hr = 180 ppm @ 25°C

TLm (mosquito fish) 96 hr = 125 ppm (fresh water)

TLm (Bluegill) 48 hours = 99 mg/L (tap water)

12. ECOLOGICAL INFORMATION (Continued)

RESULTS OF PBT AND vPvB ASSESSMENT: No data available. PBT and vPvB assessments are part of the chemical safety report required for some substances in European Union Regulation (EC) 1907/2006, Article 14.

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

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

13. DISPOSAL CONSIDERATIONS

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

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

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

U.S. EPA WASTE NUMBER:

Code GA#-HP3 Solution: Wastes of this solution should be tested for D002 (Waste Characteristic Corrosivity).

All Other Solutions: Not applicable.

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

14. TRANSPORTATION INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION REGULATIONS: This product is classified as dangerous goods, per U.S. DOT regulations, under 49 CFR 172.101. **This classification is for U.S. domestic ground shipments ONLY.**

UN Identification Number:	NA 1760
Proper Shipping Name:	Chemical Kit
Hazard Class Number and Description:	8 (Corrosive)
Packing Group:	III
Excepted Quantities:	E0
DOT Label(s) Required:	Class 8 (Corrosive)
Emergency Response Guidebook Number (2008):	154

Marine Pollutant: No component of this product is designated by the Department of Transportation to be a Marine Pollutant as per 49 CFR 172.101, Appendix B.

NOTE: Shipments of this product may be shipped under small quantity and limited quantity exceptions as indicated under 49 CFR §173.4 and 49 CFR §173.150, if all requirements are met.

Small Quantity Exception (49 CFR 173.4): Small quantities of Class 8 material are not subjected to other requirements of the Hazardous Materials Regulations (Subchapter C) when the maximum quantity per inner receptacle is limited to 30 mL (liquids). Refer to 49 CFR 173.4 for specific information in packaging small quantity materials.

Limited Quantity Exceptions [49 CFR 173.154(b)]: Limited quantities for Class 8, Packing Group III materials have inner packagings not over 4.0 L (liquids) net capacity each, packed in strong outer packaging.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This product is classified as Dangerous Goods, per regulations of Transport Canada.

UN Identification Number:	UN 3316
Proper Shipping Name:	Chemical Kit
Hazard Class Number and Description:	Class 9
Packing Group:	Not applicable
Excepted Quantities:	E0
Hazard Label(s) Required:	Class 9
Special Provisions:	65
Explosive Limit & Limited Quantity Index:	0
ERAP Index:	None
Passenger Carrying Ship Index:	None
Passenger Carrying Road or Rail Vehicle Index:	10

Marine Pollutant: No constituent in the components of this product is a marine pollutant, per Part 2, Section 2.7 of the Consolidated Transportation of Dangerous Goods Regulations.

INTERNATIONAL AIR TRANSPORT ASSOCIATION/ICAO (IATA/ICAO): This product is classified as dangerous goods, per rules of IATA.

UN Identification Number:	UN 3316
Proper Shipping Name:	Chemical Kit
Hazard Class Number and Description:	9 (Miscellaneous Dangerous Substances and Articles)
Packing Group:	None
Excepted Quantities:	E0
Hazard Label(s) Required:	Class 9

14. TRANSPORTATION INFORMATION (Continued)

INTERNATIONAL AIR TRANSPORT ASSOCIATION/ICAO (IATA/ICAO) [continued]:

Passenger and Cargo Aircraft Packing Instruction:	960
Passenger and Cargo Aircraft Maximum Net Quantity Per Pkg.:	10 kg
Passenger and Cargo Aircraft Limited Quantity Packing Instruction:	Y960
Passenger and Cargo Aircraft Limited Quantity Maximum Net Quantity Per Pkg.:	1 kg
Cargo Aircraft Only Packing Instruction:	960
Cargo Aircraft Only Maximum Net Quantity Per Pkg.:	10 kg
Special Provisions:	A44
ERG Code:	9L

INTERNATIONAL MARITIME ORGANIZATION (IMO): This product is classified as dangerous goods, per the rules of IMO.

UN Identification Number:	UN 3316
Proper Shipping Name:	Chemical Kit
Hazard Class Number and Description:	9 (Miscellaneous Dangerous Substances and Articles)
Packing Group:	None
Label(S) Required:	Class 9
Limited Quantities:	See SP251
Excepted Quantities:	See SP340
Special Provisions:	251, 340
Packing:	Instructions: P901; Provisions: None
IBCs:	Instructions: None; Provisions: None
Tanks:	Instructions: P901; Provisions: None
EmS:	F-A, S-P
Stowage and Segregation:	Category A

Marine Pollutant: No constituent in the components of this product meets the criteria for marine pollutants.

Note: This product may be shipped under the Dangerous Goods in Limited Quantities Regulations (IMDG CODE Amendment 28-96 Section 18). The maximum quantity per inner packaging for Class 9, Packing Group III materials is 5 L.

EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR): This product is classified by the United Nations Economic Commission for Europe to be dangerous goods.

Substance Identification No.:	3316
Name of Substance:	Chemical Kit
Class:	9
Classification Code:	M11
Packing Group:	III
Label:	9
Special Provisions:	251, 340
Limited Quantities:	LQ0
Excepted Quantities:	E0
Packaging/Packing Instructions:	P901
Packaging/Mixed Packing Provisions:	None
Packaging/Special Packing Provisions:	None
Portable Tanks & Bulk Containers:	Instructions: None; Special Provisions: None
Hazard Identification No.:	None

AUSTRALIAN FEDERAL OFFICE OF ROAD SAFETY CODE FOR THE TRANSPORTATION OF DANGEROUS GOODS BY ROAD OR RAIL: This product is classified as dangerous goods, per regulations of the Office of Road Safety.

U.N. Number:	3316
Name Of Substance:	Chemical Kit
Hazard Class:	9
Packing Group:	PG III
Excepted Quantities:	EQ0
Hazchem Code:	None
Packaging Code:	3.8.9

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

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

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The constituents in this product's solutions are subject to Sections 302, 304, and 313 reporting requirements under the Superfund Amendment and Reauthorization Act, as follows:

CHEMICAL NAME	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Alkali Hydroxide	No	No	Yes

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for the 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): Alkali Hydroxide = 1000 lb (454 kg).

U.S. TSCA INVENTORY STATUS: The constituents in the solutions of this product are on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Alkali Hydroxide is designated as a hazardous substance under Section 311(b)(2)(A) of the Federal Water Pollution Control Act and further regulated by the Clean Water Act Amendments of 1977 and 1978. These regulations apply to discharges of Alkali Hydroxide.

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

ADDITIONAL CANADIAN REGULATIONS:

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

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

CANADIAN WHMIS CLASSIFICATION AND SYMBOLS:

Code GA#-HP3 Solution: Class E Corrosive Material

Codes GA#-AT1 and GA#-AT2, Code GA#-LS1, and GA#-LDR1 Solutions: D2A Teratogenicity and Embryotoxicity

All Other Solutions: Not applicable.

ADDITIONAL EUROPEAN UNION REGULATIONS:

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

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

ADDITIONAL AUSTRALIAN REGULATIONS:

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

HAZARDOUS SUBSTANCES INFORMATION SYSTEM (HSIS): The constituents in this product's solutions are not listed in the HSIS.

STANDARD FOR THE UNIFORM SCHEDULING OF MEDICINES AND POISONS:

Code GA#-HP3 Solution: Schedule 6

All Other Solutions: Not applicable.

ADDITIONAL LABELING:

Code GA#-HP3 Solution: Corrosive. May produce severe burns. Attacks skin and eyes. Wear eye protection when mixing or using. Wear protective gloves when mixing or using. Do not mix with hot water. For advice, contact a Poisons Information Centre (Phone e.g. Australia 131 126; New Zealand 03 4747 000) or a doctor (at once). If swallowed, do NOT induce vomiting. If in eyes, hold eyelids apart and flush the eye continuously with running water. Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes. If skin or hair contact occurs, remove contaminated clothing and flush skin and hair with running water.

All Other Solutions: Not applicable.

ADDITIONAL JAPANESE REGULATIONS:

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

15. REGULATORY INFORMATION (Continued)

ADDITIONAL JAPANESE REGULATIONS (continued):

POISONOUS AND DELETERIOUS SUBSTANCES CONTROL LAW: The Alkali Hydroxide constituent in this product's solutions is listed as a Deleterious Substance under the Poisonous and Deleterious Substances Control Law.

16. OTHER INFORMATION

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

Code GA#-HP3 Solution: **DANGER!** CORROSIVE. CAUSES SKIN, EYE, AND DIGESTIVE TRACT BURNS. CAUSES RESPIRATORY TRACT IRRITATION. Do not taste or swallow. Do not get in eyes or on skin or clothing. Avoid breathing mist containing this product. Avoid prolonged or repeated skin contact. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Wear appropriate eye, hand, and body protection. Avoid exposure to elevated temperatures. FIRST-AID: In case of contact, immediately flush skin or eyes with plenty of water for at least 20 minutes while removing contaminated clothing and shoes. Get medical attention if irritation develops or persists. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, do not induce vomiting. If victim is fully conscious, give a cupful of water. Never give by mouth to an unconscious person. Get medical attention immediately. Wash clothing before reuse. Destroy contaminated shoes. IN CASE OF FIRE: Use water fog, foam, dry chemical, or CO_2. IN CASE OF SPILL: Wipe up spilled liquid. Place residual in appropriate container and seal. Consult Material Safety Data Sheet for additional information.

Codes GA#-AT1 and GA#AT2, Code GA#-LS1, and GA#-LDR1 Solutions: **CAUTION!** POSSIBLE BIRTH DEFECT HAZARD. MAY CAUSE BIRTH DEFECTS BASED ON ANIMAL DATA. MAY CAUSE SKIN AND EYE IRRITATION. MAY CAUSE DISCOMFORT IF SWALLOWED OR INHALED. Do not taste or swallow. Avoid skin or eye contact. Avoid prolonged or repeated skin contact. Avoid breathing mists or sprays. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Wear gloves and goggles. FIRST-AID: In case of contact, immediately flush skin or eyes with plenty of water. If inhaled, remove to fresh air. If ingested, do not induce vomiting. Get medical attention if necessary. IN CASE OF FIRE: Use water fog, dry chemical, CO_2, or "alcohol" foam. IN CASE OF SPILL: Absorb spill with polypads and place in suitable container. Consult Material Safety Data Sheet for additional information.

All Other Solutions: **CAUTION!** MAY CAUSE SKIN AND EYE IRRITATION. MAY CAUSE DISCOMFORT IF SWALLOWED OR INHALED. Do not taste or swallow. Avoid skin or eye contact. Avoid prolonged or repeated skin contact. Avoid breathing mists or sprays. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Wear gloves and goggles. FIRST-AID: In case of contact, immediately flush skin or eyes with plenty of water. If inhaled, remove to fresh air. If ingested, do not induce vomiting. Get medical attention if necessary. IN CASE OF FIRE: Use water fog, dry chemical, CO_2, or "alcohol" foam. IN CASE OF SPILL: Absorb spill with polypads and place in suitable container. Consult Material Safety Data Sheet for additional information.

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

Code GA#-HP3 Solution:

Classification: Skin Corrosive Category 1A.

Hazard Statements: H314 Causes severe skin burns and eye damage.

Precautionary Statements:

Prevention: P260 Do not breathe mists, vapours, or sprays. P264 Wash thoroughly after handling. P280 Wear corrosion resistant protective gloves, clothing, and eye protection.

Response: P301 + P330 + P331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. P303 + P361 + P353 IF ON SKIN (or hair): Remove immediately all contaminated clothing. Rinse skin with water, P363 Wash contaminated clothing before reuse. P304 + P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. P310 Immediately call a POISON CENTER or doctor. P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Storage: P405: Store locked up.

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

Codes GA#-AT1 and GA#AT2, Code GA#-LS1 and GA#-LDR1 Solutions:

Classification: Reproductive Toxicant Category 1B.

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

Precautionary Statements:

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

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

Storage: P405: Store locked up.

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

All Other Solutions:

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

16. OTHER INFORMATION (Continued)

LABELING/CLASSIFICATION FULL TEXT UNDER EU 67/548/EEC AND 2001/59/EC AUSTRALIAN NOHSC FULL TEXT:

Code GA#-HP3 Solution:

Classification: Corrosive.

Risk Phrases: R35 Causes severe burns.

Codes GA#-AT1 and GA#AT2, Code GA#-LS1 Solution, and GA#-LDR1:

Classification: Toxic to Reproduction Development, Category 2.

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

All Other Solutions:

Classification: Not applicable. *Risk Phrases*: Not applicable.

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

Aliphatic Amine:

Classification: Reproductive Toxin Category 1B

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

Alkali Hydroxide:

Classification: Skin Corrosion Category 1A

Hazard Statements: H314 Causes severe skin burns and eye damage.

Iodide Salt:

Classification: Oxidizing solid Category 2, Acute Toxicity Category 3, Skin Irritant Category 2, Eye Irritant Category 2, Specific Target Organ Toxicity (Respiratory System) Single Exposure Category 3

Hazard Statements: H272 May intensify fire; oxidizer. H301 Toxic if swallowed. H315 Causes skin irritation. H319 Causes serious eye irritation. H335 May cause respiratory irritation.

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

Aliphatic Amine:

Classification: Toxic to Reproduction, Category 2

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

Alkali Hydroxide:

Classification: Corrosive.

Risk Phrases: R35 Causes severe burns.

Iodide Salt:

Classification: Oxidizer. Harmful.

Risk Phrases: R8 Contact with combustible material may cause fire. R22 Harmful if swallowed. R36/37/38 Irritating to eyes, respiratory system, and skin.

REVISION DETAILS: April 2011: Addition of new components. Overall review and up-date. June 2011: Change in some component solution details.

REFERENCES AND DATA SOURCES: Contact the supplier for information.

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

PREPARED BY: CHEMICAL SAFETY ASSOCIATES, Inc.
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DEFINITIONS OF TERMS

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

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

EXPOSURE LIMITS IN AIR:

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

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

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

DFG MAK Pregnancy Risk Group Classification: Group A: A risk of damage to the developing embryo or fetus has been unequivocally demonstrated. Exposure of pregnant women can lead to damage of the developing organism, even when MAK and BAT (Biological Tolerance Value for Working Materials) values are observed.

EXPOSURE LIMITS IN AIR (continued):

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

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

LOQ: Limit of Quantitation.

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

NIC: Notice of Intended Change.

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

NIOSH RELs: NIOSH's Recommended Exposure Limits.

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

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

DEFINITIONS OF TERMS (Continued)

EXPOSURE LIMITS IN AIR (continued):

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

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

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

WEEL: Workplace Environmental Exposure Limits from the AIHA.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS:

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

HEALTH HAZARD: **0** Minimal Hazard: No significant health risk, irritation of skin or eyes not anticipated. *Skin Irritation*: Essentially non-irritating. Mechanical irritation may occur. PII or Draize = 0. *Eye Irritation*: Essentially non-irritating, minimal effects clearing in < 24 hours. Mechanical irritation may occur. Draize = 0. *Oral Toxicity LD_{50} Rat*: > 5000 mg/kg. *Dermal Toxicity LD_{50} Rat or Rabbit*: > 2000 mg/kg. *Inhalation Toxicity 4-hrs LC_{50} Rat*: > 20 mg/L. **1** Slight Hazard: Minor reversible injury may occur; may irritate the stomach if swallowed; may defat the skin and exacerbate existing dermatitis. *Skin Irritation*: Slightly or mildly irritating. PII or Draize > 0 < 5. *Eye Irritation*: Slightly to mildly irritating, but reversible within 7 days. Draize > 0 ≤ 25. *Oral Toxicity LD_{50} Rat*: > 500–5000 mg/kg. *Dermal Toxicity LD_{50} Rat or Rabbit*: > 1000–2000 mg/kg. *Inhalation Toxicity LC_{50} 4-hrs Rat*: > 2–20 mg/L. **2** Moderate Hazard: Temporary or transitory injury may occur; prolonged exposure may affect the CNS. *Skin Irritation*: Moderately irritating; primary irritant; sensitizer. PII or Draize ≥ 5, with no destruction of dermal tissue. *Eye Irritation*: Moderately to severely irritating; reversible corneal opacity; corneal involvement or irritation clearing in 8–21 days. Draize = 26–100, with reversible effects. *Oral Toxicity LD_{50} Rat*: > 50–500 mg/kg. *Dermal Toxicity LD_{50} Rat or Rabbit*: > 200–1000 mg/kg. *Inhalation Toxicity LC_{50} 4-hrs Rat*: > 0.5–2 mg/L. **3** Serious Hazard: Major injury likely unless prompt action is taken and medical treatment is given; high level of toxicity; corrosive. *Skin Irritation*: Severely irritating and/or corrosive; may cause destruction of dermal tissue, skin burns, and dermal necrosis. PII or Draize > 5–8, with destruction of tissue. *Eye Irritation*: Corrosive, irreversible destruction of ocular tissue; corneal involvement or irritation persisting for more than 21 days. Draize > 80 with effects irreversible in 21 days. *Oral Toxicity LD_{50} Rat*: > 1–50 mg/kg. *Dermal Toxicity LD_{50} Rat or Rabbit*: > 20–200 mg/kg. *Inhalation Toxicity LC_{50} 4-hrs Rat*: > 0.05–0.5 mg/L. **4** Severe Hazard: Life-threatening; major or permanent damage may result from single or repeated exposures; extremely toxic; irreversible injury may result from brief contact. *Skin Irritation*: Not appropriate. Do not rate as a 4, based on skin irritation alone. *Eye Irritation*: Not appropriate. Do not rate as a 4, based on eye irritation alone. *Oral Toxicity LD_{50} Rat*: ≤ 1 mg/kg. *Dermal Toxicity LD_{50} Rat or Rabbit*: ≤ 20 mg/kg. *Inhalation Toxicity LC_{50} 4-hrs Rat*: ≤ 0.05 mg/L.

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

PHYSICAL HAZARD: **0** *Water Reactivity*: Materials that do not react with water. *Organic Peroxides*: Materials that are normally stable, even under fire conditions and will not react with water. *Explosives*: Substances that are Non-Explosive. *Compressed Gases*: No Rating. *Pyrophorics*: No Rating. *Oxidizers*: No 0 rating. *Unstable Reactives*: Substances that will not polymerize, decompose, condense, or self-react.). **1** *Water Reactivity*: Materials that change or decompose upon exposure to moisture. *Organic Peroxides*: Materials that are normally stable, but can become unstable at high temperatures and pressures. These materials may react with water, but will not release energy violently. *Explosives*: Division 1.5 & 1.6 explosives. Substances that are very insensitive explosives or that do not have a mass explosion hazard. *Compressed Gases*: Pressure below OSHA definition. *Pyrophorics*: No Rating. *Oxidizers*: Packaging Group III oxidizers; Solids: any material that in either concentration tested, exhibits a mean burning time less than or equal to the mean burning time of a 3:7 potassium bromate/cellulose mixture and the criteria for Packing Group I and II are not met.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

PHYSICAL HAZARD (continued): **1 (continued):** 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. **3** *Water Reactivity*: Materials that may form explosive reactions with water. *Organic Peroxides*: Materials that are capable of detonation or explosive reaction, but require a strong initiating source or must be heated under confinement before initiation; or materials that react explosively with water. *Explosives*: Division 1.3 explosives. Explosive substances that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but do not have a mass explosion hazard. *Compressed Gases*: Pressure ≥ 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics*: No Rating. *Oxidizers*: Packing Group I oxidizers. Solids: any material that, in either concentration tested, exhibits a mean burning time less than the mean burning time of a 3:2 potassium bromate/cellulose mixture. Liquids: any material that spontaneously ignites when mixed with cellulose in a 1:1 ratio, or which exhibits a mean pressure rise time less than the pressure rise time of a 1:1 perchloric acid (50%)/cellulose mixture. *Unstable Reactives*: Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure and have a moderate potential (or moderate risk) to cause significant heat generation or explosion. **4** *Water Reactivity*: Materials that react explosively with water without requiring heat or confinement. *Organic Peroxides*: Materials that are readily capable of detonation or explosive decomposition at normal temperature and pressures. *Explosives*: Division 1.1 & 1.2 explosives. Explosive substances that have a mass explosion hazard or have a projection hazard. A mass explosion is one that affects almost the entire load instantaneously. *Compressed Gases*: No Rating. *Pyrophorics*: Add to the definition of Flammability 4. *Oxidizers*: No 4 rating. *Unstable Reactives*: Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure and have a high potential (or high risk) to cause significant heat generation or explosion.

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS

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

DEFINITIONS OF TERMS (Continued)

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

HEALTH HAZARD (continued): **4** Materials that, under emergency conditions, can be lethal. Gases with an LC_{50} for acute inhalation toxicity less than or equal to 1,000 ppm. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than ten times its LC_{50} for acute inhalation toxicity, if its LC_{50} is less than or equal to 1000 ppm. Dusts and mists whose LC_{50} for acute inhalation toxicity is less than or equal to 0.5 mg/L. Materials whose LD_{50} for acute dermal toxicity is less than or equal to 40 mg/kg. Materials whose LD_{50} for acute oral toxicity is less than or equal to 5 mg/kg.

FLAMMABILITY HAZARD: **0** Materials that will not burn under typical fire conditions, including intrinsically noncombustible materials such as concrete, stone, and sand. Materials that will not burn in air when exposed to a temperature of 816°C (1500°F) for a period of 5 minutes in according with Annex D of NFPA 704. **1** Materials that must be preheated before ignition can occur. Materials in this degree require considerable preheating, under all ambient temperature conditions, before ignition and combustion can occur: Materials that will burn in air when exposed to a temperature of 816°C (1500°F) for a period of 5 minutes in according with Annex D of NFPA 704. Liquids, solids, and semisolids having a flash point at or above 93.4°C (200°F) (i.e. Class IIIB liquids). Liquids with a flash point greater than 35°C (95°F) that do not sustain combustion when tested using the *Method of Testing for Sustained Combustibility*, per 49 CFR 173, Appendix H or the UN *Recommendations on the Transport of Dangerous Goods, Model Regulations* (current edition) and the related *Manual of Tests and Criteria* (current edition). Liquids with a flash point greater than 35°C (95°F) in a water-miscible solution or dispersion with a water non-combustible liquid/solid content of more than 85% by weight. Liquids that have no fire point when tested by ASTM D 92, *Standard Test Method for Flash and Fire Points by Cleveland Open Cup*, up to the boiling point of the liquid or up to a temperature at which the sample being tested shows an obvious physical change. Combustible pellets with a representative diameter of greater than 2 mm (10 mesh). Most ordinary combustible materials. Solids containing greater than 0.5% by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent. **2** Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not under normal conditions form hazardous atmospheres with air, but under high ambient temperatures or under moderate heating could release vapor in sufficient quantities to produce hazardous atmospheres with air. Liquids having a flash point at or above 37.8°C (100°F) and below 93.4°C (200°F) (i.e. Class II and Class IIIA liquids.) Solid materials in the form of powders or coarse dusts of representative diameter between 420 microns (40 mesh) and 2 mm (10 mesh) that burn rapidly but that generally do not form explosive mixtures with air. Solid materials in fibrous or shredded form that burn rapidly and create flash fire hazards, such as cotton, sisal, and hemp. Solids and semisolids that readily give off flammable vapors. Solids containing greater than 0.5% by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent. **3** Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures or, though unaffected by ambient temperatures, are readily ignited under almost all conditions. Liquids having a flash point below 22.8°C (73°F) and having a boiling point at or above 37.8°C (100°F) and those liquids having a flash point at or above 22.8°C (73°F) and below 37.8°C (100°F) (i.e. Class IB and IC liquids). Materials that on account of their physical form or environmental conditions can form explosive mixtures with air and are readily dispersed in air. Flammable or combustible dusts with representative diameter less than 420 microns (40 mesh). Materials that burn with extreme rapidity, usually by reason of self-contained oxygen (e.g. dry nitrocellulose and many organic peroxides). Solids containing greater than 0.5% by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent. **4** Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air and will burn readily. Flammable gases. Flammable cryogenic materials. Any liquid or gaseous materials that is liquid while under pressure and has a flash point below 22.8°C (73°F) and a boiling point below 37.8°C (100°F) (i.e. Class IA liquids). Materials that ignite when exposed to air, Solids containing greater than 0.5% by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent.

INSTABILITY HAZARD: **0** Materials that in themselves are normally stable, even under fire conditions. Materials that have an instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) below 0.01 W/mL. Materials that do not exhibit an exotherm at temperatures less than or equal to 500°C (932°F) when tested by differential scanning calorimetry. **1** Materials that in themselves are normally stable, but that can become unstable at elevated temperatures and pressures. Materials that have an instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) at or above 0.01 W/mL and below 10 W/mL. **2** Materials that readily undergo violent chemical change at elevated temperatures and pressures. Materials that have an instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) at or above 10 W/mL and below 100W/mL. **3** Materials that in themselves are capable of detonation or explosive decomposition or explosive reaction, but that require a strong initiating source or that must be heated under confinement before initiation. Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) at or above 100 W/mL and below 1000 W/mL. Materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures. **4** Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures. Materials that are sensitive to localized thermal or mechanical shock at normal temperatures and pressures. Materials that have an estimated instantaneous power density (product of heat of reaction and reaction rate) at 250°C (482°F) of 1000 W/mL or greater.

REPRODUCTIVE TOXICITY INFORMATION:

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

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_{50}: Lethal Dose (solids & liquids) that kills 50% of the exposed animals. LC_{50}: Lethal Concentration (gases) that kills 50% of the exposed animals. ppm: Concentration expressed in parts of material per million parts of air or water. mg/m^3: Concentration expressed in weight of substance per volume of air. mg/kg: Quantity of material, by weight, administered to a test subject, based on their body weight in kg. TDLo: Lowest dose to cause a symptom. TCLo: Lowest concentration to cause a symptom. TDo, LDLo, and LDo, or TC, TCo, LCLo, and LCo: Lowest dose (or concentration) to cause lethal or toxic effects. **Cancer Information:** IARC: International Agency for Research on Cancer. NTP: National Toxicology Program. RTECS: Registry of Toxic Effects of Chemical Substances. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. **Other Information:** BEI: ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV.

ECOLOGICAL INFORMATION:

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

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

U.S.:

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

CANADA:

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

EUROPE:

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

AUSTRALIA:

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

JAPAN:

METI: Ministry of Economy, Trade and Industry.