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BORON PRODUCTS

MATERIAL SAFETY DATA SHEET

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

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

1. PRODUCT IDENTIFICATION

TRADE NAME (AS LABELED):	**CAST BOROBOND 4**
CHEMICAL NAME/CLASS:	Ceramics
SYNONYMS:	Not Applicable
FORMULA:	Not Applicable
PRODUCT USE:	Various Uses
SUPPLIER/MANUFACTURER'S NAME:	**BORON PRODUCTS, LLC. A CERADYNE COMPANY**
ADDRESS:	798 Highway 69A, Quapaw, OK 74363 PO Box 798, Quapaw, OK 74363
24 HR EMERGENCY PHONE:	InfoTrac: 1-800-535-5053
TECHNICAL CONTACT PHONE:	1-918-673-2201 (8:00 a.m. to 4:30 p.m., Mon.-Fri.)
DATE OF REVISION:	November 14, 2007

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	w/w%	EXPOSURE LIMITS IN AIR					
			ACGIH-TLV		OSHA-PEL		NIOSH	OTHER
			TWA mg/m^3	STEL mg/m^3	TWA mg/m^3	STEL mg/m^3	IDLH mg/m^3	mg/m^3
Boron Carbide	12069-32-8	4-6%	NE	NE	NE	NE	NE	NE
Magnesium Oxide	1309-48-4	10-14%	10 (inhalable fraction)	NE	NE	NE	750 (fume)	DFG MAKs: TWA = 4 (inhalable fraction); 1.5 (respirable fraction)
Fly Ash	68131-74-8	30-40%	NE	NE	NE	NE	NE	NE
Monopotassium Phosphate Currently, there are no exposure limits for this compound; it is recommended that the following limits for "Particulates, Not Otherwise Classified" (PNOC) be used.	7778-77-0	30-40%	NE	NE	15 mg/m^3 or 50 mppcf (Total Dust) 5 mg/m^3 or 15 mppcf (Respirable Fraction)	NE	NE	DFG MAKs: TWA = 4 (Inhalable Fraction); 1.5 (Respirable Fraction–dusts, general)

NE = Not Established. NOTE (1): ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This product has been classified in accordance with the hazard criteria of the CPR.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This product is dark gray structural solid object. **Health Hazards:** In cast form, this product does not pose significant health hazards. If the cast product is crushed, sawn or broken, dusts from the product may irritate contaminated eyes and respiratory system. **Flammability Hazards:** This product is not flammable. If crushed, sawn or broken an accumulation of large amounts of finely divided dusts from this product may cause an air/dust explosion hazard. If involved in a fire, decomposition may result in formation of magnesium and potassium oxides. **Reactivity Hazards:** This product is not reactive. **Environmental Hazards:** As a cast item, this product does not pose a hazard to the environment. **Emergency Recommendations:** Persons who respond to releases of this product should protect themselves appropriately for a spill-response situation and follow pre-planned procedures.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: If dusts are produced by this product, the most significant route of over-exposure for this product is by inhalation and skin and eye contact. The symptoms of overexposure to this product, via route of exposure are as follows:

INHALATION: In cast form, this product does not pose an inhalation hazard. If this product is crushed, broken or sawn and dusts are produced, inhalation of dusts or particulates from this product may irritate the mucous membranes, respiratory tract, nose and throat. Symptoms of exposure may include nasal catarrh, coughing, coughing up of discolored sputum sneezing and difficulty breathing. Symptoms of exposure are expected to disappear after removal to fresh air. Systemic effects have not been reported after exposure to this product or its components by inhalation.

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3. HAZARD IDENTIFICATION (Continued)

INHALATION (continued): Inhalation of fumes from heated dusts from the product may result in a flu-like illness called “metal-fume fever”. Symptoms of metal fume fever occur 4-12 hours after exposure and can include cough, sweating, headache, fever, muscle aches, nausea, vomiting and tiredness. Recovery is complete. The volunteers exposed to magnesium oxide fumes at 4-6 mg/m^3 for less than 10 minutes experienced fever and tiredness. However, there have been no reports of metal fume fever caused by industrial exposure to magnesium oxide dust.

CONTACT WITH SKIN or EYES: Contact with the cast product should not cause adverse effects. Eye contact will cause irritation with conjunctivitis, redness, tearing and stinging.

SKIN ABSORPTION: The components of this product are not known to present a hazard of absorption via intact skin.

INGESTION: Ingestion of the cast product is not a route of exposure. If crushed, broken or sawed, dust can be produced and poor hygiene can result in ingestion. If dusts are ingested, symptoms may include irritation of the digestive system with nausea, vomiting, stomach ache and diarrhea. Additional symptoms of dust ingestion may include paresthesias of the extremities, listlessness, mental confusions, weakness or heaviness of the legs, flaccid paralysis, cold skin, gray pallor, peripheral vascular collapse with fall in blood pressure, cardiac arrhythmias, and heart block, due to the presence of Monopotassium Phosphate.

INJECTION: Injection is not a route of exposure for this product.

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

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			

For Routine Industrial Use and Handling Applications

See Section 16 for Definition of Ratings

ACUTE: As a cast product, this product does not pose acute health hazards. If dusts are produced from sawed, broken or crushed product, acute exposures to these dusts by inhalation may be irritating to mucous membranes, nose and throat. Inhalation of fumes from heated product or dusts may lead to development of metal fume fever. Eye contact of dusts will be irritating.

CHRONIC: No chronic symptoms are expected to occur.

TARGET ORGANS: ACUTE: Skin, eyes, respiratory system. CHRONIC: None expected.

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

4. FIRST-AID MEASURES

Contaminated individuals should be taken for medical attention if they feel unwell or if adverse effects occur. Take copy of label and MSDS to physician or health professional with contaminated individual.

SKIN EXPOSURE: If dusts from product contaminate the skin, decontaminate with warm, running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention if any adverse effect occurs.

EYE EXPOSURE: If dusts from product enter 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 15 minutes. Victim must seek immediate medical attention if any adverse effect occurs.

INHALATION: If dusts or fumes from this product are inhaled, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Remove or cover gross contamination to avoid exposure to rescuers. Victim must seek immediate medical attention if any adverse effect occurs.

INGESTION: If this product is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. Do not induce vomiting. Have victim rinse mouth with water, if conscious. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or unable to swallow. Victim must seek immediate medical attention if any adverse effect occurs.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: None expected.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate exposure.

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5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %):

Lower: Not applicable.
Upper: Not applicable.

FIRE EXTINGUISHING MATERIALS: Use extinguishing material suitable to the surrounding fire.

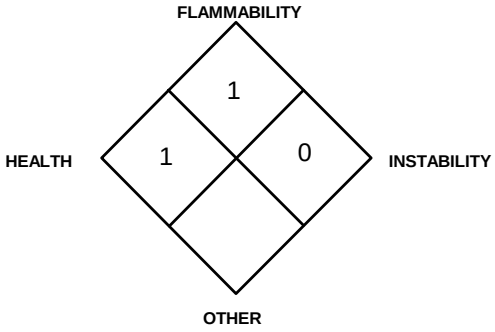
Water Spray: YES Carbon Dioxide: YES
Foam: YES Dry Chemical: YES
Halon: YES Other: Any "ABC" Class

UNUSUAL FIRE AND EXPLOSION HAZARDS: As a cast item, this product does not pose a hazard to fire-fighters. Fire-fighters should wear adequate personal protective equipment when fighting fires involving this product. If sawed, broken or crushed, finely divided dusts from the product can present a hazard of an air/dust explosion. When involved in a fire, this product may decompose and produce irritating vapors and toxic compounds (including oxides of magnesium and potassium).

Explosion Sensitivity to Mechanical Impact: Not applicable.

Explosion Sensitivity to Static Discharge: Finely divided dusts may be susceptible to static discharge.

NFPA RATING



See Section 16 for Definition of Ratings

SPECIAL FIRE-FIGHTING PROCEDURES: Incipient fire responders should wear eye protection. Structural fire fighters must wear Self-Contained Breathing Apparatus and full protective equipment. If this product is involved in a fire, fire run-off water should be contained to prevent possible environmental damage. It may be prudent to remove potentially heat-exposed cylinders from the area surrounding a fire, if it is safe for fire-fighters to do so.

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: The cast product can be picked-up or swept-up, avoiding the generation of dusts.

If product is crushed, broken or sawed and dusts are produced, 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), Tyvek or other appropriate body protection and boots.** Spilled product can be cleaned-up via sweeping or vacuuming, avoiding the generation of dusts. The atmosphere must have at least 19.5 % oxygen and levels of other compounds must be below exposure limits listed in Section 2 (Composition and Information on Ingredients) before non-emergency personnel can be allowed in the area. Spilled product should be disposed of in accordance to all applicable U.S. Federal, State and local regulations and those of Canada and is Provinces.

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

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash thoroughly after handling the product. Do not eat, drink, apply cosmetics, or smoke while handling the product. Eyewash stations and safety showers should be in areas of use of the product. Areas in which the product is used should be wiped down so that residue and dusts is not allowed to accumulate.

STORAGE AND HANDLING PRACTICES: All employees who handle this product should be trained to handle it safely. Keep the smallest amount on-site as is necessary. Store containers away from heavily trafficked areas and emergency exits. Post “No Smoking or Open Flames” signs in storage or use areas. Isolate from other incompatible chemicals (refer to Section 10, Stability and Reactivity). Storage areas must meet national electrical codes for Class 1 Hazardous Areas. Have appropriate extinguishing equipment in the storage area (e.g., sprinkler system, portable fire extinguishers). Use closed ventilation systems, approved equipment, and appropriate electrical systems.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use this product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation to ensure exposures are below limits provided in Section 2 (Composition and Information on Ingredients). Prudent practice is to ensure eyewash/safety shower stations are available near areas where this product is used.

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8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

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. Please reference applicable regulations and standards for relevant details.

RESPIRATORY PROTECTION: Respiratory equipment should not be needed when handling the cast product under normal circumstances of use. If dusts or fumes are produced during handling or use, maintain airborne contaminant concentrations below guidelines listed in Section 2 (Composition and Information on Ingredients) if applicable. If respiratory protection is needed, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent U.S. State standards, and Canadian CSA Standard Z94.4-93. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998). The following are NIOSH respiratory guidelines for the Magnesium Oxide, fume/dust.

MAGNESIUM OXIDE

CONCENTRATION	RESPIRATORY PROTECTION
Up to 150 mg/m3:	Any Dust, Mist, And Fume Respirator, or any Supplied-Air Respirator (SAR).
Up to 375 mg/m3:	Any SAR operated in a continuous-flow mode, or any Powered, Air-Purifying Respirator (PAPR) with a dust, mist, and fume filter.
Up to 750 mg/m3:	Any Air-Purifying, Full-Facepiece Respirator with a high-efficiency particulate filter, or any PAPR with a tight-fitting facepiece and a high-efficiency particulate filter, or any Self-Contained Breathing Apparatus (SCBA) with a full facepiece, or any SAR with a full facepiece.
Emergency or Planned Entry into Unknown Concentrations or IDLH Conditions:	Any SCBA that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode, or any SAR that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive-pressure mode.
Escape:	Any Air-Purifying, Full-Facepiece Respirator with a high-efficiency particulate filter, or any appropriate escape-type, SCBA.

EYE PROTECTION: Splash goggles or safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards for further information.

HAND PROTECTION: Wear light-weight plastic or rubber gloves for routine industrial use. Check gloves for leaks prior to use. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: If necessary, use body protection appropriate for task (e.g., Tyvek suit, rubber apron). If necessary, refer to appropriate Standards the U.S. and 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 U.S. OSHA 29 CFR 1910.136.

9. PHYSICAL and CHEMICAL PROPERTIES

EVAPORATION RATE (nBuAc = 1): Not applicable.

VAPOR DENSITY (air = 1): Not applicable.

SPECIFIC GRAVITY @ 20°C (water = 1): 2.2

MELTING/FREEZING POINT: > 800°C (1472°F)

SOLUBILITY IN WATER: Slightly exothermic; reacts.

BOILING POINT: Not applicable.

VAPOR PRESSURE: Not applicable.

pH: Not applicable.

ODOR THRESHOLD: Not applicable (odorless)

BULK DENSITY: < 2.2 g/cm^3

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

APPEARANCE, ODOR and COLOR: This product is dark gray structural solid object.

HOW TO DETECT THIS SUBSTANCE (warning properties): The appearance may be a distinctive warning property associated with this product.

10. STABILITY and REACTIVITY

STABILITY: Stable.

DECOMPOSITION PRODUCTS: If heated to decomposition, this product may product magnesium oxide fumes and oxides of potassium.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: None known for cast product.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: None known.

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

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following are toxicological data for the components of this product:

BORON CARBIDE:

TCLo (Inhalation-Rat) 300 mg/m^3/4 hours/1 years-intermittent: Lungs, Thorax, or Respiration: emphysema, fibrosis (interstitial), other changes

FLY ASH:

TCLo (Inhalation-Rat) 270 mg/m^3/6 hours/15 days-intermittent: Lungs, Thorax, or Respiration: changes in lung weight; Blood: changes in erythrocyte (RBC) count, changes in leukocyte (WBC) count

TCLo (Inhalation-Rat) 30 mg/m^3/6 hours/4 weeks-intermittent: Liver: changes in liver weight; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: other oxidoreductases; Biochemical: Metabolism (Intermediary): other proteins

TCLo (Inhalation-Hamster) 2 mg/kg/20 hours/26 weeks-intermittent: Liver: other changes; Biochemical: Metabolism (Intermediary): lipids including transport

TCLo (Inhalation-Hamster) 200 mg/m^3/6 hours/8 weeks-intermittent: Lungs, Thorax, or Respiration - other changes, changes in lung weight

TCLo (Inhalation-Hamster) 70 mg/m^3/6 hours/86 weeks-intermittent: Lungs, Thorax, or Respiration: structural or functional change in trachea or bronchi, other changes, changes in lung weight

FLY ASH (continued):

TCLo (Inhalation-Mouse) 5 mg/m^3/7 hours/21 weeks-intermittent: Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Lungs, Thorax, or Respiration: tumors

TDLo (Intratracheal-Rat) 350 mg/kg/7 days-intermittent: Lungs, Thorax, or Respiration: other changes; Liver: other changes; Biochemical: Enzyme inhibition, induction, or change in blood or tissue Levels: hepatic microsomal mixed oxidase (dealkylation, hydroxylation, etc.)

TDLo (Intratracheal-Rat) 600 mg/kg: female 14-19 day(s) after conception: Reproductive: Specific Developmental Abnormalities: cardiovascular (circulatory) system, urogenital system

Mutation in Microorganisms (Bacteria-Salmonella typhimurium) 1800 μg/plate

Mutation in Microorganisms (Microorganism-not otherwise specified) 535 mg/L

Sister Chromatid Exchange (Human-Lymphocyte) 10 mg/L

MAGNESIUM OXIDE:

TCLo (Inhalation-Human) 400 mg/m^3

MAGNESIUM OXIDE (continued):

TCLo (Inhalation-Rat) 1120 μg/m^3/24 hours/29 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) 1000 mg/m^3/4 hours/50 days-intermittent: Lungs, Thorax, or Respiration: other changes; Blood: other hemolysis with or without anemia

TCLo (Inhalation-Mammal-species unspecified) 4 mg/m^3/12 minutes

TDLo (Intratracheal-Hamster) 480 mg/kg/30 weeks-intermittent: Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Sense Organs and Special Senses (Olfaction): tumors; Lungs, Thorax, or Respiration: tumors

MONOPOTASSIUM PHOSPHATE:

LD_{50} (Skin-Rabbit) > 4640 mg/kg

LDLo (Oral-Rat) 4640 mg/kg: Behavioral: somnolence (general depressed activity); Gastrointestinal: other changes

SUSPECTED CANCER AGENT: The components of this product are not found on the following lists: FEDERAL OSHA Z LIST, NTP, IARC, and CAL/OSHA, and therefore are neither considered to be nor suspected to be cancer-causing agents by these agencies.

IRRITANCY OF PRODUCT: The cast product is not irritating. If the product is sawed, crushed or broken and dusts are product, the dust may be irritating to the respiratory system and eyes.

SENSITIZATION TO THE PRODUCT: The components of this product are not known to be human skin or respiratory sensitizers.

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

Mutagenicity: The components of this product are not reported to cause reproductive 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 generational lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

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

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

ENVIRONMENTAL STABILITY: Currently, there are no data on the environmental stability of this product or its components.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: There are currently no data on the effects of this product on plants or animals. This product may be harmful to contaminated terrestrial plant and animal life.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No data are currently available on the effects of this product in an aquatic environment. Releases of large quantities may be detrimental to an aquatic environment and should be avoided.

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13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate U.S. Federal, State, and local regulations and those of Canada and its Provinces. This product, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local waste regulatory authority. Empty containers, as defined by appropriate sections of RCRA, are not RCRA hazardous wastes. Insure proper management of any residuals remaining in containers.
U.S. EPA WASTE NUMBER: Not applicable.

14. TRANSPORTATION INFORMATION

THIS PRODUCT IS NOT HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME:	Not Regulated
HAZARD CLASS NUMBER and DESCRIPTION:	Not Applicable
UN IDENTIFICATION NUMBER:	Not Applicable
DOT LABEL(S) REQUIRED:	Not Applicable.
PACKAGING GROUP:	Not Applicable

NORTH AMERICAN RESPONSE GUIDEBOOK NUMBER (2000): Not Applicable
MARINE POLLUTANT: Boron is not listed as a marine pollutant as per D.O.T. (49 CFR 172.101, Appendix B).
TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This product is not considered as Dangerous Goods, per regulations of Transport Canada.

15. REGULATORY INFORMATION

U.S. STATE AND FEDERAL 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 302 EXTREMELY HAZARDOUS THRESHOLD PLANNING QUANTITY: Not applicable.
U.S. SARA 304 EXTREMELY HAZARDOUS REPORTABLE QUANTITY (RQ): Not applicable.
U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.
U.S. TSCA INVENTORY STATUS: Components of this product are listed on the TSCA Inventory.
OTHER U.S. FEDERAL REGULATIONS: Not applicable.
CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Components of this product are not on the California Proposition 65 Lists.
ANSI LABELING (Z129.1): DUSTS FROM PRODUCT MAY CAUSE RESPIRATORY TRACT, SKIN, AND EYE IRRITATION.
DUSTS MAY BE HARMFUL IF SWALLOWED.
Avoid breathing dusts.
Avoid contact of dusts with skin, eyes, and clothing.
Use with adequate ventilation.
Wash thoroughly after handling.
Use in accordance with the Material Safety Data Sheet.

FIRST-AID: **IF DUSTS ARE INHALED** remove to fresh air.
If not breathing, give artificial respiration and supplemental oxygen.
If breathing, give oxygen.
Seek medical attention.
IN CASE OF SKIN CONTACT, immediately flush skin with plenty of water.
Remove contaminated clothing and shoes.
Wash clothing before reuse.
Seek medical attention if irritation persists.
IN CASE OF EYE CONTACT, immediately flush eyes with plenty of water for at least 15 minutes.
Use in accordance with the Material Safety Data Sheet.

ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL/NDSL INVENTORY: Components of this product are listed on the DSL Inventory.
OTHER CANADIAN REGULATIONS: Not applicable.
CANADIAN ENVIRONMENTAL PROTECTION AGENCY (CEPA) PRIORITY SUBSTANCES LISTS: Not applicable.
CANADIAN WHMIS CLASSIFICATION and SYMBOLS: Not applicable.

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16. OTHER INFORMATION

PREPARED BY: CHEMICAL SAFETY ASSOCIATES, INC.
PO Box 3519, La Mesa, CA 91944-3519
(619) 670-0609

The information contained herein is furnished without warranty of any kind. Persons using this product should consider these data only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use and disposal of this material, the safety of health of employees and customers and the protection of the environment.

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. **LOQ:** Limit of Quantitation.

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

NE: Not Established. When no exposure guidelines are established, an entry of NE is made for reference. **NIC:** Notice of Intended Change.

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

NIOSH RELs: NIOSH's Recommended Exposure Limits.

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

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

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

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

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

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.

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 LD_{50} Rat*: < 5000 mg/kg. *Dermal Toxicity LD_{50}Rat or Rabbit*: < 2000 mg/kg. *Inhalation Toxicity 4-hrs LC_{50} Rat*: < 20 mg/L.); **1** (Slight Hazard: Minor reversible Injury may occur; slightly or mildly irritating. *Skin Irritation*: Slightly or mildly irritating. *Eye Irritation*: Slightly or mildly irritating. *Oral Toxicity LD_{50} Rat*: > 500-5000 mg/kg. *Dermal Toxicity LD_{50}Rat or Rabbit*: > 1000-2000 mg/kg. *Inhalation Toxicity LC_{50}* 4-hrs *Rat*: > 2-20 mg/L); **2** (Moderate Hazard: Temporary or transitory injury may occur. *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 LD_{50} Rat*: > 50-500 mg/kg. *Dermal Toxicity LD_{50}Rat or Rabbit*: > 200-1000 mg/kg. *Inhalation Toxicity LC_{50} 4-hrs Rat*: > 0.5-2 mg/L.); **3** (Serious Hazard: Major injury likely unless prompt action is taken and medical treatment is given; high level of toxicity; corrosive. *Skin Irritation*: Severely irritating and/or corrosive; may destroy dermal tissue, cause skin burns, dermal necrosis. PII or Draize > 5-8 with destruction of tissue.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

HEALTH HAZARD:

3 (continued): *Eye Irritation*: Corrosive, irreversible destruction of ocular tissue; corneal involvement or irritation persisting for more than 21 days. Draize > 80 with effects irreversible in 21 days. *Oral Toxicity LD_{50} Rat*: > 1-50 mg/kg. *Dermal Toxicity LD_{50}Rat or Rabbit*: > 20-200 mg/kg. *Inhalation Toxicity LC_{50} 4-hrs Rat*: > 0.05-0.5 mg/L.); **4** (Severe Hazard: Life-threatening; major or permanent damage may result from single or repeated 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 LD_{50} Rat*: ≤ 1 mg/kg. *Dermal Toxicity LD_{50}Rat or Rabbit*: ≤ 20 mg/kg. *Inhalation Toxicity LC_{50} 4-hrs Rat*: ≤ 0.05 mg/L).

FLAMMABILITY HAZARD:

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

PHYSICAL HAZARD:

0 (*Water Reactivity*: Materials that do not react with water. *Organic Peroxides*: Materials that are normally stable, even under fire conditions and will not react with water. *Explosives*: Substances that are Non-Explosive. Unstable *Compressed Gases*: No Rating. *Pyrophorics*: No Rating. *Oxidizers*: No "0" rating allowed. *Unstable Reactives*: Substances that will not polymerize, decompose, condense or self-react.);

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DEFINITIONS OF TERMS (Continued)

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

PHYSICAL HAZARD (continued):

1 (*Water Reactivity*: Materials that change or decompose upon exposure to moisture. *Organic Peroxides*: Materials that are normally stable, but can become unstable at high temperatures and pressures. These materials may react with water, but will not release energy. *Explosives*: Division 1.5 & 1.6 substances that are very insensitive explosives or that do not have a mass explosion hazard. *Compressed Gases*: Pressure below OSHA definition. *Pyrophorics*: No Rating. *Oxidizers*: Packaging Group III; Solids: any material that in either concentration tested, exhibits a mean burning time less than or equal to the mean burning time of a 3:7 potassium bromate/cellulose mixture and the criteria for Packing Group I and II are not met. Liquids: any material that exhibits a mean pressure rise time less than or equal to the pressure rise time of a 1:1 nitric acid (65%)/cellulose mixture and the criteria for Packing Group I and II are not met. *Unstable Reactives*: Substances that may decompose, condense or self-react, but only under conditions of high temperature and/or pressure and have little or no potential to cause significant heat generation or explosive hazard. Substances that readily undergo hazardous polymerization in the absence of inhibitors.); **2** (*Water Reactivity*: Materials that may react violently with water. *Organic Peroxides*: Materials that, in themselves, are normally unstable and will readily undergo violent chemical change, but will not detonate. These materials may also react violently with water. *Explosives*: Division 1.4 – Explosive substances where the explosive effect are largely confined to the package and no projection of fragments of appreciable size or range are expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package. *Compressed Gases*: Pressurized and meet OSHA definition but < 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics*: No Rating. *Oxidizers*: Packing Group II Solids: any material that, either in concentration tested, exhibits a mean burning time of less than or equal to the mean burning time of a 2:3 potassium bromate/cellulose mixture and the criteria for Packing Group I are not met. Liquids: any material that exhibits a mean pressure rise time less than or equal to the pressure rise of a 1:1 aqueous sodium chlorate solution (40%)/cellulose mixture and the criteria for Packing Group I are not met. *Unstable Reactives*: Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure, but have a low potential for significant heat generation or explosion. Substances that readily form peroxides upon exposure to air or oxygen at room temperature); **3** (*Water Reactivity*: Materials that may form explosive reactions with water. *Organic Peroxides*: Materials that are capable of detonation or explosive reaction, but require a strong initiating source, or must be heated under confinement before initiation; or materials that react explosively with water. *Explosives*: Division 1.2 – Explosive substances that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but do not have a mass explosion hazard. *Compressed Gases*: Pressure ≥ 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics*: No Rating. *Oxidizers*: Packing Group I Solids: any material that, in either concentration tested, exhibits a mean burning time less than the mean burning time of a 3.:2 potassium bromate/cellulose mixture. Liquids: Any material that spontaneously ignites when mixed with cellulose in a 1:1 ratio, or which exhibits a mean pressure rise time less than the pressure rise time of a 1:1 perchloric acid (50%)/cellulose mixture. *Unstable Reactives*: Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a moderate potential to cause significant heat generation or explosion.); **4** *Water Reactivity*: Materials that react explosively with water without requiring heat or confinement. *Organic Peroxides*: Materials that are readily capable of detonation or explosive decomposition at normal temperature and pressures. *Explosives*: Division 1.1 & 1.2-explosive substances that have a mass explosion hazard or have a projection hazard. A mass explosion is one that affects almost the entire load instantaneously. *Compressed Gases*: No Rating. *Pyrophorics*: Add to the definition of Flammability "4". *Oxidizers*: No "4" rating. *Unstable Reactives*: Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a high potential to cause significant heat generation or explosion

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS:

HEALTH HAZARD: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure could cause death or major residual injury).

FLAMMABILITY HAZARD: **0** Materials that will not burn under typical fire conditions, including intrinsically noncombustible materials such as concrete, stone, and sand. **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 **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. **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. **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.

INSTABILITY HAZARD: **0** Materials that in themselves are normally stable, even under fire conditions. **1** Materials that in themselves are normally stable, but that can become unstable at elevated temperatures and pressures. **2** Materials that readily undergo violent chemical change at elevated temperatures and pressures. **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. **4** Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures.

FLAMMABILITY LIMITS IN AIR:

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

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: **LD_{50}** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC_{50}** - 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/m^3** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. 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.

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DEFINITIONS OF TERMS (Continued)

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. **O**ccupational **S**afety and **H**ealth **A**dministration (**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/NDSL)**; 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.