

MATERIAL SAFETY DATA SHEET

Illumina, Inc.

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

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

1. PRODUCT IDENTIFICATION

| | |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| <u>TRADE NAME (AS LABELED):</u> | VeraCode Genotyping Test for Factor V and Factor II |
| <u>DOCUMENT NUMBER:</u> | 15015188 |
| <u>U.N. NUMBER:</u> | Not Applicable |
| <u>U.N. DANGEROUS GOODS CLASS/SUBSIDIARY RISK:</u> | Not Applicable |
| <u>HAZCHEM CODE (AUSTRALIA):</u> | Not Applicable |
| <u>POISONS SCHEDULE NUMBER (AUSTRALIA):</u> | Not Applicable |
| <u>PRODUCT USE:</u> | 2-Plex Genotyping Assay for the Factor V G1691A and Factor II (Prothrombin) G20210A Alleles in Human Genomic DNA |
| <u>U.S. SUPPLIER/MANUFACTURER'S NAME:</u> | ILLUMINA, Inc. |
| <u>Address:</u> | 9885 Towne Centre Drive San Diego, CA 92121-1975 |
| <u>Business Phone:</u> | +1-800-809-ILMN (toll-free) +1-800-809-4566 (toll-free) +1-858-202-4566 (outside North America) |
| <u>AUSTRALIAN SUPPLIER/DISTRIBUTOR'S NAME:</u> | |
| <u>Address:</u> | |
| <u>Business Phone:</u> | |
| <u>EUROPEAN SUPPLIER/ DISTRIBUTOR'S NAME:</u> | |
| <u>Address:</u> | |
| <u>Business Phone:</u> | |
| <u>EMERGENCY PHONE:</u> | 1-858-202-4566 (North America) +1-858-202-4566 (outside North America) |
| <u>EMAIL ADDRESS/COMPETENT PERSON FOR MSDS:</u> | techsupport@illumina.com |
| <u>DATE OF PREPARATION:</u> | May 03, 2010 |
| <u>DATE OF REVISION:</u> | May 11, 2010 |

NOTE: ALL United States Occupational Safety and Health Administration Standard (29 CFR 1910.1200), U.S. State equivalent Standards, Canadian WHMIS [Controlled Products Regulations], European Union [Regulation (EC) 1907/2006 Annex II], Australian [NOHSC:2011 (2003)], and Japanese Industrial Standard (JIS Z 7250: 2005) required information is included in appropriate sections based on the U.S. ANSI Z400.1-2004 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 VeraCode Genotyping Test for Factor V and Factor II. This product consists of eight 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.

EU/AUSTRALIAN LABELING AND CLASSIFICATION: The following classification is self-classification, based on possible skin contact of product in the workplace and European Union Council Directive 67/548/EEC and subsequent Directives and by the Australian National Occupational Health and Safety Commission [NOHSC(1008:2004)].

| | | |
|----------------------------------------------------------------------------------|-------------------------------|-------------------------|
| <u>AB1, AE1, and AOP1:</u> Classification: Toxic to Reproduction, Category 2. | Risk Phrases: R 61 | Symbol: T |
| <u>All Other Solutions:</u> Classification: Not applicable. | Risk Phrases: Not applicable. | Symbol: Not applicable. |

See Section 16 for full text of Risk Phrases

EMERGENCY OVERVIEW: Product Description: MSS: These solutions are clear, colorless liquids with a mild, garlic-like odor. AB1, AE1, and AOP1: These solutions are clear, colorless liquids with a mildly sulfurous odor. All Other Solutions: These solutions are clear, colorless, odorless liquids. **Health Hazards:** AB1, AE1, and AOP1: These liquids are 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:** 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 # | EINECS# | ENCS# | % v/v | CLASSIFICATION, RISK PHRASES, SYMBOL LETTERS |
|-------------------------|-------------|-------------|-------------|-------|-------------------------------------------------------------------------|
| COMPONENT 1: MSS | | | | | |
| Aliphatic Triol | Proprietary | Proprietary | Proprietary | 1-5 | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |

3. COMPOSITION AND INFORMATION ON INGREDIENTS (Continued)

| CHEMICAL NAME | CAS # | EINECS# | ENCS# | % v/v | CLASSIFICATION, RISK PHRASES, SYMBOL LETTERS |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|---------|---------------------------------------------------------------------------------------------|
| COMPONENT 1: MSS (continued) | | | | | |
| Aliphatic Sulfoxide | Proprietary | Proprietary | Proprietary | 7-13 | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| Polyethylene Compound | Proprietary | Proprietary | Proprietary | 7-13 | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| Carbohydrate Compound | Proprietary | Proprietary | Proprietary | 7-13 | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens). | | | | Balance | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| COMPONENT 2: UB3 | | | | | |
| Carboxymethyl Hydroxide Compound | Proprietary | Proprietary | Proprietary | 5-10 | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens). | | | | Balance | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| COMPONENT 3: ELM | | | | | |
| Carboxymethyl Hydroxide Compound | Proprietary | Proprietary | Proprietary | 5-10 | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| Carbohydrate Compound | Proprietary | Proprietary | Proprietary | 7-13 | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens). | | | | Balance | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| COMPONENT 4: MTR1 | | | | | |
| Aliphatic Triol | Proprietary | Proprietary | Proprietary | 1-5 | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| Carbohydrate Compound | Proprietary | Proprietary | Proprietary | 15-25 | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens). | | | | Balance | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| COMPONENT 5: FSB | | | | | |
| Carbohydrate Compound | Proprietary | Proprietary | Proprietary | 7-13 | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens). | | | | Balance | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| COMPONENT 6: AE1 | | | | | |
| Sodium Salt | Proprietary | Proprietary | Proprietary | 1-5 | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| Phosphate Compound | Proprietary | Proprietary | Proprietary | 1-5 | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| Aliphatic Amide | Proprietary | Proprietary | Proprietary | 10-20 | HAZARD CLASSIFICATION: Toxic to Reproduction Category 2 RISK PHRASES: R: 61 SYMBOL: T |
| Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens). | | | | Balance | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| COMPONENT 7: AB1 | | | | | |
| Sodium Salt | Proprietary | Proprietary | Proprietary | 1-5 | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| Phosphate Compound | Proprietary | Proprietary | Proprietary | 1-5 | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| Polyethylene Compound | Proprietary | Proprietary | Proprietary | 7-13 | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| Aliphatic Amide | Proprietary | Proprietary | Proprietary | 60-70 | HAZARD CLASSIFICATION: Toxic to Reproduction Category 2 RISK PHRASES: R: 61 SYMBOL: T |
| Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens). | | | | Balance | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| COMPONENT 8: AOP1 | | | | | |
| Polyethylene Compound | Proprietary | Proprietary | Proprietary | 1-5 | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| Sodium Salt | Proprietary | Proprietary | Proprietary | 1-5 | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
| Phosphate Compound | Proprietary | Proprietary | Proprietary | 1-5 | HAZARD CLASSIFICATION: NOT APPLICABLE. RISK PHRASES: NOT APPLICABLE. |

See Section 16 for full text of Ingredient Risk Phrases

3. COMPOSITION AND INFORMATION ON INGREDIENTS (Continued)

| CHEMICAL NAME | CAS # | EINECS# | ENCS# | % v/v | CLASSIFICATION, RISK PHRASES, SYMBOL LETTERS |
|---------------|-------|---------|-------|-------|----------------------------------------------|
|---------------|-------|---------|-------|-------|----------------------------------------------|

COMPONENT 8: AOP1 (continued)

| | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|---------|---------------------------------------------------------------------------------------------|
| Aliphatic Amide | Proprietary | Proprietary | Proprietary | 5-10 | HAZARD CLASSIFICATION: Toxic to Reproduction Category 2 RISK PHRASES: R: 61 SYMBOL: T |
| Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens). | | | | Balance | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |

COMPONENT 9: VW2

| | | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|---------|-------------------------------------------------------------------------|
| Water and other constituents. Each of the other constituents is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens). | | | | Balance | HAZARD CLASSIFICATION: Not applicable. RISK PHRASES: Not applicable. |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|---------|-------------------------------------------------------------------------|

See Section 16 for full text of Ingredient Risk Phrases

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

4. FIRST-AID MEASURES

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

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

EYE EXPOSURE: If this product contaminates the eyes, open victim's eyes while under gently running water. Use sufficient force to open eyelids. Have the contaminated individual "roll" eyes. Minimum flushing is for 20 minutes. The contaminated individual must seek medical attention if adverse effects occur after flushing.

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

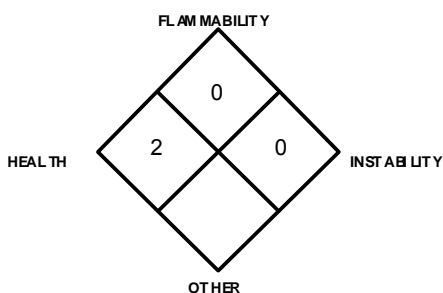
INGESTION: If this product is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. DO NOT INDUCE VOMITING unless directed by medical personnel. Have contaminated individual rinse mouth with water. Never induce vomiting or give diluents (milk or water) to someone who is unconscious,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

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

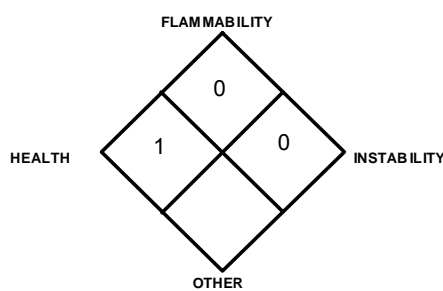
RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate overexposure.

5. FIRE-FIGHTING MEASURES

AB1, AE1, and AOP1 NFPA RATING



All Other Solutions NFPA RATING



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

FLASH POINT: Not flammable.

AUTOIGNITION TEMPERATURE: Not applicable.

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

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).

FIRE EXTINGUISHING MATERIALS NOT BE USED: Halon extinguishers should not be used for fires involving this product.

5. FIRE-FIGHTING MEASURES (Continued)

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

AE1, AB1, and AOP1: 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.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

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

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Trained personnel using pre-planned procedures should respond to uncontrolled releases. Proper protective equipment should be used. In case of a spill, clear the affected area and protect people. Avoid generating airborne dusts, mists, or sprays. The atmosphere must have levels of constituents lower than those listed in Section 8, (Exposure Controls and Personal Protective Equipment), if applicable, and have at least 19.5 percent oxygen before personnel can be allowed into the area without Self-Contained Breathing Apparatus (SCBA).

Small Spills: Lightweight gloves, a lab coat, and eye protection should be worn. Absorb spilled liquid with paper towels. Wipe up spilled solid using non-combustible material. Wash contaminated area with soap and water, absorb with paper towels, and rinse with water.

Large Spills: Minimum Personal Protective Equipment should be **Level C: triple-gloves (rubber gloves and nitrile gloves over latex gloves), chemical resistant suit and boots, hard hat, 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%.** 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. Wipe up spilled solid using non-combustible material. Decontaminate the area thoroughly. Prevent material from entering sewer or confined spaces, waterways, soil or public waters. Monitor area and confirm levels are below exposure limits given in Section 8 (Exposure Controls-Personal Protection), if applicable, before non-response personnel are allowed into the spill area.

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

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

7. HANDLING and STORAGE

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

STORAGE AND HANDLING PRACTICES: All employees who handle this material should be trained to handle it safely. Avoid breathing dusts, vapors, or mists generated by this product's components. Ensure containers of this product's components are properly labeled. Open containers slowly on a stable surface. Store vials as directed in the product insert. Store away from incompatible materials. Material should be stored in secondary containers, as appropriate. Post warning and "NO SMOKING" signs in storage and use areas, as appropriate. Have appropriate extinguishing equipment in the storage area (i.e., sprinkler system, portable fire extinguishers). Keep vials tightly closed when not in use. Inspect vials containing this product's components for leaks or damage. Read instructions provided with the product prior to use.

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

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

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

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

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)**EXPOSURE LIMITS/GUIDELINES:**

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: MSS

| | | | | | | | | | |
|-----------------------------------|----|----|----------------------------------------|----|----------------------------------------|----|----|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Proprietary Aliphatic Triol | NE | NE | NE | NE | NE | NE | NE | NE | NE |
| Proprietary Aliphatic Sulfoxide | NE | NE | NE | NE | NE | NE | NE | NE | DFG MAKs: TWA = 160 (skin) PEAK = 2•MAK 15 min. average value, 1-hr interval, 4-per shift DFG MAK Pregnancy Risk Classification: D AIHA WEEL: TWA = 250 ppm |
| Proprietary Polyethylene Compound | NE | NE | NE | NE | NE | NE | NE | NE | DFG MAKs: TWA = 1000 (inhalable fraction) PEAK = 8•MAK 15 min. average value, 1-hr interval, 4-per shift DFG MAK Pregnancy Risk Classification: C AIHA WEEL: TWA = 10 (aerosol) |
| Proprietary Carbohydrate Compound | 10 | NE | 15 (total dust), 5 (resp. fraction) | NE | 10 (total dust), 5 (resp. fraction) | NE | NE | NE | Carcinogen: TLV-A4 |

COMPONENT 2: UB3

| | | | | | | | | | |
|----------------------------------------------|----|----|----|----|----|----|----|----|----|
| Proprietary Carboxymethyl Hydroxide Compound | NE | NE | NE | NE | NE | NE | NE | NE | NE |
|----------------------------------------------|----|----|----|----|----|----|----|----|----|

COMPONENT 3: ELM

| | | | | | | | | | |
|----------------------------------------------|----|----|----------------------------------------|----|----------------------------------------|----|----|----|--------------------|
| Proprietary Carboxymethyl Hydroxide Compound | NE | NE | NE | NE | NE | NE | NE | NE | NE |
| Proprietary Carbohydrate Compound | 10 | NE | 15 (total dust), 5 (resp. fraction) | NE | 10 (total dust), 5 (resp. fraction) | NE | NE | NE | Carcinogen: TLV-A4 |

COMPONENT 4: MTR1

| | | | | | | | | | |
|-----------------------------------|----|----|----------------------------------------|----|----------------------------------------|----|----|----|--------------------|
| Proprietary Aliphatic Triol | NE | NE | NE | NE | NE | NE | NE | NE | NE |
| Proprietary Carbohydrate Compound | 10 | NE | 15 (total dust), 5 (resp. fraction) | NE | 10 (total dust), 5 (resp. fraction) | NE | NE | NE | Carcinogen: TLV-A4 |

COMPONENT 5: FSB

| | | | | | | | | | |
|-----------------------------------|----|----|----------------------------------------|----|----------------------------------------|----|----|----|----|
| Proprietary Carbohydrate Compound | 10 | NE | 15 (total dust), 5 (resp. fraction) | NE | 10 (total dust), 5 (resp. fraction) | NE | NE | NE | NE |
|-----------------------------------|----|----|----------------------------------------|----|----------------------------------------|----|----|----|----|

COMPONENT 6: AE1

| | | | | | | | | | |
|--------------------------------|--------------|----|-----------|----|----|----|----|----|-----------------------------------------------|
| Proprietary Sodium Salt | NE | NE | NE | NE | NE | NE | NE | NE | NE |
| Proprietary Phosphate Compound | NE | NE | NE | NE | NE | NE | NE | NE | NE |
| Proprietary Aliphatic Amide | 10 (skin) | NE | 10 (skin) | NE | NE | NE | NE | NE | DFG MAK: Danger of cutaneous absorption |

COMPONENT 7: AB1

| | | | | | | | | | |
|-----------------------------------|--------------|----|-----------|----|----|----|----|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Proprietary Sodium Salt | NE | NE | NE | NE | NE | NE | NE | NE | NE |
| Proprietary Phosphate Compound | NE | NE | NE | NE | NE | NE | NE | NE | NE |
| Proprietary Polyethylene Compound | NE | NE | NE | NE | NE | NE | NE | NE | DFG MAKs: TWA = 1000 (inhalable fraction) PEAK = 8•MAK 15 min. average value, 1-hr interval, 4-per shift DFG MAK Pregnancy Risk Classification: C AIHA WEEL: TWA = 10 (aerosol) |
| Proprietary Aliphatic Amide | 10 (skin) | NE | 10 (skin) | NE | NE | NE | NE | NE | DFG MAK: Danger of cutaneous absorption |

COMPONENT 8: AOP1

| | | | | | | | | | |
|-----------------------------------|----|----|----|----|----|----|----|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Proprietary Polyethylene Compound | NE | NE | NE | NE | NE | NE | NE | NE | DFG MAKs: TWA = 1000 (inhalable fraction) PEAK = 8•MAK 15 min. average value, 1-hr interval, 4-per shift DFG MAK Pregnancy Risk Classification: C AIHA WEEL: TWA = 10 (aerosol) |
|-----------------------------------|----|----|----|----|----|----|----|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

NE = Not Established.

DSEN = May Cause Dermal Sensitization

See Section 16 for Definitions of Other Terms Used

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)**EXPOSURE LIMITS/GUIDELINES (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 |

COMPONENT 8: AOP1 (continued)

| | | | | | | | | | |
|--------------------------------|-----------|----|-----------|----|----|----|----|----|--------------------------------------------|
| Proprietary Sodium Salt | NE | NE | NE | NE | NE | NE | NE | NE | NE |
| Proprietary Phosphate Compound | NE | NE | NE | NE | NE | NE | NE | NE | NE |
| Proprietary Aliphatic Amide | 10 (skin) | NE | 10 (skin) | NE | NE | NE | NE | NE | DFG MAK: Danger of cutaneous absorption |

NE = Not Established.

DSEN = May Cause Dermal Sensitization

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/m³, Skin, 2003
 Russia: STEL = 20 mg/m³, JUN 2003
 Sweden: TWA = 50 ppm (150 mg/m³); STEL = 150 ppm (500 mg/m³), Skin, JUN 2005
 Switzerland: MAK-W = 50 ppm (160 mg/m³), Skin, DEC 2006

ALIPHATIC AMIDE:

Australia: TWA = 10 ppm (18 mg/m³), JUL 2008
 Belgium: TWA = 10 ppm (18 mg/m³), Skin, MAR 2002
 Denmark: TWA = 10 ppm (18 mg/m³), OCT 2002
 Finland: TWA = 10 ppm (19 mg/m³), STEL = 20 ppm (37 mg/m³), Skin, SEP 2009
 France: VME = 20 ppm (30 mg/m³), FEB 2006
 Korea: TWA = 10 ppm (15 mg/m³), skin, 2006

ALIPHATIC AMIDE (continued):

Mexico: TWA = 20 ppm (30 mg/m³); STEL = 30 ppm (45 mg/m³), 2004
 The Netherlands: MAC-TGG = 16 mg/m³, 2003
 New Zealand: TWA = 10 ppm (18 mg/m³), skin, JAN 2002
 Norway: TWA = 10 ppm (18 mg/m³), JAN 1999
 Russia: STEL = 3 mg/m³, JUN 2003
 Sweden: TWA = 10 ppm (20 mg/m³); STEL = 15 ppm (30 mg/m³), Skin, JUN 2005
 Switzerland: MAK-W = 10 ppm (18 mg/m³), Skin, DEC 2006
 United Kingdom: TWA = 20 ppm (37 mg/m³); STEL = 30 ppm, 2005
 In Argentina, Bulgaria, Colombia, Jordan, Singapore, Vietnam check ACGIH TLV
POLYETHYLENE COMPOUND:
 Denmark: TWA = 1000 mg/m³, OCT 2002

POLYETHYLENE COMPOUND (continued):

Germany: MAK = 1000 mg/m³ (inhalable), 2005
 The Netherlands: MAC-TGG = 1000 mg/m³, 2003
SODIUM SALT:
 Russia: STEL = 5 mg/m³, JUN 2003
CARBOHYDRATE COMPOUND:
 Belgium: TWA = 10 mg/m³, MAR 2002
 France: VME = 10 mg/m³, FEB 2006
 Korea: TWA = 10 mg/m³, 2006
 Mexico: TWA = 10 mg/m³; STEL = 20 mg/m³, 2004
 The Netherlands: MAC-TGG = 10 mg/m³, 2003
 New Zealand: TWA = 10 mg/m³ (inspirable dust), JAN 2002
 United Kingdom: TWA = 10 mg/m³; STEL = 20 mg/m³, 2005
 In Argentina, Bulgaria, Colombia, Jordan, Singapore, Singapore, Vietnam check ACGIH TLV
ALIPHATIC TRIOL:
 Russia: STEL = 5 mg/m³, JUN 2003

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

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

EYE PROTECTION: Depending on the use of this product, splash goggles or safety glasses may be worn. Use goggles or safety glasses for spill response, as stated in Section 6 (Accidental Release Measures) of this MSDS. If necessary, refer to U.S. OSHA 29 CFR 1910.133, Canadian CSA Standard Z94.3-07, European Standard CR 13464:1999, Australian Standard 1337-Eye Protection for Industrial Applications and Australian Standard 1336-Recommended Practices for Eye Protection in the Industrial Environment, or Japanese Standard JIS T 8147:2003.

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

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

9. PHYSICAL and CHEMICAL PROPERTIES

APPEARANCE, ODOR and COLOR:

AB1, AE1, and AOP1: These components are clear, colorless liquids with a mildly sulfurous odor.

MSS: These solutions are clear, colorless liquids with a mildly garlic-like odor.

All Other Solutions: These solutions are clear, colorless, odorless liquids.

HOW TO DETECT THESE SUBSTANCES:

AB1, AE1, and AOP1: The odor may act as a warning property associated with these liquids.

MSS: 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.

pH: 6–10

FLASH POINT: Not applicable.

FLAMMABILITY: Not flammable.

EXPLOSIVE PROPERTIES: Not explosive

OXIDIZING PROPERTIES: Not oxidizers.

VAPOR PRESSURE: Not established.

SPECIFIC GRAVITY: Not established.

SOLUBILITY: Miscible in some organic solvents.

SOLUBILITY IN WATER: Completely soluble.

BOILING POINT: Not established.

MELTING/FREEZING POINT: Not established.

VISCOSITY: Not established.

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

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

ODOR THRESHOLD: Not established.

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

10. STABILITY AND REACTIVITY

DECOMPOSITION CONDITIONS/STABILITY: Stable.

DECOMPOSITION PRODUCTS:

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

Hydrolysis: None known.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE:

AB1, AE1, and AOP1: Karl Fischer reagent (mixture of toluene, pyridine and sulfur trioxide), strong oxidizers, strong acids, some metals, substances that are incompatible with water.

MSS: 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 POLYMERIZATION: Will not occur.

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

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

11. TOXICOLOGICAL INFORMATION

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

INHALATION:

AB1, AE1, and AOP1: 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.

CONTACT WITH SKIN or EYES:

AB1, AE1, and AOP1: Depending on the duration and concentration of overexposure, skin and eye contact can irritate contaminated tissue. Symptoms of skin overexposure may include redness and discomfort. Symptoms of eye overexposure may include redness, tearing, and pain.

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

SKIN ABSORPTION:

AB1, AE1, and AOP1: The Aliphatic Amide constituent of these components can be absorbed through the skin and may cause adverse reproductive effects.

MSS: 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 solutions are known to be absorbed via intact skin.

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



AB1, AE1, and AOP1: If these liquids are swallowed, they may irritate the mouth, throat, and other tissues of the digestive system. Ingestion may cause adverse reproductive effects.

MSS: If these solutions are swallowed, they may cause gastric distress. Large doses may cause nausea, vomiting, chills, cramps, and lethargy.



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

11. TOXICOLOGICAL INFORMATION (Continued)

AE1, AB1, and AOP1

| 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 | | | |

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

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:

AB1, AE1, and AOP1: Inhalation of vapors, mists, or sprays of the Aliphatic Amide constituent of these components may cause nausea, headache, and vomiting. Depending on the duration and concentration of overexposure, skin and eye contact can irritate contaminated tissue. Aliphatic Amide can be absorbed through the skin and may cause adverse reproductive effects. Ingestion may cause adverse reproductive effects.

MSS: 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:

MSS: 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:

AB1, AE1, and AOP1: Eyes, skin, reproductive system.

MSS: Eyes, gastrointestinal tract.

All Other Solutions: Eyes, gastrointestinal tract.

CHRONIC:

MSS: 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 than 1 percent concentration and listed in Section 3 (Composition and Information on Ingredients).

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

ALIPHATIC SULFOXIDE (continued):

LD₅₀ (oral, rat) = 14500 mg/kg; Eye: hemorrhage, conjunctive irritation

LD₅₀ (oral, mouse) = 7920 mg/kg

LD₅₀ (oral, dog) > 10 g/kg

LD₅₀ (oral, chicken) = 12 g/kg

LD₅₀ (skin, rat) = 40 g/kg

LD₅₀ (skin, mouse) = 50 g/kg

LD₅₀ (intraperitoneal, rat) = 8200 mg/kg

LD₅₀ (intraperitoneal, mouse) = 2500 mg/kg

LD₅₀ (subcutaneous, rat) = 12 g/kg; Behavioral: changes in motor activity (specific assay); Lungs, Thorax, or Respiration: dyspnea

LD₅₀ (subcutaneous, mouse) = 14 g/kg; Behavioral: changes in motor activity (specific assay); Lungs, Thorax, or Respiration: other changes; Kidney, Ureter, Bladder: hematuria

ALIPHATIC SULFOXIDE (continued):

LD₅₀ (intravenous, rat) = 5360 mg/kg; Behavioral: tremor; muscle weakness; Lungs, Thorax, or Respiration: dyspnea

LD₅₀ (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

11. TOXICOLOGICAL INFORMATION (Continued)

TOXICITY DATA (continued):

ALIPHATIC SULFOXIDE (continued):

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

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 AMIDE:

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

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

LD₅₀ (oral, rat) = 5577 mg/kg; Autonomic Nervous System: other (direct) parasympathomimetic; Behavioral: ataxia Incontinence

LD₅₀ (oral, mouse) > 3150 mg/kg

LD₅₀ (oral, mammal) = 3150 mg/kg

LD₅₀ (intraperitoneal, rat) = 5700 mg/kg

LD₅₀ (subcutaneous, rat) > 4 g/kg

LD₅₀ (intraperitoneal, mouse) = 2450 mg/kg

LD₅₀ (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)

ALIPHATIC AMIDE (continued):

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

POLYETHYLENE COMPOUND:

LD₅₀ (Oral-Rat) > 50 gm/kg

LD₅₀ (Skin-Rabbit) > 20 gm/kg

SODIUM SALT:

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

SODIUM SALT (continued):

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

LD₅₀ (Oral-Rat) 3000 mg/kg

LD₅₀ (Oral-Mouse) 4 mg/kg

LD₅₀ (Intraperitoneal-Rat) 2600 mg/kg

LD₅₀ (Intraperitoneal-Mouse) 2602 mg/kg

LD₅₀ (Subcutaneous-Mouse) 3 gm/kg

LD₅₀ (Intravenous-Mouse) 645 mg/kg

LD₅₀ (Intracervical-Mouse) 131 mg/kg

LDLo (Oral-Rabbit) 8 mg/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

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

SODIUM SALT (continued):

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

TDLo (Intrauterine-Rat) 500 mg/kg; female 4 day(s) after conception; Reproductive: Fertility: post-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 (Intraplental-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

PHOSPHATE COMPOUND:

Standard Draize Test (Skin-Rabbit) 500 mg/24 hours: Mild

Standard Draize Test (Eye-Rabbit) 500 mg/24 hours: Mild

LD₅₀ (Oral-Rat) 17,000 mg/kg

LDLo (Intraperitoneal-Rat) 1 gm/kg

LDLo (Subcutaneous-Rat) 1 gm/kg

LDLo (Intramuscular-Rat) 1 gm/kg

LDLo (Intravenous-Rabbit) 1075 mg/kg; Behavioral: tetany

TDLo (Intravenous-Rat) 3976 mg/kg/14 days-intermittent; Kidney/Ureter/Bladder: changes primarily in glomeruli, proteinuria

TDLo (Intravenous-Rat) 1988 mg/kg/7 days-intermittent; Kidney/Ureter/Bladder: proteinuria

CARBOHYDRATE COMPOUND:

LD₅₀ (oral, rat) = 29,700 mg/kg; Behavioral: somnolence (general depressed activity); Lungs, Thorax, or Respiration: cyanosis; Gastrointestinal: hypermotility, diarrhea

LD₅₀ (intraperitoneal, mouse) = 14,000 mg/kg

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

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

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

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

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

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

11. TOXICOLOGICAL INFORMATION (Continued)

TOXICITY DATA (continued):

CARBOHYDRATE COMPOUND (continued):

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

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

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

ALIPHATIC TRIOL:

Standard Draize Test (Skin-Rat) 100 mg

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

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

LD₅₀ (Oral-Rat) > 3000 mg/kg

LD₅₀ (Oral-Mouse) 5500 mg/kg

LD₅₀ (Intravenous-Rat) 1800 mg/kg

LD₅₀ (Intravenous-Rat) 3.28 gm/kg: Liver: hepatitis

(hepatocellular necrosis), diffuse;

Kidney/Ureter/Bladder: changes in tubules

(including acute renal failure, acute tubular necrosis)

LD₅₀ (Intravenous-Mouse) 1210 mg/kg

ALIPHATIC TRIOL (continued):

LD₅₀ (Intravenous-Mouse) 6100 mg/kg: Behavioral: muscle weakness; Lungs, Thorax, or Respiration: respiratory depression

LD₅₀ (Intraperitoneal-Mouse) 3350 mg/kg

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

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

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

ALIPHATIC TRIOL (continued):

TDLo (Oral-Mouse) 3000 mg/kg:

Kidney/Ureter/Bladder: urine volume increased

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

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

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

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

CARCINOGENIC POTENTIAL OF COMPONENTS: The constituents in the solutions of this product are listed by agencies tracking the carcinogenic potential of chemical compounds as follows:

CARBOHYDRATE COMPOUND: ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen)

The remaining 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.

AB1, AE1, and AOP1: 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:

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

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

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

Mutagenicity: The constituents in the solutions in this product are not reported to produce mutagenic effects in humans. Human mutation data are available for the Aliphatic 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 Amide and Carbohydrate Compound 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 Amide, and Carbohydrate Compound 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 Amide constituents in this product's solutions indicate adverse reproductive effects.

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

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

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

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

ALIPHATIC SULFOXIDE:

The Koc of Aliphatic Sulfoxide 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 Aliphatic Sulfoxide is expected to have very high mobility in soil.

ALIPHATIC AMIDE:

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

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

ALIPHATIC SULFOXIDE:

If released to air, a vapor pressure of 6.1X10⁻¹ mm Hg at 25°C indicates Aliphatic Sulfoxide will exist solely as a vapor phase in the atmosphere. Vapor-phase Aliphatic Sulfoxide 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. Aliphatic Sulfoxide 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, Aliphatic Sulfoxide 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. Aliphatic Sulfoxide is expected to slowly volatilize from dry soil surfaces based upon its vapor pressure. A 3% theoretical BOD after 2 weeks in activated sludge indicates that biodegradation is not expected to be an important environmental fate process. If released into water, Aliphatic Sulfoxide is not expected to adsorb to suspended solids and sediment based upon the estimated Koc. A low experimental BCF of <1 suggests that bioconcentration in aquatic organisms is low. Hydrolysis is not expected to be an important environmental fate process since this compound lacks functional groups that hydrolyze under environmental conditions.

12. ECOLOGICAL INFORMATION (Continued)

PERSISTENCE AND BIODEGRADABILITY (continued):

ALIPHATIC AMIDE:

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

POLYETHYLENE COMPOUND:

Solubility: Readily soluble in water.

Degradation: This compound is chemically identical to the natural amino acid L-Serine and can therefore be degraded microbiologically.

SODIUM SALT:

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

PHOSPHATE COMPOUND:

Water Solubility = 12.5 g/100 mL (25°C); 14 lbs/ 100 gal (± 0°C)

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

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

ALIPHATIC SULFOXIDE:

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

ALIPHATIC AMIDE:

An estimated BCF of 3 was calculated for Aliphatic Amide, using a log K_{ow} 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.

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

ALIPHATIC SULFOXIDE:

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

LC₅₀ (*Salvelinus fontinalis* Brook trout) 24 hours = 54 g/L; static; 95% CI (50.9-58.3)

LC₅₀ (*Salvelinus namaycush* Lake trout) 24 hours = 47.8 g/L; static; 95% CI (42.3-54.0)

LC₅₀ (*Oncorhynchus mykiss* Rainbow trout) 24 hours = 53.0 g/L; static; 95% CI (48.6-57.8)

LC₅₀ (*Cyprinus carpio* Carp) 24 hours = 44.0 g/L; static; 95% CI (48.6-57.8)

LC₅₀ (*Ictalurus melas* Black bullhead) 24 hours = 42.5 g/L; static; 95% CI (37.9-47.6)

LC₅₀ (*Ictalurus punctatus* Channel catfish) 24 hours = 39.0 g/L; static; 95% CI (36.1-42.1)

LC₅₀ (*Lepomis cyanellus* Green sunfish) 24 hours = 65.0 g/L; static; 95% CI (61.3-68.9)

LC₅₀ (*Lepomis macrochirus* Bluegill) 24 hours = 72.0 g/L; static; 95% CI (63.2-82.1)

ALIPHATIC SULFOXIDE (continued):

LC₅₀ (*Perca flavescens* Yellow perch) 24 hours = 65.0 g/L; static; 95% CI (61.3-68.9)

LC₅₀ (*Salvelinus fontinalis* Brook trout) 24 hours = 54.5 g/L; static; 95% CI (50.9-58.3)

LC₅₀ (*Salvelinus fontinalis* Brook trout) 48 hours = 46.0 g/L; static; 95% CI (42.2-50.1)

LC₅₀ (*Pimephales promelas* Fathead minnow) 96 hours = 34 g/L; static

LC₅₀ (*Lepomis macrochirus* Bluegill) 96 hours = > 40 g/L; static

LC₅₀ (*Salvelinus fontinalis* Brook trout) 96 hours = 36.5 g/L; static; 95% CI (33.2-40.2)

EC₅₀ (*Daphnia magna* water flea) 24 hours = 7000 mg/L; toxic effect: inhibition of mobility

ALIPHATIC AMIDE:

LC₅₀ (minnow) > 500 mg/L/ 48 hours

POLYETHYLENE COMPOUND:

Toxic to fishes

SODIUM SALT:

LC₅₀ (*Tinca tinca* tench) 12 hours = 112 mg/L @ 25°C, freshwater, static bioassay

LC₅₀ (*Tinca tinca* tench) 12 hours = 1142 mg/L @ 20°C, freshwater, static bioassay

LC₅₀ (*Carassius auratus* goldfish) 240 hours = 11,764.3 mg/L (@ 23.5°C, tap water, static bioassay)

LC₅₀ (*Tinca tinca* tench) 24 hours = 119 mg/L @ 25°C, freshwater, static bioassay

LC₅₀ (*Tinca tinca* tench) 24 hours = 104 mg/L @ 20°C, freshwater, static bioassay

EC₅₀ (*Daphnia magna* water flea) 48 hours = 340.7-469.2 mg/L s.c. (11.5-14.5°C, well water, static bioassay)

LC₅₀ (*Daphnia magna* Water flea) 25 hours = 154 mg/L; static

LC₅₀ (*Daphnia magna* Water flea) 50 hours = 1089 mg/L; static

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

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:

Denaturation 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 NOT classified as dangerous goods, per U.S. DOT regulations, under 49 CFR 172.101.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This product is NOT classified as Dangerous Goods, per regulations of Transport Canada.

INTERNATIONAL AIR TRANSPORT ASSOCIATION/ICAO (IATA/ICAO): This product is NOT classified as dangerous goods, per rules of IATA.

INTERNATIONAL MARITIME ORGANIZATION (IMO): This product is NOT dangerous goods, per the rules of IMO.

14. TRANSPORTATION INFORMATION (Continued)

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

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

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

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

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for the constituents in this product's solutions. The default Federal MSDS submission and inventory requirement filing.

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

U.S. TSCA INVENTORY STATUS: This product is regulated by the Food and Drug Administration; it is exempt from the requirements of TSCA.

OTHER U.S. FEDERAL REGULATIONS: Not applicable.

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

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

AB1, AE1, and AOP1: **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, CO₂, 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, CO₂, or "alcohol" foam. **IN CASE OF SPILL**: Absorb spill with polypads and place in suitable container. Consult Material Safety Data Sheet for additional information.

ADDITIONAL CANADIAN REGULATIONS:

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

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

CANADIAN WHMIS CLASSIFICATION AND SYMBOLS:

AB1, AE1, and AOP1: D2A Teratogenicity and embryotoxicity



All Other Solutions: Not applicable.

ADDITIONAL EUROPEAN UNION REGULATIONS:

LABELING AND CLASSIFICATION: The following classification is self-classification, based on possible skin contact of product in the workplace and European Union Council Directive 67/548/EEC and subsequent Directives.

AB1, AE1, and AOP1:

Classification: Toxic to Reproduction Development, Category 2.

Risk Phrases: [R 61]: May cause harm to the unborn child.

Safety Phrases: [S 45]: In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). [S 53]: Avoid exposure-obtain special instructions before use.

Hazard Symbol:



All Other Solutions:

Classification: Not applicable.

Safety Phrases: Not applicable.

Risk Phrases: Not applicable.

Hazard Symbol: Not applicable.

LABELING AND CLASSIFICATION FOR CONSTITUENTS:

ALIPHATIC AMIDE:

Classification: Toxic to Reproduction, Category 2

Risk Phrases: [R 61]: May cause harm to the unborn child.

Safety Phrases: [S 45]: In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). [S 53]: Avoid exposure-obtain special instructions before use.

15. REGULATORY INFORMATION (Continued)

ADDITIONAL EUROPEAN UNION REGULATIONS (continued):

LABELING AND CLASSIFICATION FOR CONSTITUENTS (continued):

ALL OTHER CONSTITUENTS:

Official classifications for these substances have not been published in Commission Directives 93/72/EEC, 94/69/EC, 96/56/EC, or 98/98/EC.

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.

LABELING AND CLASSIFICATION: The following classification is self-classification, based on possible skin contact of product in the workplace and the Australian National Occupational Health and Safety Commission [NOHSC(1008:2004)].

AB1, AE1, and AOP1:

Classification: Toxic to Reproduction Development, Category 2.

Risk Phrases: [R 61]: May cause harm to the unborn child.

Safety Phrases: [S 45]: In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). [S 53]: Avoid exposure-obtain special instructions before use.

Hazard Symbol:



All Other Solutions:

Classification: Not applicable.

Safety Phrases: Not applicable.

Risk Phrases: Not applicable.

Hazard Symbol: Not applicable.

POISONS SCHEDULE NUMBER: Not applicable.

ADDITIONAL LABELING: Not applicable.

ADDITIONAL JAPANESE REGULATIONS:

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

POISONOUS AND DELETERIOUS SUBSTANCES CONTROL LAW: No constituent in this product's solutions is listed under the Poisonous and Deleterious Substances Control Law.

16. OTHER INFORMATION

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.

PO Box 1961, Hilo, HI 96721 • 800/441-3365 • 808/969-4846

REVISION INFORMATION:

May 11, 2010: Addition of new component solution.

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

EXPOSURE LIMITS IN AIR (continued):

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

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

LOQ: Limit of Quantitation.

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

NIC: Notice of Intended Change.

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

NIOSH RELs: NIOSH's Recommended Exposure Limits.

DEFINITIONS OF TERMS (Continued)

EXPOSURE LIMITS IN AIR (continued):

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

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

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

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

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

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 LD₅₀ Rat:* > 5000 mg/kg. *Dermal Toxicity LD₅₀ Rat or Rabbit:* > 2000 mg/kg. *Inhalation Toxicity 4-hrs LC₅₀ 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 LD₅₀ Rat:* > 500–5000 mg/kg. *Dermal Toxicity LD₅₀ Rat or Rabbit:* > 1000–2000 mg/kg. *Inhalation Toxicity LC₅₀ 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 LD₅₀ Rat:* > 50–500 mg/kg. *Dermal Toxicity LD₅₀ Rat or Rabbit:* > 200–1000 mg/kg. *Inhalation Toxicity LC₅₀ 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 LD₅₀ Rat:* > 1–50 mg/kg. *Dermal Toxicity LD₅₀ Rat or Rabbit:* > 20–200 mg/kg. *Inhalation Toxicity LC₅₀ 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 LD₅₀ Rat:* ≤ 1 mg/kg. *Dermal Toxicity LD₅₀ Rat or Rabbit:* ≤ 20 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* ≤ 0.05 mg/L.

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

PHYSICAL HAZARD: 0 Water Reactivity: Materials that do not react with water. *Organic Peroxides:* Materials that are normally stable, even under fire conditions and will not react with water. *Explosives:* Substances that are Non-Explosive. *Compressed Gases:* No Rating. *Pyrophorics:* No Rating. *Oxidizers:* No 0 rating. *Unstable Reactives:* Substances that will not polymerize, decompose, condense, or self-react.). **1 Water Reactivity:** Materials that change or decompose upon exposure to moisture. *Organic Peroxides:* Materials that are normally stable, but can become unstable at high temperatures and pressures. These materials may react with water, but will not release energy violently.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

PHYSICAL HAZARD (continued): 1 (continued): Explosives: Division 1.5 & 1.6 explosives. Substances that are very insensitive explosives or that do not have a mass explosion hazard. *Compressed Gases:* Pressure below OSHA definition. *Pyrophorics:* No Rating. *Oxidizers:* Packaging Group III oxidizers; Solids: any material that in either concentration tested, exhibits a mean burning time less than or equal to the mean burning time of a 3:7 potassium bromate/cellulose mixture and the criteria for Packing Group I and II are not met. Liquids: any material that exhibits a mean pressure rise time less than or equal to the pressure rise time of a 1:1 nitric acid (65%)/cellulose mixture and the criteria for Packing Group I and II are not met. *Unstable Reactives:* Substances that may decompose, condense, or self-react, but only under conditions of high temperature and/or pressure and have little or no potential to cause significant heat generation or explosion hazard. Substances that readily undergo hazardous polymerization in the absence of inhibitors. **2 Water Reactivity:** Materials that may react violently with water. *Organic Peroxides:* Materials that, in themselves, are normally unstable and will readily undergo violent chemical change, but will not detonate. These materials may also react violently with water. *Explosives:* Division 1.4 explosives. Explosive substances where the explosive effects are largely confined to the package and no projection of fragments of appreciable size or range are expected. An external fire must not cause a 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 LC₅₀ for acute inhalation toxicity greater than 10,000 ppm. Dusts and mists with an LC₅₀ for acute inhalation toxicity greater than 200 mg/L. Materials with an LD₅₀ for acute dermal toxicity greater than 2000 mg/kg. Materials with an LD₅₀ 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 LC₅₀ for acute inhalation toxicity greater than 5,000 ppm but less than or equal to 10,000 ppm. Dusts and mists with an LC₅₀ for acute inhalation toxicity greater than 10 mg/L but less than or equal to 200 mg/L. Materials with an LD₅₀ 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 LD₅₀ 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 LC₅₀ 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 LC₅₀ for acute inhalation toxicity, if its LC₅₀ 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 LC₅₀ for acute inhalation toxicity greater than 2 mg/L but less than or equal to 10 mg/L. Materials with an LD₅₀ 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 LD₅₀ 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 LC₅₀ 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 LC₅₀ for acute inhalation toxicity, if its LC₅₀ 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 LC₅₀ for acute inhalation toxicity greater than 0.5 mg/L but less than or equal to 2 mg/L. Materials with an LD₅₀ 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.

DEFINITIONS OF TERMS (Continued)

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

FLAMMABILITY HAZARD: 3 (continued) Compressed liquefied gases with boiling points 55°C (-66.5°F) that cause frostbite and irreversible tissue damage. Materials with an LD₅₀ for acute oral toxicity greater than 5 mg/kg but less than or equal to 50 mg/kg. **4** Materials that, under emergency conditions, can be lethal. Gases with an LC₅₀ 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 LC₅₀ for acute inhalation toxicity, if its LC₅₀ is less than or equal to 1000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is less than or equal to 0.5 mg/L. Materials whose LD₅₀ for acute dermal toxicity is less than or equal to 40 mg/kg. Materials whose LD₅₀ for acute oral toxicity is less than or equal to 5 mg/kg.

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

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

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

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

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (NFPA). **Flash Point:** Minimum temperature at which a liquid gives off sufficient vapor to form an ignitable mixture with air near the surface of the liquid or within the test vessel used. **Autoignition Temperature:** Minimum temperature of a solid, liquid, or gas required to initiate or cause self-sustained combustion in air with no other source of ignition. **LEL:** Lowest concentration of a flammable vapor or gas/air mixture that will ignite and burn with a flame. **UEL:** Highest concentration of a flammable vapor or gas/air mixture that will ignite and burn with a flame.

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. **LD₅₀:** Lethal Dose (solids & liquids) that kills 50% of the exposed animals. **LC₅₀:** 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/m³:** 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. **TD₀, LDLo, and LD₀, or TC, TC₀, 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. **BCE:** Bioconcentration Factor, which is used to determine if a substance will concentrate in life forms that consume contaminated plant or animal matter. **TLm:** Median threshold limit. **log K_{ow}** or **log K_{oc}:** Coefficient of Oil/Water Distribution is used to assess a substance's behavior in the environment.

REGULATORY INFORMATION:

U.S. and CANADA:

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

EUROPE:

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

AUSTRALIA:

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

JAPAN:

METI: Ministry of Economy, Trade and Industry.