

MATERIAL SAFETY DATA SHEET

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

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: NUSORB® KITEG™ (Impregnated coconut carbon for radioiodine removal)**SYNONYMS:** None**CHEMICAL FAMILY NAME:** Carbon (all coconut-based)/Potassium Iodide & Triethylenediamine Mixture**PRODUCT USE:** Adsorbent**SUPPLIER:****NUCON International, Inc.****ADDRESS:**

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NOTE: ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-2004 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR, and EU Directives

2. HAZARD IDENTIFICATION

EU LABELING AND CLASSIFICATION: This product does not meet the definition of any hazardous as defined by the European Economic Community Guidelines.

EU LABELING/CLASSIFICATION: Not Applicable **EU RISK PHRASES:** Not Applicable

EU SAFETY PHRASES: Not Applicable

See Section 16 for full text of Ingredient Risk Phrases

EMERGENCY OVERVIEW: Product Description: This product is a granular solid, with no odor or taste. **Health Hazards:** Dusts from this product may mildly irritate the respiratory system, throat and nose if inhaled. **Flammability Hazards:** This product is not flammable; however, the product can burn if subjected to high temperatures or if involved in a fire. If the product is heated to combustion, carbon oxides, nitrogen oxides, hydrogen iodide and potassium oxides will be generated. Finely-divided dusts generated from this product present a significant hazard of an air/dust explosion. **Reactivity Hazards:** This product is not normally reactive. **Environmental Hazards:** Release of this product to the environment is not expected to cause significant harm to plants and animals. **Emergency Response Procedures:** Emergency responders must wear personal protective equipment suitable for the situation to which they are responding.

3. COMPOSITION and INFORMATION ON INGREDIENTS

| Components | CAS # | EINECS # | WT % | Hazard Classification; Risk Phrases |
|--------------------|-----------|-----------|----------|---|
| Potassium Iodide | 7681-11-0 | 231-659-4 | 1.5-2.5% | HAZARD CLASSIFICATION: Not Applicable RISK PHRASES: Not Applicable |
| Triethylenediamine | 280-57-9 | 205-999-9 | 1.5-2.5% | HAZARD CLASSIFICATION: Not Applicable RISK PHRASES: Not Applicable |
| Activated Carbon | 7440-44-0 | 231-153-3 | 95-97% | HAZARD CLASSIFICATION: Not Applicable RISK PHRASES: Not Applicable |

See Section 16 for full text of Ingredient Risk Phrases

4. FIRST-AID MEASURES

Victims of chemical exposure must be taken for medical attention if adverse effect occurs. Rescuers should be taken for medical attention if necessary. Remove or cover gross contamination to avoid exposure to rescuers. Take a copy of label and MSDS to health professional with victim.

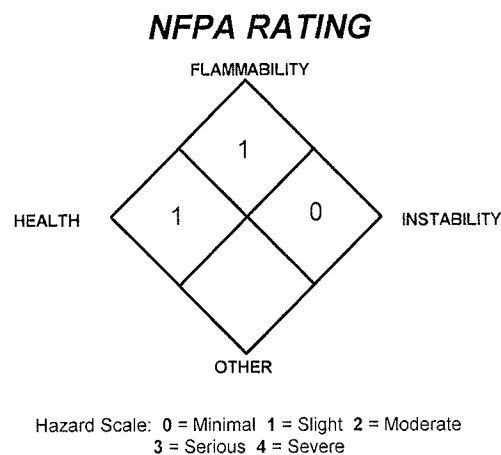
► **INHALATION:** If dusts of this product are inhaled, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Contaminated individual must seek medical attention if adverse effect continues after removal to fresh air.

4. FIRST-AID MEASURES (Continued)

- ▶ **SKIN EXPOSURE:** If the product contaminates the skin and adverse effects occur, begin decontamination with running water. Minimum flushing is for 15 minutes. Do not interrupt flushing. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Contaminated individual must seek medical attention if adverse effect continues.
- ▶ **EYE EXPOSURE:** If contamination occurs, open victim's eyes while under gently running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Do not interrupt flushing. Contaminated individual must seek immediate medical attention if adverse effect continues.
- ▶ **INGESTION EXPOSURE:** If this product is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. DO NOT INDUCE VOMITING. Rinse mouth with water immediately, if victim is 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:** Acute or chronic respiratory conditions may be aggravated by overexposure to this product.
- ▶ **RECOMMENDATIONS TO PHYSICIANS:** Treat symptoms and eliminate exposure.

5. FIRE-FIGHTING MEASURES

- ▶ **FLASH POINT:** Not applicable.
- ▶ **AUTOIGNITION TEMPERATURE:** N
Powdered Product - No generally accepted test method available.
Granular - About 450°C (842°F) by ANSI/ASTM D3466
- ▶ **FLAMMABLE LIMITS (in air by volume, %):** Not applicable.
Lower (LEL): Not applicable. Upper (UEL): Not applicable.
- ▶ **FIRE EXTINGUISHING MATERIALS:**
Water Spray: Yes Carbon Dioxide: YES Halon: No
Foam: Yes Dry Chemical: YES Other: Yes
- ▶ **FIRE EXTINGUISHING MATERIALS NOT TO BE USED:** Halon extinguishers should not be used.
- ▶ **UNUSUAL FIRE AND EXPLOSION HAZARDS:** All carbonaceous materials will burn under certain conditions and activated carbons are not an exception. Activated carbons, however, are not highly flammable and burn slowly without producing smoke or flame. An accumulation of large amounts of dust from this material in air can cause a risk of an air/dust explosion.
Explosion Sensitivity to Mechanical Impact: Not sensitive.
Explosion Sensitivity to Static Discharge: Although this product is not sensitive to static discharge, dusts of this material can be ignited by static discharge, especially if large amounts of dusts are allowed to accumulate. All equipment in used in the handling of this material should be electrically grounded.
- ▶ **SPECIAL FIRE-FIGHTING PROCEDURES:** Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Water spray can be used to cool fire-exposed containers. If necessary, decontaminate fire-response equipment with soap and water solution.



6. ACCIDENTAL RELEASE MEASURES

- ▶ **SPILL AND LEAK RESPONSE:** Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a spill, clear the affected area and protect people. Eliminate all sources of ignition before clean-up begins. Use non-sparking tools. The atmosphere must have levels of the components of this product lower than those listed in Section 8, (Exposure Limits and Personal Protection) and at least 19.5 percent oxygen before personnel can be allowed into the area without Self-Contained Breathing Apparatus (SCBA).
Small Spills: Sweep up spilled material or vacuum with explosion-proof vacuum, avoiding generation of dusts, wearing gloves, goggles and apron. Place spilled material in appropriate container for disposal, sealing tightly. Clean spill area with soap and copious amounts of water.
Spills in Hoods: Decontamination of all interior hood surfaces may be required after the above procedures for small spills have been followed. If the HEPA filter of a hood is contaminated, the unit must be labeled "Do not use-contaminated" and the filter must be changed and disposed of properly as soon as possible by trained personnel wearing protective equipment. Protective goggles should be cleaned with an alcohol wipe after the cleanup.

ACCIDENTAL RELEASE MEASURES (Continued)

► **SPILL AND LEAK RESPONSE (continued):**

Large Spills: 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, protect people, and respond with trained personnel. Minimum Personal Protective Equipment should be the following: **triple-gloves (rubber gloves and nitrile gloves over latex gloves), chemical resistant suit and boots, hard hat, and Self-Contained Breathing Apparatus.** Monitor the surrounding area for oxygen levels. The atmosphere must have at least 19.5 % oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus. Spread should be limited by gently covering the spill with polypads. Sweep up or vacuum spilled solid (an explosion-proof vacuum should be used), avoiding the generation of airborne dusts. The dispersal of particles into surrounding air must be avoided. Decontaminate the area thoroughly. All contaminated absorbents and other materials should be placed in an appropriate container and sealed.

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

7. HANDLING and USE

► **WORK PRACTICES 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 dusts or particulates generated by this product. Use in a well-ventilated location. Launder contaminated clothing before reuse.

► **SPECIFIC USE(S):** This product is for use in radioiodine removal. Follow all industry standards for use.

► **STORAGE AND HANDLING PRACTICES:** All employees who handle this material should be trained to handle it safely. Containers of this product must be properly labeled. Keep container tightly closed when not in use. Store containers in a cool, dry location, away from direct sunlight or sources of intense heat. Store containers away from incompatible chemicals (see Section 10, Stability and Reactivity). Containers should be separated from oxidizing materials. Avoid accumulation of dusts, which can create a hazard of an air/dust explosion. Storage of this material in a confined space, such as in silos, can create an oxygen-deficient atmosphere. Entry into such locations should be with Self-Contained Breathing Apparatus (SCBA) if ventilation is not adequate. **CAUTION:** Wet activated carbon removes oxygen from air causing a severe hazard to workers inside carbon vessels and enclosed or confined spaces. Before entering such an area, sampling and work procedures for low oxygen levels should be taken to ensure ample oxygen availability, observing all local, state, and federal regulations.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

► **VENTILATION AND ENGINEERING CONTROLS:** Use with adequate ventilation to ensure exposure levels are maintained below the limits provided below. Ensure eyewash/safety shower stations are available near areas where this product is used.

► **EXPOSURE LIMITS:**

| CHEMICAL NAME | CAS # | EXPOSURE LIMITS IN AIR | | | | | | | |
|--|-----------|--------------------------|---------------------------|--------------------------|---------------------------|--------------------------|---------------------------|---------------------------|--------------------|
| | | ACGIH-TLVs | | OSHA-PELs | | NIOSH-RELS | | NIOSH | OTHER |
| | | TWA mg/m ³ | STEL mg/m ³ | TWA mg/m ³ | STEL mg/m ³ | TWA mg/m ³ | STEL mg/m ³ | IDLH mg/m ³ | |
| Carbon Currently, there are no exposure limits for this material. It is recommended that the exposure limits for 'Graphite, Synthetic' be used. | 7440-44-0 | 2 (respirable fraction) | NE | 15 mppcf | NE | NE | NE | NE | NE |
| Potassium Iodide Exposure limits are for Iodides | 7681-11-0 | 0.1 (inhalable fraction) | NE | NE | NE | NE | NE | NE | Carcinogen: TLV-A4 |
| Triethylenediamine | 280-57-9 | NE | NE | NE | NE | NE | NE | NE | NE |

NE = Not Established. mppcf = Millions of Particles Per Cubic Foot NIC = Notice of Intended Change Section 16 for Definitions of Terms Used.

► **INTERNATIONAL EXPOSURE LIMITS:** The following international exposure limits are in place for components. Not all individual country exposure limits given may be most currently available. Please check for most currently available individual country guidelines.

CARBON:

Austria: MAK = 6 mg/m³ (resp. dust), JAN 1999
Germany: MAK = 6 mg/m³ (resp. dust), JAN 1999

CARBON (continued):

Sweden: TWA = 3 mg/m³ (dust), JAN 1999
Switzerland: MAK-W = 2.5 mg/m³ (resp. dust), JAN 1999

CARBON (continued):

Switzerland: MAK-W = 5 mg/m³ (inhalable dust), JAN 1999

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

▶ INTERNATIONAL EXPOSURE LIMITS (continued):

CARBON (continued):

United Kingdom: TWA = 10 mg/m³, graphite, total inhalable dust, SEP 2000

United Kingdom: TWA = 4 mg/m³, graphite, respirable dust, SEP 2000

CARBON (continued):

In Argentina, Bulgaria, Colombia, Jordan, Korea, New Zealand, Singapore, Vietnam, New Zealand, Singapore, Vietnam check ACGIH TLV

POTASSIUM IODIDE:

Russia: STEL = 3 mg/m³, JUN 2003

TRIETHYLENEDIAMINE:

Russia: STEL = 1 mg/m³, Skin, JUN 2003

The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132) or equivalent standard of Canada, or standards of EU member states. Please reference applicable regulations and standards for relevant details.

▶ **RESPIRATORY PROTECTION:** Maintain airborne contaminant concentrations below guidelines listed above, if applicable. If necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), equivalent U.S. State standards, Canadian CSA Standard Z94.4-93, the European Standard EN 529:2005, and EU member states. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under U.S. Federal OSHA's Respiratory Protection Standard (1910.134-1998) or the regulations of various U.S. States, Canada, or EU Member States. Air-purifying respirators with dust/mist/fume filters are recommended if operations may involve prolonged exposures to mists. Use supplied air respiration protection during emergency response operations.

▶ **EYE PROTECTION:** Splash goggles or safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133, the European Standard CR 13464:1999 and the Canadian CSA Standard Z94.3-M1982, *Industrial Eye and Face Protectors*.

▶ **HAND PROTECTION:** Wear neoprene or butyl rubber gloves for routine industrial use. Use triple gloves for spill response. Wash hands before putting on gloves and after removing gloves. If necessary, refer to U.S. OSHA 29 CFR 1910.138, the European Standard CEN/TR 15419:2006 and the appropriate Standards of Canada.

▶ **BODY PROTECTION:** Use body protection appropriate for task. An apron or other body protection is suggested. Full-body chemical protective clothing is recommended for emergency response procedures. If necessary, refer to appropriate Standards of Canada or the European Standard CEN/TR 15419:2006 for other requirements. 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-M1984, *Protective Footwear*.

9. PHYSICAL and CHEMICAL PROPERTIES

▶ **VAPOR DENSITY (air = 1):** Not applicable.

▶ **VAPOR PRESSURE @ 20°C:** Zero (mmHg)

▶ **BOILING POINT:** Not applicable.

▶ **FREEZING/MELTING POINT:** Not applicable.

▶ **SPECIFIC GRAVITY (water = 1):** 400-600 g/L

▶ **pH:** Not applicable.

▶ **SOLUBILITY IN WATER:** Insoluble.

▶ **SOLUBILITY IN SOLVENTS:** Insoluble in organic solvents.

▶ **MOLECULAR WEIGHT:** Not applicable for product.

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

▶ **PERCENT VOLATILE BY VOLUME @ 150°C:** Less than 1% (Activated Carbon)

▶ **PERCENT VOLATILE BY WEIGHT:** Less than 25% (Triethylenediamine)

▶ **ODOR THRESHOLD:** Not applicable.

▶ **LOG COEFFICIENT WATER/OIL DISTRIBUTION:** Not determined.

▶ **APPEARANCE, ODOR AND COLOR:** This product is a granular solid, with no odor or taste.

▶ **HOW TO DETECT THIS SUBSTANCE (warning properties):** The appearance may be a warning of a release of this product.

10. STABILITY and REACTIVITY

▶ **STABILITY:** This product is stable under circumstances of normal temperature and pressure.

▶ **DECOMPOSITION PRODUCTS:** Thermal: Products of thermal decomposition include carbon oxides, nitrogen oxides, hydrogen iodide and potassium oxides will be generated. Hydrolysis: None known.

10. STABILITY and REACTIVITY (Continued)

- ▶ **MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE:** Carbon has frequently been involved in hazardous reactions, particularly finely divided or high-porosity forms exhibiting a high ratio of surface area to mass (up to 2000 sq m/g). Less active forms of carbon will ignite or explode on suitable intimate contact with oxygen, oxides, peroxides, oxosalts, halogens, interhalogens and other oxidizing species, such as fluorine, chlorine fluoride and potassium peroxide. This product may also be incompatible with fluorine perchlorate.
- ▶ **HAZARDOUS POLYMERIZATION:** Will not occur.
- ▶ **CONDITIONS TO AVOID:** Contact with incompatible materials and exposure to heat, sparks and other sources of ignition.

11. TOXICOLOGICAL INFORMATION

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: The most significant routes of occupational overexposure are by inhalation, skin and eye contact. The symptoms of overexposure to this product are as follows:

▶ **INHALATION:** Inhalation of dust or particulates from this product can mildly irritate tissues of the nose, mouth, throat, and upper respiratory system. Symptoms of transient exposure may include coughing, sneezing, and difficulty breathing. Symptoms should be alleviated upon exposure to fresh air. Prolonged inhalation exposure to dusts may cause bronchitis and emphysema-like symptoms.

▶ **CONTACT WITH SKIN or EYES:** Transient skin contact with this product is not expected to cause adverse effect. Eye contact may cause irritation via mechanical irritation. Symptoms should be relieved upon cessation of exposure. Due to the presence of Triethylenediamine, if heated, exposure to fumes may cause a corneal disturbance in workers exposed to the vapor. It is reported to have induced fine corneal epithelial edema and to have caused people to see haloes around lights several hours after exposure.

▶ **SKIN ABSORPTION:** This product does not present a hazard of exposure via skin absorption.

▶ **INGESTION:** Ingestion is not anticipated to be a likely route of occupational overexposure for this product. If this product is swallowed, significant adverse effect is not expected to occur. Ingestion of large quantities may cause upset to the gastrointestinal system.

▶ **INJECTION:** Injection is not anticipated to be a significant route of overexposure for this product. If this product is "injected" (as may occur through punctures by contaminated, sharp objects), local swelling and irritation can occur.



▶ **OTHER HEALTH EFFECTS:** Due to the presence of Potassium Iodide, iodism (chronic iodine poisoning) may occur upon prolonged or chronic exposure. Symptoms can include metallic taste, sore mouth, swollen eyelids, sneezing, skin eruptions, nausea, vomiting, epigastric pain, and diarrhea, angioedema, laryngeal edema, and cutaneous hemorrhages. Hypersensitivity reactions to iodides may occur and may be manifested by angioedema, cutaneous and mucosal hemorrhage, and signs and symptoms resembling serum sickness, such as fever, arthralgia, lymph node enlargement, and eosinophilia. Urticaria, thrombotic thrombocytopenic purpura, and fatal periarteritis have also been attributed to iodide hypersensitivity. Hypocomplementemic vasculitis in some patients with chronic urticaria or systemic lupus erythematosus has been associated with iodide sensitivity, and some clinicians caution that Potassium Iodide may precipitate severe systemic illness in such patients.

▶ **HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms.** Over-exposure to this product may cause the following health effects:

ACUTE: Inhalation of dusts or particulates from this product may cause mild, transient irritation the respiratory system. Direct skin or eye contact may cause mechanical irritation.

CHRONIC: Chronic inhalation exposure to dusts may cause bronchitis and emphysema-like symptoms. Chronic exposure to this product may lead to iodism, with symptoms described above.

TARGET ORGANS: Acute: Skin, eyes, respiratory system. **Chronic:** Respiratory system, skin.

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

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

11. TOXICOLOGICAL INFORMATION (Continued)

► **TOXICITY DATA:** Currently, the following toxicological data are available for the components of this product, as follows.

CARBON:

LD₅₀ (Intravenous-Mouse) 440 mg/kg
LD (Oral-Rat) > 5 gm/kg
LD (Oral-Mouse) > 5 gm/kg
LD (Oral-Dog) > 5 gm/kg
LD (Intraperitoneal-Rat) > 5 gm/kg
LD (Subcutaneous-Rat) > 5 gm/kg
LD (Subcutaneous-Mouse) > 5 gm/kg
LD (Subcutaneous-Dog) > 5 gm/kg
LD (Intraperitoneal-Mouse) > 5 gm/kg
LD (Intraperitoneal-Dog) > 5 gm/kg

TDLo (Subcutaneous-Rat) 167 mg/kg; female 8 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants)

POTASSIUM IODIDE:

TDLo (Oral-Woman) 2700 mg/kg; female 1-39 week(s) after conception: Reproductive: Specific Developmental Abnormalities: endocrine system

TDLo (Oral-Woman) 3240 mg/kg; female 1-39 week(s) after conception: Reproductive: Specific Developmental Abnormalities: endocrine system; Effects on Newborn: other neonatal measures or effects; Effects on Newborn: physical

TDLo (Oral-Rat) 7980 mg/kg/19 weeks-continuous: Endocrine: other changes

TDLo (Oral-Rat) 1680 mg/kg/4 weeks-continuous: Endocrine: toxic goiter-hypofunction

TDLo (Oral-Rat) 822 mg/kg; male 2 week(s) pre-mating female 2 week(s) pre-mating: 13 day(s) post-birth: Reproductive: Effects on Newborn: behavioral

TDLo (Oral-Rat) 922 mg/kg; male 2 week(s) pre-mating female 2 week(s) pre-mating: 21 day(s) post-birth: Reproductive: Effects on Newborn: viability index (e.g., # alive at day 4 per # born alive)

POTASSIUM IODIDE (continued):

TDLo (Oral-Rat) 300 mg/kg; female 9 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants); Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus), fetal death

TDLo (Oral-Rat) 2150 mg/kg; female 22 day(s) after conception lactating female 21 day(s) post-birth: Reproductive: Specific Developmental Abnormalities: Central Nervous System; Effects on Newborn: growth statistics (e.g.%, reduced weight gain)

TDLo (Oral-Rat) 50 mg/kg; Multi-generations: Reproductive: Effects on Newborn: behavioral, delayed effects

TDLo (Oral-Rat) 10,530 mg/kg; female 1-9 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); Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)

TDLo (Oral-Hamster) 3600 mg/kg; female 5-16 day(s) after conception: Reproductive: Effects on Newborn: growth statistics (e.g.%, reduced weight gain)

TDLo (Oral-Chicken) 4313 mg/kg/21 weeks-continuous: Nutritional and Gross Metabolic: weight loss or decreased weight gain

TDLo (Oral-Mammal -Species Unspecified) 294 mg/kg; female 30 day(s) pre-mating: Reproductive: Maternal Effects: parturition

TDLo (Oral-Mammal -Species Unspecified) 1177 mg/kg; female 30 day(s) pre-mating: Reproductive: Effects on Newborn: growth statistics (e.g.%, reduced weight gain)

POTASSIUM IODIDE (continued):

TDLo (Subcutaneous-Mouse) 1900 mg/kg; Cardiac: other changes

TDLo (Intraperitoneal-Mouse) 3.2 mg/kg/4 days-intermittent: Endocrine: other changes; Biochemical: Metabolism (Intermediary): effect on cyclic nucleotides

LDLo (Oral-Mouse) 1862 mg/kg; Behavioral: somnolence (general depressed activity), muscle weakness; Lungs, Thorax, or Respiration: dyspnea

LDLo (Oral-Rabbit) 916 mg/kg

LDLo (Intravenous-Rat) 167 mg/kg; Behavioral: convulsions or effect on seizure threshold

LDLo (Intraperitoneal-Mouse) 1117 mg/kg; Behavioral: convulsions or effect on seizure threshold, excitement Lungs, Thorax, or Respiration: other changes

Cytogenetic Analysis (Rat-Ascites tumor) 500 mg/kg

TRIETHYLENEDIAMINE:

Open Irritation Test (Skin-Rabbit) 2500 µg: Mild
Standard Draize Test (Eye-Rabbit) 25 mg: Moderate

LD₅₀ (Oral-Rat) 1700 mg/kg

LD₅₀ (Oral-Rabbit) 1100 mg/kg; Behavioral: somnolence (general depressed activity), muscle weakness, muscle contraction or spasticity

LD₅₀ (Oral-Guinea Pig) 2250 mg/kg; Behavioral: somnolence (general depressed activity), muscle weakness, muscle contraction or spasticity

TDLo (Oral-Rat) 4680 mg/kg/26 weeks-intermittent: Behavioral: alteration of classical conditioning; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: true cholinesterase, Enzyme inhibition, induction, or change in blood or tissue levels: transaminases

► **CARCINOGENIC POTENTIAL:** The components of this product are listed by agencies tracking the carcinogenic potential of chemical compounds, as follows:

POTASSIUM IODIDE (as an iodide compound): ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen)

The remaining components of this product is not listed by U.S. FEDERAL OSHA Z LIST, NTP, IARC, and CAL/OSHA and therefore is not considered to be, nor suspected to be, a cancer causing agent by these agencies.

► **IRRITANCY OF PRODUCT:** The dusts from this product may mildly irritate the respiratory system and eyes.

► **SENSITIZATION TO THE PRODUCT:** The component of this product is not known to be human skin or respiratory sensitizers.

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

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

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 generation 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 Biological Exposure Indices 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 not expected to be mobile.

► **PERSISTENCE AND BIODEGRADABILITY:** No specific data are available this product. The Triethylenediamine component may biodegrade to some extent.

12. ECOLOGICAL INFORMATION

- ▶ **BIO-ACCUMULATION POTENTIAL:** No component of this product is known to have bio-accumulation potential.
- ▶ **ECOTOXICITY:** This product has not been tested for aquatic or animal toxicity. All release to terrestrial, atmospheric and aquatic environments should be avoided.
- ▶ **OTHER ADVERSE EFFECTS:** The components of this product are not listed as having ozone depletion potential.
- ▶ **ENVIRONMENTAL EXPOSURE CONTROLS:** Controls should be engineered to prevent release to the environment, including procedures to prevent spills, atmospheric release and release to waterways.

13. DISPOSAL CONSIDERATIONS

- ▶ **DISPOSAL METHODS:** It is the responsibility of the generator to determine at the time of disposal whether the product meets the criteria of a hazardous waste per regulations of the area in which the waste is generated and/or disposed of. Waste disposal must be in accordance with appropriate Federal, State, and local regulations. This product, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local hazardous waste regulatory authority. Shipment of wastes must be done with appropriately permitted and registered transporters. Consult an expert for disposal.
- ▶ **DISPOSAL CONTAINERS:** Waste materials must be placed in and shipped in appropriate 5-gallon or 55 gallon poly or metal waste pails or drums. Permeable cardboard containers are not appropriate and should not be used. Ensure that any required marking or labeling of the containers be done to all applicable regulations.
- ▶ **PRECAUTIONS TO BE FOLLOWED DURING WASTE HANDLING:** Wear proper protective equipment when handling waste materials. Dispose of in accordance with applicable Federal, State, and local procedures and standards
- ▶ **U.S. EPA WASTE NUMBER:** Not applicable for wastes of this product.
- ▶ **EUROPEAN UNION EWC CODE:** Waste from this product is NOT considered as a hazardous waste pursuant to Directive 91/689/EEC on hazardous waste, and is NOT subject to the provisions of that Directive unless Article 1(5) of that Directive. It is recommended that end users consult Commission Decision 2000/532/EC and Commission Directive 2001/118/EC to confirm that no waste code is appropriate to the end use of their product.

14. TRANSPORTATION INFORMATION

- ▶ **U.S. DEPARTMENT OF TRANSPORTATION REGULATIONS:** This product is NOT classified as dangerous goods, per U.S. DOT regulations, under 49 CFR 172.101.
- ▶ **TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:** This product is NOT classified as Dangerous Goods, per regulations of Transport Canada.
- ▶ **INTERNATIONAL AIR TRANSPORT ASSOCIATION 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 rules of the International Maritime Organization.
- ▶ **EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR):** This product is NOT classified by the Economic Commission for Europe to be dangerous goods.

15. REGULATORY INFORMATION

ADDITIONAL UNITED STATES REGULATIONS:

- ▶ **U.S. SARA REPORTING REQUIREMENTS:** The components of this product are NOT subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act.
- ▶ **U.S. SARA THRESHOLD PLANNING QUANTITY:** The components of this product have no specific Threshold Planning Quantity. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lbs. (4,540 kg) therefore applies, per 40 CFR 370.20.
- ▶ **U.S. SARA HAZARD CATEGORIES (SECTION 311/312, 40 CFR 370-21):** ACUTE: Yes; CHRONIC: No; FIRE: No; REACTIVE: No; SUDDEN RELEASE: No
- ▶ **U.S. TSCA INVENTORY STATUS:** The components of this product are listed on the TSCA Inventory.

15. REGULATORY INFORMATION (Continued)

ADDITIONAL UNITED STATES REGULATIONS (continued):

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

▶ **OTHER U.S. FEDERAL REGULATIONS:**

- The components of this product are not subject to the reporting requirements of CFR 29 1910.1000.
- The components of this product are not subject to the reporting requirements of Section 112(r) of the Clean Air Act.
- The components of this product are not Class I or Class II ozone depleting chemicals (40 CFR part 82).
- The components of this product are not listed under Table 1 as Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Release Prevention.

▶ **CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65):** The components of this product are not on the California Proposition 65 Lists.

ADDITIONAL CANADIAN REGULATIONS:

▶ **CANADIAN DSL/NDL INVENTORY STATUS:** The components of this product are included in the DSL Inventory.

▶ **CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS:** The components of this product are not on the CEPA Priorities Substances Lists.

▶ **CANADIAN WHMIS CLASSIFICATION:** This product does not meet the criteria to be classified as a Controlled Product.

▶ **CANADIAN WHMIS SYMBOLS:** Not applicable.

ADDITIONAL EUROPEAN UNION REGULATIONS:

▶ **EU LABELING/CLASSIFICATION:** This product meets does NOT the definition of hazardous as defined by the European Economic Community Guidelines.

EU CLASSIFICATION: Not applicable.

EU RISK PHRASES: Not applicable.

EU SAFETY PHRASES: Not applicable.

EUROPEAN COMMUNITY ANNEX II HAZARD SYMBOL: Not applicable.

▶ **EUROPEAN UNION CLASSIFICATION ON COMPONENTS:**

CARBON: A classification by the European Union Directives has not yet been published for this compound.

16. OTHER INFORMATION

This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this product. To the best of Aviza Technology's knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this product is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.

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DEFINITIONS OF TERMS

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

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

EXPOSURE LIMITS IN AIR:

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

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

EXPOSURE LIMITS IN AIR:

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 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 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. 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.)

DEFINITIONS OF TERMS (Continued)

EXPOSURE LIMITS IN AIR (continued):

DFG MAK Germ Cell Mutagen Categories(continued): 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 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". 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.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM**HAZARD RATINGS (continued):****HEALTH HAZARD (continued):**

3 (continued): 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.); 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 products 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 product 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 product 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 product 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 product 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 ≥ 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 product. 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 product. 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.

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

HEALTH HAZARD (continued): 2 (continued): 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.

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 products 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).

DEFINITIONS OF TERMS (Continued)

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

FLAMMABILITY HAZARD (continued): 3 (continued): Materials that, on account of their physical form or environmental conditions, can form explosive products 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 product 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.

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

EUROPEAN:

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