

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

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

1. PRODUCT IDENTIFICATION

TRADE NAME (AS LABELED): SHINE™ 2-13-13 + micros
CHEMICAL NAME/CLASS: Potassium/Phosphorous/Chelated Cu, Mn, Fe, Zn Aqueous Solution
PRODUCT NUMBER: 2-13-13 + micros
PRODUCT USE: Fertilizer
SUPPLIER/MANUFACTURER'S NAME: Source-to-Source
ADDRESS: 3233 South "I" Street
Tulare, CA 93274
559-686-5115
BUSINESS PHONE: 559-686-5115
EMERGENCY PHONE: CHEMTREC: 1-800-424-9300 (U.S., Canada, Puerto Rico) 24-hrs
INTERNATIONAL: 1-703-527-3887 (International) 24-hrs
EMAIL ADDRESS/COMPETENT PERSON FOR MSDS: DESIREE@TULAREAG.COM
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DATE OF PREPARATION: June 16, 2011

NOTE: These products have been classified in accordance with the hazard criteria of the CPR. All US (29 CFR 1910.1200), and Canada WHMIS (Controlled Products Regulations). It is located in appropriate sections based on the ANSI Z400.1-2004 format.

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	% w/w
The total analysis for this product indicates that there is available Nitrogen 2%, Phosphoric Acid 13%, Soluble Potash 13%, Chelated Zinc 0.5%, Chelated Manganese 0.25%, Chelated Iron 0.23%, Boron 0.15% and Chelated Copper 0.11%		
Phosphorous Solution from: Ammonium Hydroxide Phosphoric Acid Potassium Hydroxide Urea	1336-21-6 7664-38-2 1310-58-3 57-13-6	70-90%
Potassium Solution from: Potassium Hydroxide Carbonate Salts, Potassium Acid Salts, Organic Carboxylic/Propanoic Acids, Glucoisosaccharinic Acid	1310-58-3 Not Applicable	5.0-10.0%
Chelated Copper, Iron, Manganese and Zinc Solution from: Copper(EDTA Cu), (EDTA Fe), Manganese (EDTA Mn), Zinc (EDTA Zn)	Mixture	5.0-10.0%
Boric Acid	10043-35-3	< 1.0%
Water and Other Trace Ingredients		Balance

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: *Product Description:* This product is a brown-colored liquid with a strong, stringent, musty odor. *Health Hazards:* This product is irritating and can cause mild to moderate irritation all routes of exposure. Severity of irritation will depend on the concentration and duration of exposure. *Flammability Hazards:* This product is not flammable or combustible. If involved in a fire this product may produce toxic gases and irritating compounds (e.g., nitrogen, carbon, copper, iron, phosphorous, manganese and zinc oxides, ammonia, chlorides and other organic materials). *Reactivity Hazards:* This product is not normally reactive. Contact with some metals may produce flammable hydrogen gas. *Environmental Hazards:* This product is a fertilizer; release of large quantity to the environment may substantially alter the nutrient composition and adversely affect plant and animal life in terrestrial and aquatic environments. *Emergency Response Considerations:* Emergency responders must wear the personal protective equipment suitable for the situation to which they are responding.

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

4. FIRST-AID MEASURES

Persons who experience adverse reactions to this product should be taken for medical attention. Take a copy of the label and MSDS to physician or health professional with victim.

SKIN EXPOSURE: If product contaminates the skin and adverse effect occurs, immediately decontaminate the affected area with running water. The minimum recommended flushing time is 20 minutes. If necessary, remove exposed or contaminated clothing, taking care not to contaminate eyes. Seek medical attention if adverse effect continues after rinsing.

EYE EXPOSURE: If product contacts the eyes rinse eyes thoroughly. If irritation occurs, open victim's eyes while under gently running water. Use sufficient force to open eyelids and then "roll" while flushing eyes. Minimum flushing is for at least 20 minutes. If the exposure has resulted in an adverse effect, seek medical attention.

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

4. FIRST-AID MEASURES (Continued)

INGESTION: If product is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. DO NOT INDUCE VOMITING, unless directed by medical personnel. Have victim rinse mouth with water, if conscious. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or unable to swallow. If vomiting occurs naturally, position head lower than chest area in order to prevent aspiration into the lungs.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Preexisting respiratory problems, dermatitis, other skin disorders, and conditions involving the Target Organs (See Section 11, Toxicological Information) can be aggravated by exposure to this product.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate overexposure.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable.

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

FIRE EXTINGUISHING MATERIALS:

Water Spray: YES Carbon Dioxide: YES Foam: YES
Dry Chemical: YES Halon: YES Other: Any "ABC" Class.

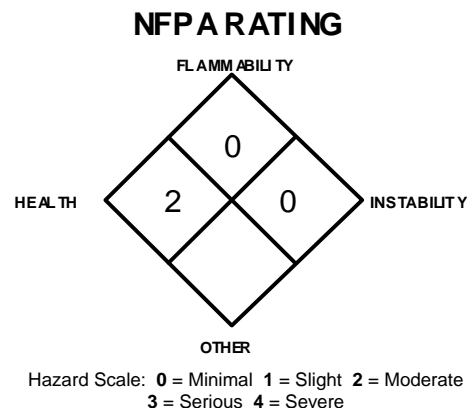
FIRE EXTINGUISHING MATERIALS NOT TO BE USED: None known.

UNUSUAL FIRE AND EXPLOSION HAZARDS: When involved in a fire and exposed to extremely high temperatures, this product will decompose to produce irritating vapors and toxic gases (e.g., nitrogen, carbon, copper, iron, phosphorous, manganese and zinc oxides, ammonia, chlorides and other organic materials). Contact with some metals may produce flammable hydrogen gas. This product contains potential skin sensitizers and so poses a possible contact hazard to fire-fighters.

Explosion Sensitivity to Mechanical Impact: Not applicable.

Explosion Sensitivity to Static Discharge: Not applicable.

SPECIAL FIRE-FIGHTING PROCEDURES: Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. If possible, prevent runoff water from entering storm drains, bodies of water, or other environmentally sensitive areas.



6. ACCIDENTAL RELEASE MEASURES

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

Small Spills: Absorb spilled liquid with clay, sand, activated carbon, polypads, or other suitable absorbent materials, wearing gloves, goggles and apron.

Large Spills: Minimum Personal Protective Equipment should be **Level B: triple-gloves (rubber gloves and nitrile gloves over latex gloves), chemical resistant suit and boots, hard hat, and Self-Contained Breathing Apparatus**. For large spills, dike or otherwise contain spill and remove with vacuum truck or pump to storage/salvage vessels. Decontaminate the area thoroughly. Prevent material from entering sewer or confined spaces, waterways, soil or public waters. Monitor area to ensure that exposure 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.

Decontaminate the area thoroughly. Place all spill residue in a double plastic bag or other containment and seal. Do not mix with wastes from other materials. Do not allow spill to contaminate waterways. 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

WORK AND HYGIENE PRACTICES: As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash thoroughly after handling this product. Do not eat, drink, smoke, or apply cosmetics while handling this product. Avoid breathing vapors or mists generated by this product when in dilute form. Remove contaminated clothing immediately.

STORAGE AND HANDLING PRACTICES -- NON-BULK CONTAINERS: All employees who handle this product should be trained to handle them safely. Open containers and drums slowly, on a stable surface. Open drum bunks carefully, to relieve any pressure build-up, which may have developed during storage. Containers of this product must be properly labeled. All Empty containers may contain residual amounts of product; therefore, empty containers should be handled with care. Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Store away from incompatible materials (see Section 10, Stability and Reactivity). Material should be stored in secondary containers or in a diked area, as appropriate. Keep container tightly closed when not in use. Inspect all incoming containers before storage to ensure that containers are properly labeled and are not damaged.

7. HANDLING and STORAGE (Continued)

STORAGE AND HANDLING PRACTICES -- BULK CONTAINERS: Bulk containers (e.g., 250 gallon "mini-bulk" tanks) holding this product should be loaded and unloaded in strict accordance with container manufacturer's recommendation and all established on-site safety procedures. Appropriate personal protective equipment must be used (see Section 8, Personal Protection). All transfer and dilution equipment must be inspected prior to each use. Transfer and dilution operations must be attended at all times. Hoses must be verified to be clean and free of incompatible chemicals prior to connection to the tank. Valves and hoses must be verified to be in the correct positions prior to starting transfer and dilution operations.

TANK CAR SHIPMENTS: Tank cars carrying this product should be loaded and unloaded in strict accordance with tank manufacturer's recommendation and all established on-site safety precautions. Appropriate personal protective equipment must be used (see Section 8, Exposure Controls and Personal Protection). All loading and unloading equipment must be level and wheels must be locked or blocked prior to loading or unloading. Tank car (for loading) or storage tank (for unloading) must be verified to be properly prepared before starting transfer of product. Hoses must be verified to be clean and free of incompatible chemicals prior to connection to the tank car or vessel. Valves and hoses must be in correct positions before starting product transfer. A sample (if required) must be taken and verified (if required) prior to starting transfer. All lines must be blown-down and purged before disconnecting them from the tank car or vessel.

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, if necessary. Collect all rinsates and dispose of in accordance U.S. Federal, State, or local procedures and appropriate Canadian standards (see Section 13, Disposal Considerations).

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation to prevent inhalation. Eyewash stations/safety showers should be near areas where this product are used or sprayed.

EXPOSURE LIMITS/GUIDELINES:

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
Ammonium Hydroxide	1336-21-6	See exposure limits below for similar compound, Potassium Hydroxide							
Boric Acid Limits given are for boron compounds	10043-35-3	NE	NE	NE	NE	NE	NE	NE	Carcinogen: Boric Acid: TLV-A4
EDTA Cu Limits given are for copper dusts & mists, as Cu	Proprietary	1	NE	1	NE	1	NE	100 (as Cu)	Carcinogen: EPA-D
EDTA Fe Limits given are for iron salts, soluble, as Fe	Proprietary	1	NE	1 (vacated 1989 PEL)	NE	1	NE	NE	NE
EDTA Mn	Proprietary	NE	NE	NE	NE	NE	NE	NE	NE
EDTA Zn Limits given are for zinc compounds	Proprietary	NE	NE	NE	NE	NE	NE	NE	DFG MAKs: TWA = 0.1 (resp. fraction), 2 (inhalable fraction) PEAK = Respirable Fraction: 4•MAK 15 min. average value, 1-hr interval, 4 per shift; Inhalable Fraction: 2•MAK 15 min. average value, 1-hr interval, 4 per shift Carcinogen (zinc compounds): EPA-II, EPA-D, EPA-I
Phosphoric Acid	7664-38-2	1	3	1	3 (vacated 1989 PEL)	1	3	1000	DFG MAKs: TWA = 2 (inhalable fraction) PEAK = 2•MAK 15 min. average value, 1-hr interval, 4 per shift DFG MAK Pregnancy Risk Classification: C
Potassium Hydroxide	1310-58-3	NE	2 (ceiling)	2 (vacated 1989 PEL)	NE	NE	2 (ceiling)	NE	NE
Urea	57-13-6	NE	NE	NE	NE	NE	NE	NE	AIHA WEEL: TWA = 10

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

RESPIRATORY PROTECTION: Use NIOSH approved respirators if ventilation is inadequate to control mists of diluted product. Maintain airborne contaminate concentrations below guidelines listed in this Section. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93 and applicable standards of Canadian Provinces. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a

full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

EYE PROTECTION: Splash goggles or safety glasses. Wear a face shield when using more than 1 gallon of this product. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or the Canadian CSA Standard Z94.3-02, *Industrial Eye and Face Protectors*.

HAND PROTECTION: Wear rubber gloves for routine industrial use. Resistance of specific materials can vary from product to product. Evaluate resistance under conditions of use and maintain clothing carefully. Use triple gloves for spill response, as stated in Section 6 (Accidental Release Measures) of this MSDS. If necessary, refer to U.S. OSHA 29 CFR 1910.138.

BODY PROTECTION: Use body protection appropriate for task. Clothing such as protective coveralls with long sleeves and full-length legs is suggested. Full-body chemical protective clothing is recommended for emergency response procedures. If necessary, refer to the OSHA Technical Manual (Section VII: Personal Protective Equipment). 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

RELATIVE VAPOR DENSITY (air = 1): Not established

DENSITY: Not available.

SOLUBILITY IN WATER: Completely soluble.

VAPOR PRESSURE: Not established.

ODOR THRESHOLD: Not available.

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

APPEARANCE, ODOR and COLOR: This product is a brown-colored liquid with a strong, stringent, musky odor.

HOW TO DETECT THIS SUBSTANCE (warning properties): The odor and color may be distinguishing characteristics to identify this product if accidentally released.

EVAPORATION RATE (n-BuAc = 1): < 1.0

MELTING/FREEZING POINT: Not established.

BOILING POINT: Not established.

pH: Not available.

10. STABILITY and REACTIVITY

STABILITY: Stable under conditions of normal temperature and pressure. May decompose or discolor upon prolonged exposure to air or heat. Contact with some metals may result in production of hydrogen gas.

DECOMPOSITION PRODUCTS: *Combustion:* When exposed to extremely high temperatures, this product will decompose to produce irritating vapors and toxic gases (e.g., nitrogen, carbon, copper, iron, phosphorous, manganese and zinc oxides, ammonia, chlorides and other organic materials). *Hydrolysis:* None known.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong oxidizers, strong bases, strong reducers and water-reactive chemicals.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Exposure to extreme temperatures and incompatible materials.

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

11. TOXICOLOGICAL INFORMATION

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: The chief routes of overexposure to this product are via contact with skin or eyes or by inhalation. The symptoms of overexposure, via route of entry, are as follows:

INHALATION: If vapors, mists or sprays of this solution are inhaled, symptoms of exposure may include breathing difficulty, irritation of the mucus membranes, coughing, nasal congestion, and a sore throat. Prolonged inhalation may result in more serious irritation of the respiratory system. Prolonged or chronic inhalation exposure may cause damage to the respiratory system, including reduced lung function.

CONTACT WITH SKIN or EYES: Contact with the eyes will cause moderate to severe irritation, pain, reddening and watering. Prolonged, direct eye contact may cause burns and damage to eyes. Depending on the duration of skin contact, skin overexposures may cause reddening, discomfort and mild to moderate irritation. Repeated contact with abraded or broken skin may cause necrosis. Repeated skin-overexposures to low concentrations can result in dermatitis (inflammation and reddening of the skin).

SKIN ABSORPTION: Skin absorption is not a significant route of exposure for this product.

INGESTION: Ingestion is not anticipated to be a likely route of occupational exposure to this product. If ingestion does occur, severe irritation and burns of the mouth, throat, esophagus, and other tissues of the digestive system will occur immediately upon contact.



HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH HAZARD	(BLUE)	2
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FLAMMABILITY HAZARD	(RED)	0
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PHYSICAL HAZARD	(YELLOW)	0
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PROTECTIVE EQUIPMENT

EYES	RESPIRATORY	HANDS	BODY
	SEE SECTION 8		SEE SECTION 8

For Routine Industrial Use and Handling Applications

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

11. TOXICOLOGICAL INFORMATION (Continued)

INGESTION (continued): Symptoms of such over-exposure can include nausea, vomiting, diarrhea. Ingestion of large volumes of this product may be harmful.

INJECTION: Injection of this product, via puncture with a contaminated object, will lead to a burning sensation, reddening, and swelling around the site of injection.

OTHER POTENTIAL HEALTH EFFECTS: Although not expected to occur, due to the small percentage in this product, due to the presence of Boric Acid, repeated exposure to this product may cause boric acid poisoning. Boric acid poisoning from ingestion usually begins about 8 hours after ingestion. Signs include vomiting, diarrhea, rapidly progressing prostration, tremors, meningismus, and convulsions. An erythematous eruption of the skin that may progress to exfoliative dermatitis is characteristic. The eruption tends to be prominent on the palms, soles, and buttocks. Other effects can include central nervous system effects include hyper-excitability, irritability, restlessness, opisthotonus, tremor, convulsions, delirium, coma, weakness, lethargy, headaches, excitement, and central nervous system depression. In severe cases, hepatic injury, hyperthermia, and cardiovascular collapse can occur. Skin contact may lead to effects, including skin effects reported from ingestion exposure.

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

ACUTE: This product may cause mild to moderate irritation by all routes of exposure. May be harmful if ingested.

CHRONIC: Dermatitis (inflammation and redness of the skin) may occur after chronic, low-level skin contact. Prolonged inhalation of the vapors may lead to respiratory disorders (e.g., bronchitis). **TARGET ORGANS:** ACUTE: Respiratory system, skin, eyes. CHRONIC: Respiratory system, skin.

TOXICITY DATA: The specific toxicology data available for components greater than 1% in concentration are as follows.

AMMONIUM HYDROXIDE:

Standard Draize Test (Eye-Rabbit) 250 µg: Severe
Standard Draize Test (Eye-Rabbit) 44 µg: Severe
Rinsed with Water (Eye-Rabbit) 1 mg/30 Seconds: Severe
LDLo (Oral-Human) 43 mg/kg
LCLo (Inhalation-Human) 5000 ppm
TCLo (Inhalation-Human) 408 ppm: Lungs, Thorax, or Respiration: fibrosis, focal (pneumoconiosis); Lungs, Thorax, or Respiration: acute pulmonary edema
LD₅₀ (Oral-Rat) 350 mg/kg: Gastrointestinal: other changes; Liver: other changes; Kidney/Ureter/Bladder: other changes
LD₅₀ (Intravenous-Mouse) 91 mg/kg: Behavioral: convulsions or effect on seizure threshold, coma; Lungs, Thorax, or Respiration: respiratory stimulation
LDLo (Oral-Cat) 750 mg/kg
LDLo (Subcutaneous-Mouse) 160 mg/kg
LDLo (Subcutaneous-Rabbit) 200 mg/kg
LDLo (Intravenous-Rabbit) 10 mg/kg
LDLo (Parenteral-Frog) 2500 mg/kg
Mutation in Microorganisms (Bacteria-*Escherichia coli*) 10 mg/disc

LACTIC ACID MONOPOTASSIUM SALT:

Standard Draize Test (Eye-Rabbit) 100 mg: Mild

PHOSPHORIC ACID:

LDLo (Unreported-Man) 220 mg/kg
LD₅₀ (Oral-Rat) 1.25 gm/kg: Lungs, Thorax, or Respiration: acute pulmonary edema; Liver: changes in liver weight
LD₅₀ (Oral-Mouse) 1.25 gm/kg: Lungs, Thorax, or Respiration: acute pulmonary edema; Liver: changes in liver weight
LC₅₀ (Inhalation-Rat) 25.5 mg/m³: Lungs, Thorax, or Respiration: acute pulmonary edema; Liver: changes in liver weight
LC₅₀ (Inhalation-Mouse) 25.5 mg/m³: Lungs, Thorax, or Respiration: acute pulmonary edema; Liver: changes in liver weight

POTASSIUM HYDROXIDE:

Standard Draize Test (Skin-Human) 50 mg/24 hours: Severe
Standard Draize Test (Skin-Rabbit) 50 mg/24 hours: Severe
Standard Draize Test (Skin-Guinea Pig) 50 mg/24 hours: Severe
Rinsed with Water (Eye-Rabbit) 1 mg/24 hours: Moderate

POTASSIUM HYDROXIDE:

LD₅₀ (Oral-Rat) 273 mg/kg
Cytogenetic Analysis (Rat-Ascites tumor) 1800 mg/kg
Cytogenetic Analysis (Hamster-Ovary) 12 mmol/L
UREA:
Standard Draize Test (Skin-Human) 22 mg/3 days-intermittent: Mild
Standard Draize Test (Skin-Human) 20%/24 hours: Moderate
TDLo (Intraplacental-Human) 1400 mg/kg: female 16 week(s) after conception: Reproductive: Fertility: abortion
TDLo (Intraplacental-Human) 1600 mg/kg: female 16 week(s) after conception: Reproductive: Fertility: abortion
LD₅₀ (Oral-Rat) 8471 mg/kg
LD₅₀ (Oral-Mouse) 11 gm/kg
LD₅₀ (Intraperitoneal-Rat) > 5 gm/kg
LD₅₀ (Subcutaneous-Rat) 8200 mg/kg: Behavioral: altered sleep time (including change in righting reflex), changes in motor activity (specific assay), antipsychotic
LD₅₀ (Subcutaneous-Mouse) 9200 mg/kg: Behavioral: altered sleep time (including change in righting reflex), changes in motor activity (specific assay), antipsychotic
LD₅₀ (Intravenous-Rat) 5300 mg/kg: Behavioral: altered sleep time (including change in righting reflex), changes in motor activity (specific assay), antipsychotic
LD₅₀ (Intravenous-Mouse) 4600 mg/kg: Behavioral: altered sleep time (including change in righting reflex), changes in motor activity (specific assay), antipsychotic
LD₅₀ (Intratracheal-Rat) 567 mg/kg: Behavioral: convulsions or effect on seizure threshold; Lungs, Thorax, or Respiration: dyspnea; Blood: methemoglobinemia-carboxyhemoglobin
LDLo (Oral-Rabbit) 10 gm/kg: Brain and Coverings: other degenerative changes; Lungs, Thorax, or Respiration: structural or functional change in trachea or bronchi; Blood: hemorrhage
LDLo (Oral-Mammal-Domestic) 511 mg/kg: Behavioral: tetany; Lungs, Thorax, or Respiration: dyspnea; Gastrointestinal: changes in structure or function of salivary glands
LDLo (Intraperitoneal-Mouse) 6608 mg/kg: Behavioral: convulsions or effect on seizure threshold, coma

UREA (continued):

LDLo (Subcutaneous-Rabbit) 3 gm/kg
LDLo (Subcutaneous-Dog) 3 gm/kg
LDLo (Subcutaneous-Pigeon) 14,800 mg/kg
LDLo (Subcutaneous-Frog) 600 mg/kg
LDLo (Intravenous-Rabbit) 4800 mg/kg
LDLo (Intravenous-Dog) 3 gm/kg
TDLo (Oral-Rat) 750 mg/kg: Kidney/Ureter/Bladder: urine volume increased, other changes in urine composition; Nutritional and Gross Metabolic: changes in sodium
TDLo (Oral-Rat) 750 mg/kg: Kidney/Ureter/Bladder: urine volume increased; Nutritional and Gross Metabolic: changes in sodium, changes in potassium
TDLo (Oral-Rat) 821 gm/kg/1 year-continuous: Tumorigenic: neoplastic by RTECS criteria; Blood: tumors, lymphoma, including Hodgkin's disease
TDLo (Oral-Mouse) 394 gm/kg/1 year-continuous: Tumorigenic: carcinogenic by RTECS criteria; Blood: tumors, lymphoma, including Hodgkin's disease
TDLo (Oral-Cattle) 200 mg(N)/kg: Behavioral: tremor, muscle weakness; Gastrointestinal: alteration in gastric secretion
TDLo (Skin-Rat) 3024 mg/kg/4 weeks-continuous: Liver: changes in liver weight; Endocrine: changes in thymus weight; Related to Chronic Data: changes in testicular weight
TDLo (Skin-Rat) 37,800 mg/kg/25 weeks-continuous: Brain and Coverings: changes in brain weight; Related to Chronic Data: changes in prostate weight
TDLo (Intrauterine-Monkey) 6 gm/kg: female 18 week(s) after conception: Reproductive: Fertility: abortion
TCLo (Inhalation-Rat) 288 mg/m³/17 weeks-intermittent: Kidney/Ureter/Bladder: other changes in urine composition; Blood: other changes; Nutritional and Gross Metabolic: changes in chlorine
DNA Inhibition (Human Lymphocyte) 600 mmol/L
Cytogenetic Analysis (Human Leukocyte) 50 mmol/L
DNA Damage (Mouse Lymphocyte) 628 mmol/L
DNA Damage (Hamster Fibroblast) 8 mol/L
Cytogenetic Analysis (Oral-Mouse) 100 gm/kg/5 days-continuous
Cytogenetic Analysis (Hamster Fibroblast) 16 gm/L/24 hours
Cytogenetic Analysis (Hamster Lung) 13 gm/L
Mutation in Mammalian Somatic Cells (Mouse Lymphocyte) 265 mmol/L

CARCINOGENIC POTENTIAL OF PRODUCT/COMPONENTS: Components of this product are listed by agencies tracking the carcinogenic potential of chemical compounds, as follows:

BORIC ACID: ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen)

COPPER EDTA (as a copper compound): EPA-D (Not Classifiable as to Human Carcinogenicity)

ZINC EDTA (as a zinc compound): EPA-II (Inadequate Information to Assess Carcinogenic Potential); EPA-D (Not Classifiable as to Human Carcinogenicity); EPA-I (Data are Inadequate for an Assessment of Human Carcinogenicity)

IRRITATION OF PRODUCT: This product may cause mild to moderate irritation, depending on concentration on duration of exposure.

SENSITIZATION TO THE PRODUCT: No component of this product is known to be a human skin or respiratory sensitizer.

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

Mutagenicity: The components of this product are not reported to produce mutagenic effects in humans.

11. TOXICOLOGICAL INFORMATION (Continued)

REPRODUCTIVE TOXICITY INFORMATION (continued):

Embryotoxicity: The components of this product are not reported to produce embryotoxic effects in humans.

Teratogenicity: The components of this product are not reported to cause teratogenic effects in humans.

Reproductive Toxicity: The components of this product are not reported to cause reproductive effects in humans.

A *mutagen* is a chemical, which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An *embryotoxin* is a chemical, which 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, which causes damage to a developing fetus, but the damage does not propagate across generational lines. A *reproductive toxin* is any substance, which interferes in any way with the reproductive process.

ACGIH BIOLOGICAL EXPOSURE INDICES: Currently, there are no ACGIH Biological Exposure Indices (BEIs) determined for the components of this product.

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

MOBILITY: This product has not been tested for mobility in soil. It is expected to be highly mobile as a liquid fertilizer. The following information is available for some components.

PHOSPHORIC ACID:

When spilled onto soil, Phosphoric Acid will infiltrate downward, the rate being greater with lower concentration because of reduced viscosity. During transport through the soil, phosphoric acid will dissolve some of the soil material, in particular, carbonate-based materials. The acid will be neutralized to some degree with adsorption of the proton and phosphate ions also possible. However, significant amounts of acid will remain for transport down toward the groundwater table. Upon reaching the groundwater table, the acid will continue to move in the direction of groundwater flow. A contaminated plume will be produced with dilution and dispersion serving to reduce the acid concentration.

UREA:

The adsorption of this compound was measured in six different British soils with organic carbon contents ranging from 1.76 to 36.5%. No adsorption was measurable in five of the soils. In a sixth soil (36.5% organic carbon), a Koc of 8 can be determined from the Freundlich isotherm. According to a classification scheme, this Koc value suggests that this material is expected to have high mobility in soil. However, it has been reported that this compound can adsorb to humic acids by free-radical complexation. Complexed material may adsorb to soil more strongly than uncomplexed Urea.

PERSISTENCE AND BIODEGRADABILITY: This product has not been tested for persistence or biodegradability. It is expected that some biodegradation will occur to this product; however, no specific information is known. The following information is available for some components.

PHOSPHORIC ACID:

While acidity may be reduced readily by natural water hardness minerals, the phosphate may persist indefinitely.

UREA:

If released to air, a vapor pressure of 1.20X10⁻⁵ mm Hg at 25°C indicates this compound will exist in both the vapor and particulate phases in the ambient atmosphere. Vapor-phase material will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 9.6 hrs. Particulate-phase material will be removed from the atmosphere by wet and dry deposition. If released to soil, this compound is expected to have very high mobility based upon a Koc of 8. Volatilization from moist soil surfaces is not expected to be an important fate process based upon an estimated Henry's Law constant of 1.74X10⁻¹² atm-cu m/mole. If released into water, this compound is not expected to adsorb to suspended solids and sediment based upon its Koc. Biodegradation is expected to be the major fate process in the aquatic ecosystem. Various screening studies have demonstrated that this material can biodegrade readily with the release of carbon dioxide and ammonia. In a river die-away test-conducted at 5°C, 1.05-2.20% of added material hydrolyzed after 10-days while only 0.35% hydrolyzed in sterile controls. This compound was completely biodegraded in aerobic biodegradation studies using activated sludge and a 14-day incubation period. Volatilization from water surfaces is not expected to be an important fate process based upon this compound's estimated Henry's Law constant. Chemical hydrolysis is catalyzed by increasing temperatures, alkalinity, and especially the presence of the biological enzyme, urease.

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

PHOSPHORIC ACID:

Phosphoric acid has not been found to bioconcentrate.

UREA:

In a 6 to 72 hour bioaccumulation study using carp (*Cyprinus carpio*), the concentration of this compound was found to be equally distributed between tissue and water during all time periods; thus, the BCF would be 1 for this species. In 3-day static-system tests using golden ide fish (*Leuciscus idus melanotus*), the BCF of this material was < 10. According to a classification scheme, these BCF values suggest the potential for bioconcentration in aquatic organisms is low.

ECOTOXICITY: This product has not been tested for terrestrial aquatic or animal toxicity. This product is a fertilizer; release of large quantity to the environment may substantially alter the nutrient composition and adversely affect plant and animal life in terrestrial and aquatic environments. All accidental release to terrestrial, atmospheric and aquatic environments should be avoided. The following aquatic toxicity data is available for some components.

AMMONIUM HYDROXIDE:

TLm (Fathead minnow) 96 hours = 8.2 mg/L (hard water) /Conditions of bioassay not specified

TLm (Bluegill) 96 hours = 3.4 mg/L/hard water, 20°C/Conditions of bioassay not specified

TLm (Diatom) 120 hours = 420 mg/L 50% growth reduction/hard water and soft water, 22°C/Conditions of bioassay not specified

TLm (Snail) 96 hours = 90 mg/L (soft water, 20°C)/Conditions of bioassay not specified

TLm (Striped bass) 96 hours = 0.97 µg/L (15°C)/Unionized NH₃/Conditions of bioassay not specified

TLm (Striped bass) 96 hours = 0.73 µg/L (23°C)/Unionized NH₃/Conditions of bioassay not specified

TLm (Stickleback) 96 hours = 5.05 µg/L (15°C)/Unionized ammonia /Conditions of bioassay not specified

TLm (Stickleback) 96 hours = 1.12 mg/L (23°C) (Unionized ammonia) /Conditions of bioassay not specified

TLm (Goldfish) 24-96 hours = 2 to 2.5 mg/L/Conditions of bioassay not specified

LC₅₀ (*Lepomis macrochirus* bluegill) 48 hours = 0.024-0.093 mg/L/Conditions of bioassay not specified

LC₅₀ (*Ictalurus punctatus* channel catfish) 1 week = 0.974 mg/liter/pH= 7.7 Temp = 21.1°C/Conditions of bioassay not specified

LC₅₀ (*Ictalurus punctatus* channel catfish) 1 week = 1.27 mg/liter/pH= 7.8 Temp = 21.7°C/Conditions of bioassay not specified

LC₅₀ (*Ictalurus punctatus* channel catfish) 1 week = 1.41 mg/liter/pH= 7.8 Temp = 22.8°C/Conditions of bioassay not specified

LC₅₀ (*Ictalurus punctatus* channel catfish) 1 week = 1.97 mg/liter/pH= 8.0 Temp = 22.8°C/Conditions of bioassay not specified

LC₅₀ (Atlantic Salmon smelt) 24 hours = 5 to 8 mg/L/Conditions of bioassay not specified

AMMONIUM HYDROXIDE (continued):

LC₅₀ (Perch) 7 days = 0.29 mg/L/Un-ionized ammonia/Conditions of bioassay not specified

LC₅₀ (*Daphnia magna*) 48 hours = 0.66 mg/L 22°C/Conditions of bioassay not specified

LC₅₀ (*Salmo gairdnerii*) 24 hours = 8 µg/mL NH₃/Conditions of bioassay not specified

LC₅₀ (Coho salmon) 96 hours = 0.45 mg/L, Flow-through bioassay

LC₅₀ (Guppy fry) 72 hours = 74 mg/L, Static bioassay

LC₅₀ (*Salmo clarki* cutthroat trout fry) 96 hours = 0.5-0.8 mg/L/flow-through bioassay

LC₅₀ (*Salmo clarki* cutthroat trout fry) 96 hours = 0.56 mg/L/36 day 0.56 mg/L

LC₅₀ (*Salmo clarki* cutthroat trout fry) 36 days = 0.56 mg/L

LC₅₀ (Rainbow trout fertilized egg) 24 hours = > 3.58 mg/L; alevin (0-50 days old) > 3.58 mg/L/Static bioassay

LC₅₀ (Rainbow trout fertilized egg) 24 hours = > 3.58 mg/L; fry (85 days old)/Static bioassay

LC₅₀ (Rainbow trout fertilized egg) 24 hours = 0.068 mg/L; adult/Static bioassay

LC₅₀ (Rainbow trout fertilized egg) 24 hours = 0.097 mg/L, Static bioassay

LC₅₀ (Walking catfish) 48 hours = 0.28 mg/L/Static bioassay

PHOSPHORIC ACID:

TLm (mosquito fish) = 138 mg/L 24-96 hours in turbid water at 22-24°C (conditions of bioassay not specified)

UREA:

Toxicity Threshold (*Scenedesmus quadricauda* green algae) > 10,000 mg/L, toxic effect: multiplication inhibition of cell/Time not specified

Toxicity Threshold (*Entosiphon sulcatum* protozoa) >29 mg/L, toxic effect: inhibition of cell multiplication/Time not specified

Toxicity Threshold (*Pseudomonas putida*) > 10,000 mg/L; toxic effect: inhibition of cell multiplication/Time not specified

12. ECOLOGICAL INFORMATION (Continued)

OTHER ADVERSE EFFECTS: This product does not contain any component with 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

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate U.S. Federal, State, and local regulations or those of Canada and its Provinces. This product, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local hazardous waste regulatory authority.

U.S. EPA WASTE NUMBER: Wastes of this product should be tested to determine if they meet the criteria for D002, Waste Characteristic, Corrosivity.

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.

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The components of this product are subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows.

CHEMICAL NAME	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Ammonium Hydroxide	No	No	Yes
Copper EDTA (as a copper compound)	No	No	Yes (N100)
Manganese EDTA (as a manganese compound)	No	No	Yes (N450)
Potassium Hydroxide	No	No	Yes
Zinc EDTA (as a zinc compound)	No	No	Yes (N982)

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for any component of this product. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lbs. (4,540 kg) may apply, per 40 CFR 370.20.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Ammonium Hydroxide = 1000 lb (454 kg); Phosphoric Acid = 5000 lb (2270 kg); Potassium Hydroxide = 1000 lb (454 kg); As a copper, manganese and zinc compounds, Copper EDTA, Manganese EDTA and Zinc EDTA are CERCLA Hazardous Substances although no specific CERCLA RQ has been assigned.

U.S. TSCA INVENTORY STATUS: The components of this product are listed on the TSCA Inventory or are excepted from listing.

OTHER U.S. FEDERAL REGULATIONS: Potassium Hydroxide is subject to the reporting requirements of Section 311(b) (2) (A) of the Federal Water Pollution Act and further regulated by the Clean Water Act Amendments of 1997 and 1978. These regulations apply to discharges of this substance. The Reportable Quantity (RQ) for notification for Potassium Hydroxide is 1,000 lb/454 kg. As Copper and Zinc compounds, Copper and Zinc EDTA are Toxic Pollutants designated pursuant to Section 307(a)(1) of the Clean Water Act and may be subject to effluent limitations.

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

ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL/NDSL INVENTORY STATUS: The components of this product are on the DSL/NDSL Inventory Lists or are excepted.

CANADIAN ENVIRONMENTAL PROTECTION AGENCY (CEPA) PRIORITIES SUBSTANCES LISTS: Not applicable.

CANADIAN WHMIS CLASSIFICATION and SYMBOLS: This product is classified as a Controlled Product, Hazard Class D2B (Irritating).



16. OTHER INFORMATION

ANSI LABELING (Z129.1, Provided to Summarize Occupational Hazard Information): **WARNING!** MAY BE HARMFUL IF SWALLOWED. CAUSES RESPIRATORY SYSTEM, SKIN AND EYE IRRITATION. FOR AGRICULTURAL USE ONLY. KEEP AWAY FROM CHILDREN. Do not taste or swallow. Do not get on skin or in eyes. Avoid breathing vapors or mist. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Wear gloves, goggles, faceshields, suitable body protection, and NIOSH-approved respiratory protection, as appropriate. **FIRST-AID:** In case of contact, immediately flush skin or eyes with plenty of water for at least 20 minutes while removing contaminated clothing and shoes. If inhaled, remove to fresh air. If ingested, do not induce vomiting. Get medical attention. **IN CASE OF FIRE:** Use water fog, dry chemical, CO₂, or "alcohol" foam.

16. OTHER INFORMATION (Continued)

ANSI LABELING (continued): IN CASE OF SPILL: Absorb spill with inert material or neutralizing agent for acids. Place residue in suitable container. Consult Material Safety Data Sheet for additional information.

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The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Tulare Ag. assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, Tulare Ag. assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

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.

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

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which 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 Time Weighted Average (**TWA**), the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (**C**). Skin absorption effects must also be considered.

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

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

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

LOQ: Limit of Quantitation.

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

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

NIC: Notice of Intended Change.

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

NIOSH RELs: NIOSH's Recommended Exposure Limits.

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

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

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

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

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

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS:

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

HEALTH HAZARD: 0 (Minimal Hazard): No significant health risk, irritation of skin or eyes not anticipated. *Skin Irritation:* Essentially non-irritating. PII or Draize = "0".

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

HEALTH HAZARD (continued): 0 (continued): *Eye Irritation:* Essentially non-irritating, or minimal effects which clear in < 24 hours [e.g. mechanical irritation]. Draize = "0". *Oral Toxicity LD₅₀ Rat* < 5000 mg/kg. *Dermal Toxicity LD₅₀Rat or Rabbit* < 2000 mg/kg. *Inhalation Toxicity 4-hrs LC₅₀ Rat* < 20 mg/L; **1** (Slight Hazard: Minor reversible injury may occur; slightly or mildly irritating. *Skin Irritation:* Slightly or mildly irritating. *Eye Irritation:* Slightly or mildly irritating. *Oral Toxicity LD₅₀ Rat* > 500-5000 mg/kg. *Dermal Toxicity LD₅₀Rat 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. *Skin Irritation:* Moderately irritating; primary irritant; sensitizer. PII or Draize > 0, < 5. *Eye Irritation:* Moderately to severely irritating and/or corrosive; reversible corneal opacity; corneal involvement or irritation clearing in 8-21 days. Draize > 0, ≤ 25. *Oral Toxicity LD₅₀ Rat* > 50-500 mg/kg. *Dermal Toxicity LD₅₀Rat 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 destroy dermal tissue, cause skin burns, dermal necrosis. PII or Draize > 5-8 with destruction of tissue. *Eye Irritation:* Corrosive, irreversible destruction of ocular tissue; corneal involvement or irritation persisting for more than 21 days. Draize > 80 with effects irreversible in 21 days. *Oral Toxicity LD₅₀ Rat* > 1-50 mg/kg. *Dermal Toxicity LD₅₀Rat 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 exposure. *Skin Irritation:* Not appropriate. Do not rate as a "4", based on skin irritation alone. *Eye Irritation:* Not appropriate. Do not rate as a "4", based on eye irritation alone. *Oral Toxicity LD₅₀ Rat* ≤ 1 mg/kg. *Dermal Toxicity LD₅₀Rat 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 exposure to a temperature of 815.5°C [1500°F] for a period of 5 minutes.); **1** (Slight Hazard-Materials that must be pre-heated before ignition can occur. Material require considerable pre-heating, under all ambient temperature conditions before ignition and combustion can occur, including: Materials that will burn in air when exposed to a temperature of 815.5°C (1500°F) for a period of 5 minutes or less; Liquids, solids and semisolids having a flash point at or above 93.3°C [200°F] (e.g. OSHA Class IIIB, or; Most ordinary combustible materials [e.g. wood, paper, etc.]); **2** (Moderate Hazard-Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not, under normal conditions, form hazardous atmospheres in air, but under high ambient temperatures or moderate heating may release vapor in sufficient quantities to produce hazardous atmospheres in air, including: Liquids having a flash-point at or above 37.8°C [100°F]; Solid materials in the form of course dusts that may burn rapidly but that generally do not form explosive atmospheres; Solid materials in a fibrous or shredded form that may burn rapidly and create flash fire hazards (e.g. cotton, sisal, hemp; Solids and semisolids that readily give off flammable vapors.); **3** (Serious Hazard- Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures, or, unaffected by ambient temperature, are readily ignited under almost all conditions, including: Liquids having a flash point below 22.8°C [73°F] and having a boiling point at or above 38°C [100°F] and below 37.8°C [100°F] [e.g. OSHA Class IB and IC]; Materials that on account of their physical form or environmental conditions can form explosive mixtures with air and are readily dispersed in air [e.g., dusts of combustible solids, mists or droplets of flammable liquids]; Materials that burn extremely rapidly, usually by reason of self-contained oxygen [e.g. dry nitrocellulose and many organic peroxides]); **4** (Severe Hazard-Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air, and which will burn readily, including: Flammable gases; Flammable cryogenic materials; Any liquid or gaseous material that is liquid while under pressure and has a flash point below 22.8°C [73°F] and a boiling point below 37.8°C [100°F] [e.g. OSHA Class IA; Material that ignite spontaneously when exposed to air at a temperature of 54.4°C [130°F] or below [e.g. pyrophoric]).

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

DEFINITIONS OF TERMS (Continued)

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

PHYSICAL HAZARD (continued): 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 – Explosive substances where the explosive effect are largely confined to the package and no projection of fragments of appreciable size or range are expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package. **Compressed Gases:** Pressurized and meet OSHA definition but < 514.7 psi absolute at 21.1°C (70°F) [500 psig]. **Pyrophorics:** No Rating. **Oxidizers:** Packing Group II **Solids:** any material that, either in concentration tested, exhibits a mean burning time of less than or equal to the mean burning time of a 2:3 potassium bromate/cellulose mixture and the criteria for Packing Group I are not met. **Liquids:** any material that exhibits a mean pressure rise time less than or equal to the pressure rise of a 1:1 aqueous sodium chlorate solution (40%/cellulose mixture and the criteria for Packing Group I are not met. **Unstable Reactives:** Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure, but have a low potential for significant heat generation or explosion. Substances that readily form peroxides upon exposure to air or oxygen at room temperature); **3 (Water Reactivity):** Materials that may form explosive reactions with water. **Organic Peroxides:** Materials that are capable of detonation or explosive reaction, but require a strong initiating source, or must be heated under confinement before initiation; or materials that react explosively with water. **Explosives:** Division 1.2 – Explosive substances that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but do not have a mass explosion hazard. **Compressed Gases:** Pressure \geq 514.7 psi absolute at 21.1°C (70°F) [500 psig]. **Pyrophorics:** No Rating. **Oxidizers:** Packing Group I **Solids:** any material that, in either concentration tested, exhibits a mean burning time less than the mean burning time of a 3:2 potassium bromate/cellulose mixture. **Liquids:** Any material that spontaneously ignites when mixed with cellulose in a 1:1 ratio, or which exhibits a mean pressure rise time less than the pressure rise time of a 1:1 perchloric acid (50%/cellulose mixture. **Unstable Reactives:** Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a moderate potential to cause significant heat generation or explosion.); **4 (Water Reactivity):** Materials that react explosively with water without requiring heat or confinement. **Organic Peroxides:** Materials that are readily capable of detonation or explosive decomposition at normal temperature and pressures. **Explosives:** Division 1.1 & 1.2-explosive substances that have a mass explosion hazard or have a projection hazard. A mass explosion is one that affects almost the entire load instantaneously. **Compressed Gases:** No Rating. **Pyrophorics:** Add to the definition of Flammability "4". **Oxidizers:** No "4" rating. **Unstable Reactives:** Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a high potential to cause significant heat generation or explosion.).

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS:

HEALTH HAZARD: 0 (materials that, under emergency conditions, would offer no hazard beyond that of ordinary combustible materials): Gases and vapors whose LC₅₀ for acute inhalation toxicity is greater than 10,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is greater than 200 mg/L. Materials whose LD₅₀ for acute dermal toxicity is greater than 2000 mg/kg. Materials whose LD₅₀ for acute oral toxicity is greater than 2000 mg/kg. Materials that are essentially non-irritating to the respiratory tract, eyes and skin. **1** (materials that, under emergency conditions, can cause significant irritation): Gases and vapors whose LC₅₀ for acute inhalation toxicity is greater than 5,000 ppm but less than or equal to 10,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is greater than 10 mg/L but less than or equal to 200 mg/L. Materials whose LD₅₀ for acute dermal toxicity is greater than 1000 mg/kg but less than or equal to 2000 mg/kg. Materials whose LD₅₀ for acute oral toxicity is greater than 500 mg/kg but less than or equal to 2000 mg/kg. Materials that cause slight to moderate irritation to the respiratory tract, eyes and skin. **2** (materials that, under emergency conditions, can cause temporary incapacitation or residual injury): Gases and vapors whose LC₅₀ for acute inhalation toxicity is greater than 3,000 ppm but less than or equal to 5,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is greater than 2 mg/L but less than or equal to 10 mg/L. Materials whose LD₅₀ for acute dermal toxicity is greater than 200 mg/kg but less than or equal to 1000 mg/kg. Materials whose LD₅₀ for acute oral toxicity is greater than 50 mg/kg but less than or equal to 500 mg/kg. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than one-fifth its 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. Compressed liquefied gases with boiling points between -30°C (-22°F) and -55°C (-66.5°F) that cause severe tissue damage, depending on duration of exposure. Materials that are respiratory irritants. Materials that cause severe, but reversible irritation to the eyes or are lachrymators. Materials that are primary skin irritants or sensitizers. **3** (materials that, under emergency conditions, can cause serious or permanent injury): Gases and vapors whose LC₅₀ for acute inhalation toxicity is greater than 1,000 ppm but less than or equal to 3,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is greater than 0.5 mg/L but less than or equal to 2 mg/L. Materials whose LD₅₀ for acute dermal toxicity is greater than 40 mg/kg but less than or equal to 200 mg/kg. Materials whose LD₅₀ for acute oral toxicity is greater than 5 mg/kg but less than or equal to 50 mg/kg. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than one-fifth its 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. Compressed liquefied gases with boiling points between -30°C (-22°F) and -55°C (-66.5°F) that cause frostbite and irreversible tissue damage. Materials that are respiratory irritants. Cryogenic gases that cause frostbite and irreversible tissue damage. Materials that are corrosive to the respiratory tract. Materials that are corrosive to the eyes or cause irreversible corneal opacity. Materials that are corrosive to the skin. **4** (materials that, under emergency conditions, can be lethal): Gases and vapors whose LC₅₀ for acute inhalation toxicity less than or equal to 1,000 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. 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 1000 ppm.

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

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

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

FLAMMABILITY LIMITS IN AIR:

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

DEFINITIONS OF TERMS (Continued)

TOXICOLOGICAL INFORMATION:

Human and Animal Toxicology: Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/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. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **Cancer Information:**

The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. **Other Information:** **BEI** - ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV.

ECOLOGICAL INFORMATION:

EC is the effect concentration in water. **BCF** = Bioconcentration Factor, which is used to determine if a substance will concentrate in lifeforms which consume contaminated plant or animal matter. **TL_m** = median threshold limit; Coefficient of Oil/Water Distribution is represented by **log K_{ow}** or **log K_{oc}** and is used to assess a substance's behavior in the environment.

REGULATORY INFORMATION:

U.S. and CANADA:

ACGIH: American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits.

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