



SAFETY DATA SHEET

Prepared to U.S. OSHA (CFR 1910.1200), Canadian WHMIS 2015 (HPR-GHS), European Union CLP EC 1272/2008, REACH, the Korean ISHA (Notice 2019-28), Chinese GB 20576 ~ GB 20602-2006, Australian NOSH, New Zealand HSNO, Japanese JIS Z7253, and the UN Global Harmonization Standard (Revision 8).

1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

PRODUCT IDENTIFIER

PRODUCT IDENTIFIER/TRADE NAME (AS LABELED):

CHEMICAL NAMES:

PRODUCT USE:

SYNONYMS:

ULTRACAPACITOR

Capacitor Containing Electrolyte Solution Absorbed in Carbon Energy Storage Device
EDLC

SUPPLIER OF THE SAFETY DATA SHEET

U.S. SUPPLIER/MANUFACTURER'S NAME (USA/Canada):

ADDRESS:

BUSINESS PHONE:

EUROPEAN SUPPLIER/MANUFACTURER'S NAME (USA/Canada):

ADDRESS:

BUSINESS PHONE:

EMAIL ADDRESS:

EMERGENCY PHONE:

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DATE OF PREPARATION:

March 19, 2015

DATE OF REVISION:

May 26, 2020

NOTE: This product is an "Article" under the U.S. Federal OSHA Hazard Communication Standard (29 CFR 1910.1200), EU CLP 1272: 2008, New Zealand, Australian, Japanese, Chinese and Korean regulations, the Canadian Workplace Hazardous Materials Standard and the Global Harmonization Standard. Refer to Section 15 (Regulatory Information) for specific regulatory citations. As an article, this product presents negligible health and physical hazards under reasonably anticipated circumstances of use. Subsequently, a Safety Data Sheet is not required for this product under Standards cited above. This document is prepared to provide persons using this product with additional safety information.

2. HAZARD IDENTIFICATION

This capacitor is manufactured electronic product that contains primarily non-hazardous materials, including metal and plastic. Ultracapacitors are sealed, metal containers (steel or aluminum) which enclose layers of Proprietary Carbon which is saturated by an electrolyte solution, aluminum and plastic. The electrolyte solution contains a quaternary salt compound (tetraethyl aluminum tetrafluoroborate) dissolved in the solvent Proprietary Cyano-Substituted Hydrocarbon. The assembled layers are inserted into the outer metal container and are saturated with the electrolyte, sealed and stored in an uncharged state. There are minor hazards that can arise from exposure to the Proprietary Carbon. If the contents of these Ultracapacitors remain sealed in the outer shell and they are kept uncharged, persons handling this product will avoid most of the risks described herein for all hazardous components of the electrolyte. As such, precautions should be taken to avoid rupture or overheating the sealed metal containers.

GLOBAL HARMONIZATION, EU CLP REGULATION (EC) 1272/2008, AUSTRALIAN NATIONAL OCCUPATION HEALTH and SAFETY

COMMISSION, JAPANESE INDUSTRIAL STANDARD, NEW ZEALAND HAZARDOUS SUBSTANCE CLASSIFICATIONS

STANDARD HSNO COP, LABELING AND CLASSIFICATION: This product is an article and is not required to be classified under above regulations. No classification, hazard statements, precautionary statements or hazard pictograms are required.

KOREAN ISHA LABELING AND CLASSIFICATION: Classified in accordance with ISHA. Under ISHA, this product is an article and is not required to be classified.

EMERGENCY OVERVIEW: Product Description: This product a solid article consisting of an opaque plastic and metal, sealed case, which is filled with an electrolyte solution that has been completely absorbed on Proprietary Carbon. **Health Hazards:** This product is considered a manufactured article and presents negligible health hazards under typical use conditions. Misuse of this product, such as deliberate destruction, overcharging or heating, may cause electric shock or may release the Proprietary Carbon or electrolyte solution contained within the sealed case. **Flammability Hazards:** The Proprietary Carbon may be combustible and may be ignited if exposed to an ignition source or if subjected to direct flame. If involved in a fire, the chemicals contained in the case may decompose and produce toxic gases (e.g. ammonium oxides, nitrogen oxides, carbon oxides, hydrogen cyanide and fluoride and boron compounds). During a fire involving this product care should be taken to avoid inhalation of fumes. Misuse of this product, such as overcharging, may release these toxic fumes as well. Involvement in a fire may cause the capacitor case to burst. **Reactivity Hazards:** Negligible. **Environmental Hazards:** Negligible. **Emergency Considerations:** Emergency responders must wear the proper personal protective equipment (and have appropriate fire-suppression equipment) suitable for the situation to which they are responding. Appropriate precautions should be taken in event of rupture of container under emergency conditions including fire.

3. COMPOSITION and INFORMATION ON INGREDIENTS

This product is a solid article consisting of an opaque plastic and metal with cells filled with Proprietary Carbon saturated with an electrolyte solution. The following information is for the components of the electrolyte solution and the Proprietary Carbon. As manufactured, exposure to individual electrolyte components is not expected. If this product is heated, cut or otherwise manipulated in such a way that will release the Proprietary Carbon or produce fumes, exposure to these components is possible.

3. COMPOSITION and INFORMATION ON INGREDIENTS (Continued)

CHEMICAL NAME	CAS #	European EINECS #	Japanese MITI/ENC #	Korean ECL # Inventory	Chinese IECSC Inventory	New Zealand NZIoC Inventory	% w/w	GHS & EU Classification (1272/2008) Korean ISHA Classification (Notice 2009-68) Hazard Statements Codes
Proprietary Cyano-substituted Hydrocarbon		Listed	Listed	Listed	Listed	Listed	10-20%	<u>Harmonized Classification - Annex VI of Regulation (EC) NO 1272/2008 (CLP Regulation) US, GHS & Korean ISHA:</u> Classification: Flammable Liquid Cat. 2, Acute Oral Toxicity Cat. 4, Acute Dermal Toxicity Cat. 4, Acute Inhalation Toxicity Cat. 4, Eye Irritation Cat. 2A Hazard Statement Codes: H225, H302 + H312 + H332, H319
Proprietary Carbon		Listed	Mineral Excepted	Listed	Listed	Listed	10-20%	<u>Notified Classification Under GHS & EU CLP 1272/2008 & Korean ISHA:</u> Classification: Specific Target Organ Toxicity (Inhalation-Lungs) Repeated Exposure Cat. 2 Hazard Statement Codes: H373 HNOC: Combustible Dust Hazard
Proprietary Quaternary Ammonium Tetrafluoroborate		Listed	Not Listed	Listed	Listed	Listed	5-15%	<u>Notified Classification Under GHS & EU CLP 1272/2008 & Korean ISHA:</u> Classification: Eye Irritation Cat. 2A Hazard Statement Codes: H319
Proprietary Hydrocarbon Substituted Nitrogen		Listed	Listed	Listed	Listed	Listed	1-5%	<u>Harmonized Classification - Annex VI of Regulation (EC) NO 1272/2008 (CLP Regulation) US, GHS & Korean ISHA:</u> Classification: Acute Oral Toxicity Cat. 4, Acute Dermal Toxicity Cat. 4 Hazard Statement Codes: H302 + H312 <u>Additional Self-Classification:</u> Classification: Combustible Liquid Cat. 4, Acute Inhalation Toxicity Cat. 4, Skin Irritation Cat. 2 Hazard Statement Codes: H227, H332, H315
Other components which can form the balance of the capacitor (e.g. metal can, plastic)							Balance	<u>Classification:</u> Not Applicable

See Section 16 for full classification information of product and components.

4. FIRST-AID MEASURES

PROTECTION OF FIRST AID RESPONDERS: RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS PRODUCT WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. Rescuers should be taken for medical attention, if necessary. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary.

DESCRIPTION OF FIRST AID MEASURES: Victim(s) must be taken for medical attention. Take copy of label and SDS to physician or other health professional with victim(s). Remove victim(s) to fresh air, as quickly as possible. First-aid measures applicable to contamination with the electrolyte solution are as follows:

Skin Exposure: None under normal conditions of use and handling. If exposure to the electrolyte solution occurs that result in adverse skin effects, immediately flush contaminated area. Seek medical attention if adverse effect occurs after flushing.

Eye Exposure: None under normal conditions of use and handling. If vapors or fumes from the chemicals contained in the electrolyte solution contaminate the eyes, rinse eyes under gently running water. Use sufficient force to open eyelids and then "roll" eyes while flushing. Minimum flushing is for 20 minutes. Seek medical attention.

Inhalation: None under normal conditions of use and handling. If vapors or fumes from the chemicals contained in the electrolyte solution are inhaled remove victim to fresh air. If necessary, use artificial respiration to support vital functions. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Seek medical attention.

Ingestion: Ingestion is extremely unlikely during normal use and handling. In the unlikely event that the Proprietary Carbon contained in this product is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. If professional advice is not available, DO NOT INDUCE VOMITING. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or unable to swallow. If victim is convulsing, maintain an open airway and obtain immediate medical attention.

Electric Shock: Victim should not be touched if connection to the capacitor still exists. Once the device is no longer in contact with the victim, if electric shock from the device has resulted in cessation of breathing, immediately begin mouth-to-mouth resuscitation. If the heart has stopped, a qualified person should begin CPR. If no person is trained in CPR is available, obtain immediate medical advice on how to perform CPR. Immediate medical attention should be sought while attempts to revive the victim is on-going.

MOST IMPORTANT SYMPTOMS AND EFFECTS: See Sections 3 (Hazard Identification) and 11 (Toxicological Information).

Acute: Accidental electric shock can cause heart stoppage and cessation of breathing.

Chronic: No chronic symptoms are expected under normal use and handling conditions.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: No medical conditions are known to be aggravated by exposure to this product.

INDICATION OF IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT IF NEEDED: Eliminate exposure and treat symptoms.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable for product as a whole. For electrolyte solution components:

For Proprietary Cyano-Substituted Hydrocarbon: 5.6°C (42°F); For Proprietary Hydrocarbon Substituted Nitrogen: 70°C (158°F)

AUTOIGNITION TEMPERATURE: Not applicable for product as a whole. For electrolyte solution components:

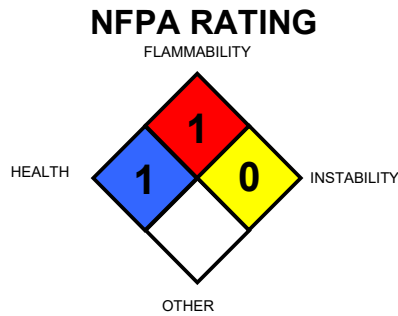
For Proprietary Cyano-Substituted Hydrocarbon: 524°C (975°F); For Proprietary Hydrocarbon Substituted Nitrogen: 550°C (1022°F)

FLAMMABLE LIMITS (in air by volume, %): Not applicable for product as a whole. For electrolyte solution components:

For Proprietary Cyano-Substituted Hydrocarbon: LEL: 3.0%, UEL: 16.0%; For Proprietary Hydrocarbon Substituted Nitrogen: LEL: 1.4%, UEL: 7.2%

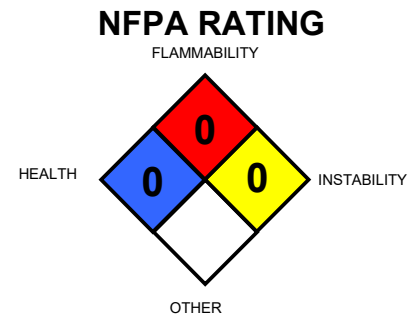
5. FIRE-FIGHTING MEASURES (Continued)

EXPOSURE TO PROPRIETARY CARBON



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

EXPOSURE TO PRODUCT AS MANUFACTURED



FIRE EXTINGUISHING MEDIA: Use fire extinguishing media appropriate for surrounding fire.

UNSUITABLE FIRE EXTINGUISHING MEDIA: None known.

SPECIAL HAZARDS ARISING FROM THE PRODUCT: This product is not flammable under normal operational and non-operational conditions; however, if this product is punctured or exposed to high temperatures, as may be encountered in a fire situation, the saturated Proprietary Carbon may ignite. Due to the small amount of electrolyte solution in each device and the presence of Proprietary Carbon, ultracapacitors contain little or no free-standing liquid and so are not anticipated to pose a significant fire hazard under normal conditions of storage, use and shipment. Sealed devices involved in a fire may rupture explosively if sufficiently heated for a long period of time. If involved in a fire, the chemicals contained in the case may decompose and produce toxic gases (e.g. ammonium oxides, nitrogen oxides, carbon oxides, hydrogen cyanide and fluoride and boron compounds).

Explosion Sensitivity to Mechanical Impact or Static Discharge: Not sensitive.

SPECIAL PROTECTIVE ACTIONS FOR FIRE-FIGHTERS: Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus (SCBA) and full protective equipment. Chemical resistant clothing may be necessary. Move containers from fire area if it can be done without risk to personnel. Water spray can be used to cool fire-exposed capacitors. Water fog or spray can also be used by trained firefighters to disperse this product's vapors and to protect personnel. If possible, prevent runoff water from entering storm drains, bodies of water, or other environmentally sensitive areas.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS: No special precautions are normally required. If use or misuse of the product results in a spill of the electrolyte solution, releases should be responded to by trained personnel using pre-planned procedures.

PERSONAL PROTECTIVE EQUIPMENT: Not normally needed. If liquid is present, wear appropriate protective equipment.

Small Spill: Pick-up spilled product using gloves and safety goggles if any liquid is present, absorb with appropriate non-reactive material.

Large Spill: If a large number of capacitors have been damaged and liquid is present, minimum Personal Protective Equipment should be rubber gloves, rubber boots, face shield, and Tyvek suit. Minimum level of personal protective equipment for releases in which the level of oxygen is less than 19.5% or is unknown must be **Level B: triple-gloves (rubber gloves and nitrile gloves over latex gloves), chemical resistant suit and boots, hard hat, and Self-Contained Breathing Apparatus.**

METHODS FOR CLEAN-UP AND CONTAINMENT: Due to the nature of this product, no special accidental release measures are normally required. If use or misuse of the product results in a spill of the electrolyte solution, releases should be responded to by trained personnel using pre-planned procedures. Eliminate all sources of ignition before cleanup begins. Absorb spilled electrolyte solution using appropriate non-reactive absorbent. Place spill residue in appropriate container and seal. Decontaminate spill area thoroughly, avoiding release of any material or decontamination liquids to the environment. Dispose of all spill residue under appropriate regulations. Call CHEMTREC (1-800-424-9300) for emergency assistance. Or if in Canada, call CANUTEC (613-996-6666).

ENVIRONMENTAL PRECAUTIONS: Avoid release to the environment. Run-off water may be contaminated by other materials and should be contained to prevent possible environmental damage.

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

7. HANDLING and USE

PRECAUTIONS FOR SAFE HANDLING: Employees must be trained to properly use this product. Keep away from heat, sparks, and other sources of ignition. Do not charge in unventilated areas. Do not eat, drink, smoke, or apply cosmetics while handling this product. Wash hands thoroughly after handling this product. Avoid contact with any liquid that has escaped the capacitor. Follow SPECIFIC USE INSTRUCTIONS supplied with product. Do not use organic solvents other than recommended chemical cleaners.

7. HANDLING and USE (Continued)

CONDITIONS FOR SAFE STORAGE: When stacking capacitors, place cardboard between layers of capacitors, to avoid damage and short circuiting. Store in a cool, dry, ventilated area away from combustible materials and away from material with which it is incompatible (see Section 10, Stability and Reactivity). Post warning and "NO SMOKING" signs in storage and use areas as appropriate. Have appropriate extinguishing equipment in the storage area (i.e., sprinkler system, portable fire extinguishers). Inspect all incoming packages before storage to ensure batteries are properly labeled and not damaged.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

EXPOSURE LIMITS/CONTROL PARAMETERS:

Occupational/Workplace Exposure Limits/Guidelines: This product is a solid article consisting of an opaque plastic and metal case with Proprietary Carbon saturated with an electrolyte solution. The following information is for the electrolyte solution and Proprietary Carbon. As manufactured, exposure to individual components is not expected. If this product is damaged or otherwise manipulated in such a way that will produce mists or fumes, exposure to these components is possible. Only compounds with existing exposure limits are listed.

CHEMICAL NAME	CAS #	EXPOSURE LIMITS IN AIR							
		ACGIH-TLVs		OSHA-PELs		NIOSH-RELS		NIOSH	OTHER
		TWA ppm	STEL ppm	TWA ppm	STEL ppm	TWA ppm	STEL ppm	IDLH ppm	ppm
Proprietary Cyano-Substituted Hydrocarbon	75-05-8	20 (skin)	Skin	40	60 (vacated 1989 PEL)	20	NE	500	DFG MAKs TWA = 10 (skin) PEAK = 2•MAK 15 min, average value, 1-hr interval, 4 per shift DFG MAK Pregnancy Risk Classification: C Carcinogen: EPA-CBD, EPA-D, TLV-A4

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

International Occupational Exposure Limits: In addition to the exposure limit values cited in this section, other exposure limits have been established by various countries for the components of this mixture. Limits can change and these limits may not be the most current. It is recommended that competent authorities in specific countries to determine if more current limits are in force.

Proprietary Cyano-Substituted Hydrocarbon

	<u>Limit Value - Eight Hours</u>	<u>Limit Value - Short Term</u>
Australia	40 ppm	60 ppm
Austria	40 ppm	160 ppm
Belgium	20 ppm (1)	
Canada (Ontario)	20 ppm	
Canada (Québec)	40 ppm	60 ppm
Denmark	40 ppm (1)	80 (1)(2)
European Union	40 ppm	
Finland	20 ppm	40 ppm (1)
France	40 ppm	
Germany (AGS)	10 ppm (1)	20 (1)(2)
Germany (DFG)	10 ppm (1)	20 (1)(2)
Hungary	70 mg/m ³	280 mg/m ³
Ireland	40 ppm	
Italy	20 ppm	
Latvia	40 ppm	
New Zealand	40 ppm	60 ppm
People's Republic of China	30 mg/m ³	
Poland	70 mg/m ³ (1)	140 mg/m ³ (1) (2)
Romania	40 ppm	
Singapore	40 ppm	60 ppm
South Korea	20 ppm	
Spain	40 ppm (1)	
Sweden	30 ppm	60 ppm (1)
Switzerland	20 ppm	40 ppm
The Netherlands	34 mg/m ³	
Turkey	40 ppm	
United Kingdom	40 ppm	60 ppm
	<u>Remarks</u>	
Belgium	(1) Additional indication "D" means that the absorption of the agent through the skin, mucous membranes or eyes is an important part of the total exposure. It can be the result of both direct contact and its presence in the air.	
Denmark	(1) Skin (2) 15 minutes average value	
European Union	Bold-type: Indicative Occupational Exposure Limit Value (IOELV)	
France	Italic type: Indicative statutory limit values	
Germany (ASG)	(1) Skin (2) 15 minutes average value	
Germany (DFG)	(1) Skin (2) 15 minutes average value	
Italy	Skin	
Poland	(1) Skin (2) 15 minutes average value	
Spain	(1) Skin	
Sweden	(1) 15 minutes average value	

Proprietary Hydrocarbon Substituted Nitrogen

	<u>Limit Value - Eight Hours</u>	<u>Limit Value - Short Term</u>
Latvia	1 mg/m ³	

Ventilation and Engineering Controls: Normal room ventilation should be sufficient during normal use and handling.

ACGIH Biological Exposure Indices (BEIs): Currently, there are no ACGIH Biological Exposure Indices (BEIs) determined for the components of the electrolyte solution.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

PERSONAL PROTECTIVE EQUIPMENT: The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132), equivalent standards of Canada (including CSA Standard Z94.4-02 and CSA Standard Z94.3-07), standards of EU member states (including EN 529:2005 for respiratory PPE, CEN/TR 15419:2006 for hand/body protection, and CR 13464:1999 for face/eye protection), standards of Australia (including AS/NZS 1715:1994 for respiratory PPE, AS/NZS 4501.2:2006 for protective clothing, AS/NZS 2161.1:2000 for glove selection, and AS/NZS 1336:1997 for eye protection), or standards of Japan (including JIS T 8116:2005 for glove selection, JIS T 8150:2006 for respiratory PPE, JIS T 8147:2003 for eye protectors, and JIS T 8030:2005 for protective clothing), U.S. OSHA 29 CFR 1910.136, Canadian CSA Standard Z195.1-02, *Guideline on Selection, Care, and Use of Protective Footwear*, or European Standard CEN ISO/TR 18690:2006.. Please reference applicable regulations and standards for relevant details.

Respiratory Protection: Respiratory protection is not generally needed when using this product. If fumes from this product are created during use, use appropriate respiratory protection. If necessary, use only respiratory protection authorized in per appropriate country standards. 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).

Eye Protection: Depending on the use of this product, safety glasses may be worn. Use goggles or safety glasses for spill response, as stated in Section 6 (Accidental Release Measures) of this SDS. If necessary, refer to appropriate country standards.

Hand Protection: Wear leather or other protective gloves while handling capacitors. Use triple gloves for spill response. The Propylene Carbonate component of the electrolyte solution can react with nitrile Buna N, Hypalon (chloro-sulfonyl-polyethylene) and Viton A. It does not attack Teflon, ethylene-propylene, neoprene, natural rubber, and polyethylene. Gloves made of these materials should not be worn if possible, contact with the electrolyte solution can occur. If necessary, refer to appropriate country standards.

Body Protection: Use body protection appropriate for task (e.g., lab coat, coveralls, Tyvek suit). If necessary, refer to appropriate country standards. 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 applicable regulations.

9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for the product:

APPEARANCE, ODOR, AND COLOR: This product a solid article consisting of an opaque plastic and metal, sealed case, which is filled with Proprietary Carbon saturated with an electrolyte solution with a sweet, solvent odor.

HOW TO DETECT THIS SUBSTANCE (warning properties in event of accidental release): In event of a leak of the electrolyte solution from the capacitor, the odor may assist in identification of the solution.

The following information is for Proprietary Carbon:

FORM: Solid

BOILING POINT: Sublimes at 3642°C.

FREEZING/MELTING POINT: Not available.

EVAPORATION RATE (n-butyl acetate = 1): Not applicable.

SOLUBILITY IN WATER: Insoluble.

VAPOR PRESSURE @ 3642°C: 1 mmHg

SPECIFIC GRAVITY: 1.8-3.53

pH: Not applicable.

VAPOR DENSITY (air = 1): Not applicable.

ODOR THRESHOLD: Not applicable.

PERCENT VOLATILES: Not applicable

COEFFICIENT WATER/OIL DISTRIBUTION: Not available.

10. STABILITY and REACTIVITY

CHEMICAL STABILITY: Stable under condition of normal temperature.

DECOMPOSITION PRODUCTS:

Combustion: Products of thermal decomposition can include toxic gases (e.g. ammonium oxides, nitrogen oxides, carbon oxides, hydrogen cyanide and fluoride and boron compounds).

Hydrolysis: Acetic acid and ammonia are formed very slowly on reaction Proprietary Cyano-Substituted Hydrocarbon with water, but not in hazardous amounts.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Electrolyte Solution: Strong reducing agents, strong oxidizers, strong acids, diphenyl sulfoxide, trichlorosilane, n-fluoro compounds, nitrating agents.

POSSIBILITY OF HAZARDOUS REACTIONS/POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Avoid exposure to or contact with sparks, flames, or other sources of ignition, extreme temperatures, and incompatible chemicals.

11. TOXICOLOGICAL INFORMATION



SYMPTOMS OF EXPOSURE BY ROUTE OF EXPOSURE: There is no health hazard anticipated to occur during routine use of this product. In the unlikely event that the metal can ruptures and the electrolyte solution is released there are potential health hazards associated with this solution that may impact persons in the immediate area of the release. The most significant routes of exposure in case of such a release are by inhalation and skin and eye contact and are described as follows:

Inhalation: Under normal conditions of use and handling, no inhalation hazard is present. Misuse of this product, such as deliberate destruction or heating, may release toxic vapors and create an inhalation hazard in the immediate vicinity. Breathing fumes from the electrolyte solution may cause irritation of the respiratory system. Symptoms may include difficulty breathing, coughing and sneezing. Though not likely to occur, severe inhalation exposure may cause weakness, shortness of breath, nausea, vomiting and other health effects, due to the presence of Proprietary Cyano-Substituted Hydrocarbon and excessive sweating, thirst, fever, anxiety, hyperventilation and high heart rate, due to the presence of Proprietary Hydrocarbon Substituted Nitrogen.



Contact with Eyes: Under normal conditions of use and handling, this product does not pose a hazard to the eyes. Eye contact with vapors or fumes of the electrolyte solution mild to moderate irritation may occur, including tearing, as the Proprietary Cyano-Substituted Hydrocarbon component is a lachrymator. Direct contact with the liquid can cause stinging, tearing and redness.

11. TOXICOLOGICAL INFORMATION (Continued)

EXPOSURE TO PROPRIETARY CARBON

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			

EXPOSURE TO PRODUCT AS MANUFACTURED

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

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

SYMPTOMS OF EXPOSURE BY ROUTE OF EXPOSURE (continued):

Contact with Skin: Under normal conditions of use and handling, this product does not pose a hazard to the skin. Skin contact with the electrolyte solution may be irritating, especially after prolonged exposure. Repeated skin contact may lead to dermatitis. Symptoms should be alleviated when exposure ends.

Skin Absorption: Not a likely route of exposure under normal use and handling. The Proprietary Cyano-Substituted Hydrocarbon component of the electrolyte solution can be absorbed via intact skin. If a large area of the skin is involved, symptoms may occur as described under 'Inhalation' and 'Contact with Skin and Eyes'. The Proprietary Hydrocarbon Substituted Nitrogen component can also be absorbed via intact skin. If a large area of skin is involved, cyanide toxicity may occur.

Ingestion: Ingestion is not a likely route of exposure for this product.

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

OTHER HEALTH EFFECTS: If this product has been charged, it poses a risk of shock. Normally, Ultracapacitors are stored in an uncharged state (large ultracapacitors are short-circuited during storage). When in operation, they carry a charge. Individual cells are rated at 2.5V maximum when operational. The voltage of any device is a function of the number of discrete cells connected in a series; cells connected in series may have higher voltage, which will be labeled on the device. Precautions should be taken to avoid electric shock and unintended discharge where ultracapacitors are in a charged state. In extreme cases of electric shock, burns can occur and there is a risk that the heart or breathing can stop.

DELAYED and IMMEDIATE EFFECTS and CHRONIC EFFECTS FROM SHORT-TERM and LONG-TERM EXPOSURE: Exposure to chemicals contained in this capacitor (due to deliberate destruction, heating or other misuse) may cause the following health effects:

Acute: Fumes from chemicals in the electrolyte solution may cause irritation by all routes of exposure. If charged, contact with this product may result in electric shock and possible cessation of respiration and the heart.

Chronic: Repeated skin contact with the saturated Proprietary Carbon may cause dermatitis.

TARGET ORGANS:

Acute: Respiratory system, skin, eyes (from fumes from the electrolyte solution).

Chronic: Skin (from contact with the saturated Proprietary Carbon).

TOXICITY DATA: As an article, this product does not present a health hazard by inhalation, ingestion, or skin contact. As an article, this product does not present a health hazard by inhalation, ingestion, or skin contact. The following data are for components of the electrolyte solution and Proprietary Carbon and are presented for additional information should exposure to these materials occur due to misuse or abuse of the product. Only human data and LD₅₀ Oral-Rat, Oral-Mouse, LC₅₀ Inhalation-Rat and Inhalation-Mouse and Skin testing data are provided for the Proprietary Cyano-Substituted Hydrocarbon component due to the large amount of data available. Additional data are available but are not presented in this SDS.

PROPRIETARY CYANO-SUBSTITUTED HYDROCARBON:

Open irritation test (Skin-Rabbit) 10 mg/24 hours

Open irritation test (Skin-Rabbit) 500 mg: Mild

Open irritation test (Eye-Rabbit) 20 mg: Severe

TDLo (Oral-Child) 800 mg/kg: Behavioral: hallucinations, distorted, convulsions or effect on seizure threshold; Gastrointestinal: nausea or vomiting

TDLo (Oral-Man) 571 mg/kg: Behavioral: convulsions or effect on seizure threshold; Gastrointestinal: nausea or vomiting; Nutritional and Gross Metabolic: metabolic acidosis

TDLo (Oral-Man) 64 mg/kg: Behavioral: excitement

LD₅₀ (Oral-Rat) 2460 mg/kg

11. TOXICOLOGICAL INFORMATION (Continued)

TOXICITY DATA (continued):

PROPRIETARY CYANO-SUBSTITUTED HYDROCARBON (continued):

LD₅₀ (Oral-Mouse) 269 mg/kg
LD₅₀ (Skin-Rabbit) 1250 µL/kg
LC₅₀ (Inhalation-Rat) 7551 ppm/8 hours: Behavioral: altered sleep time (including change in righting reflex), convulsions or effect on seizure threshold; Blood: hemorrhage
LC₅₀ (Inhalation-Mouse) 2693 ppm/1 hour: Liver: other changes
PROPRIETARY CARBON:
LD (Oral-Rat) > 5 gm/kg
LD (Oral-Mouse) > 5 gm/kg

PROPRIETARY HYDROCARBON SUBSTITUTED NITROGEN:

Standard Draize Test (Skin-Rabbit) 500 mg/24 hours: Moderate
LD₅₀ (Oral-Mouse) 971 mg/kg
LD₅₀ (Skin-Rabbit) 1250 mg/kg
LD₅₀ (Skin-Rat) 1200 mg/kg
Sex Chromosome Loss and Non-Disjunction (Inhalation-*Drosophila melanogaster*) 168 ppm
Sex Chromosome Loss and Non-Disjunction (Yeast-*Saccharomyces cerevisiae*) 1580 mg/L
Micronucleus Test (Hamster Ovary) 0.01 µmol/L /18 hours
Micronucleus Test (Hamster Fibroblast) 0.1 µmol/L

IRRITANCY OF PRODUCT: Misuse of this product, such as deliberate destruction, heating or overcharging, may toxic fumes which may irritate contaminated tissues.

SENSITIZATION OF PRODUCT: Contact with this product does not pose a hazard of sensitization.

CARCINOGENIC POTENTIAL OF COMPONENTS: The components of the electrolyte solution are listed by agencies tracking the carcinogenic potential of chemical compounds as follows:

PROPRIETARY CYANO-SUBSTITUTED HYDROCARBON: ACGIH-TLV-A4 (Not Classifiable as a Human Carcinogen); EPA-D (Not Classifiable as to Human Carcinogenicity); EPA-CBD (Cannot Be Determined)

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects the electrolyte solution and its components on human and animal reproductive systems.

Mutagenicity: Components of the electrolyte solution are not reported to cause human mutagenic effects. It is not possible to conclude that the Proprietary Cyano-Substituted Hydrocarbon component is mutagenic, based on the available information. Both weak positive and negative results have been obtained for in vivo micronucleus tests in mice. In vitro tests using mammalian cells have given both negative and positive results and negative results have been obtained for point mutations in yeast and bacteria. Positive results have been obtained for aneuploidy in yeast and *Drosophila* (fruit flies).

Embryotoxicity/Teratogenicity/Reproductive Toxicity: Components of the electrolyte solution are not reported to cause human embryotoxic, teratogenic or reproductive toxicity effects.

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

ENVIRONMENTAL STABILITY: This product is not expected to decompose in the environment. The following environmental data are available for components of the electrolyte solution.

MOBILITY: This product has not been tested for mobility in soil. The following information is available for the Proprietary Cyano-Substituted Hydrocarbon and Proprietary Hydrocarbon Substituted Nitrogen components of the electrolyte solution.

PROPRIETARY CYANO-SUBSTITUTED HYDROCARBON: The Koc of this material is 120. According to a classification scheme, this estimated Koc value suggests that this compound is expected to have high mobility in soil.

PROPRIETARY CYANO-SUBSTITUTED HYDROCARBON: The Koc of this compound is estimated as 168, using a measured log Kow of 1.56 and a regression-derived equation. According to a classification scheme, this estimated Koc value suggests that this material is expected to have moderate mobility in soil.

PERSISTENCE AND BIODEGRADABILITY: The metal and plastic case of this product will persist in the environment for extended periods of time. The following information is available for the Proprietary Cyano-Substituted Hydrocarbon and Proprietary Hydrocarbon Substituted Nitrogen components of the electrolyte solution.

PROPRIETARY CYANO-SUBSTITUTED HYDROCARBON: If released to air, a vapor pressure of 88.8 mm Hg at 25°C indicates this compound will exist solely as a vapor in the ambient atmosphere. Vapor-phase material will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 620 days. This material is not expected to be susceptible to direct photolysis by sunlight as it absorbs light only in the far UV region. If released to soil, Proprietary Cyano-Substituted Hydrocarbon is expected to have high mobility based upon a Koc of 120. Volatilization from moist soil surfaces is expected to be an important fate process based upon a Henry's Law constant of 3.45X10⁻⁵ atm-cu m/mole. This material may volatilize from dry soil surfaces based upon its vapor pressure of 88.8 mm Hg. Biodegradation studies of This compound with mixed cultures of microorganisms from activated sludge and sewage show that degradation proceeds slowly without acclimatization of microorganisms. If released into water, the material is not expected to adsorb to suspended solids and sediment based upon its Koc value. Volatilization from water surfaces is expected to be an important fate process based upon this compound's Henry's Law constant. Estimated volatilization half-lives for a model river and model lake are 18 hours and 7 days, respectively. The biodegradability of this material was also observed with river water; the 12-day ThOD (theoretical oxygen demand) with river water was 40%. An estimated BCF suggests that the potential for bioconcentration in aquatic organisms is low. Hydrolysis is not expected to be an important environmental fate process since this compound lacks functional groups that hydrolyze under environmental conditions.

PROPRIETARY CYANO-SUBSTITUTED HYDROCARBON: If released to soil, this compound is expected to have moderate mobility based upon an estimated Koc of 168. Volatilization from moist soil surfaces is expected to be an important fate process based upon an estimated Henry's Law constant of 5.21X10⁻⁵ atm-cu m/mole. If released into water, this material is expected to adsorb to suspended solids and sediment based upon the estimated Koc. A screening test using Ohio River water from Cincinnati had theoretical BODs for t of 0, 60, and 90% after 2, 5, and 12 days, respectively, which suggests that this material is biodegradable. Volatilization from water surfaces is expected to be an important fate process based upon this compound's estimated Henry's Law constant. Estimated volatilization half-lives for a model river and model lake are 12 hours and 9 days, respectively. Chemical hydrolysis is expected to occur slowly under environmental conditions.

BIO-ACCUMULATION POTENTIAL: The metal and plastic materials that make up the case of this product will not bioaccumulate. The following information is available for the Proprietary Cyano-Substituted Hydrocarbon and Proprietary Hydrocarbon Substituted Nitrogen components of the electrolyte solution.

PROPRIETARY CYANO-SUBSTITUTED HYDROCARBON: An estimated BCF of 3 was calculated for Proprietary Cyano-Substituted Hydrocarbon, using a log Kow of -0.34 and a regression-derived equation. According to a classification scheme, this BCF suggests the potential for bioconcentration in aquatic organisms is low.

PROPRIETARY CYANO-SUBSTITUTED HYDROCARBON: An estimated BCF of 3 was calculated for Proprietary Hydrocarbon Substituted Nitrogen, using a log Kow of 1.56 and a regression-derived equation. According to a classification scheme, this BCF suggests the potential for bioconcentration in aquatic organisms is low.

AQUATIC TOXICITY: If release of the electrolyte solution occurs to an aquatic environment, damage to aquatic plants and animals may occur. The following are aquatic toxicity data available for the Proprietary Cyano-Substituted Hydrocarbon and Proprietary Hydrocarbon Substituted Nitrogen components of the electrolyte solution. Only select data are provided; contact loxus for information on additional data.

PROPRIETARY CYANO-SUBSTITUTED HYDROCARBON:
EC₅₀ (*Pimephales promelas* fathead minnow) 96 hours = 1640 mg/L exponential growth phase)
48 hours = 7943 mg/L
LC₅₀ (*Pimephales promelas* fathead minnow) 96 hours = 1640 mg/L

PROPRIETARY HYDROCARBON SUBSTITUTED NITROGEN:
TLm (Fathead minnow) 96 hours = 78-135 mg/L
TLm (Bluegill) 96 hours = 78 mg/L (soft water)
TLm (Guppy) 96 hours = 400 mg/L (soft water)

OTHER ADVERSE EFFECTS: This product does not contain any component with known ozone depletion potential.

RESULTS OF PBT and vPvB ASSESSMENT: No data available. PBT and vPvB assessments are part of the chemical safety report required for some substances in European Union Regulation (EC) 1907/2006, Article 14.

ENVIRONMENTAL EXPOSURE CONTROLS: Controls should be engineered to prevent release to the environment, including procedures to prevent spills, atmospheric release and release to waterways.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Ultracapacitors contain an organic electrolyte, which is regulated as a Characteristic/ Ignitable Liquid under USEPA RCRA standards. It is recommended that ultracapacitor users contact the local hazardous waste regulatory authority for guidance on proper recycling or disposal procedures. Under no cases should the ultracapacitor be disposed of in fire. Prior to recycling or disposal, the ultracapacitor should be electrically discharged and securely shorted. A copy of the SDS should be provided to the recycler or disposer during the planning process. Regulations exist in most countries that restrict the disposal of electronic and capacitor waste; all applicable local regulations should be followed.

DISPOSAL METHODS: Ultracapacitors are neither specifically listed nor exempted from government hazardous waste regulations. The only material of possible concern is the organic solvent, which when discarded or disposed of, is a hazardous waste according to Federal regulations (40 CFR 261). It is listed as Hazardous Waste Number U003, so listed due to its toxicity and ignitability. Disposal can occur only in properly permitted facilities. Check state and local regulations for any additional requirements, as these may be more restrictive than federal laws and regulations. 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. Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Check with the competent authority in your area for specific guidance and advice on local capacitor collectors and recyclers. Shipment of wastes must be done with appropriately permitted and registered transporters.

DISPOSAL CONTAINERS: Waste materials must be placed in and shipped in appropriate 5-gallon or 55-gallon poly or metal waste pails or drums. Permeable cardboard containers are not appropriate and should not be used. Ensure that any required marking or labeling of the containers be done to all applicable regulations.

PRECAUTIONS TO BE FOLLOWED DURING WASTE HANDLING: Wear proper protective equipment when handling waste materials.

U.S. EPA WASTE NUMBER: Wastes of this product should be tested to see if they meet D001 (Waste Characteristic/Ignitability).

EUROPEAN WASTE CODES: 16 02: Wastes from Electrical and Electronic Equipment: 16 02 13: Discarded Equipment Containing Hazardous Components Other Than Those Mentioned in 16 02 09 to 16 02 12.

14. TRANSPORTATION INFORMATION

Per United Nations material classification UN 3499, all loxus ultracapacitors have less than 10 Wh capacity and meet the requirements of Special Provisions 361. Both individual ultracapacitors and modules composed of those ultracapacitors shipped by loxus can be transported without being treated as dangerous goods (hazardous materials) under ALL transportation regulations. If criteria of this provision/exception are met, the following shipping information is applicable.

U.S. DEPARTMENT OF TRANSPORTATION: This material is not classified as dangerous goods, per U.S. DOT regulations, under 49 CFR 172.101, per UN Special Provision 361.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This product is NOT classified as Dangerous Goods, per regulations of Transport Canada, per UN Special Provision 361.

INTERNATIONAL MARITIME ORGANIZATION (IMO) DESIGNATION: This product is NOT classified as Dangerous Goods by the International Maritime Organization, per UN exception 361.

AUSTRALIAN FEDERAL OFFICE OF ROAD SAFETY CODE FOR THE TRANSPORTATION OF DANGEROUS GOODS BY ROAD OR RAIL: This product is NOT classified as dangerous goods, per regulations of the Australian Federal Office of Road Safety, per UN exception 361.

INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA): This product is NOT currently classified as dangerous goods under rules of IATA, per UN exception 361.

EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR): This product is NOT classified by the United Nations Economic Commission for Europe to be dangerous goods, per UN exception 361.

If the product does not meet the requirements of Special Provision 361, the following shipping classification applies.

UN No.:	3499
Name and Description:	Capacitor, electric double layer (with an energy storage capacity greater than 0.3 Wh)
Class:	9
Classification Code:	M11
Packing Group:	None
Labels:	9
Danger Number:	
Transport Category:	4
Transport Category Tunnel Restriction Code:	(E)
Special Provisions:	361
Limited Quantities:	0
Excepted Quantities:	E0
Packing Instructions:	P003
Special Packing Instructions:	None
Mixed Packing Provisions:	MP24
Portable Tanks and Bulk Containers Instructions:	None
Portable Tanks and Bulk Containers Special Instructions:	None

14. TRANSPORTATION INFORMATION (Continued)

If the product does not meet the requirements of Special Provision 361, the following shipping classification applies.

<u>Tank Codes for ADR Tanks:</u>	None
<u>Special Provisions for ADR Tanks:</u>	None
<u>Vehicle for Tank Carriage:</u>	None
<u>Special Provisions for Carriage: Packages:</u>	None
<u>Special Provisions for Carriage: Bulk:</u>	None
<u>Special Provisions for Carriage: Loading and Unloading:</u>	None
<u>Special Provisions for Carriage: Operations:</u>	None

Additional Classification Under Australian Federal Office of Road Safety Code for the Transportation of Dangerous Goods By Road or Rail:

Hazchem Emergency Action Code :1 (z)

Hazard Identification Number (HIN): No HIN issued under RID and ADR in Australia.

TRANSPORT IN BULK ACCORDING TO THE IBC CODE: Not applicable.

ENVIRONMENTAL HAZARDS: This product does not meet the criteria of environmentally hazardous according to the criteria of the UN Model Regulations (as reflected in the IMDG Code, ADR, RID, and ADN).

15. REGULATORY INFORMATION

ADDITIONAL UNITED STATES REGULATIONS:

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

CHEMICAL NAME	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Proprietary Cyano-Substituted Hydrocarbon	No	No	Yes

U.S. SARA Threshold Planning Quantity (TPQ): There are no specific Threshold Planning Quantities for the components of this product.

The default Federal SDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

U.S. SARA Hazard Categories (Section 311/312, 40 CFR 370-21):

For Product as Manufactured: ACUTE: No; CHRONIC: No; FIRE: No; REACTIVE: No; SUDDEN RELEASE: No;

For Electrolyte Solution: ACUTE: Yes; CHRONIC: No; FIRE: Yes; REACTIVE: No; SUDDEN RELEASE: No

U.S. CERCLA Reportable Quantity (RQ): Proprietary Cyano-Substituted Hydrocarbon = 5000 lb (2270 kg); Proprietary Hydrocarbon Substituted Nitrogen = 5000 lb (2270 kg)

U.S. TSCA Inventory Status: This is an article and is not subject to the requirements of TSCA.

Other U.S. Federal Regulations: This product meets the definition of an "Article" under the U.S. Federal OSHA Hazard Communication Standard (29 CFR 1910.1200). For further information, the definition of "Article" is provided below.

Article means a manufactured item other than a fluid or particle: (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities, e.g., minute or trace amounts of a hazardous chemical, and does not pose a physical hazard or health risk to employees.

Components have requirements under the following U.S. Federal regulations.

PROPRIETARY CYANO-SUBSTITUTED HYDROCARBON:

CLEAN AIR ACT: Listed as a Hazardous Air Pollutant (HAP) generally known or suspected to cause serious health problems. The Clean Air Act, as amended in 1990, directs EPA to set standards requiring major sources to sharply reduce routine emissions of toxic pollutants. EPA is required to establish and phase in specific performance-based standards for all air emission sources that emit one or more of the listed pollutants. Proprietary Cyano-Substituted Hydrocarbon is included on this list.

CLEAN WATER ACT REQUIREMENTS: Proprietary Cyano-Substituted Hydrocarbon is designated as a Toxic Pollutant pursuant to section 307(a)(1) of the Federal Water Pollution Control Act and is subject to effluent limitations.

CERCLA: Persons in charge of vessels or facilities are required to notify the National Response Center (NRC) immediately, when there is a release of this designated hazardous substance, in an amount equal to or greater than its reportable quantity of 5000 lb or 2270 kg. The toll-free number of the NRC is (800) 424-8802. The rule for determining when notification is required is stated in 40 CFR 302.4 (section IV. D.3.b).

PROPRIETARY HYDROCARBON SUBSTITUTED NITROGEN:

CLEAN WATER ACT REQUIREMENTS: Proprietary Hydrocarbon Substituted Nitrogen is designated as a hazardous substance under section 311(b)(2)(A) of the Federal Water Pollution Control Act and further regulated by the Clean Water Act Amendments of 1977 and 1978. These regulations apply to discharges of this substance. This designation includes any isomers and hydrates, as well as any solutions and mixtures containing this substance.

CERCLA: Persons in charge of vessels or facilities are required to notify the National Response Center (NRC) immediately, when there is a release of this designated hazardous substance, in an amount equal to or greater than its reportable quantity of 5000 lb or 2270 kg. The toll-free number of the NRC is (800) 424-8802. The rule for determining when notification is required is stated in 40 CFR 302.4 (section IV. D.3.b).

California Safe Drinking Water and Toxic Enforcement Act (Proposition 65): No component of this product is on the California Proposition 65 Lists.

ADDITIONAL CANADIAN REGULATIONS:

Canadian DSL Inventory: This is a manufactured item and is not subject to the DSL requirements under CEPA.

Other Canadian Regulations: This product meets the definition of an article under WHMIS Regulations (Hazardous Products Act, 6 & 7, Part II (Sections 11 and 12).

Canadian Environmental Protection Agency (CEPA) Priorities Substances Lists: No component of this product is listed on the Priorities Substances Lists.

Canadian WHMIS Classification and Symbols: Not applicable for articles.

ADDITIONAL EUROPEAN REGULATIONS:

Safety, Health, and Environmental Regulations/Legislation Specific for the Product: Requirements under the Waste Electrical and Electronic Equipment Directive (WEEE Directive), Directive 2002/96/EC, on Waste Electrical And Electronic (WEEE) which, together with the RoHS Directive 2002/95/EC may be applicable for wastes of this product.

Chemical Safety Assessment: No data available. The chemical safety assessment is required for some substances according to European Union Regulation (EC) 1907/2006, Article 14.

15. REGULATORY INFORMATION (Continued)

ADDITIONAL AUSTRALIAN REGULATIONS:

Australian Inventory Of Chemical Substances (AICS) Status: The components of this product are listed on the AICS.

Hazardous Substances Information System (HSIS): No component of this product is listed in the HSIS.

Standard for the Uniform Scheduling of Drugs and Poisons: Not applicable.

Labeling and Classification: This product does not meet the definition of any hazard class, based a review of the regulation [NOHSC: 10005 (1994)].

ADDITIONAL JAPANESE REGULATIONS:

Japanese Existing and New Chemical Substance List (ENCS) Status: As an article, this product is not subject to the requirements of the Japanese ENCS Inventory.

Japanese Minister of International Trade and Industry (MITI) Status: Not applicable.

Japanese Poisonous and Deleterious Substances Control Law: Not applicable.

ADDITIONAL KOREAN REGULATIONS:

Korean Existing Chemicals List (ECL) Status: As an article, this product is not subject to the requirements of the Korean ECL Inventory.

16. OTHER INFORMATION

GLOBAL HARMONIZATION, EU CLP REGULATION (EC) 1272/2008, AUSTRALIAN NATIONAL OCCUPATION HEALTH and SAFETY COMMISSION, JAPANESE INDUSTRIAL STANDARD, NEW ZEALAND HAZARDOUS SUBSTANCE CLASSIFICATIONS STANDARD HSNO COP, LABELING AND CLASSIFICATION, OR KOREAN ISHA LABELING AND CLASSIFICATION: This product is an article and is not required to be classified under above regulations. No classification, hazard statements, precautionary statements or hazard pictograms are required.

COMPONENT FULL TEXT

FOR GLOBAL HARMONIZATION:

Proprietary Cyano-Substituted Hydrocarbon: This is a Harmonized classification.

Classification: Flammable Liquid Category 2, Acute Oral Toxicity Category 4, Acute Dermal Category 4, Acute Inhalation Toxicity Category 4, Eye Irritation Category 2

Hazard Statements: H225: Highly flammable liquid and vapor. H302 + H312 + H332: Harmful if swallowed, in contact with skin or if inhaled. H319: Causes serious eye irritation.

Activated Charcoal: This is a Notified classification.

Classification: Specific Target Organ Toxicity (Inhalation-Lungs) Repeated Exposure Category 2

Hazard Statements: H373: May cause damage to the lungs through prolonged or repeated exposure by inhalation.

Proprietary Hydrocarbon Substituted Nitrogen: This is a Harmonized classification.

Classification: Acute Oral Toxicity Category 4, Acute Dermal Category 4

Hazard Statements: H302 + H312: Harmful if swallowed or in contact with skin.

Additional Self-Classification:

Classification: Combustible Liquid Category 4, Acute Inhalation Toxicity Category 4, Skin Irritation Category 2

Hazard Statements: H227: Combustible flammable liquid and vapor. H332: Harmful if swallowed if inhaled. H315: Causes skin irritation.

Proprietary Quaternary Ammonium Tetrafluoroborate: This is a self-classification.

Classification: Eye Irritation Category 2A

Hazard Statements: H319: Causes serious eye irritation.

FOR NEW ZEALAND HSNO COP: The following are classifications under HSNO for components in pure form. These classifications do not apply to the product.

Proprietary Cyano-Substituted Hydrocarbon:

3.1B Flammable Liquids: High Hazard

6.1B (Oral): Acutely Toxic

6.1C (Dermal): Acutely Toxic

6.1C (Inhalation): Acutely Toxic

6.4A: Irritating to the eye.

9.2D: Slightly Harmful in the soil environment.

9.3A: Very ecotoxic to terrestrial vertebrates.

Proprietary Carbon:

42C: Spontaneously Combustible Substances: self-heating substances: low hazard

Proprietary Hydrocarbon Substituted Nitrogen:

6.1D (Oral): Acutely Toxic

6.1D (Dermal): Acutely Toxic

9.3C: Harmful to terrestrial vertebrates.

Proprietary Quaternary Ammonium Tetrafluoroborate:

6.1E (Inhalation): Acutely toxic.

6.3A: Irritating to the skin.

8.3A: Corrosive to ocular tissue.

DATE OF PREPARATION: March 19, 2015

REVISION DETAILS: May 2020: Review and up-date of entire SDS for current GHS compliance and other regulations.

REFERENCES AND DATA SOURCES: Contact the supplier for information.

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

PREPARED BY: CHEMICAL SAFETY ASSOCIATES, Inc. • PO Box 1961, Hilo, HI 96721 • 800/441-3365 • 808/969-4846

DATE OF PRINTING: May 26, 2020

16. OTHER INFORMATION (Continued)

DEFINITIONS OF TERMS

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

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

EXPOSURE LIMITS IN AIR:

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

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

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

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

LOQ: Limit of Quantitation.

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

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

NIC: Notice of Intended Change.

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

NIOSH RELs: NIOSH's Recommended Exposure Limits.

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

SKIN: Used when 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. *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).

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

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

DEFINITIONS OF TERMS (Continued)

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS:

HEALTH HAZARD: 0 (materials that, under emergency conditions, would offer no hazard beyond that of ordinary combustible materials): Gases and vapors whose LC₅₀ for acute inhalation toxicity is greater than 10,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is greater than 200 mg/L. Materials whose LD₅₀ for acute dermal toxicity is greater than 2000 mg/kg. Materials whose LD₅₀ for acute oral toxicity is greater than 2000 mg/kg. Materials that are essentially non-irritating to the respiratory tract, eyes and skin. 1 (materials that, under emergency conditions, can cause significant irritation): Gases and vapors whose LC₅₀ for acute inhalation toxicity is greater than 5,000 ppm but less than or equal to 10,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is greater than 10 mg/L but less than or equal to 200 mg/L. Materials whose LD₅₀ for acute dermal toxicity is greater than 1000 mg/kg but less than or equal to 2000 mg/kg. Materials whose LD₅₀ for acute oral toxicity is greater than 500 mg/kg but less than or equal to 2000 mg/kg. Materials that cause slight to moderate irritation to the respiratory tract, eyes and skin. 2 (materials that, under emergency conditions, can cause temporary incapacitation or residual injury): Gases and vapors whose LC₅₀ for acute inhalation toxicity is greater than 3,000 ppm but less than or equal to 5,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is greater than 2 mg/L but less than or equal to 10 mg/L. Materials whose LD₅₀ for acute dermal toxicity is greater than 200 mg/kg but less than or equal to 1000 mg/kg. Materials whose LD₅₀ for acute oral toxicity is greater than 50 mg/kg but less than or equal to 500 mg/kg. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than one-fifth its LC₅₀ for acute inhalation toxicity, if its LC₅₀ is less than or equal to 5000 ppm and that does not meet the criteria for either degree of hazard 3 or degree of hazard 4. Compressed liquefied gases with boiling points between -30°C (-22°F) and -55°C (-66.5°F) that cause severe tissue damage, depending on duration of exposure. Materials that are respiratory irritants. Materials that cause severe, but reversible irritation to the eyes or are lachrymators. Materials that are primary skin irritants or sensitizers. 3 (materials that, under emergency conditions, can cause serious or permanent injury): Gases and vapors whose LC₅₀ for acute inhalation toxicity is greater than 1,000 ppm but less than or equal to 3,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is greater than 0.5 mg/L but less than or equal to 2 mg/L. Materials whose LD₅₀ for acute dermal toxicity is greater than 40 mg/kg but less than or equal to 200 mg/kg. Materials whose LD₅₀ for acute oral toxicity is greater than 5 mg/kg but less than or equal to 50 mg/kg. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than one-fifth its LC₅₀ for acute inhalation toxicity, if its LC₅₀ is less than or equal to 3000 ppm and that does not meet the criteria for degree of hazard 4. Compressed liquefied gases with boiling points between -30°C (-22°F) and -55°C (-66.5°F) that cause frostbite and irreversible tissue damage. Materials that are respiratory irritants. Cryogenic gases that cause frostbite and irreversible tissue damage. Materials that are corrosive to the respiratory tract. Materials that are corrosive to the eyes or cause irreversible corneal opacity. Materials that are corrosive to the skin. 4 (materials that, under emergency conditions, can be lethal): Gases and vapors whose LC₅₀ for acute inhalation toxicity less than or equal to 1,000 ppm. Dusts and mists whose LC₅₀ for acute inhalation toxicity is less than or equal to 0.5 mg/L. Materials whose LD₅₀ for acute dermal toxicity is less than or equal to 40 mg/kg. Materials whose LD₅₀ for acute oral toxicity is less than or equal to 5 mg/kg. Any liquid whose saturated vapor concentration at 20°C (68°F) is equal to or greater than one-fifth its LC₅₀ for acute inhalation toxicity, if its LC₅₀ is less than or equal to 1000 ppm.

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-cup flash point of the solvent. Most ordinary combustible materials. 2 Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not under normal conditions form hazardous atmospheres with air, but under high ambient temperatures or under moderate heating could release vapor in sufficient quantities to produce hazardous atmospheres with air: Liquids having a flash point at or above 37.8°C (100°F) and below 93.4°C (200°F) (i.e. Class II and Class IIIA liquids.) Solid materials in the form of powders or coarse dusts of representative diameter between 420 microns (40 mesh) and 2 mm (10 mesh) that burn rapidly but that generally do not form explosive mixtures in air. Solid materials in fibrous or shredded form that burn rapidly and create flash fire hazards, such as cotton, sisal and hemp. Solids and semisolids that readily give off flammable vapors. Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent. 3 Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures or, though unaffected by ambient temperatures, are readily ignited under almost all conditions: Liquids having a flash point below 22.8°C (73°F) and having a boiling point at or above 37.8°C (100°F) and those liquids having a flash point at or above 22.8°C (73°F) and below 37.8°C (73°F) and below 37.8°C (100°F) (i.e. Class IB and IC liquids). Materials that, on account of their physical form or environmental conditions, can form explosive mixtures with air and are readily dispersed in air. Flammable or combustible dusts with a representative diameter less than 420 microns (40 mesh). Materials that burn with extreme rapidity, usually by reason of self-contained oxygen (e.g. dry nitrocellulose and many organic peroxides). Solids containing greater than 0.5 percent by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent.

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

FLAMMABILITY HAZARD (continued): 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 100 W/mL.

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

FLAMMABILITY LIMITS IN AIR:

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

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.

REPRODUCTIVE TOXICITY INFORMATION:

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

ECOLOGICAL INFORMATION:

EC 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:

This section explains the impact of various laws and regulations on the material. **ACGIH:** American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **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. **AUSTRALIAN:** **AICS** is the Australian Inventory of Chemical Substances. **NOHSC**: National Occupational Health & Safety Code.