

SAFETY DATA SHEET



Synthacalk GC-2+ Activator

1. PRODUCT IDENTIFICATION

IDENTIFICATION of the SUBSTANCE or PREPARATION

| | |
|---------------------------------|----------------------------------------------|
| <u>TRADE NAME (AS LABELED):</u> | Pecora Synthacalk GC-2+ Activator |
| <u>PRODUCT DESCRIPTION:</u> | Polysulfide-Based Sealant |
| <u>CHEMICAL NAME/CLASS:</u> | Pigmented Polysulfide Polymer |
| <u>SYNONYMS:</u> | Synthacalk GC-2+ Part A |
| <u>RELEVANT USE:</u> | Weather-Tight Seal Joint Caulking (Two-Part) |
| <u>USES ADVISED AGAINST:</u> | Other Than Relevant Use |

COMPANY/UNDERTAKING IDENTIFICATION:

| | |
|--------------------------------------|------------------------------------------|
| <u>SUPPLIER/MANUFACTURER'S NAME:</u> | Pecora Corporation |
| <u>ADDRESS:</u> | 165 Wambold Road, Harleysville, PA 19438 |
| <u>EMERGENCY PHONE:</u> | 800-424-9300 (CHEMTREC, 24-hours) |
| <u>BUSINESS PHONE:</u> | 215-723-6051 (Mon–Fri, 8 AM–5 PM ET) |

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|--------------------------|------------------|
| <u>PREPARATION DATE:</u> | January 12, 2012 |
| <u>REVISION DATE:</u> | April 3, 2017 |

This product is sold for commercial use. This MSDS has been developed to address safety concerns of those individuals working with bulk quantities of this material, as well as those of potential users of this product in industrial/occupational settings. ALL United States Occupational Safety and Health Administration Standard (29 CFR 1910.1200), U.S. State equivalent Standards, and Canadian WHMIS [Controlled Products Regulations] and the Global Harmonization Standard required information is included in appropriate sections based on the U.S. ANSI Z400.1-2008 format. This product has been classified in accordance with the hazard criteria of the countries listed above.

2. HAZARD IDENTIFICATION

GLOBAL HARMONIZATION LABELING AND CLASSIFICATION: This product has been classified per GHS Standards.

Classification: Combustible Liquid Cat. 4, Acute Oral Toxicity Cat. 4, Acute Inhalation Toxicity Cat. 4, Eye Irritation Cat. 2A, Skin Irritation Cat. 2, STOT (Central Nervous and Neurological Systems) RE Cat. 2, Skin Sensitization Cat. 1, Aquatic Acute Toxicity Cat. 1, Aquatic Chronic Toxicity Cat. 1

Signal Word: Warning

Hazard Statement Codes: H227, H302 + H332, H315, H319, H317, H373, H410

Precautionary Statement Codes: P260, P264, P270, P271, P272, P273, P280, P301 + P312, P330, P304 + P340, P305 + P351 + P338, P337 + P313, P302 + P352, P333 + P313, P362 + P364, P314, P321, P391, P501

Hazard Symbols/Pictogram: GHS07, GHS08, GHS09



EMERGENCY OVERVIEW:

PHYSICAL DESCRIPTION: This product is a thin, black paste with a mildly sweet odor.

HEALTH HAZARDS: CAUTION! Harmful if ingested. Inhalation of fumes if heated may be harmful. Prolonged skin contact may cause irritation. May cause skin sensitization. Chronic exposure may cause damage to neurological and central nervous systems. Components are suspect carcinogens (no specific route of exposure). Limited evidence of reproductive effect from animal exposure.

FLAMMABILITY HAZARD: This product is combustible and can ignite if exposed to high temperature for a prolonged period or direct flame. If this product should be allowed to dry out, this product may exhibit the properties of a Class 1 Oxidizer. See Section 5 (Fire-Fighting Measures) for additional information.

REACTIVITY HAZARD: This product is not reactive.

ENVIRONMENTAL HAZARD: This product has not been tested for environmental impact. This product contains a compound that can cause acute and chronic aquatic toxicity and harm to terrestrial organisms.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM (HMIS®)

| | | |
|------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Health | 2* | See Section 16 for definitions of ratings 0 = Minimal 3 = Serious 1 = Slight 4 = Severe 2 = Moderate * = Chronic |
| Flammability | 2 | |
| Physical Hazard | 0 | |

HMIS® is a registered trademark of the National Paint and Coatings Association.

CANADIAN WHMIS CLASSIFICATION: Class D2B. See Section 15 (Regulatory Information) for all classification details.

U.S. OSHA REGULATORY STATUS: This material has a classification under the Global Harmonization Standard, as applied under OSHA regulations, as given earlier in this Section.

3. MATERIAL IDENTIFICATION

| Chemical Name | CAS # | W/W% | GHS Classification Hazard Statements |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Manganese Oxide | 1313-13-9 | 50.0-60.0 | <u>Classification:</u> Acute Oral Toxicity Cat. 4, Acute Inhalation Toxicity Cat. 4 <u>Hazard Statement Codes:</u> H302 + H332 |
| Tetramethylthiuram Disulfide | 137-26-8 | 1.0-3.0 | <u>Classification:</u> Combustible Liquid Cat. 4, Acute Oral Toxicity Cat. 4, Acute Inhalation Toxicity Cat. 4, STOT (Central Nervous System, Brain) RE Cat. 2, Skin Irritation Cat. 2, Eye Irritation Cat. 2A, Skin Sensitization Cat. 1, Aquatic Acute Toxicity Cat. 1, Aquatic Chronic Toxicity Cat. 1 <u>Hazard Statement Codes:</u> H227, H302 + H332, H373, H315, H319, H317, H400, H410 |
| Other components. Each of the other components is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens) or is considered to be non-hazardous. | | Balance | <u>Classification:</u> Not Applicable |

See Section 16 for full text of classification

4. FIRST-AID MEASURES

PROTECTION OF FIRST AID RESPONDERS: Rescuers should not attempt to retrieve victims of exposure to this material without adequate personal protective equipment. Rescuers should be taken for medical attention, if necessary.

DESCRIPTION OF FIRST AID MEASURES: Remove victim(s) to fresh air, as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. Remove and isolate contaminated clothing and shoes. Seek immediate medical attention. Take copy of label and MSDS to physician or other health professional with victim(s).

INHALATION: If dusts of this material are inhaled, remove victim to fresh air. If necessary, use artificial respiration to support vital functions.

SKIN EXPOSURE: If the material contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 20 minutes. Do not interrupt flushing. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention.

EYE EXPOSURE: If this product enters the eyes, open victim's eyes while under gently running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 20 minutes. Do not interrupt flushing.

INGESTION: If this material is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. DO NOT INDUCE VOMITING, unless directly by medical personnel. Have victim rinse mouth with water or give several cupfuls of 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, lean patient forward or place on left side (head-down position, if possible) to maintain an open airway and prevent aspiration.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Central nervous or neurological system, dermatitis or other pre-existing skin disorders may be aggravated by overexposures to this product.

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

5. FIRE-FIGHTING MEASURES

FLASH POINT: > 60°C (> 140°F) **AUTOIGNITION:** Unknown.

FLAMMABLE LIMITS IN AIR: Unknown.

EXTINGUISHING MEDIA:

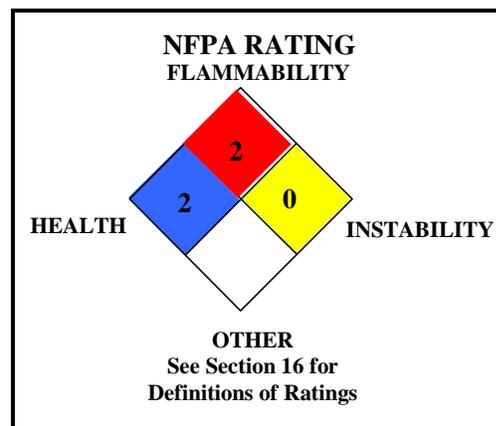
SUITABLE EXTINGUISHING MEDIA: Use extinguishing material suitable to the surrounding fire, including foam, halon, carbon dioxide and dry chemical.

UNSUITABLE EXTINGUISHING MEDIA: None known.

PROTECTION OF FIREFIGHTERS:

SPECIAL HAZARDS ARISING FROM THE SUBSTANCE: This product is combustible and can be ignited when exposed to its flashpoint. Not sensitive to mechanical impact under normal conditions. Not sensitive to static discharge under normal conditions. Closed containers may develop pressure and rupture in event of fire. Should this product be allowed to dry out, it may present hazards of a Class 1 Oxidizer (any material that readily yields oxygen or other oxidizing gas, or that readily reacts to promote or initiate combustion of combustible materials) and does not moderately increase the burning rate of combustible materials with which it comes into contact.

SPECIAL PROTECTIVE ACTIONS FOR FIRE-FIGHTERS: Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Move containers from fire area if it can be done without risk to personnel. If possible, prevent runoff water from entering storm drains, bodies of water, or other environmentally sensitive areas.



6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS AND EMERGENCY PROCEDURES: An accidental release can result in a fire. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. Eliminate any possible sources of ignition, and provide maximum explosion-proof ventilation. Use only non-sparking tools and equipment during the response. The atmosphere must at least 19.5 percent Oxygen before non-emergency personnel can be allowed in the area without Self-Contained Breathing Apparatus and fire protection.

6. ACCIDENTAL RELEASE MEASURES (Continued)

PERSONAL PROTECTIVE EQUIPMENT: Responders should wear the level of protection appropriate to the type of chemical released, the amount of the material spilled, and the location where the incident has occurred.

Small Spills: For releases of 1 drum or less, Level D Protective Equipment (gloves, chemical resistant apron, boots, and eye protection) should be worn.

Large Spills: Minimum Personal Protective Equipment should be rubber gloves, rubber boots, face shield, and Tyvek suit. Minimum level of personal protective equipment for releases in which the level of oxygen is less than 19.5% or is unknown must be **Level B: triple-gloves (rubber gloves and nitrile gloves over latex gloves), chemical resistant suit, fire-retardant clothing and boots, hard hat, and Self-Contained Breathing Apparatus.**

METHODS FOR CLEAN-UP AND CONTAINMENT:

All Spills: Access to the spill area should be restricted. Spread should be limited by gently covering the spill with polypads. Scrape up or pick-up spilled material, placing in suitable containers. Absorb any residual on appropriate material, such as sand. All contaminated absorbents and other materials should be placed in an appropriate container and seal. Do not mix with wastes from other materials. Dispose of in accordance with applicable Federal, State, and local procedures (see Section 13, Disposal Considerations). Dispose of recovered material and report spill per regulatory requirements. Remove all residue before decontamination of spill area. Clean spill area with soap and copious amounts of water.

ENVIRONMENTAL PRECAUTIONS: Minimize use of water to prevent environmental contamination. Prevent spill or rinsate from contaminating storm drains, sewers, soil or groundwater. Place all spill residues in a suitable container and seal. Do not discharge effluent containing this product into streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA.

OTHER INFORMATION: U.S. regulations may require reporting of spills of this material that reach surface waters if a sheen is formed. If necessary, the toll-free phone number for the US Coast Guard National Response Center is 1-800-424-8802.

REFERENCE TO OTHER SECTIONS: See information in Section 8 (Exposure Controls – Personal Protection) and Section 13 (Disposal Considerations) for additional information.

7. HANDLING and STORAGE

PRECAUTIONS FOR SAFE HANDLING: As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash thoroughly after handling this product. Do not eat or drink while handling this material. Avoid contact with eyes, skin, and clothing. Avoid breathing fumes, dusts, vapors or mist. Do not taste or swallow. Use only with adequate ventilation. Keep away from heat and flame. In the event of a spill, follow practices indicated in Section 6: ACCIDENTAL RELEASE MEASURES.

CONDITIONS FOR SAFE STORAGE: This product is stable under ordinary conditions of handling, use and storage. 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). Keep container tightly closed when not in use. Inspect all incoming containers before storage, to ensure containers are properly labeled and not damaged. To prolong shelf life, store at temperatures below 26°C (80°F).

PRODUCT END USE: This product is used as a sealant. Follow all industry standards for use of this product.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

EXPOSURE LIMITS/CONTROL PARAMETERS:

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation to ensure exposure levels are maintained below the limits provided below.

OCCUPATIONAL/WORKPLACE EXPOSURE LIMITS/GUIDELINES:

| Chemical Name | CAS # | Guideline | Value |
|---------------------------------------------------------------------------------------------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Manganese Oxide Exposure limits given are for Manganese and inorganic compounds, and Manganese fume, as Mn | 1313-13-9 | ACGIH TLV TWA OSHA PEL STEL/CEIL(C) NIOSH REL TWA NIOSH REL STEL NIOSH IDLH DFG MAK TWA DFG MAK PEAK | 0.2 mg/m ³ NIC: 0.02 mg/m ³ respirable fraction; 0.2 mg/m ³ inhalable fraction Fume: 0.2 mg/m ³ 5 mg/m ³ ceiling 1 mg/m ³ 3 mg/m ³ Fume: 750 mg/m ³ 0.2 inhalable fraction, 0.02 respirable fraction 8•MAK 15 minute average value, 1-hr interval, 4 per shift |
| Tetramethylthiuram Disulfide | 137-26-8 | ACGIH TLV TWA OSHA PEL TWA NIOSH REL TWA NIOSH IDLH DFG MAK TWA DFG PEAK DFG OTHER DFG PREGNANCY RISK CAT. | 0.05 mg/m ³ measured as the inhalable fraction and vapor (sensitizer) 5 mg/m ³ 5 mg/m ³ 100 mg/m ³ 1 mg/m ³ 2•MAK 15 minute average value, 1-hr interval, 4 per shift Danger of sensitization of the skin C |

NE = Not Established. NIC = Notice of Intended Change See Section 16 for Definitions of Terms Used.

PERSONAL PROTECTIVE EQUIPMENT (PPE): 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, including the Respiratory Protection Standard (29 CFR 1910.134), Eye Protection Standard 29 CFR 1910.13, the Hand Protection Standard 29 CFR 1910.138, and the Foot Protection Standard 29 CFR 1910.136), equivalent standards of Canada (including the Canadian CSA Respiratory Standard Z94.4-93-02, the CSA Eye Protection Standard Z94.3-M1982, Industrial Eye and Face Protectors and the Canadian CSA Foot Protection Standard Z195-M1984, Protective Footwear). Please reference applicable regulations and standards for relevant details.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

PERSONAL PROTECTIVE EQUIPMENT (PPE) [continued]:

EYE/FACE PROTECTION: Use approved safety goggles or safety glasses. If necessary, refer to appropriate regulations and standards.

SKIN PROTECTION: Wear chemical impervious gloves (e.g., Nitrile or Neoprene). Use triple gloves for spill response. If necessary, refer to appropriate regulations and standards.

BODY PROTECTION: Use body protection appropriate for task (e.g., lab coat, coveralls, Tyvek suit). If necessary, refer to the OSHA Technical Manual (Section VII: Personal Protective Equipment) or appropriate Standards of Canada. 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 appropriate regulations and standards.

RESPIRATORY PROTECTION: If mists or sprays from this product are created during use, use appropriate respiratory protection. If necessary, use only respiratory protection authorized in appropriate regulations. 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 appropriate regulations and standards.

9. PHYSICAL and CHEMICAL PROPERTIES

FORM: Thin paste.

MOLECULAR WEIGHT: Mixture.

ODOR THRESHOLD: For Tetramethylthiuram Disulfide: 0.5 ppm

SPECIFIC GRAVITY: 1.76

RELATIVE VAPOR DENSITY (air = 1): Heavier than air.

SOLUBILITY IN WATER: Insoluble.

MELTING/FREEZING POINT: Not available.

VOC (less water and exempt): 0 g/L

FLASH POINT: > 60°C (> 140°F)

pH: Not available.

FLAMMABLE LIMITS (in air by volume, %): Lower: Not established; Upper: Not established.

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

HOW TO DETECT THIS SUBSTANCE (IDENTIFYING PROPERTIES): The appearance of this product may act as an identifying property in the event of an accidental release.

COLOR: Black.

MOLECULAR FORMULA: Mixture.

ODOR: Slightly sweet.

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

EVAPORATION RATE (BuAc = 1): < 1

OTHER SOLUBILITIES: Not available.

BOILING POINT: Not established.

WEIGHT % VOC: Not available.

AUTOIGNITION TEMPERATURE: Not established.

10. STABILITY and REACTIVITY

CHEMICAL STABILITY: Stable under normal circumstances of use and handling.

CONDITIONS TO AVOID: Avoid contact with incompatible chemicals and exposure to extreme temperatures.

INCOMPATIBLE MATERIALS: This product is not compatible with strong acids and oxidizers. Due to high concentration of Manganese Oxide, this product may also be incompatible with interhalogens (e.g. chlorine trifluoride), reducers (e.g. metals such as aluminum, lithium; metal hydrides such as lithium hydride); ammonia, ammonium salts, metal halide salts (e.g. sodium chloride, sodium bromide), Lewis acids (e.g. diboron tetrafluoride), potassium azide, hydroxylaminiumchloride, organic matter (e.g. oil, waxes, cotton, carbon), organic compounds (e.g. secondary and primary alcohols, alkenes, aldehydes, amines, saturated hydrocarbons), hydrogen sulfide, sulfur dioxide, and inorganic acids (e.g. hydrochloric acid, sulfuric acid, nitric acid).

HAZARDOUS DECOMPOSITION PRODUCTS: Combustion: Thermal decomposition of this product can generate dusts, irritating fumes, and toxic gases (e.g., manganese and sulfur oxides, carbon disulfide). Hydrolysis: None known.

POSSIBILITY OF HAZARDOUS REACTIONS/POLYMERIZATION: This product is not expected to undergo hazardous polymerization, decomposition, condensation, or self-reactivity. Due to the high concentration of Manganese Oxide, this product may react violently or in other hazardous manner with interhalogens, reducers, ammonium salts, metal halides and Lewis acids. If allowed to dry, the product may also react with organic matter to cause fire.

11. TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS: The most significant routes of occupational overexposure are inhalation and contact with skin and eyes. The symptoms of overexposure to this product are as follows:

CONTACT WITH SKIN or EYES: Contact may mildly irritate the skin and cause redness and discomfort. Prolonged or repeated skin contact may cause dermatitis (dry, red skin). May cause sensitization and allergic reaction by skin contact. Symptoms may include rash, swelling, itching and contact dermatitis. Eye contact may cause redness, pain, and tearing.

SKIN ABSORPTION: No information is available on possible hazards by skin absorption.

INGESTION: If the product is swallowed, it may mildly irritate the mouth, throat, and other tissues of the gastro-intestinal system and may cause nausea, vomiting, and diarrhea.

INHALATION: Overexposure to vapors of this product generated during curing, or dusts of this product generated during use after curing may mildly irritate the respiratory tract and cause coughing and sneezing. Vapors or fumes when used in an enclosed space, if heated or during curing may cause irritation of the respiratory system. Symptoms include nose irritation, dry or sore or burning throat, runny nose, shortness of breath. Chronic inhalation of dusts from dried product may result in lung injury or damage. Due to the presence of Manganese Disulfide, inhalation exposure may cause adverse effects described under 'Other Health Effects'.

INJECTION: Accidental injection of this product (e.g. puncture with a contaminated object) may cause irritation and redness, in addition to the wound.

OTHER POTENTIAL HEALTH EFFECTS: Due to the high level of Manganese Oxide, exposure to this product may cause symptoms of manganese toxicity. Effects may include adverse effects on the lungs and central nervous system, resulting in increased susceptibility to bronchitis, pneumonitis and neurologic, neuropsychiatric disorders (manganism). Animal tests show that Manganese Oxide possibly causes toxicity to human reproduction or development.

11. TOXICOLOGICAL INFORMATION

TARGET ORGANS: Acute: Skin, eyes, central nervous system. Chronic: Skin, respiratory system, central nervous system, neurological system, reproductive system.

CHRONIC EFFECTS: Prolonged or repeated skin contact may cause dermatitis (dry, red skin). May cause skin sensitization and allergic reaction in susceptible individuals. Chronic exposure may cause adverse effects on central nervous and neurological system, as described under 'Other Potential Health Effects'.

TOXICITY DATA: There are currently no toxicity data available for this product; the following toxicology information is available for components greater than 1% in concentration.

MANGANESE OXIDE:

TCLo (Inhalation-Man) 0.66 mg/m³/14 year-intermittent: Brain and Coverings: recordings from specific areas of CNS
TDLo (Intramuscular-Human) 21 µg/m³/5.3 years-intermittent: Behavioral: changes in psychophysiological tests; Nutritional and Gross Metabolic: changes in iron
LD₅₀ (Oral-Rat) 3478 mg/kg
LD₅₀ (Subcutaneous-Mouse) 422 mg/kg
LDLo (Intratracheal-Rat) 50 mg/kg: Lungs, Thorax, or Respiration: emphysema, acute pulmonary edema
LDLo (Intravenous-Rabbit) 45 mg/kg
TCLo (Inhalation-Rat) 1800 µg/m³/24 hours/35 days-continuous: Brain and Coverings: recordings from specific areas of CNS; Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol); Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: true cholinesterase
TCLo (Inhalation-Rat) 7 mg/m³/24 hours/34 weeks-continuous: Behavioral: alteration of classical conditioning
TCLo (Inhalation-Mouse) 49 mg/m³/7 hours: female 75 day(s) pre-mating 1-18 day(s) after conception: Reproductive: Effects on Newborn: growth statistics (e.g., reduced weight gain), behavioral
TCLo (Inhalation-Monkey) 0.6 mg/m³/1 hour/17 weeks-intermittent: Behavioral: tremor, excitement, changes in motor activity (specific assay)
TDLo (Subcutaneous-Mouse) 6000 mg/kg/12 days-intermittent: Related to Chronic Data: death
TDLo (Subcutaneous-Monkey) 150 mg/kg/3 weeks-intermittent: Behavioral: changes in motor activity (specific assay)

TETRAMETHYLTHIURAM DISULFIDE:

TCLo (Inhalation-Human) 30 µg/m³/5 years-intermittent: Sense Organs and Special Senses (Eye): conjunctive irritation; Cardiac: other changes; Lungs, Thorax, or Respiration: structural or functional change in trachea or bronchi
Standard Draize Test (Eye-Rabbit) 100 mg/24 hours: Moderate
Standard Draize Test (Eye-Rabbit) 100%
Standard Draize Test (Eye-Rabbit) 100 mg: Mild
Standard Draize Test (Eye-Skin) 100%: Mid
LD₅₀ (Oral-Rat) 560 mg/kg: Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: true cholinesterase
LD₅₀ (Oral-Rat) 1800 mg/kg: Behavioral: somnolence (general depressed activity), tremor; Lungs, Thorax, or Respiration: respiratory depression
LD₅₀ (Oral-Rat) 560 mg/kg
LD₅₀ (Oral-Mouse) 1250 mg/kg: Behavioral: somnolence (general depressed activity); Skin and Appendages: hair
LD₅₀ (Oral-Mouse) 1350 mg/kg
LD₅₀ (Oral-Rabbit) 210 mg/kg
LD₅₀ (Oral-Wild Bird Species) 300 mg/kg
LD₅₀ (Skin-Rat) > 5000 mg/kg
LD₅₀ (Intraperitoneal-Rat) 138 mg/kg: Behavioral: changes in motor activity (specific assay); Nutritional and Gross Metabolic: body temperature decrease
LD₅₀ (Intraperitoneal-Rat) 138 mg/kg
LD₅₀ (Subcutaneous-Rat) 646 mg/kg
LD₅₀ (Subcutaneous-Mouse) 1109 mg/kg
LD₅₀ (Subcutaneous-Mouse) 70 mg/kg
LD₅₀ (Unreported-Rat) 740 mg/kg
LD₅₀ (Unreported-Mouse) 1150 mg/kg
LD₅₀ (Unreported-Rabbit) 210 mg/kg
LD₅₀ (Unreported-Chicken) 840 mg/kg
LD₅₀ (Unreported-Mammal-Domestic) 225 mg/kg
LD₅₀ (Unreported-Mammal-Species Unspecified) 400 mg/kg
LD₅₀ (Inhalation-Rat) 4420 mg/m³/4 hours: Sense Organs and Special Senses (Eye): lachrymation; Behavioral: somnolence (general depressed activity); Kidney/Ureter/Bladder: urine volume increased
LD₅₀ (Inhalation-Rat) 500 mg/m³/4 hours
LDLo (Oral-Cat) 230 mg/kg: Behavioral: convulsions or effect on seizure threshold, ataxia, analgesia
LDLo (Skin-Rat) 5 gm/kg: Behavioral: somnolence (general depressed activity)
LDLo (Skin-Rabbit) 1000 mg/kg
TDLo (Oral-Rat) 450 mg/kg/90 days-intermittent: Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol); Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: multiple enzyme effects; Related to Chronic Data: death
TDLo (Oral-Rat) 406 mg/kg/14 days-intermittent: Liver: other changes; Blood: other changes; Biochemical: Metabolism (Intermediary): lipids including transport
TDLo (Oral-Rat) 350 mg/kg/7 days-continuous: Brain and Coverings: other degenerative changes; Kidney/Ureter/Bladder: other changes, changes in metals, not otherwise specified
TDLo (Oral-Rat) 10,920 mg/kg/2 years-continuous: Behavioral: food intake (animal); Musculoskeletal: other changes; Nutritional and Gross Metabolic: weight loss or decreased weight gain
TDLo (Oral-Rat) 1680 mg/kg/4 weeks-continuous: Blood: changes in erythrocyte (RBC) count; Skin and Appendages: hair; Nutritional and Gross Metabolic: weight loss or decreased weight gain
TDLo (Oral-Rat) 125 mg/kg/5 days-intermittent: Endocrine: changes in luteinizing hormone
TDLo (Oral-Rat) 387.5 mg/kg/31 days-intermittent: Endocrine: other changes
TDLo (Oral-Rat) 1550 mg/kg/31 days-intermittent: Endocrine: changes in luteinizing hormone

TETRAMETHYLTHIURAM DISULFIDE (continued):

TDLo (Oral-Rat) 3200 mg/kg/4 days-intermittent: Liver: changes in liver weight
TDLo (Oral-Rat) 1000 mg/kg/4 days-intermittent: Endocrine: evidence of thyroid hypofunction
TDLo (Oral-Rat) 2250 mg/kg/90 days-intermittent: Gastrointestinal: gastritis; Blood: changes in erythrocyte (RBC) count; Nutritional and Gross Metabolic: weight loss or decreased weight gain
TDLo (Oral-Rat) 5.46 gm/kg/13 weeks-intermittent: Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol); Nutritional and Gross Metabolic: weight loss or decreased weight gain
TDLo (Oral-Rat) 13.65 gm/kg/13 weeks-intermittent: Reproductive: Paternal Effects: testes, epididymis, sperm duct; Nutritional and Gross Metabolic: weight loss or decreased weight gain; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: transaminases
TDLo (Oral-Mouse) 12,222 mg/kg/97 weeks-intermittent: Behavioral: food intake (animal) Nutritional and Gross Metabolic: weight loss or decreased weight gain
TDLo (Oral-Mouse) 24,444 mg/kg/97 weeks-intermittent: Behavioral: food intake (animal); Blood: changes in spleen; Nutritional and Gross Metabolic: weight loss or decreased weight gain
TDLo (Oral-Mouse) 48,888 mg/kg/97 weeks-intermittent: Blood: normocytic anemia, changes in spleen; Nutritional and Gross Metabolic: weight loss or decreased weight gain
TDLo (Oral-Mouse) 100 mg/kg: female 6-15 day(s) after conception: Reproductive: Specific Developmental Abnormalities: craniofacial (including nose and tongue), musculoskeletal system
TDLo (Oral-Mouse) 300 mg/kg: female 6-15 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants)
TDLo (Oral-Mouse) 80 mg/kg: male 3 day(s) pre-mating: Reproductive: Paternal Effects: spermatogenesis (incl. genetic material, sperm morphology, motility, and count)
TDLo (Oral-Rabbit) 1520 mg/kg/15 weeks-intermittent: Vascular: BP lowering not characterized in autonomic section; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: other Enzymes; Related to Chronic Data: death
TDLo (Oral-Hamster) 125 mg/kg: female 7 day(s) after conception: Reproductive: Specific Developmental Abnormalities: musculoskeletal system
TDLo (Oral-Hamster) 250 mg/kg: female 8 day(s) after conception: Reproductive: Specific Developmental Abnormalities: craniofacial (including nose and tongue)
TDLo (Oral-Hamster) 250 mg/kg: female 7 day(s) after conception: Reproductive: Specific Developmental Abnormalities: body wall
TDLo (Oral-Hamster) 300 mg/kg: female 7 day(s) after conception: Reproductive: Specific Developmental Abnormalities: Central Nervous System
TDLo (Oral-Hamster) 250 mg/kg: female 7-8 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus); Specific Developmental Abnormalities: other developmental abnormalities
TDLo (Oral-Hamster) 500 mg/kg: female 7-8 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus), fetal death; Specific Developmental Abnormalities: other developmental abnormalities
TDLo (Oral-Dog) 29,120 mg/kg/2 years-intermittent: Sense Organs and Special Senses (Eye): retinal changes (pigmentary depositions, retinitis, other); Blood: changes in erythrocyte (RBC) count; Related to Chronic Data: death
TDLo (Oral-Dog) 1120 mg/kg/4 weeks-intermittent: Sense Organs and Special Senses (Eye): retinal changes (pigmentary depositions, retinitis, other); Gastrointestinal: nausea or vomiting; Nutritional and Gross Metabolic: weight loss or decreased weight gain
TDLo (Oral-Pig) 1820 µg/kg/1 year-continuous: Cardiac: arrhythmias (including changes in conduction), other changes
TDLo (Oral-Mammal-Species Unspecified) 848 mg/kg: female 60 day(s) pre-mating 1-53 day(s) after conception: Reproductive: Effects on Newborn: growth statistics (e.g., reduced weight gain)
TDLo (Skin-Mouse) 100 mg/kg: Nutritional and Gross Metabolic: conditioned vitamin deficiency; Skin and Appendages: tumors
TDLo (Intraperitoneal-Rat) 24 mg/kg: Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: hepatic microsomal mixed oxidase (dealkylation, hydroxylation, etc.)
TDLo (Intraperitoneal-Rat) 120 mg/kg: Liver: hepatitis (hepatocellular necrosis), zonal, liver function tests impaired
TDLo (Subcutaneous-Mouse) 46 mg/kg: Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Lungs, Thorax, or Respiration: tumors; Blood: tumors
TDLo (Subcutaneous-Mouse) 90 mg/kg: female 6-14 day(s) after conception: Reproductive: Fertility: pre-implantation mortality (e.g. reduction in number of implants per female; total number of implants per corpora lutea), litter size (e.g. # fetuses per litter; measured before birth); Effects on Embryo or Fetus: extra-embryonic structures (e.g., placenta, umbilical cord)
TDLo (Subcutaneous-Mouse) 1035 mg/kg: female 6-14 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)
TDLo (Parenteral-Rat) 400 mg/kg: female 4-11 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus), fetal death
TDLo (Parenteral-Rat) 800 mg/kg: male 2 day(s) pre-mating female 2 day(s) pre-mating: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus), fetal death
TDLo (Unreported-Rat) 50 mg/kg: female 1 day(s) pre-mating: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants); Effects on Embryo or Fetus: fetal death
TDLo (Unreported-Rat) 50 mg/kg: Endocrine: evidence of thyroid hypofunction
TD (Skin-Mouse) 1500 mg/kg/51 weeks-intermittent: Tumorigenic: neoplastic by RTECS criteria; Skin and Appendages: tumors
TCLo (Inhalation-Rat) 91 mg/m³/26 weeks-intermittent: Cardiac: other changes
Micronucleus Test (Human Lymphocyte) 5 mg/L
DNA Damage (Human Lymphocyte) 100 µg/L

11. TOXICOLOGICAL INFORMATION (Continued)

TOXICITY DATA (continued):

TETRAMETHYLTHIURAM DISULFIDE (continued):

DNA Inhibition (Human Lymphocyte) 1 mg/L
Mutation in Microorganisms (Bacteria-*Salmonella typhimurium*) 50 µg/plate
Mutation in Microorganisms (Bacteria-*Salmonella typhimurium*) 5 µg/plate
Mutation in Microorganisms (Microorganism-Not Otherwise Specified) 1000 ppm
Mutation in Microorganisms (Mold-*Aspergillus nidulans*) 500 ng/plate
Mutation in Microorganisms (Bacteria-*Salmonella typhimurium*) 50 µg/plate
DNA Repair (Bacteria-*Escherichia coli*) 2 µg/disc
DNA Repair (Bacteria-*Salmonella typhimurium*) 50 µg/plate
DNA Repair Phage Inhibition Capacity (Bacteria-*Escherichia coli*) 1 µg/tube
Sex Chromosome Loss and Non-Disjunction (Oral-*Drosophila melanogaster*) 4 gm/L

TETRAMETHYLTHIURAM DISULFIDE (continued):

Sex Chromosome Loss and Non-Disjunction (Mold-*Aspergillus nidulans*) 20 ppm
Morphological Transformation (Oral-Rat) 2520 mg/kg/6 weeks
DNA Inhibition (Rat Cells-Not Otherwise Specified) 100 µg/L
Micronucleus Test (Intraperitoneal-Mouse) 100 mg/kg
DNA Damage (Oral-Mouse) 2400 mg/kg/8 days-continuous
Cytogenetic Analysis (Oral-Mouse) 80 mg/kg/3 days-continuous
Cytogenetic Analysis (Hamster Ovary) 5600 µg/L
Dominant Lethal Test (Oral-Mouse) 150 mg/kg/8 weeks-continuous
Sperm Morphology (Oral-Mouse) 80 mg/kg/3 days-continuous
Sperm Morphology (Intraperitoneal-Mouse) 100 mg/kg
Mutation in Mammalian Somatic Cells (Hamster Lung) 5 mg/L

CARCINOGENIC POTENTIAL: The following table summarizes the carcinogenicity listing for the components of this product. "NO" indicates that the substance is not considered to be or suspected to be a carcinogen by the listed agency, see section 16 for definitions of other ratings.

| CHEMICAL | EPA | IARC | NTP | NIOSH | ACGIH | OSHA | PROP 65 |
|------------------------------|-----|------|-----|-------|---------|------|---------|
| Manganese Oxide | D | No | No | No | NIC: A4 | No | No |
| Tetramethylthiuram Disulfide | No | 3 | No | No | A4 | No | No |

IARC 3: Unclassifiable as to Carcinogenicity in Humans. EPA-D: Not Classifiable as to Human Carcinogenicity. ACGIH TLV-A4: Not Classifiable as a Human Carcinogen.

IRRITANCY OF PRODUCT: This product may mildly irritate contaminated tissue, especially if contact is prolonged. Eye irritation may be more pronounced.

SENSITIZATION TO THE PRODUCT: This product may cause skin sensitization. The Tetramethylthiuram Disulfide component may be a skin sensitizer based on human and animal information. A positive result was obtained for Tetramethylthiuram Disulfide in the human maximization test in which 4/25 subjects showed a positive response. There are several reports of contact dermatitis in people exposed to products containing Tetramethylthiuram Disulfide. Positive results have been reported in a number of animal studies.

TOXICOLOGICAL SYNERGISTIC PRODUCTS: None known.

REPRODUCTIVE TOXICITY INFORMATION: This product has not been tested for reproductive toxicity. The following information is available for components.

Mutagenicity: The Tetramethylthiuram Disulfide component induced micronucleus formation in mouse bone marrow, chromosomal aberrations in mouse spermatocytes and morphologically abnormal sperm in mice in vivo. A negative response was obtained in one of three studies of micronucleus formation. Tetramethylthiuram Disulfide induced marked dose related increases in aberrations (mainly chromatid exchanges and breaks) in Chinese Hamster epithelial- liver (CHEL) cells. In CHO cells, significant increases in aberration frequencies were produced only in the presence of rat S9.

Teratogenicity: The Tetramethylthiuram Disulfide component was teratogenic, causing cleft palate, skeletal malformations including micrognathia, wavy ribs, and distorted bones during the period of organogenesis in tests with rats and mice. In tests with chickens, eye defects and open coeloms have occurred.

Reproductive Toxicity: In animal tests involving the Tetramethylthiuram Disulfide component, marginal increase in the relative weight of testes and epididymis and decrease in the weight of seminal vesicle and prostate. Marked degenerative changes were observed in seminiferous tubules together with alterations in testicular enzyme profile. The activity of testicular enzymes such as ACP, SDH and ATPase (Na+K+ dependent) was decreased whereas activity of LDH, G-6-PDH and ALP increased. Other adverse effects have included abnormal sperm heads, alteration (prolongation) of the estrous cycle in association with a reduction in ovarian and uterine weights in female rats and decreased fertility in male rats. Animal tests involving the Manganese Disulfide component indicate this substance possibly causes toxicity to human reproduction or development.

BIOLOGICAL EXPOSURES INDICES (BEIs): There are no BEI's established for any component of this product at this time.

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 the Tetramethylthiuram Disulfide component.

TETRAMETHYLTHIURAM DISULFIDE: A Koc value of 676 has been measured for this compound. According to a classification scheme, this Koc value suggests that this material is expected to have low mobility in soil. This compound has been reported to be relatively immobile in loamy sand, peat moss, and black clay.

PERSISTENCE AND BIODEGRADABILITY: This product has not been tested for persistence or biodegradability. The following information is available for the Tetramethylthiuram Disulfide component.

TETRAMETHYLTHIURAM DISULFIDE: If released to air, a vapor pressure of 1.72X10⁻⁵ 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 1 hour. Particulate-phase material will be removed from the atmosphere by wet and dry deposition. Photolysis half lives of 20 days and 4.3 hours have been calculated from measured rate constants in soil and water, respectively. If released to soil, this compound is expected to have low mobility based upon a Koc of 676. Volatilization from moist soil surfaces is not expected to be an important fate process based upon a Henry's Law constant of 3.26X10⁻⁷ atm-cu m/mole. This compound is not expected to volatilize from dry soil surfaces based upon its vapor pressure. Half-lives for this material measured during soil field studies range from 1 day to 15 weeks. This material is expected to undergo biodegradation in soil since this substance has been reported to degrade more rapidly in unsterilized soil than in sterilized soil. If released into water, this compound is expected to adsorb to suspended solids and sediment based upon the measured Koc. Biodegradation is expected to be slow in water based on only 2.8% and 30% degradation after 20 days during screening tests that used sewage sludge inocula. Volatilization from water surfaces is not expected to be an important fate process based upon this compound's Henry's Law constant. The hydrolysis half-lives measured for this material at pH 5, pH 7 and pH 9 were 68.5 days, 3.5 days, and 6.9 hours, respectively.

BIO-ACCUMULATION POTENTIAL: This product has not been tested for bio-accumulation potential. The following information is available for the Tetramethylthiuram Disulfide component.

TETRAMETHYLTHIURAM DISULFIDE: During a 6-week bioconcentration study using carp, BCF values of 1.1-4.4 and < 3.4 were experimentally determined at concentrations of 25 and 2.5 µg/L, respectively. According to a classification scheme, these BCF values suggest the potential for bioconcentration in aquatic organisms is low.

12. ECOLOGICAL INFORMATION (Continued)

ECOTOXICITY: This product has not been tested for aquatic or animal toxicity. The following data are available for the Tetramethylthiuram Disulfide component.

TETRAMETHYLTHIURAM DISULFIDE:

LD₅₀ (*Anas Platyrhynchos* Mallard duck, female 3 month old) oral, > 2800 mg/kg /sample purity >=99%
LD₅₀ (*Phasianus colchicus* Ring-necked pheasant, male 3-4 months old) oral, 673 mg/kg (95% confidence limit: 485-932 mg/kg) sample purity >= 99%
LD₅₀ (*Agelaius phoeniceus* Redwing blackbird) oral, > 100 mg/kg
LD₅₀ (*Apis mellifera* Honey bee) topical 48 hours = 74 µg/bee
LD₅₀ (*Sturnus vulgaris* European starling) oral 14 days =>100 mg/kg
LD₅₀ (*Peromyscus maniculatus* Deer mouse) oral >750 mg/kg bw
LC₅₀ (*Phasianus colchicus* Ring-necked pheasant, 10 day old) oral, 8 days => 5000 ppm
LC₅₀ (*Coturnix japonica* Japanese quail, 14 day old) oral, 8 days => 5000 ppm
LC₅₀ (*Colinus virginianus* Northern bobwhite quail, 14 day old) oral, 8 days = 3950 ppm
LC₅₀ (*Anas Platyrhynchos* Mallard duck; reduced numbers of eggs hatched, reduced survival) 5 days = 5,000 ppm
LC₅₀ (*Cyprinus carpio* carp) 4 mg/L/Conditions of bioassay not specified
LC₅₀ (*Dugesia gonocephala* platyhelminth) 24 hours = 0.53 ppm/Conditions of bioassay not specified in source examined
LC₅₀ (*Dugesia gonocephala* platyhelminth) 96 hours = 0.48 ppm/Conditions of bioassay not specified in source examined
LC₅₀ (*Asellus aquaticus* crustacean) 24 hours = 1882 ppm/Conditions of bioassay not specified in source examined
LC₅₀ (*Asellus aquaticus* crustacean) 96 hours = 61 ppm/Conditions of bioassay not specified in source examined
LC₅₀ (*Xenopus laevis* amphibian stage 47) 24 hours = 0.017 ppm/Conditions of bioassay not specified in source examined
LC₅₀ (*Xenopus laevis* amphibian stage 47) 96 hours = 0.013 ppm/Conditions of bioassay not specified in source examined
LC₅₀ (*Xenopus* stage 53) 24 hours = 0.025 ppm/Conditions of bioassay not specified in source examined

TETRAMETHYLTHIURAM DISULFIDE (continued):

LC₅₀ (*Xenopus* stage 53) 96 hours = 0.021 ppm/Conditions of bioassay not specified in source examined
LC₅₀ (*Gammarus pulex* scud) 24 hours = 14 ppm/Calculated, Pomarsol, Thiram 80%, Conditions of bioassay not specified in source examined
LC₅₀ (*Gammarus pulex* scud) 96 hours = 0.195 ppm/Calculated, Pomarsol, Thiram 80%, Conditions of bioassay not specified in source examined
LC₅₀ (*Gammarus pulex* scud) 24 hours = 4.77 ppm/Calculated, KB Peach-leaf curl, Thiram 80%, Conditions of bioassay not specified in source examined
LC₅₀ (*Gammarus pulex* scud) 96 hours = 0.13 ppm/Calculated, KB Peach-leaf curl, Thiram 80%, Conditions of bioassay not specified in source examined
LC₅₀ (*Daphnia magna* giant water flea) 48 hours = 0.21 mg/L/Conditions of bioassay not specified in source examined
LC₅₀ (*Lymnea stagnalis*) 96 hours = 3-35 mg/L/Conditions of bioassay not specified in source examined
LC₅₀ (*Poecilia reticulata*) 96 hours = 0.27 mg/L/Conditions of bioassay not specified in source examined
LC₅₀ (*Rasbora heteromorpha* Harlequin fish) 96 hours = 0.007 mg/L/Conditions of bioassay not specified in source examined
LC₅₀ (*Rasbora heteromorpha* Harlequin fish) 24 hours = 0.02 mg/L/Conditions of bioassay not specified in source examined
LC₅₀ (*Oncorhynchus mykiss* Rainbow trout) 48 hours = 0.13-0.23 mg/L/Conditions of bioassay not specified in source examined
LC₅₀ (*Lepomis macrochirus* Bluegill sunfish) 48 hours = 0.13-0.23 mg/L/Conditions of bioassay not specified in source examined
LC₅₀ (*Lepomis macrochirus* Bluegill sunfish) 96 hours = 42 ppb/Conditions of bioassay not specified in source examined
LC₅₀ (*Crassostrea gigas* Eastern oyster) 96 hours = 4.7 ppb /Conditions of bioassay not specified in source examined

OTHER ADVERSE EFFECTS: This material is not expected to have any 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: As supplied, this product would not be a hazardous waste as defined by U.S. federal regulation (40 CFR 261) if discarded or disposed. State and local regulations may differ from federal regulations. The generator of the waste is responsible for proper waste determination and management.

U.S. EPA WASTE NUMBER: May be subject to RCRA code U244 (Tetramethylthiuram Disulfide)

14. TRANSPORTATION INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION: 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 SHIPPING INFORMATION (IATA): This product is NOT classified as dangerous goods, per the International Air Transport Association.

INTERNATIONAL MARITIME ORGANIZATION SHIPPING INFORMATION (IMO): This product is not classified as dangerous goods, per the International Maritime Organization.

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The following 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.

| CHEMICAL | SECTION 302 EHS (TPQ) (40 CFR 355, Appendix A) | SECTION 304 RQ (40 CFR Table 302.4) | SECTION 313 TRI (threshold) (40 CFR 372.65) |
|-------------------------------------------|---------------------------------------------------|----------------------------------------|------------------------------------------------|
| Manganese Oxide (as a manganese compound) | No | No | Yes (Code N450) |
| Tetramethylthiuram Disulfide | No | No | Yes |

U.S. SARA HAZARD CATEGORIES (SECTION 311/312, 40 CFR 370-21): ACUTE: Yes; CHRONIC: Yes; FIRE: No; REACTIVE: No; SUDDEN RELEASE: No

U.S. TSCA INVENTORY STATUS: All components of this product are in compliance with the inventory listing requirements of the U.S. Toxic Substances Control Act (TSCA) Chemical Substance Inventory.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Tetramethylthiuram Disulfide = 10 lb (0.45 kg). As a manganese compound, Manganese Disulfide has no specific CERCLA RQ, but is a CERCLA Hazardous Substance.

U.S. CLEAN AIR ACT (CA 112r) THRESHOLD QUANTITY (TQ): Not applicable.

OTHER U.S. FEDERAL REGULATIONS: The Manganese Oxide component is listed as a Hazardous Air Pollutant (HAP) generally known or suspected to cause serious health problems. The Clean Air Act, as amended in 1990, directs EPA to set standards requiring major sources to sharply reduce routine emissions of toxic pollutants. EPA is required to establish and phase in specific performance based standards for all air emission sources that emit one or more of the listed pollutants. Manganese Oxide is included on this list.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): No component is found on the Proposition 65 List of chemicals.

ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL/NDL INVENTORY STATUS: The components of this product are listed on the DSL Inventory.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: No component of this product is on the CEPA Priorities Substances Lists.

CANADIAN WHMIS REGULATIONS: This product is classified as a Controlled Product, Hazard Classes B3 (Combustible Liquid) and D2B (Immediate Acute Toxicity/Irritation, Sensitization) as per the Controlled Product Regulations.



ADDITIONAL MEXICAN REGULATIONS:

MEXICAN WORKPLACE REGULATIONS (NOM-018-STPS-2000): This product is not classified as hazardous.

16. OTHER INFORMATION

WARNINGS (per ANSI Z129.1): WARNING! HARMFUL IF INGESTED. MAY BE HARMFUL IF FUMES OR PARTICULATES ARE INHALED. MAY CAUSE EYE, SKIN, AND RESPIRATORY TRACT IRRITATION, ESPECIALLY IF EXPOSURE IS PROLONGED. MAY CAUSE SKIN SENSITIZATION AND ALLERGIC REACTIONS IN SUSCEPTIBLE INDIVIDUALS. CHRONIC EXPOSURE MAY CAUSE ADVERSE EFFECTS TO THE CENTRAL NERVOUS NEUROLOGICAL SYSTEMS. CONTAINS COMPOUNDS WITH LIMITED EVIDENCE OF CARCINOGENIC AND REPRODUCTIVE EFFECTS, BASED ON ANIMAL INFORMATION. COMBUSTIBLE-MAY IGNITE IF HIGHLY HEATED FOR PROLONGED PERIOD OR IF SUBJECTED TO DIRECT FLAME. CONTAINS COMPOUND THAT MAY CAUSE ACUTE AND CHRONIC HARM TO TERRESTRIAL AND AQUATIC ORGANISMS. IF ALLOWED TO DRY, MAY BECOME OXIDIZING MATERIAL.

WARNINGS (per ANSI Z129.1) [continued]: Avoid contact with eyes, skin, and clothing. Avoid breathing fumes, dusts, vapors or mist. Do not taste or swallow. Wash thoroughly after handling. Keep container tightly closed. Use only with adequate ventilation. Keep away from heat and flame. Wear gloves, eye protection, respiratory protection, and appropriate body protection. **FIRST-AID:** In case of contact, immediately flush skin and eyes with plenty of water. Remove contaminated clothing and shoes. Get medical attention if irritation develops or persists. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, do not induce vomiting. Get medical attention. **IN CASE OF FIRE:** Use water fog, foam, dry chemical, or CO₂. **IN CASE OF SPILL:** Absorb spilled product with polypads or other suitable absorbing material. Place all spill residue in an appropriate container and seal. Dispose of in accordance with U.S. Federal, State, and local hazardous waste disposal regulations and those of Canada.

GLOBAL HARMONIZATION LABELING AND CLASSIFICATION: Classified in accordance with the Global Harmonization Standard.

Classification: Combustible Liquid Category 4, Acute Oral Toxicity Category 4, Acute Inhalation Toxicity Category 4, Eye Irritation Category 2A, Skin Irritation Category 2, Specific Target Organ Toxicity (Central Nervous and Neurological Systems) Repeated Exposure Category 2, Skin Sensitization Category 1, Aquatic Acute Toxicity Category 1, Aquatic Chronic Toxicity Category 1

Signal Word: Warning

Hazard Statements: H227: Combustible liquid. H302 + H332: Harmful if swallowed or inhaled. H315: Causes skin irritation. H319: Causes serious eye irritation. H317: May cause an allergic skin reaction. H373: May cause damage to organs (central nervous and neurological systems) through prolonged or repeated exposure. H410: Very toxic to aquatic life with long-lasting effects.

Precautionary Statements:

Prevention: P210: Keep away from heat/sparks/open flames/hot surfaces. — No smoking. P260: Do not breathe vapors/spray. P264: Wash thoroughly after handling. P270: Do not eat, drink or smoke when using this product. P271: Use only outdoors or in a well-ventilated area. P272: Contaminated work clothing should not be allowed out of the workplace. P273: Avoid release to the environment. P280: Wear protective gloves/protective clothing/eye protection/face protection.

Response: P301 + P312: If swallowed, Call a POISON CENTER or doctor if you feel unwell. P330: Rinse mouth. P304 + P340: If inhaled, remove victim to fresh air and keep at rest in a position comfortable for breathing. P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. P337 + P313: If eye irritation persists: Get medical advice/attention. P302 + P352: IF ON SKIN: Wash with plenty of soap and water. P333 + P313: If skin irritation or rash occurs: Get medical advice/attention. P362 + P364: Take off contaminated clothing and wash it before reuse. P314: Get medical advice/attention if you feel unwell. P321: Specific treatment (remove from exposure and treat symptoms). Refer to other portions of precautionary text on this label, SDS or other product information sheets, as appropriate. P391: Collect spillage. P370 + P378: In case of fire: Use materials appropriate for surrounding fire for extinction.

Storage: P403 + P235: Store in a well-ventilated place.

Disposal: P501: Dispose of contents/containers in accordance with all local, regional, national and international regulations.

Hazard Symbols/Pictogram: GHS07, GHS08, GHS09

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

The information presented in this Material Safety Data Sheet is presented in good faith based on data believed to be accurate as of the date this Material Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. In no case shall the descriptions, information, data or designs provided be considered a part of our terms and conditions of sale.

All materials may present hazards and should be used with caution. Because many factors may affect processing or application/use, we recommend that you make tests to determine the suitability of a product for your particular purpose prior to use. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices or applicable federal, state, or local laws or regulations. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

16. OTHER INFORMATION (Continued)

REFERENCES AND DATA SOURCES: Contact the supplier for information.

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

REVISION DETAILS: September 2012: Up-date and revise entire MSDS to include current GHS requirements.

DATE OF PRINTING

April 3, 2017

DEFINITIONS OF TERMS

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

KEY ACRONYMS:

CHEMTREC: Chemical Transportation Emergency Center, a 24-hour emergency information and/or emergency assistance to emergency responders.

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.

KEY ACRONYMS (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)

KEY ACRONYMS (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.

WEEL: Workplace Environmental Exposure Limits from the AIHA.

HAZARD RATINGS:

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

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

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

PHYSICAL HAZARD (continued): 1 (continued): Liquids: any material that exhibits a mean pressure rise time less than or equal to the pressure rise time of a 1:1 nitric acid (65%)/cellulose mixture and the criteria for Packing Group I and II are not met. *Unstable Reactives:* Substances that may decompose, condense, or self-react, but only under conditions of high temperature and/or pressure and have little or no potential to cause significant heat generation or explosion hazard. Substances that readily undergo hazardous polymerization in the absence of inhibitors. **2 Water Reactivity:** Materials that may react violently with water. *Organic Peroxides:* Materials that, in themselves, are normally unstable and will readily undergo violent chemical change, but will not detonate. These materials may also react violently with water. *Explosives:* Division 1.4 explosives. Explosive substances where the explosive effects are largely confined to the package and no projection of fragments of appreciable size or range are expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package. *Compressed Gases:* Pressurized and meet OSHA definition but < 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics:* No Rating. *Oxidizers:* Packing Group II oxidizers. Solids: any material that, either in concentration tested, exhibits a mean burning time of less than or equal to the mean burning time of a 2:3 potassium bromate/cellulose mixture and the criteria for Packing Group I are not met. Liquids: any material that exhibits a mean pressure rise time less than or equal to the pressure rise of a 1:1 aqueous sodium chlorate solution (40%)/cellulose mixture and the criteria for Packing Group I are not met. *Reactives:* Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure, but have a low potential (or low risk) for significant heat generation or explosion. Substances that readily form peroxides upon exposure to air or oxygen at room temperature. **3 Water Reactivity:** Materials that may form explosive reactions with water. *Organic Peroxides:* Materials that are capable of detonation or explosive reaction, but require a strong initiating source or must be heated under confinement before initiation; or materials that react explosively with water. *Explosives:* Division 1.3 explosives. Explosive substances that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but do not have a mass explosion hazard. *Compressed Gases:* Pressure ≥ 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics:* No Rating. *Oxidizers:* Packing Group I oxidizers. Solids: any material that, in either concentration tested, exhibits a mean burning time less than the mean burning time of a 3:2 potassium bromate/cellulose mixture. Liquids: any material that spontaneously ignites when mixed with cellulose in a 1:1 ratio, or which exhibits a mean pressure rise time less than the pressure rise time of a 1:1 perchloric acid (50%)/cellulose mixture. *Unstable Reactives:* Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure and have a moderate potential (or moderate risk) to cause significant heat generation or explosion. **4 Water Reactivity:** Materials that react explosively with water without requiring heat or confinement. *Organic Peroxides:* Materials that are readily capable of detonation or explosive decomposition at normal temperature and pressures. *Explosives:* Division 1.1 & 1.2 explosives. Explosive substances that have a mass explosion hazard or have a projection hazard. A mass explosion is one that affects almost the entire load instantaneously. *Compressed Gases:* No Rating. *Pyrophorics:* Add to the definition of Flammability 4. *Oxidizers:* No 4 rating. *Unstable Reactives:* Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure and have a high potential (or high risk) to cause significant heat generation or explosion. *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. Compressed liquefied gases with boiling points below -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.

DEFINITIONS OF TERMS (Continued)

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM 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 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. 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.

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

INSTABILITY HAZARD (continued): 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 LC₀:** 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.

REPRODUCTIVE TOXICITY INFORMATION: A **mutagen** is a chemical that causes permanent changes to genetic material (DNA) such that the changes will propagate through generational 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.

ECOLOGICAL INFORMATION:

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

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

U.S.:

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

CANADA:

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