



SAFETY DATA SHEET

SDS Prepared to Canadian WHMIS 2015 (HPR-GHS) and the UN Global Harmonization Standard (Revision 8)

Section 1 – IDENTIFICATION

1.1 – PRODUCT IDENTIFIER: K100+S

1.2 – OTHER MEANS OF IDENTIFICATION:	None
1.3 – RECOMMENDED USE:	Diesel Fuel Treatment
1.4 – RESTRICTIONS ON USE:	Do Not Use for Other than Recommended Use
1.5 – CANADIAN SUPPLIER/DISTRIBUTOR:	Stephen Doucette, SWD Sales & Distribution
1.5.1 - ADDRESS:	532 Thornview Place, Waterloo, Ontario, Canada
1.5.2 - BUSINESS PHONE:	1-519-580-555 (Monday thru Friday 8 a.m. to 5 p.m., EST/GMT-5)
1.6 – U.S. SUPPLIER/MANUFACTURER:	KINETIC FUEL TECHNOLOGY, INC.
1.6.1 - ADDRESS:	1205 Balmer Road; Youngstown, NY, USA, 14174
1.6.2 - BUSINESS PHONE/GENERAL SDS INFORMATION:	1-716-745-1461 (Monday thru Friday 8 a.m. to 5 p.m., EST)
1.6.3 - WEBSITE:	www.k100fuelreatment.com
1.7 - EMERGENCY PHONE (U.S./Canada/Puerto Rico):	United States/Canada/Puerto Rico: 1-800/424-9300 (Chemtrec) [24-hrs]
1.7.1 - EMERGENCY PHONE (OUTSIDE U.S./CANADA):	International: 01-703-527-3887 (Chemtrec) [24-hours]
1.8 - PRODUCT IDENTIFIER HMIRA REGISTRY NUMBER AND FILING DATE:	
1.8.1 - PRODUCT IDENTIFIER:	K100S+; 1.8.2 - HMIRA REGISTRY NUMBER: 10020; 1.8.3 - FILING DATE: 2020-01-31

Section 2 - HAZARD IDENTIFICATION

2.1 - GLOBAL HARMONIZATION LABELING AND CLASSIFICATION: Classified in accordance with Global Harmonization Standard under Canadian WHMIS 2015 (HPR-GHS).

2.1.1 - Classification: Flammable Liquid Category 3, Serious Eye Damage Category 1, Acute Dermal Toxicity Category 3, Acute Inhalation Toxicity Cat. 3, Acute Oral Toxicity Cat. 4, Skin Irritation Category 2, Specific Target Organ Toxicity (Inhalation-Irritation) Single Exposure Category 3, Specific Target Organ Toxicity (Inhalation-Narcotic Effect) Single Exposure Category 3, Specific Target Organ Toxicity (Ingestion-Eye) Single Exposure Category 1

2.1.2 - Signal Word: Danger

2.1.3 - Hazard Statements: H226: Flammable liquid and vapour. H311 + H331: Toxic in contact with skin or if inhaled. H318: Causes serious eye damage. H302: Harmful if swallowed. H315: Causes skin irritation. H335: May cause respiratory irritation. H336: May cause drowsiness or dizziness. H370: Causes damage to organs (optic nerve) if ingested.

2.1.4 - Precautionary Statements:

2.1.4.2 - Prevention: P210: Keep away from heat, sparks, open flames or hot surfaces. — No smoking. P233: Keep container tightly closed. P240: Ground or bond container and receiving equipment. P241: Use explosion-proof electrical, ventilating, and lighting equipment. P242: Use only non-sparking tools. P243: Take precautionary measures against static discharge. P261: Avoid breathing mists, vapours or spray. P264: Wash thoroughly all contaminated areas of the body after handling. P270: Do not eat, drink or smoke when using this product. P271: Use only outdoors or in a well-ventilated area. P280: Wear protective gloves, protective clothing, and eye protection and face protection.

2.1.4.1 - Response: P370 + P378: In case of fire: Use materials appropriate for surrounding fire for extinction. Do not use halons. P303 + P361 + P353: IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. P361 + P364: Take off immediately all contaminated clothing and wash before reuse. P301 + P316: If swallowed: Get medical help immediately. P330: Rinse mouth. P304 + P340: If inhaled, remove victim to fresh air and keep at rest in a position comfortable for breathing. P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. P316: Get emergency medical help immediately. P321: Specific treatment (remove from exposure and treat symptoms).

2.1.4.2 - Storage: P403 + P233 + P235: Store in a well-ventilated place. Keep container tightly closed. Keep cool. P405: Store locked up.

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

2.1.5 – Physical Hazards Not Otherwise Classified: None known.

2.1.6 – Other Hazards: Not applicable.

2.1.7 – Percent of Unknown Acute Toxicity: This product is a mixture; the following are percentages of unknown acute toxicity, by route of exposure. Dermal and Inhalation: 10% (based on component toxicity and a calculation of Acute Toxicity Estimate (ATE) for these routes).

2.1.8 - Hazard Symbols/Pictograms: GHS02, GHS05, GHS06, GHS07, GHS08



2.2 - EMERGENCY OVERVIEW:

2.2.1 - Product Description: This product is clear yellow, combustible liquid with a mild ether or sweet odor.

2.2.2 - Health Hazards: This product may be harmful by inhalation, ingestion or by skin absorption. Inhalation and ingestion can cause central nervous system effects. Eye contact may cause severe irritation. Skin contact, especially if prolonged, may cause dermatitis. Ingestion may result in aspiration and damage to the lungs. Due to the presence of Primary Alkyl Alcohol, severe vision effects, including increased sensitivity to light, blurred vision, and blindness may develop following an 8 to 24-hour symptom-free period if ingested. Vapour may produce temporary blurring of vision with a general bluish or grayish haze and the appearance of halos around lights. Components are suspect reproductive toxins.

2.2.3 - Flammability Hazards: This product is combustible. When involved in a fire, this material may decompose and produce irritating vapours and toxic compounds (including carbon oxides, nitrogen oxides, ammonia, peroxides and formaldehyde).

2.2.4 - Reactivity Hazards: This product is not reactive.

2.2.5 - Environmental Hazards: This product may cause harm if released to the environment.

2.2.6 - Emergency Considerations: Emergency responders should wear appropriate protection, including fire protective equipment for situation to which they respond.



Section 3 - COMPOSITION and INFORMATION ON INGREDIENTS

3.1 - COMPONENT NAMES, CAS NUMBERS, PERCENTAGES and GLOBAL HARMONIZATION CLASSIFICATION

Chemical Name	CAS #	% w/w	LABEL ELEMENTS GHS Classification under Canadian WHMIS 2015 (HPR-GHS) Hazard Statement Codes
Ethylene Glycol Monobutyl Ether (2-Butoxyethanol)	111-76-2	30-45%	HARMONISED CLASSIFICATION - ANNEX VI OF REGULATION (EC) NO 1272/2008 (CLP REGULATION) Classification: Acute Oral Toxicity Cat. 4, Acute Dermal Toxicity Cat. 4, Acute Inhalation Cat. 4, Eye Irritation Cat. 2, Skin Irritation Cat. 2 Hazard Statement Codes: H302 + H312 + H332, H319, H315
n-Butyl Alcohol (1-Butanol)	71-36-3	30-40%	HARMONISED CLASSIFICATION - ANNEX VI OF REGULATION (EC) NO 1272/2008 (CLP REGULATION) Classification: Flammable Liquid Cat. 3, Acute Oral Toxicity Cat. 4, Eye Damage Cat. 1, Skin Irritation Cat. 2, Specific Target Organ Toxicity (Inhalation-Irritation) Single Exposure Cat. 3, Specific Target Organ Toxicity (Inhalation-Narcotic Effect) Single Exposure Cat. 3 Hazard Statement Codes: H226, H302, H318, H315, H335, H336
Proprietary Primary Alkyl Alcohol*		15-20%	HARMONISED CLASSIFICATION - ANNEX VI OF REGULATION (EC) NO 1272/2008 (CLP REGULATION) Classification: Flammable Liquid Cat. 2, Acute Oral Toxicity Cat. 3, Acute Dermal Toxicity Cat. 3, Acute Inhalation Toxicity Cat. 3, Specific Target Organ Toxicity (Ingestion-Optic Nerve) Single Exposure Cat. 1 Hazard Statement Codes: H225, H301 + H311 + H331, H370
Proprietary Alkenoic Acid*		5-10%	HARMONISED CLASSIFICATION - ANNEX VI OF REGULATION (EC) NO 1272/2008 (CLP REGULATION) Classification: Skin Irritation Cat. 2, Eye Irritation Cat. 2A, Specific Target Organ Toxicity (Inhalation-Respiratory Irritation) Single Exposure Cat. 3 Hazard Statement Codes: H315, H319, H335 EU ECHA Properties of Concern: Suspected carcinogen: equivocal carcinogenicity data according to ISSCAN. Suspected skin sensitizer: CAESAR skin sensitization model in VEGA (Q)SAR platform predicts that the chemical is Sensitizer (good reliability).
Proprietary Cyclic Secondary Amine*		3-7%	HARMONISED CLASSIFICATION - ANNEX VI OF REGULATION (EC) NO 1272/2008 (CLP REGULATION) Classification: Flammable Liquid Cat. 3, Acute Oral Toxicity Cat. 4, Acute Dermal Toxicity Cat. 4, Acute Inhalation Toxicity Cat. 4, Skin Corrosion Cat. 1B Hazard Statement Codes: H226, H302 + H312 + H332, H314

See Section 16 for full text of classification. The actual concentration range is withheld as a trade secret

*1.8.2 - HMIRA REGISTRY NUMBER: 10020; 1.8.3 - FILING DATE: 2020-01-31

Section 4 - FIRST-AID MEASURES

4.1 - PROTECTION OF FIRST AID RESPONDERS: Rescuers should be taken for medical attention if necessary. Remove or cover gross contamination to avoid exposure to rescuers.

4.2 - DESCRIPTION OF FIRST AID MEASURES: Persons developing hypersensitivity reactions should receive medical attention. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Take a copy of label and SDS to physician or health professional with the contaminated individual. Where applicable, GHS precautionary statements are included.

4.2.1 - Skin Exposure: Wash gently and thoroughly with water for 20 minutes or until chemical is removed. While under running water, remove contaminated clothing, shoes and leather goods. Seek medical attention if adverse effect persists after decontamination.

4.2.1.1 - P264: Wash thoroughly all contaminated areas of the body after handling. P303 + P361 + P353: IF ON SKIN (or hair): Remove immediately all contaminated clothing. Rinse skin with water or shower. P361 + P364: Take off immediately all contaminated clothing and wash before reuse.

4.2.2 - Eye Exposure: If this product contaminates 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. The contaminated individual must seek medical attention if any adverse effect continues after rinsing.

4.2.2.1 - P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. P316: Get emergency medical help immediately.

4.2.3 - Inhalation: If vapours of this product are inhaled, causing irritation, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Seek medical attention if adverse effect continues after removal to fresh air.

4.2.3.1 - P304 + P340: If inhaled, remove victim to fresh air and keep at rest in a position comfortable for breathing. P316: Get emergency medical help immediately.

4.2.4 - Ingestion: If 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. Lean victim forward to avoid aspiration into the lungs if vomiting occurs naturally. If victim is convulsing, maintain an open airway and obtain immediate medical attention. If heart or breathing has stopped, trained persons should administer cardiopulmonary resuscitation (CPR) until medical personnel arrive.

4.2.4.1 - P301 + P316: If swallowed: Get medical help immediately. P330: Rinse mouth.

4.3 - MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory or skin conditions may be aggravated by repeated exposure to this product.

4.4 - MOST IMPORTANT SYMPTOMS and EFFECTS, WHETHER ACUTE OR DELAYED:

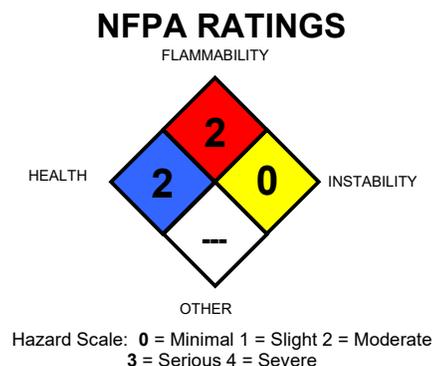
4.4.1 - Acute: This product may be harmful by inhalation, ingestion or if absorbed via intact skin. Ingestion may be fatal or cause significant eye effects or blindness. Inhalation of high concentration may be fatal or may cause adverse blood effects. Eye contact may cause severe irritation. Skin contact may be irritating.

4.4.2 - Delayed (Chronic): Prolonged or chronic skin contact may cause dermatitis. Long-term occupational exposure (inhalation and dermal) to ethylene glycol ethers, including 2-Butoxyethanol, may be associated with increased oxalic acid loads, which can alter kidney function and may result in kidney stones.

4.5 - IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT NEEDED: Treat symptoms and eliminate exposure.

Section 5 - FIRE-FIGHTING MEASURES

- 5.1 - FLASH POINT (Cleveland open cup):** 40.5°C (105°F)
- 5.2. - AUTOIGNITION TEMPERATURE:** Not established.
- 5.3 - FLAMMABLE LIMITS (in air by volume, %):** LEL: 1.1% UEL: 10.6%
- 5.4 - FIRE EXTINGUISHING MEDIA:** In the event of a fire, use suppression media for surrounding materials (e.g., water spray, dry chemical, carbon dioxide, foam, any “ABC” class extinguisher).
- 5.5 - UNSUITABLE FIRE EXTINGUISHING MEDIA:** Halons.
- 5.6 - SPECIAL HAZARDS ARISING FROM THE MIXTURE:** This product is combustible. When involved in a fire, this product may decompose and produce irritating vapours and toxic compounds (including carbon oxides). Vapours can travel a long distance to an ignition source and flash back.
- 5.6.1 - Explosion Sensitivity to Mechanical Impact:** Not sensitive.
- 5.6.2 - Explosion Sensitivity to Static Discharge:** Vapours from this product may be ignited by static energy.
- 5.7 - SPECIAL PROTECTIVE ACTIONS FOR FIRE-FIGHTERS:** Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. In case fire involving large volume of product, water may be ineffective to completely extinguish fire; however, water can be used to extinguish the fire when a number of hose streams are applied by experienced firefighters to sweep the flames off the surface of the burning liquid. Water can also be applied as a fine spray to absorb the heat of the fire and to cool exposed containers and materials and can be used to extinguish the fire when hose streams are applied by experienced firefighters trained in fighting all types of combustible liquid fires. Water spray can be used to dilute spills to raise the flash point and to flush spills away from ignition sources. Solid streams of water may be ineffective and spread material. If this liquid is involved in a fire, fire runoff water should be contained to prevent possible environmental damage. If necessary, decontaminate fire-response equipment with soap and water solution.



Section 6 - ACCIDENTAL RELEASE MEASURES

- 6.1 - PERSONAL PRECAUTIONS AND EMERGENCY PROCEDURES:** Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. Eliminate any possible sources of ignition and provide maximum explosion-proof ventilation. Use only non-sparking tools and equipment during the response. Call CHEMTREC (1-800-424-9300) for emergency assistance. The atmosphere must at least 19.5 percent Oxygen before non-emergency personnel can be allowed in the area without Self-Contained Breathing Apparatus and fire protection.
- 6.2 - PERSONAL PROTECTIVE EQUIPMENT:** Proper protective equipment should be used. Use only non-sparking tools and equipment.
- 6.2.1 - Small Spills:** Wear rubber gloves, splash goggles, and appropriate body protection.
- 6.2.2 - Large Spills:** Minimum Personal Protective Equipment should be rubber gloves, rubber boots, face shield, and Tyvek suit. Minimum level of personal protective equipment for releases in which the level of oxygen is less than 19.5% or is unknown must be **Level B: triple-gloves (rubber gloves and nitrile gloves over latex gloves), chemical resistant suit and boots, hard hat, and Self-Contained Breathing Apparatus.**
- 6.3 - METHODS FOR CLEAN-UP AND CONTAINMENT:**
- 6.3.1 - Small Spills:** Carefully absorb spill using polypads or other non-reactive absorbent. Place spilled material in appropriate container for disposal, sealing tightly. Remove all residue before decontamination of spill area.
- 6.3.2 - Large Spills:** Access to the spill area should be restricted. For large spills, dike or otherwise contain spill and absorb spill with polypads or other non-reactive absorbent material. Monitor area for combustible vapour levels.
- 6.3.3 - All Spills:** Place all spill residue in a double plastic bag or other containment and seal. Decontaminate the area thoroughly. Do not mix with wastes from other materials. Dispose of in accordance with applicable Federal, State, and local procedures (see Section 13, Disposal Considerations). For spills on water, contain, minimize dispersion and collect. Dispose of recovered material and report spill per regulatory requirements.
- 6.4 - 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.
- 6.5 - REFERENCE TO OTHER SECTIONS:** See information in Section 8 (Exposure Controls – Personal Protection) and Section 13 (Disposal Considerations) for additional information.

Section 7 - HANDLING and STORAGE

- 7.1 - PRECAUTIONS FOR SAFE HANDLING:** All employees who handle this material should be trained to handle it safely. Minimize all exposure to this substance. As with all chemicals, avoid getting this product ON YOU or IN YOU. P260: Do not breathe mists, vapours or spray. P264: Wash thoroughly all contaminated areas of the body after handling. P270: Do not eat, drink, smoke, or apply cosmetics while handling this product. P271: Use only outdoors or in a well-ventilated area. P280: Wear protective gloves, protective clothing, and eye protection and face protection. P241: Use explosion-proof electrical, ventilating, and lighting equipment. P242: Use only non-sparking tools. P243: Take precautionary measures against static discharge. Keep away from heat, sparks, and other sources of ignition. Bond and ground containers during transfers of material. Containers of this product must be properly labeled.



Section 7 - HANDLING and STORAGE (Continued)

7.2 - CONDITIONS FOR SAFE STORAGE: P403 + P233 + P235: Store in a well-ventilated place. Keep container tightly closed. Keep cool. P405: Store locked up. Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Material should be stored in secondary containers or in a diked area, as appropriate. Inspect all incoming containers before storage, to ensure containers are properly labeled and not damaged. Store containers away from incompatible chemicals (see Section 10, Stability and Reactivity). Containers should be separated from oxidizing materials by a minimum distance of 20 ft. or by a barrier of non-combustible material at least 5 ft. high having a fire-resistance rating of at least 0.5 hours. Storage areas should be made of fire-resistant materials. Post warning and "NO SMOKING" signs in storage and use areas, as appropriate. Have appropriate extinguishing equipment in the storage area (such as sprinkler systems or portable fire extinguishers). Inspect all incoming containers before storage to ensure containers are properly labeled and not damaged.

7.3 - SPECIFIC END USE(S): This product is a gasoline fuel additive. Follow all industry standards for use of this product.

7.4 - 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. Decontaminate equipment thoroughly, before maintenance begins. Collect all rinsates and dispose of according to applicable Federal, State, or local procedures.

Section 8 - EXPOSURE CONTROLS - PERSONAL PROTECTION

8.1 - EXPOSURE LIMITS/CONTROL PARAMETERS:

8.1.1 - Ventilation and Engineering Controls: Use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits provided in this section, if applicable. Use a non-sparking, grounded, explosion-proof ventilation system separated from other exhaust ventilation systems. Exhaust directly to the outside, taking necessary precautions for environmental protection. Ensure eyewash/safety shower stations are available near where this product is used.

8.1.2 - Occupational/Workplace Exposure Limits/Guidelines:

8.1.2.1 - 1-Butanol:

ACGIH TLV TWA: 20 ppm
ACGIH TLV STEL: Not Applicable
OSHA PEL TWA: 100 ppm
OSHA PEL STEL: Vacated 1989 PEL: 50 ppm (ceiling)
NIOSH REL TWA: Not Applicable
NIOSH REL STEL: 50 ppm, Skin (ceiling)
NIOSH IDLH: 1400 ppm (based on 10% of the LEL)
DFG MAK TWA: 100 ppm
DFG MAK PEAK: 1•MAK 15 min. average value, 1-hr interval, 4 per shift
DFG MAK Pregnancy Risk Classification: C
Carcinogen Status: EPA-D

8.1.2.2 - 2-Butoxyethanol:

ACGIH TLV TWA: 20 ppm
ACGIH TLV STEL: Not Applicable
OSHA PEL TWA: 50 ppm (skin); Vacated 1989 PEL: 20 ppm
OSHA PEL STEL: Vacated 1989 PEL: 300 ppm
NIOSH REL TWA: 5 (skin)
NIOSH REL STEL: Not Applicable
NIOSH IDLH: 700 ppm
DFG MAK TWA: 10 ppm (sum of the concentrations of EGBE and its acetate in air) [skin]
DFG MAK PEAK: 2•MAK 15 min. average value, 1-hr interval, 4 per shift
DFG MAK Pregnancy Risk Classification: C
Carcinogen Status: EPA-NL, IARC-3, TLV-A3

8.1.2.2 - Proprietary Primary Alkyl Alcohol:

ACGIH TLV TWA: 200 ppm (skin)
ACGIH TLV STEL: 250 ppm (skin)
OSHA PEL TWA: 200 ppm
OSHA PEL STEL: Vacated 1989 PEL: 250 ppm
NIOSH REL TWA: 200 (skin)
NIOSH REL STEL: 250 (skin)
NIOSH IDLH: 6000 ppm
DFG MAK TWA: 100 ppm (skin)
DFG MAK PEAK: 2•MAK 15 min. average value, 1-hr interval, 4 per shift
DFG MAK Pregnancy Risk Classification: C

8.1.2.3 - Proprietary Alkenoic Acid:

ACGIH TLV TWA: 20 ppm (skin)
ACGIH TLV STEL: Not Applicable
OSHA PEL TWA: 20 ppm (skin)
OSHA PEL STEL: Vacated 1989 PEL: 30 ppm
NIOSH REL TWA: 20 (skin)
NIOSH REL STEL: 30 (skin)
NIOSH IDLH: 1400 ppm (based on 10% of the LEL)
DFG MAK TWA: 10 ppm (skin)
DFG MAK PEAK: 2•MAK 15 min. average value, 1-hr interval, 4 per shift
DFG MAK Pregnancy Risk Classification: C
Carcinogen Status: IARC-3, TLV-A4

8.1.2.4 - Proprietary Cyclic Secondary Amine:

Carcinogen Status: MAK-3

See Section 16 for Definitions of Terms Used.

8.1.3 - ACGIH BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, ACGIH Biological Exposure Indices (BEIs) have been determined for some components of this product, as follows:

8.1.3.1 - 2-Butoxyethanol: Butoxyacetic Acid (BAA) in Urine; Sampling Time: End of Shift; Biological Exposure Indices: 200 mg/g creatine

8.1.3.2 - Primary Alkyl Alcohol: Methanol in Urine; Sampling Time: End of Shift; Biological Exposure Indices: 15 mg/L

8.2 - PROTECTIVE EQUIPMENT: The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with standards of Canada (including CSA Respiratory Standard Z94.4-02, Z94.3-M1982, *Industrial Eye and Face Protectors* and CSA Standard Z195-02, *Protective Footwear*). Please reference applicable regulations and standards for relevant details.

8.2.1 - Respiratory Protection: Maintain airborne contaminant concentrations below exposure limits listed in this section, if applicable. If respiratory protection is needed, use only protection authorized in applicable regulations. Oxygen levels below 19.5% are considered dangerous. 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 recommended.

8.2.2 - Eye Protection: Splash goggles or safety glasses. If necessary, refer to appropriate regulations.

8.2.3 - Hand Protection: Wear gloves appropriate for use with glycol ethers and alcohols. Use triple gloves for spill response, as stated in Section 6 (Accidental Release Measures) of this SDS. If necessary, refer to appropriate regulations.

8.2.4 - Body Protection: 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 under appropriate regulations.



Section 9 - PHYSICAL and CHEMICAL PROPERTIES

FORM: Liquid.

MOLECULAR FORMULA: Mixture.

ODOR: Mild, sweet, ether-like.

BOILING POINT: 123°C (253.5°F)

SOLUBILITY IN WATER: 100%

VAPOUR PRESSURE (air = 1): 4.0 torr

SPECIFIC GRAVITY @ 20°C (water = 1): 0.85

VISCOSITY: Not established.

FLAMMABILITY: Combustible liquid and vapours.

AUTOIGNITION TEMPERATURE: Not established.

FLAMMABLE LIMITS (in air by volume, %): LEL: 1.1%; UEL: 10.6%

COEFFICIENT WATER/OIL DISTRIBUTION: Not available for product.

HOW TO DETECT THIS SUBSTANCE (identification properties): The appearance and odor of this product can be a distinguishing characteristic to identify it in event of accidental release.

COLOR: Yellowish.

MOLECULAR WEIGHT: Mixture.

ODOR THRESHOLD: For Proprietary Alkenoic Acid: 0.011 ppm

FREEZING/MELTING POINT: Not established.

OTHER SOLUBILITIES: Not established.

VAPOUR DENSITY (air = 1): 2.71

pH: Not established.

EVAPORATION RATE (n-butyl acetate = 1): 0.41

FLASH POINT (Cleveland open cup): 40.5°C (105°F)

DECOMPOSITION TEMPERATURE: Not established.

Section 10 - STABILITY and REACTIVITY

10.1 – REACTIVITY: Not applicable.

10.2 - CHEMICAL STABILITY: This product is stable under conditions of normal pressure and temperature.

10.3 - DECOMPOSITION PRODUCTS:

10.3.1 - Combustion: Irritating fumes and toxic gases (e.g., carbon oxides, nitrogen oxides, ammonia, hydrogen cyanide, peroxides and formaldehyde).

10.3.2 - Hydrolysis: None.

10.4 - MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: This material may be incompatible with strong oxidizing agents (e.g. bromine, chlorine, chromium trioxide, nitric acid, perchlorates or sodium hypochlorite), hydrogen peroxide, metals (e.g. powdered aluminum or magnesium), carbon tetrachloride and metals (e.g. aluminum, magnesium or zinc), alkali metals (e.g. sodium or potassium), acetyl bromide, dichloromethane, perchloric acid or metal perchlorates (e.g. barium perchlorate or lead perchlorate), potassium tert-butoxide, alkylaluminum solutions, beryllium hydride, cyanuric chloride, isocyanates or phosphorus (iii) oxide (tetraphosphorus hexaoxide), diethyl zinc, mineral acids (e.g. sulfuric acid), organic acids, acid anhydrides, acid chlorides or sodium hydroxide and chloroform, cellulose nitrate, nitromethane, nitrites, nitrous acid, nitrogen oxides, aluminum, halogens (e.g. bromine or chlorine), lithium aluminum hydride, isocyanates (e.g. toluene diisocyanate, hexamethylene diisocyanate or methyl isocyanate).

10.5 - POSSIBILITY OF HAZARDOUS REACTIONS/POLYMERIZATION: Will not occur.

10.6 - CONDITIONS TO AVOID: Avoid heat, light and contact with incompatible chemicals. Take precautions to prevent static discharge.

Section 11 - TOXICOLOGICAL INFORMATION

11.1 - SYMPTOMS OF EXPOSURE BY ROUTE OF EXPOSURE: The most significant routes of occupational exposure are expected to be by inhalation, skin and eye contact. The symptoms of exposure to this product are as follows:

11.1.2 - Inhalation: Inhalation of mists, sprays, fumes or vapours from this product may cause central nervous system effects, including incoordination, dizziness, drowsiness, headache, nausea and vomiting. In addition, inhalation of high concentration may cause corrosive effects such as a burning sensation, sore throat, runny nose, coughing, wheezing, shortness of breath and difficulty breathing. In severe cases, potentially fatal lung injury (pulmonary edema) may result. The symptoms of pulmonary edema, such as chest pain and shortness of breath, may be delayed up to 24 hours after exposure. Due to the high level of 2-Butoxyethanol, short-term exposure by inhalation may cause adverse blood system effects (red blood cell fragility, hemoglobinuria) at low concentrations, based on animal tests.

11.1.3 - Contact with Skin or Eyes: Contact with the liquid and the eyes will cause severe irritation. Vapour contact will cause irritation, including stinging, redness and tearing. Vapour contact may also produce temporary blurring of vision with a general bluish or grayish haze and the appearance of halos around lights. Prolonged eye contact may cause damage to tissue. Skin contact may be irritating. Prolonged skin contact may cause defatting of the skin and dermatitis and may cause severe irritation, burns, blistering and permanent scarring.

11.1.4 - Skin Absorption: Components of this product can be absorbed through the skin and may cause harmful effect if a large area of skin is involved or contact is prolonged. Symptoms may include adverse central nervous system effects described under 'Inhalation' and 'Ingestion' and adverse blood system effects.

11.1.5 - Ingestion: Ingestion is not a significant route of occupational exposure. Ingestion of this product can cause adverse central nervous system effects, with symptoms such as dizziness, incoordination, drowsiness, headache, nausea and vomiting. Due to the presence of the Primary Alkyl Alcohol, severe vision effects, including increased sensitivity to light, blurred vision, and blindness may develop following an 8 to 24-hour symptom-free period if ingested. Due to the high level of 2-Butoxyethanol, ingestion may cause adverse blood system effects (red blood cell fragility, hemoglobinuria) at low concentrations, based on animal tests. Ingestion of products containing glycol ethers may cause harm to kidneys. Aspiration into the lungs is a potential hazard after ingestion.

11.1.6 - Injection: Though not anticipated to be a significant route of exposure for this product, injection (via punctures or lacerations by contaminated objects) may cause redness at the site of injection.

Section 11 - TOXICOLOGICAL INFORMATION (Continued)

11.2 - IRRITANCY OF PRODUCT: This product may mildly to moderately irritate contaminated tissue.

11.3 - SENSITIZATION OF PRODUCT: No component of this product is known to cause human skin or respiratory sensitization. The Proprietary Cyclic Secondary Amine component has been shown to cause skin sensitization in a laboratory animal assay in animals. The EU ECHA database lists Proprietary Cyclic Secondary Amine as a Suspected skin sensitizer: CAESAR skin sensitization model in VEGA (Q)SAR platform predicts that the chemical is Sensitizer (good reliability).

11.4 – DELAYED and IMMEDIATE EFFECTS and CHRONIC EFFECTS FROM SHORT-TERM and LONG-TERM EXPOSURE:

11.4.1 – Short-Term: This product may be harmful by inhalation, ingestion or if absorbed via intact skin. Ingestion may be fatal or cause significant eye effects or blindness. Inhalation of high concentration may be fatal or may cause adverse blood effects. Eye contact may cause severe irritation. Skin contact may be irritating.

11.4.2 – Long-Term: Prolonged or chronic skin contact may cause dermatitis. Long-term occupational exposure (inhalation and dermal) to ethylene glycol ethers, including 2-Butoxyethanol, may be associated with increased oxalic acid loads, which can alter kidney function and may result in kidney stones.

11.5 - TARGET ORGANS:

11.5.1 - Short-Term: Skin, eyes, respiratory system, central nervous system, blood, blood-forming system.

11.5.2 - Long-Term: Skin, kidneys.

11.6 – OVERALL ACUTE TOXICITY ESTIMATES (ATE) FOR PRODUCT:

11.6.1 – Oral ATE: 670 mg/kg (0% unknown)

11.6.2 – Dermal ATE: 725 mg/kg (10% unknown)

11.6.3 – Inhalation Vapour ATE: 7.7 mg/L (10% unknown)

11.7 - TOXICITY DATA FOR COMPONENTS: The following toxicity data are available for components of 1% concentration or greater. Due to the large amount of data for components, only available human data, LD50 (Oral-Rat or Mouse), LD50 (Skin-Rabbit or Rat), LC50 (Inhalation-Rat or Mouse), mutation data and irritation data are provided in this SDS. Contact Kinetic Fuel Technology for information on other data available.

11.7.1 – 1-Butanol:

Standard Draize Test (Eye-Human) 50 ppm

Standard Draize Test (Eye-Human) 990 ppm/1 hour

Standard Draize Test (Skin-Human) 20 µL/20 minutes

TCLo (Inhalation-Human) 25 ppm: Sense Organs and Special Senses (Olfaction): effect, not otherwise specified; Sense Organs and Special Senses (Eye): conjunctive irritation; Lungs, Thorax, or Respiration: other changes

TDLo (Eye-Human) 72.5 mg/m³: Sense Organs and Special Senses (Eye): conjunctive irritation

LDLo (Oral-Human) 428 mg/kg

Standard Draize Test (Skin-Rabbit) 20 mg/24 hours: Moderate

Standard Draize Test (Eye-Rabbit) 2 mg/24 hours: Severe

Standard Draize Test (Eye-Rabbit) 1.62 mg: Severe

Standard Draize Test (Eye-Rabbit) 0.005 mL: Severe

LD₅₀ (Oral-Rat) 790 mg/kg: Liver: fatty liver degeneration; Kidney/Ureter/Bladder: other changes; Blood: other changes

LD₅₀ (Oral-Rat) 4.36 gm/kg: Gastrointestinal: gastritis; Liver: other changes; Blood: hemorrhage

LD₅₀ (Oral-Rat) 0.79 gm/kg

LD₅₀ (Oral-Mouse) 100 mg/kg

LD₅₀ (Skin-Rabbit) 3400 mg/kg

LD₅₀ (Skin-Rabbit) 34300 mg/kg

11.7.2 – 2-Butoxyethanol:

Open Irritation Test (Skin-Rabbit) 500 mg: Mild

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

Standard Draize Test (Eye-Rabbit) 100 mg/24 hours: Moderate

LDLo (Oral-Human) 143 mg/kg

TDLo (Oral-Woman) 600 mg/kg: Behavioral: coma; Lungs, Thorax, or Respiration: dyspnea; Nutritional and Gross Metabolic: metabolic acidosis

TDLo (Oral-Woman) 7813 µL/kg: Behavioral: coma; Vascular: BP lowering not characterized in autonomic section; Nutritional and Gross Metabolic: metabolic acidosis

TCLo (Inhalation-Human) 195 ppm/8 hours: Gastrointestinal: nausea or vomiting

TCLo (Inhalation-Human) 100 ppm: Sense Organs and Special Senses (Olfaction): effect, not otherwise specified; Sense Organs and Special Senses (Eye): effect, not otherwise specified; Lungs, Thorax, or Respiration: other changes

TCLo (Inhalation-Human) 1500 mg/m³: Sense Organs and Special Senses (Eye): conjunctive irritation; Liver: other changes; Kidney/Ureter/Bladder: other changes

LC₅₀ (Inhalation/Vapour-Rat) 2.2 mg/L/4 hours

LC₅₀ (Inhalation-Rat) 450 ppm/4 hours: Behavioral: ataxia; Nutritional and Gross Metabolic: weight loss or decreased weight gain

LC₅₀ (Inhalation-Rat) 2900 mg/m³/7 hours: Liver: other changes; Kidney/Ureter/Bladder: other changes; Blood: other hemolysis with or without anemia

LC₅₀ (Inhalation-Mouse) 3380 mg/m³/7 hours: Liver: other changes; Kidney/Ureter/Bladder: other changes; Blood: other hemolysis with or without anemia

LC₅₀ (Inhalation-Mouse) 700 ppm/7 hours: Behavioral: analgesia; Lungs, Thorax, or Respiration: dyspnea; Kidney/Ureter/Bladder: hematuria

11.7.2 – 2-Butoxyethanol (continued)

LD₅₀ (Oral-Rat) 470 mg/kg

LD₅₀ (Oral-Rat) 530 mg/kg

LD₅₀ (Oral-Rat) 917 mg/kg: Liver: other changes; Kidney/Ureter/Bladder: other changes;

Blood: other hemolysis with or without anemia

LD₅₀ (Oral-Mouse) 1230 mg/kg: Behavioral: altered sleep time (including change in righting reflex), somnolence (general depressed activity); Skin and Appendages: hair

LD₅₀ (Oral-Mouse) 1167 mg/kg: Liver: other changes; Kidney/Ureter/Bladder: other changes; Blood: other hemolysis with or without anemia

LD₅₀ (Skin-Rabbit) 220 mg/kg

LD₅₀ (Skin-Rabbit) 400 mg/kg

Mutation in Microorganisms (*Bacteria-Salmonella typhimurium*) 19 µmol/plate

11.7.3 – Primary Alkyl Alcohol:

TDLo (Oral-Man) 3571 µL/kg: Sense Organs and Special Senses (Eye): visual field changes; Lungs, Thorax, or Respiration: dyspnea; Blood: other changes

TDLo (Oral-Man) 9450 µL/kg: Sense Organs and Special Senses (Eye): mydriasis (pupillary dilation); Behavioral: general anesthetic; Nutritional and Gross Metabolic: body temperature decrease

TDLo (Oral-Man) 3429 mg/kg: Sense Organs and Special Senses (Eye): visual field changes

TDLo (Oral-Woman) 4 gm/kg: Sense Organs and Special Senses (Eye): visual field changes; Lungs, Thorax, or Respiration: dyspnea; Gastrointestinal: nausea or vomiting

LDLo (Oral-Man) 6422 mg/kg: Brain and Coverings: changes in circulation (hemorrhage, thrombosis, etc.); Lungs, Thorax, or Respiration: dyspnea; Gastrointestinal: nausea or vomiting

LDLo (Oral-Woman) 10 mL/kg: Lungs, Thorax, or Respiration: respiratory depression; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: multiple enzyme effects; Gastrointestinal: changes in structure or function of endocrine pancreas

LDLo (Oral-Human) 428 mg/kg: Behavioral: headache; Lungs, Thorax, or Respiration: other changes

LDLo (Oral-Human) 143 mg/kg: Sense Organs and Special Senses (Eye): optic nerve neuropathy; Lungs, Thorax, or Respiration: dyspnea; Gastrointestinal: nausea or vomiting

LDLo (Unreported-Man) 868 mg/kg

TCLo (Inhalation-Human) 86,000 mg/m³: Sense Organs and Special Senses (Eye): lachrymation; Lungs, Thorax, or Respiration: cough, other changes

TCLo (Inhalation-Human) 300 ppm: Sense Organs and Special Senses (Eye): visual field changes; Behavioral: headache; Lungs, Thorax, or Respiration: other changes

Standard Draize Test (Skin-Rabbit) 20 mg/24 hours: Moderate

Standard Draize Test (Eye-Rabbit) 40 mg: Moderate

Standard Draize Test (Eye-Rabbit) 100 mg/24 hours: Moderate

LD₅₀ (Oral-Human-Acute Toxicity Point Estimate) 500 mg/kg (based human toxicity values)

LD₅₀ (Oral-Rat) 5600 mg/kg

LD₅₀ (Oral-Mouse) 7300 mg/kg

LD₅₀ (Skin-Rabbit) 15,800 mg/kg

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

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

YES	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



Section 11 - TOXICOLOGICAL INFORMATION (Continued)

11.7 - TOXICITY DATA (continued):

11.7.3 - PRIMARY ALKYL ALCOHOL (continued):

LC₅₀ (Inhalation-Rat) 64000 ppm/4 hours
LC₅₀ (Inhalation-Rabbit) 81000 mg/m³/14 hours
DNA Inhibition (Human Lymphocyte) 300 mmol/L
DNA Repair (Bacteria-*Escherichia coli*) 20 mg/well
Mutation in Microorganisms (Yeast-*Saccharomyces cerevisiae*) 12 ppb
Mutation in Microorganisms (Mouse Lymphocyte) 7900 mg/L
Sex Chromosome Loss and Non-Disjunction (Mold-*Aspergillus nidulans*) 56,000 ppm
Cytogenetic Analysis (Parenteral-Grasshopper) 3000 ppm
Cytogenetic Analysis (Oral-Mouse) 1 gm/kg
Cytogenetic Analysis (Intraperitoneal-Mouse) 75 mg/kg
DNA Damage (Oral-Rat) 10 μmol/kg
Morphological Transformation (Mouse-Fibroblast) 0.01 mg/L/21 days

11.7.4 - PROPRIETARY ALKENOIC ACID:

Open Irritation Test (Skin-Rabbit) 500 mg: Moderate
Standard Draize Test (Eye-Rabbit) 2 mg: Severe
LC₅₀ (Inhalation-Rat) 8000 ppm/8 hours
LC₅₀ (Inhalation/Vapour-Rat) 11 mg/L/4 hours
LC₅₀ (Inhalation-Mouse) 1320 mg/m³/2 hours: Sense Organs and Special Senses (Eye): lachrymation; Behavioral: ataxia; Lungs, Thorax, or Respiration: cyanosis
LC₅₀ (Inhalation-Mouse) 12,000 mg/m³: Behavioral: alteration of classical conditioning
LC₅₀ (Inhalation-Mouse) 1.35 gm/m³

11.7.4 - PROPRIETARY ALKENOIC ACID (continued):

LD₅₀ (Oral-Rat) 1050 mg/kg
LD₅₀ (Oral-Rat) 1738 mg/kg: Kidney/Ureter/Bladder: changes in blood vessels or in circulation of kidney
LD₅₀ (Oral-Mouse) 525 mg/kg: Behavioral: sleep, somnolence (general depressed activity)
LD₅₀ (Oral-Mouse) 1200 mg/kg
LD₅₀ (Skin-Rabbit) 505 mg/kg
Morphological Transformation (Mouse-Fibroblast) 125 mg/L
Morphological Transformation (Mouse Lymphocyte) 1 μL/L
Mutation in Mammalian Somatic Cells (Mouse Lymphocyte) 1 gm/L
Sister Chromatid Exchange (Hamster Ovary) 160 mg/L
Cytogenetic Analysis (Inhalation-Rat) 0.07 mg/L/122 days-intermittent
11.7.5 - PROPRIETARY CYCLIC SECONDARY AMINE:
Standard Draize Test (Skin-Human) 15 mg/3 days-intermittent: Moderate
Standard Draize Test (Eye-Rabbit) 100 mg: Mild
Open Irritation Test (Skin-Rabbit) 500 mg: Mild
LD₅₀ (Oral-Rat) 25,000 mg/kg
LD₅₀ (Oral-Mouse) 28,000 mg/kg
Cytogenetic Analysis (Yeast-*Saccharomyces cerevisiae*) 100 mg/L
Cytogenetic Analysis (Hamster Fibroblast) 2500 μg/L
Unscheduled DNA Synthesis (Rectal-Mouse) 35 mg/kg

11.8 - CARCINOGENIC POTENTIAL: Components of this product are listed by agencies tracking the carcinogenic potential of chemical compounds, as follows:

11.8.1 - 1-BUTANOL: EPA-D (Not Classifiable a to Human Carcinogenicity)

11.8.2 - 2-BUTOXYETHANOL: ACGIH TLV-A3 (Confirmed Animal Carcinogen); EPA-NL (Not Likely to Be Carcinogenic to Humans); IARC-3 (Not Classifiable as to Carcinogenicity to Humans)

11.8.3 - PROPRIETARY ALKENOIC ACID: ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen); IARC-3 (Not Classifiable as to Carcinogenicity to Humans)

11.8.4 - PROPRIETARY CYCLIC SECONDARY AMINE: MAK-3 (Substances Which Cause Concern that They Could be Carcinogenic for Man but Cannot Be Assessed Conclusively Because of Lack of Data. The classification in Category 3 is provisional. The EU ECHA database lists Proprietary Cyclic Secondary Amine as a Suspected carcinogen: equivocal carcinogenicity data according to ISSCAN.

11.8.5 - PRIMARY ALKYL ALCOHOL: In 2015 the EU ECHA evaluated Primary Alkyl Alcohol for evidence of carcinogenicity. In the concluding report, there are no epidemiological studies of the carcinogenic effects of Primary Alkyl Alcohol. Based on the lack of genotoxic potential and negative results from two inhalation carcinogenicity studies submitted by the Registrants, it is concluded that classification of Primary Alkyl Alcohol as carcinogen is not warranted.

The remaining components of this product are not found on the following lists: U.S. EPA, U.S. NTP, U.S. OSHA, U.S. NIOSH, GERMAN MAK, IARC, or ACGIH and therefore are neither considered to be nor suspected to be cancer-causing agents by these agencies.

11.9 - REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this product and its components on animal or human reproductive systems.

11.9.1 - Mutagenicity: The components of this product are not reported to cause mutagenic effects in humans. There is insufficient information available to conclude that the Primary Alkyl Alcohol component is mutagenic. A positive result was obtained in a limited oral study in mice, however other oral and inhalation studies in live rats and mice have given negative results. Mostly negative results have been obtained in cultured mammalian cells, bacteria and fruit flies (*Drosophila*).

11.9.2 - Embryotoxicity: The components of this product are not reported to cause embryotoxic effects in humans. The Primary Alkyl Alcohol component has produced fetotoxicity in rats and teratogenicity in mice exposed by inhalation to high concentrations that did not produce significant maternal toxicity. The 1-Butanol component has caused embryotoxic and teratogenic effects in animal tests, but only with maternal toxicity.

11.9.3 - Teratogenicity: The components of this product are not reported to cause teratogenic effects in humans. The 2-Butoxyethanol has caused teratogenic effects, but only with maternal toxicity.

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

Section 12 - ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

12.1 - MOBILITY: This product has not been tested for mobility in soil. The following information is available for some components.

12.1.1 - 1-Butanol: The Koc of 1-Butanol is estimated as 72, using a log Kow of 0.88 and a regression-derived equation. According to a classification scheme, this estimated Koc value suggests that 1-Butanol is expected to have high mobility in soil.

12.1.2 - 2-Butoxyethanol: The Koc of 2-Butoxyethanol is estimated as 67, using a log Kow of 0.83 and a regression-derived equation. According to a classification scheme, this estimated Koc value suggests that 2-Butoxyethanol is expected to have high mobility in soil.

12.1.3 - Primary Alkyl Alcohol: Using a structure estimation method based on molecular connectivity indices, the Koc for Primary Alkyl Alcohol can be estimated to be 1. According to a classification scheme, this estimated Koc value suggests that Primary Alkyl Alcohol is expected to have very high mobility in soil.

12.2 - PERSISTENCE AND BIODEGRADABILITY: This product has not been tested for persistence or biodegradability. The following information is available for some components.

12.2.1 - 1-Butanol: If released to air, a vapour pressure of 7 mm Hg at 25° C indicates 1-Butanol will exist solely as a vapour in the ambient atmosphere. Vapour-phase 1-Butanol 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 46 hours. If released to soil, 1-Butanol is expected to have high mobility based upon an estimated Koc of 72. Volatilization from moist soil surfaces is expected to be an important fate process based upon a Henry's Law constant of 8.8X10⁻⁶ atm-cu m/mole. 1-Butanol may volatilize from dry soil surfaces based upon its vapour pressure. The biodegradation half-life of 1-Butanol in a sub-surface soil was approximately 7 days. If released into water, 1-Butanol is not expected to adsorb to suspended solids and sediment in water based upon the estimated Koc. Volatilization from water surfaces is expected to be an important environmental fate process based upon this compound's Henry's Law constant. Estimated volatilization half-lives for a model river and model lake are 2 and 29 days, respectively. In a river die-away test, 1-Butanol achieved 33% of its theoretical BOD in 5 days, suggesting biodegradation will be an important fate process in water. Hydrolysis is not expected to be an important environmental fate process since this compound lacks functional groups that hydrolyze under environmental conditions.

12.2.2 - 2-Butoxyethanol: If released to air, a vapour pressure of 0.88 mm Hg at 25°C indicates 2-Butoxyethanol will exist solely as a vapour in the ambient atmosphere. Vapour-phase 2-Butoxyethanol 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 16 hours. If released to soil, 2-Butoxyethanol is expected to have high mobility based upon an estimated Koc of 67. Volatilization from moist soil surfaces is expected to be an important fate process based upon a Henry's Law constant of 1.60X10⁻⁶ atm-cu m/mole. If released into water, 2-Butoxyethanol is not expected to adsorb to suspended solids and sediment based upon the estimated Koc. 2-Butoxyethanol reached 91% of its theoretical BOD in 14 days using an activated sludge inoculum. Therefore, this compound has the potential to biodegrade rapidly in water. Based upon this compound's estimated Henry's Law constant it is concluded that the volatilization of 2-Butoxyethanol from water surfaces may be an important fate process. The estimated volatilization half-lives for a model river and model lake are 25 and 185 days, respectively. Hydrolysis is not expected to be an important environmental fate process since this compound lacks functional groups that hydrolyze under environmental conditions.



Section 12 - ECOLOGICAL INFORMATION (Continued)

12.2 - PERSISTENCE AND BIODEGRADABILITY (continued):

12.2.3 - Primary Alkyl Alcohol: If released to the atmosphere, a vapour pressure of 127 mm Hg at 25°C indicates that Primary Alkyl Alcohol will exist solely in the vapour phase. Vapour phase Primary Alkyl Alcohol is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 17 days. If released to soil, Primary Alkyl Alcohol is expected to have very high mobility based upon an estimated Koc of 1. Volatilization from moist soil surfaces is expected to be an important fate process based upon a Henry's Law constant of 4.55X10⁻⁶ atm-cu m/mole. Primary Alkyl Alcohol may also volatilize from dry soils based upon its vapour pressure. Biodegradation of Primary Alkyl Alcohol in soils is expected to occur rapidly based on half-lives in a sandy silt loam from Texas and a sandy loam from Mississippi of 1 and 3.2 days, respectively. If released into water, Primary Alkyl Alcohol is not expected to adsorb to suspended solids and sediment based upon the estimated Koc. 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 3 and 35 days, respectively. Biodegradation is expected to occur in natural waters since Primary Alkyl Alcohol is degraded quickly in soils and was biodegraded rapidly in various aqueous screening tests using sewage seed or activated sludge. BCF values of less than 10, measured in fish suggests bioconcentration in aquatic organisms is low. Hydrolysis of Primary Alkyl Alcohol and photolysis in sunlit surface waters are not expected since Primary Alkyl Alcohol lacks functional groups that are susceptible to hydrolysis or photolysis under environmental conditions.

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

12.3.1 1-Butanol: An estimated BCF of 3 was calculated for 1-Butanol, using a log Kow of 0.88 and a regression-derived equation. According to a classification scheme, this BCF suggests the potential for bioconcentration in aquatic organisms is low. Octanol/Water Partition Coefficient: Log Kow = 0.88

12.3.2 2-Butoxyethanol: An estimated BCF of 3 was calculated for 2-Butoxyethanol, using an estimated log Kow of 0.83 and a regression-derived equation. According to a classification scheme, this BCF suggests the potential for bioconcentration in aquatic organisms is low.

12.3.3 - Primary Alkyl Alcohol: Fish (golden ide) exposed to 0.05 mg/L of Primary Alkyl Alcohol for three days in an aquatic tank had measured BCF values of less than 10. Based on a classification scheme, this BCF value suggests that bioconcentration in aquatic organisms is low.

12.4 - ECOTOXICITY: This product has not been tested for toxicity to aquatic or terrestrial organisms; however, all release to terrestrial, atmospheric and aquatic environments should be avoided. Release of this product to an aquatic environment may be harmful to aquatic plant and animal life in contaminated bodies of water, especially in large quantities. The following aquatic toxicity data are available for some components. Only select data are presented in this SDS. Contact Kinetic Fuel Technologies for information on other data available.

12.4.1 - 1-Butanol:

LC₅₀, S (fathead minnow) 96 hours = 1,910 mg/L

LC₅₀ (*Alburnus alburnus*) 96 hours = 2,300 mg/L

LC₅₀ (*Nitocra spinipes*) 96 hours = 2,100 mg/L

12.4.2 - 2-Butoxyethanol:

LC₅₀ (*Menidia beryllina* Inland silverside) 96 hours = 1250 mg/L; static

LC₅₀ (*Crangon crangon* brown shrimp) 96 hours = 775 mg/L (range: 550-950 mg/L)

LC₅₀ (*Lepomis macrochirus* Bluegill) 96 hours = 1,490 mg/L; static

LC₅₀ (*Pimephales promelas* Fathead minnow) 96 hours = 2137 mg/L

LC₅₀ (*Oncorhynchus mykiss* Rainbow trout) 96 hours = > 1000 mg/L

LC₅₀ (*Cyprinodon variegatus* Sheepshead minnow) 96 hours = 116 mg/L

LC₅₀ (*Artemia salina* Brine shrimp) 24 hours = 1000 mg/L

12.4.3 - Primary Alkyl Alcohol:

EC₅₀ (*Daphnia magna* Water flea; immobilization) 24 hours = > 10,000 mg/L

LC₅₀ (*Artemia salina* Brine shrimp, 24 hr old) 24 hours = 1578.84 mg/L

LC₅₀ (*Oncorhynchus mykiss* Rainbow trout, 0.8 g) 96 hours = 19,000 mg/L

LC₅₀ (*Lepomis macrochirus* Bluegill) 96 hours = 15,400 mg/L; flow-through

12.4.3 - Proprietary Alkenoic Acid:

LC₅₀ (bluegill) 96 hours = 350 mg/L

LC₅₀ (daphnia) 24 hours = 100 mg/L

EC₅₀ (*Daphnia magna*) 24 hours = 119 mg/L (immobilization)

12.4.4 - Proprietary Cyclic Secondary Amine:

LC₅₀ (*Pimephales promelas* Fathead minnow, juvenile 4-8 wks., length 1.1-3.1 cm) 96 hours = 205,000 µg/L

12.5 - OTHER ADVERSE EFFECTS: No component of this product is known to have ozone depletion potential.

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

Section 13 - DISPOSAL CONSIDERATIONS

13.1 - WASTE TREATMENT/DISPOSAL METHODS: It is the responsibility of the generator to determine at the time of disposal whether the product meets the criteria of a hazardous waste per regulations of the area in which the waste is generated and/or disposed of. Waste disposal must be in accordance with appropriate Province/Federal, State, and local regulations. This product, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local hazardous waste regulatory authority. Shipment of wastes must be done with appropriately permitted and registered transporters.

13.2 - 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.

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

13.4 - PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, Province/State, and local regulations. This product, if unaltered by handling, may be disposed of by treatment at a permitted facility or as advised by your local hazardous waste regulatory authority.

13.5 - Canadian Environmental Protection Act, 1999 Regulations Related to Hazardous Waste and Hazardous Recyclable Materials: Wastes of this product are regulated by the CEPA, including classification of wastes, transportation (both interprovincial transportation and international transportation of wastes) and disposal of wastes.

13.5.1 - Interprovincial Movement of Hazardous Waste Regulations (SOR/2002-301) Interprovincial Movement of Hazardous Waste Regulations (SOR/2002-301): Requirements under this regulation may be applicable to shipments and disposal of wastes from this product within Canada.

13.5.2 - Classifying Hazardous Waste and Hazardous Recyclable Material Using Codes Required under the Regulations that are Shipped Canada and Other Countries: Wastes from this product must be classified and marked per the requirements laid out in the CEPA 1999 (and subsequent up-dates). The regulations state that codes to be used are the International Waste Identification Codes, as promulgated in the Basel Convention. These codes are known as the IWIC and provide a method of classification and marking for hazardous waste materials and hazardous recyclable materials that is standardized for export/import/transit purposes between countries. All hazardous wastes for disposal require a Basel Code; all hazardous recyclable materials with the OECD require an OECD Code.



Section 13 - DISPOSAL CONSIDERATIONS (Continued)

13.5 - Canadian Environmental Protection Act, 1999 Regulations Related to Hazardous Waste and Hazardous Recyclable Materials (continued):

13.5.2.1 – Use of Canadian Customs Codes on Shipments Between Canada and Other Countries: A Canadian Customs Code (tariff item and statistical suffix) set out in Customs Tariff Departmental Consolidation, published by the Canada Border Services Agency (CBSA) must also be used. Under the Canadian Harmonized System for these codes, the first six digits of the Customs Code are based on the World Customs Organization's Harmonized Commodity Description and Coding System. The seventh and eighth digits are for Canadian trade purposes, and the ninth and tenth are the statistical suffix. This code is also a requirement for reporting purposes under the CBSA and Statistics Canada. Please refer to applicable regulations for specific requirements.

13.5.2.2 – Required Notice of Import, Export or Transit of Hazardous Wastes or Recyclable Materials Between Other Countries: In addition, prior to shipments of hazardous wastes or recyclable materials provisions of Paragraph 8(j) of the Regulations specifies information required in a notice of import, export, or transit with respect to each hazardous waste or hazardous recyclable material. Distinct line item numbers are required for each hazardous waste or hazardous recyclable material entry, as well as any information associated with that entry.

Section 14 - TRANSPORTATION INFORMATION

14.1 - U.S. DEPARTMENT OF TRANSPORTATION SHIPPING REGULATIONS: This product is classified as Dangerous Goods, per regulations of the DOT. These regulations should be used when shipping this product from the U.S. to Canada.

- 14.1.1 - UN Identification Number:** UN 1993
- 14.1.2 - Proper Shipping Name:** Flammable liquid, n.o.s. (1-Butanol, Primary Alkyl Alcohol)
- 14.1.3 - Hazard Class Number and Description:** 3 (Flammable)
- 14.1.4 - Packing Group:** PG III
- 14.1.5 - DOT Label(s) Required:** Class 3 (Flammable)
- 14.1.6 - Emergency Response Guidebook Number (2016):** 128
- 14.1.7 - Marine Pollutant:** The components of this product are not specifically listed as Marine Pollutants and does not meet the criteria of a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).
- 14.1.8 - CERCLA RQ:** 5000 lb (2270 kg)

14.2 - INTERNATIONAL AIR TRANSPORT ASSOCIATION/ICAO (IATA/ICAO): This material is classified as dangerous goods, per the International Air Transport Association.

- 14.2.1 - UN Identification Number:** UN 1993
- 14.2.2 - Proper Shipping Name/Description:** Flammable liquid, n.o.s. (1-Butanol, Primary Alkyl Alcohol)
- 14.2.3 - Hazard Class or Division:** 3 (Flammable)
- 14.2.4 - Hazard Label(s) Required:** Class 3 (Flammable)
- 14.2.5 - Packing Group:** III
- 14.2.6 - Excepted Quantities:** E1
- 14.2.7 - Passenger and Cargo Aircraft Packing Instruction:** 355
- 14.2.8 - Passenger and Cargo Aircraft Packing Maximum Net Quantity per Pkg.:** 60 L
- 14.2.9 - Passenger and Cargo Aircraft Packing Limited Quantity Packing Instruction:** Y344
- 14.2.10 - Passenger and Cargo Aircraft Packing Limited Quantity Maximum Net Quantity per Pkg.:** 10 L
- 14.2.11 - Cargo Aircraft Only Packing Instruction:** 366
- 14.2.12 - Cargo Aircraft Only Maximum Net Quantity per Pkg.:** 60 L
- 14.2.13 - Special Provisions:** A3
- 14.2.14 - ERG Code:** 3L

14.3 - TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This product is classified as Dangerous Goods, per regulations of Transport Canada. The use of the above U.S. DOT information from the U.S. 49 CFR regulations is allowed for shipments that originate in the U.S. For shipments via ground vehicle or rail that originate in Canada, the following information is applicable.

- 14.3.1 - UN Identification Number:** UN 1993
- 14.3.2 - Proper Shipping Name:** Flammable liquid, n.o.s. (1-Butanol, Primary Alkyl Alcohol)
- 14.3.3 - Hazard Class Number and Description:** 3 (Flammable)
- 14.3.4 - Packing Group:** PG III
- 14.3.5 - Hazard Label(s) Required:** Class 3 (Flammable)
- 14.3.6 - Special Provisions:** 16, 150
- 14.3.7 - Explosive Limit and Limited Quantity Index:** 5 L
- 14.3.8 - Excepted Quantities:** E1
- 14.3.9 - ERAP Index:** None
- 14.3.10 - Passenger Carrying Ship Index:** None
- 14.3.11 - Passenger Carrying Road or Rail Vehicle Index:** 60 L
- 14.3.12 - Marine Pollutant:** This product does not meet the criteria of a Marine Pollutant under Transport Canada regulations, as per TDG 2.7.



Section 14 - TRANSPORTATION INFORMATION (Continued)

14.4 - INTERNATIONAL MARITIME ORGANIZATION SHIPPING INFORMATION (IMO): This product is classified as dangerous goods, per the International Maritime Organization.

14.4.1 - UN No.:	1993
14.4.2 - Proper Shipping Name:	Flammable liquid, n.o.s. (1-Butanol, Primary Alkyl Alcohol)
14.4.3 - Hazard Class Number:	3
14.4.4 - Packing Group:	III
14.4.5 - Special Provisions:	223, 274, 955
14.4.6 - Limited Quantities:	5 L
14.4.7 - Excepted Quantities:	E1
14.4.8 - Packing:	Instructions: P001, Provisions: LP01
14.4.9 - IBCs:	Instructions: IBC03, Provisions: None
14.4.10 - Tanks:	Instructions: T4, Provisions: TP1, TP29
14.4.11 - EmS:	F-E, S-E
14.4.12 - Stowage Category:	Category A.
14.3.13 - Segregation:	None

14.3.14 - Marine Pollutant: This product does not meet the criteria of a Marine Pollutant under UN criteria.

14.5 - EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR): This product is classified by the Economic Commission for Europe to be dangerous goods.

14.5.1 - UN NO.:	1993
14.5.2 - Name and Description:	Flammable liquid, n.o.s. (1-Butanol, Primary Alkyl Alcohol)
14.5.3 - Class:	3
14.5.4 - Classification Code:	F1
14.5.5 - Packing Group:	III
14.5.6 - Labels:	3
14.5.7 - Special Provisions:	274, 601
14.5.8 - Limited Quantities:	5 L
14.5.9 - Excepted Quantities:	E1
14.5.10 - Packing Instructions:	Instructions: P001, IBC03, LP01, R001
14.5.11 - Packing Provisions:	None
14.5.12 - Mixed Packing Provisions:	MP19
14.5.13 - Portable Tanks and Bulk Containers:	Instructions: T4, Provisions: TP1, TP29
14.5.14 - Hazard Identification No.:	30

14.6 - TRANSPORT IN BULK ACCORDING TO THE IBC CODE: See the information under the individual jurisdiction listings for IBC information.

14.7 - 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); and is not specifically listed in Annex III under MARPOL 73/78.

Section 15 - REGULATORY INFORMATION

15.1 - CANADIAN REGULATIONS:

15.1.1 - Canadian DSL/NDSL Inventory Status: The components of this product are on the DSL Inventory.

15.1.2 - Canadian DSL Categorization of Components: 1-Butanol: Moderate Human Health Priority; 2-Butoxyethanol: Low Human Health Priority; Primary Alkyl Alcohol: Moderate Human Health Priority; Proprietary Alkenoic Acid: Moderate Human Health Priority; Proprietary Cyclic Secondary Amine: Low Human Health Priority, Inherently Toxic to Aquatic Organisms

15.1.3 - Canadian Environmental Protection Act (CEPA) Priorities Substances Lists: The components of this product are not on the CEPA Priorities Substances Lists.

15.1.4 - Canadian National Pollutant Release Inventory (NPRI): The 1-Butanol, 2-Butoxyethanol and Primary Alkyl Alcohol components are listed on the NPRI: NPRI Part (Threshold Category): 1A, Reportable to NPRI if manufactured, processed, or otherwise used at quantities greater than: 10 tonnes.

15.1.5 - Canadian WHMIS HPR 2015 Classification and Symbols: See Section 3 for classification and symbols under WHMIS.

16.1 - GLOBAL HARMONIZATION LABELING AND CLASSIFICATION- COMPONENT CLASSIFICATION: The following information is classification details of components.

16.1.1 - 1-Butanol: This is a published, Harmonized classification.

Classification: Flammable Liquid Category 3, Acute Oral Toxicity Category 4, Eye Damage Category 1, Skin Irritation Category 2, Specific Target Organ Toxicity (Inhalation-Irritation) Single Exposure Category 3, Specific Target Organ Toxicity (Inhalation-Narcotic Effect) Single Exposure Category 3

Hazard Statements: H226: Flammable liquid and vapour. H302: Harmful if swallowed. H318: Causes serious eye damage. H315: Causes skin irritation. H335: May cause respiratory irritation. H336: May cause drowsiness or dizziness.

16.1.2 - 2-Butoxyethanol: This is a published, Harmonized classification.

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

Hazard Statements: H302 + H312 + H332: Harmful if swallowed, in contact with skin or if inhaled. H319: Causes serious eye irritation. H315: Causes skin irritation.



Section 16 - OTHER INFORMATION (Continued)

16.1 - GLOBAL HARMONIZATION LABELING AND CLASSIFICATION- COMPONENT CLASSIFICATION (CONTINUED):

16.1.3. - Primary Alkyl Alcohol: This is a published, Harmonized classification.

Classification: Flammable Liquid Category 2, Acute Oral Toxicity Category 3, Acute Dermal Toxicity Category 3, Acute Inhalation Toxicity Category 3, Specific Target Organ Toxicity (Ingestion-Eye) Single Exposure Category 1

Hazard Statements: H225: Highly flammable liquid and vapour. H301 + H311 + H331: Toxic if swallowed, in contact with skin or if inhaled. H370: Causes damage to organs.

16.1.4 - Proprietary Alkenoic Acid: This is a published, Harmonized classification.

Classification: Flammable Liquid Category 3, Acute Oral Toxicity Category 4, Acute Dermal Toxicity Category 4, Acute Inhalation Toxicity Category 4, Skin Corrosion Category 1B

Hazard Statements: H226: Flammable liquid and vapour. H302 + H312 + H332: Harmful if swallowed, in contact with skin or if inhaled. H314: Causes severe skin burns and eye damage.

16.1.5 - Proprietary Cyclic Secondary Amine: This is a notified classification.

Classification: Skin Irritation Category 2, Eye Irritation Category 2A, Specific Target Organ Toxicity (Inhalation-Respiratory Irritation) Single Exposure

Hazard Statements: H315: Causes skin irritation. H315: Causes skin irritation. H335: May cause respiratory irritation.

Additional EU ECHA Properties of Concern: Suspected carcinogen: equivocal carcinogenicity data according to ISSCAN. Suspected skin sensitizer: CAESAR skin sensitization model in VEGA (Q)SAR platform predicts that the chemical is Sensitizer (good reliability).

This Safety Data Sheet is offered pursuant to *Canadian WHMIS 2015 (HPR-GHS)*. Other government regulations must be reviewed for applicability to this product. To the best of Kinetic Fuel Technology Inc.'s knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this product is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.

16.2 - REVISIONS DETAILS: November 2019: Up-date of entire SDS for current compliance with the Global Harmonization Standard under Canadian regulations. March 2020: Up-date entire SDS to current compliance with UN GHS under Canadian Regulations.

16.3 - REFERENCES AND DATA SOURCES: Contact the supplier for information.

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

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

16.7 - DEFINITION 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.

16.7.1. - EXPOSURE LIMITS IN AIR:

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

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

16.7.1.4 - 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.

16.7.1.5 - 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.

16.7.1.6 - LOQ: Limit of Quantitation.

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

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

16.7.1.9 - NIC: Notice of Intended Change.

16.7.1.10 - 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.

16.7.1.11 - NIOSH RELs: NIOSH's Recommended Exposure Limits.

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

16.7.1. - EXPOSURE LIMITS IN AIR (continued):

16.7.1-13 - SKIN: Used when there is a danger of cutaneous absorption.

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

16.7.1.15 - 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.

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

16.7.1.17 - WEEL: Workplace Environmental Exposure Limits from the AIHA.

16.7.2 - 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.

16.7.2.1 - HEALTH HAZARD: 0 Minimal Hazard: No significant health risk, irritation of skin or eyes not anticipated. *Skin Irritation:* Essentially non-irritating. Mechanical irritation may occur. *PII or Draize* = 0. *Eye Irritation:* Essentially non-irritating, minimal effects clearing in < 24 hours. Mechanical irritation may occur. *Draize* = 0. *Oral Toxicity LD₅₀ Rat:* > 5000 mg/kg. *Dermal Toxicity LD₅₀ Rat or Rabbit:* > 2000 mg/kg. *Inhalation Toxicity 4-hrs LC₅₀ Rat:* > 20 mg/L. **1 Slight Hazard:** Minor reversible injury may occur; may irritate the stomach if swallowed; may defat the skin and exacerbate existing dermatitis. *Skin Irritation:* Slightly or mildly irritating. *PII or Draize* > 0 < 5. *Eye Irritation:* Slightly to mildly irritating, but reversible within 7 days. *Draize* > 0 ≤ 25. *Oral Toxicity LD₅₀ Rat:* > 500-5000 mg/kg. *Dermal Toxicity LD₅₀ Rat or Rabbit:* > 1000-2000 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* > 2-20 mg/L. **2 Moderate Hazard:** Temporary or transitory injury may occur; prolonged exposure may affect the CNS. *Skin Irritation:* Moderately irritating; primary irritant; sensitizer. *PII or Draize* ≥ 5, with no destruction of dermal tissue. *Eye Irritation:* Moderately to severely irritating; reversible corneal opacity; corneal involvement or irritation clearing in 8-21 days. *Draize* = 26-100, with reversible effects. *Oral Toxicity LD₅₀ Rat:* > 50-500 mg/kg. *Dermal Toxicity LD₅₀ Rat or Rabbit:* > 200-1000 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* > 0.5-2 mg/L. **3 Serious Hazard:** Major injury likely unless prompt action is taken, and medical treatment is given; high level of toxicity; corrosive. **3 Serious Hazard (continued):** *Skin Irritation:* Severely irritating and/or corrosive; may cause destruction of dermal tissue, skin burns, and dermal necrosis. *PII or Draize* > 5-8, with destruction of tissue. *Eye Irritation:* Corrosive, irreversible destruction of ocular tissue; corneal involvement or irritation persisting for more than 21 days. *Draize* > 80 with effects irreversible in 21 days. *Oral Toxicity LD₅₀ Rat:* > 1-50 mg/kg. *Dermal Toxicity LD₅₀ Rat or Rabbit:* > 20-200 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* > 0.05-0.5 mg/L. **4 Severe Hazard:** Life-threatening; major or permanent damage may result from single or repeated exposure; extremely toxic; irreversible injury may result from brief contact. *Skin Irritation:* Not appropriate. Do not rate as a 4, based on skin irritation alone. *Eye Irritation:* Not appropriate. Do not rate as a 4, based on eye irritation alone. *Oral Toxicity LD₅₀ Rat:* ≤ 1 mg/kg. *Dermal Toxicity LD₅₀ Rat or Rabbit:* ≤ 20 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* ≤ 0.05 mg/L.

16.7.2.2 - 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 requires considerable pre-heating, under all ambient temperature conditions before ignition and combustion can occur. This usually includes the following: Materials that will burn in air when exposed to a temperature of 815.5°C (1500°F) for a period of 5 minutes or less; Liquids, solids and semisolids having a flash point at or above 93.3°C (200°F) (i.e. OSHA Class IIIB); and Most ordinary combustible materials (e.g. wood, paper, etc.).



Section 16 - OTHER INFORMATION (Continued)

16.7 - DEFINITION OF TERMS (continued)

16.7.2 - HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

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

16.7.2.3 - PHYSICAL HAZARD: 0 Water Reactivity: Materials that do not react with water. **Organic Peroxides:** Materials that are normally stable, even under fire conditions and will not react with water. **Explosives:** Substances that are Non-Explosive. **Compressed Gases:** No Rating. **Pyrophorics:** No Rating. **Oxidizers:** No 0 rating. **Unstable Reactives:** Substances that will not polymerize, decompose, condense, or self-react. **1 Water Reactivity:** Materials that change or decompose upon exposure to moisture. **Organic Peroxides:** Materials that are normally stable but can become unstable at high temperatures and pressures. These materials may react with water but will not release energy violently. **Explosives:** Division 1.5 & 1.6 explosives. Substances that are very insensitive explosives or that do not have a mass explosion hazard. **Compressed Gases:** Pressure below OSHA definition. **Pyrophorics:** No Rating. **Oxidizers:** Packaging Group III oxidizers; Solids: any material that in either concentration tested, exhibits a mean burning time less than or equal to the mean burning time of a 3:7 potassium bromate/cellulose mixture and the criteria for Packing Group I and II are not met. Liquids: any material that exhibits a mean pressure rise time less than or equal to the pressure rise time of a 1:1 nitric acid (65%)/cellulose mixture and the criteria for Packing Group I and II are not met. **Unstable Reactives:** Substances that may decompose, condense, or self-react, but only under conditions of high temperature and/or pressure and have little or no potential to cause significant heat generation or explosion hazard. Substances that readily undergo hazardous polymerization in the absence of inhibitors. Substances that readily undergo hazardous polymerization in the absence of inhibitors. **2 Water Reactivity:** Materials that may react violently with water. **Organic Peroxides:** Materials that, in themselves, are normally unstable and will readily undergo violent chemical change but will not detonate. These materials may also react violently with water. **Explosives:** Division 1.4 explosives. Explosive substances where the explosive effects are largely confined to the package and no projection of fragments of appreciable size or range are expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package. **Compressed Gases:** Pressurized and meet OSHA definition but < 514.7 psi absolute at 21.1°C (70°F) [500 psig]. **Pyrophorics:** No Rating. **Oxidizers:** Packaging Group II oxidizers. Solids: any material that, either in concentration tested, exhibits a mean burning time of less than or equal to the mean burning time of a 2:3 potassium bromate/cellulose mixture and the criteria for Packing Group I are not met. Liquids: any material that exhibits a mean pressure rise time less than or equal to the pressure rise of a 1:1 aqueous sodium chlorate solution (40%)/cellulose mixture and the criteria for Packing Group I are not met.

16.7.2.2 - 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 requires considerable pre-heating, under all ambient temperature conditions before ignition and combustion can occur. This usually includes the following: Materials that will burn in air when exposed to a temperature of 815.5°C (1500°F) for a period of 5 minutes or less; Liquids, solids and semisolids having a flash point at or above 93.3°C (200°F) (i.e. OSHA Class IIIB); and Most ordinary combustible materials (e.g. wood, paper, etc.). **2 Moderate Hazard:** Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not, under normal conditions, form hazardous atmospheres in air, but under high ambient temperatures or moderate heating may release vapour in sufficient quantities to produce hazardous atmospheres with air. This usually includes the following: Liquids having a flash-point at or above 37.8°C (100°F); Solid materials in the form of coarse dusts that may burn rapidly but that generally do not form explosive atmospheres; Solid materials in a fibrous or shredded form that may burn rapidly and create flash fire hazards (e.g. cotton, sisal, hemp); and Solids and semisolids (e.g. viscous and slow flowing as asphalt) that readily give off flammable vapours.

16.7.2 - HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

16.7.2.2 - FLAMMABILITY HAZARD (continued): 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. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures, or, unaffected by ambient temperature, are readily ignited under almost all conditions. This usually includes the following: Liquids having a flash point below 22.8°C (73°F) and having a boiling point at or above 38°C (100°F) and those liquids having a flash point at or above 22.8°C (73°F) and below 37.8°C (100°F) (i.e. OSHA Class IB and IC); Materials that on account of their physical form or environmental conditions can form explosive mixtures with air and are readily dispersed in air (e.g., dusts of combustible solids, mists or droplets of flammable liquids); and Materials that burn extremely rapidly, usually by reason of self-contained oxygen (e.g. dry nitrocellulose and many organic peroxides). **4 Severe Hazard:** Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air, and that will burn readily. This usually includes the following: Flammable gases; Flammable cryogenic materials; Any liquid or gaseous material that is liquid while under pressure and has a flash point below 22.8°C (73°F) and a boiling point below 37.8°C (100°F) (i.e. OSHA Class IA); and Materials that ignite spontaneously when exposed to air at a temperature of 54.4°C (130°F) or below (pyrophoric).

16.7.2.3 - PHYSICAL HAZARD: 0 Water Reactivity: Materials that do not react with water. **Organic Peroxides:** Materials that are normally stable, even under fire conditions and will not react with water. **Explosives:** Substances that are Non-Explosive. **Compressed Gases:** No Rating. **Pyrophorics:** No Rating. **Oxidizers:** No 0 rating. **Unstable Reactives:** Substances that will not polymerize, decompose, condense, or self-react. **1 Water Reactivity:** Materials that change or decompose upon exposure to moisture. **Organic Peroxides:** Materials that are normally stable but can become unstable at high temperatures and pressures. These materials may react with water but will not release energy violently. **Explosives:** Division 1.5 & 1.6 explosives. Substances that are very insensitive explosives or that do not have a mass explosion hazard. **Compressed Gases:** Pressure below OSHA definition. **Pyrophorics:** No Rating. **Oxidizers:** Packaging Group III oxidizers; Solids: any material that in either concentration tested, exhibits a mean burning time less than or equal to the mean burning time of a 3:7 potassium bromate/cellulose mixture and the criteria for Packing Group I and II are not met. Liquids: any material that exhibits a mean pressure rise time less than or equal to the pressure rise time of a 1:1 nitric acid (65%)/cellulose mixture and the criteria for Packing Group I and II are not met. **Unstable Reactives:** Substances that may decompose, condense, or self-react, but only under conditions of high temperature and/or pressure and have little or no potential to cause significant heat generation or explosion hazard. Substances that readily undergo hazardous polymerization in the absence of inhibitors. Substances that readily undergo hazardous polymerization in the absence of inhibitors. **2 Water Reactivity:** Materials that may react violently with water. **Organic Peroxides:** Materials that, in themselves, are normally unstable and will readily undergo violent chemical change but will not detonate. These materials may also react violently with water. **Explosives:** Division 1.4 explosives. Explosive substances where the explosive effects are largely confined to the package and no projection of fragments of appreciable size or range are expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package. **Compressed Gases:** Pressurized and meet OSHA definition but < 514.7 psi absolute at 21.1°C (70°F) [500 psig]. **Pyrophorics:** No Rating. **Oxidizers:** Packaging Group II oxidizers. Solids: any material that, either in concentration tested, exhibits a mean burning time of less than or equal to the mean burning time of a 2:3 potassium bromate/cellulose mixture and the criteria for Packing Group I are not met. Liquids: any material that exhibits a mean pressure rise time less than or equal to the pressure rise of a 1:1 aqueous sodium chlorate solution (40%)/cellulose mixture and the criteria for Packing Group I are not met. **Reactives:** Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure, but have a low potential (or low risk) for significant heat generation or explosion. Substances that readily form peroxides upon exposure to air or oxygen at room temperature. **3 Water Reactivity:** Materials that may form explosive reactions with water. **Organic Peroxides:** Materials that are capable of detonation or explosive reaction but require a strong initiating source or must be heated under confinement before initiation; or materials that react explosively with water. **Explosives:** Division 1.3 explosives. Explosive substances that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but do not have a mass explosion hazard. **Compressed Gases:** Pressure ≥ 514.7 psi absolute at 21.1°C (70°F) [500 psig]. **Pyrophorics:** No Rating. **Oxidizers:** Packaging Group I oxidizers. Solids: any material that, in either concentration tested, exhibits a mean burning time less than the mean burning time of a 3:2 potassium bromate/cellulose mixture. Liquids: any material that spontaneously ignites when mixed with cellulose in a 1:1 ratio, or which exhibits a mean pressure rise time less than the pressure rise time of a 1:1 perchloric acid (50%)/cellulose mixture. **Unstable Reactives:** Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure and have a moderate potential (or moderate risk) to cause significant heat generation or explosion. **4 Water Reactivity:** Materials that react explosively with water without requiring heat or confinement. **Organic Peroxides:** Materials that are readily capable of detonation or explosive decomposition at normal temperature and pressures. **Explosives:** Division 1.1 & 1.2 explosives. Explosive substances that have a mass explosion hazard or have a projection hazard. A mass explosion is one that affects almost the entire load instantaneously. **Compressed Gases:** No Rating. **Pyrophorics:** Add to the definition of Flammability 4. **Oxidizers:** No 4 rating. **Unstable Reactives:** Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure and have a high potential (or high risk) to cause significant heat generation or explosion.

Section 16 - OTHER INFORMATION (Continued)

16.7 - DEFINITION OF TERMS (continued)

16.7.3 - NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS:

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

16.7.3.2 - 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 according with Annex D of NFPA 704. **1** Materials that must be preheated before ignition can occur. Materials in this degree require considerable preheating, under all ambient temperature conditions, before ignition and combustion can occur. Materials that will burn in air when exposed to a temperature of 816°C (1500°F) for a period of 5 minutes in according with Annex D of NFPA 704. Liquids, solids, and semisolids having a flash point at or above 93.4°C (200°F) (i.e. Class IIIB liquids). Liquids with a flash point greater than 35°C (95°F) that do not sustain combustion when tested using the *Method of Testing for Sustained Combustibility*, per 49 CFR 173, Appendix H or the UN *Recommendations on the Transport of Dangerous Goods, Model Regulations* (current edition) and the related *Manual of Tests and Criteria* (current edition). Liquids with a flash point greater than 35°C (95°F) in a water-miscible solution or dispersion with a water non-combustible liquid/solid content of more than 85% by weight. Liquids that have no fire point when tested by ASTM D 92, *Standard Test Method for Flash and Fire Points by Cleveland Open Cup*, up to the boiling point of the liquid or up to a temperature at which the sample being tested shows an obvious physical change. Combustible pellets with a representative diameter of greater than 2 mm (10 mesh). Most ordinary combustible materials. Solids containing greater than 0.5% by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent. **2** Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not under normal conditions form hazardous atmospheres with air, but under high ambient temperatures or under moderate heating could release vapour in sufficient quantities to produce hazardous atmospheres with air. Liquids having a flash point at or above 37.8°C (100°F) and below 93.4°C (200°F) (i.e. Class II and Class IIIA liquids.) Solid materials in the form of powders or coarse dusts of representative diameter between 420 microns (40 mesh) and 2 mm (10 mesh) that burn rapidly but that generally do not form explosive mixtures with air. Solid materials in fibrous or shredded form that burn rapidly and create flash fire hazards, such as cotton, sisal, and hemp. Solids and semisolids that readily give off flammable vapours. Solids containing greater than 0.5% by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent. **3** Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures or, though unaffected by ambient temperatures, are readily ignited under almost all conditions. Liquids having a flash point below 22.8°C (73°F) and having a boiling point at or above 37.8°C (100°F) and those liquids having a flash point at or above 22.8°C (73°F) and below 37.8°C (100°F) (i.e. Class IB and IC liquids). Materials that on account of their physical form or environmental conditions can form explosive mixtures with air and are readily dispersed in air. Flammable or combustible dusts with representative diameter less than 420 microns (40 mesh).

16.7.3 - NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

16.7.3.2 - FLAMMABILITY HAZARD (continued): 3 (continued): Materials that burn with extreme rapidity, usually by reason of self-contained oxygen (e.g. dry nitrocellulose and many organic peroxides). Solids containing greater than 0.5% by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent. **4** Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air and will burn readily. Flammable gases. Flammable cryogenic materials. Any liquid or gaseous materials that is liquid while under pressure and has a flash point below 22.8°C (73°F) and a boiling point below 37.8°C (100°F) (i.e. Class IA liquids). Materials that ignite when exposed to air. Solids containing greater than 0.5% by weight of a flammable or combustible solvent are rated by the closed cup flash point of the solvent.

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

16.7.4 - 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 vapour to form an ignitable mixture with air near the surface of the liquid or within the test vessel used. **Autoignition Temperature:** Minimum temperature of a solid, liquid, or gas required to initiate or cause self-sustained combustion in air with no other source of ignition. **LEL:** Lowest concentration of a flammable vapour or gas/air mixture that will ignite and burn with a flame. **UEL:** Highest concentration of a flammable vapour or gas/air mixture that will ignite and burn with a flame.

16.7.5 - TOXICOLOGICAL INFORMATION:

Human and Animal Toxicology: Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. **LD₅₀:** Lethal Dose (solids & liquids) that kills 50% of the exposed animals. **LC₅₀:** Lethal Concentration (gases) that kills 50% of the exposed animals. **ppm:** Concentration expressed in parts of material per million parts of air or water. **mg/m³:** Concentration expressed in weight of substance per volume of air. **mg/kg:** Quantity of material, by weight, administered to a test subject, based on their body weight in kg. **TDLo:** Lowest dose to cause a symptom. **TCLo:** Lowest concentration to cause a symptom. **TD₀, LDLo, and LDo, or TC, TC₀, LCLo, and LCo:** Lowest dose (or concentration) to cause lethal or toxic effects. **Cancer Information:** **IARC:** International Agency for Research on Cancer. **NTP:** National Toxicology Program. **RTECS:** Registry of Toxic Effects of Chemical Substances. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. **Other Information:** **BEI:** ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV.

16.7.6 - 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.

16.7.7 - ECOLOGICAL INFORMATION:

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

16.7.8 - REGULATORY INFORMATION:

CANADA:

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/NDSL**).