MATERIAL SAFETY DATA SHEET

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

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

1. PRODUCT IDENTIFICATION

TRADE NAME (AS LABELED): **CO-BRA BOND™ OXIDIZER 50**

CHEMICAL NAME/CLASS: Hydrogen Peroxide Solution
PRODUCT CODE NUMBER: 4046
PRODUCT USE: Printed Wiring Board Chemistry

SUPPLIER/MANUFACTURER'S NAME: **ELECTROCHEMICALS, Inc.**
ADDRESS: 5630 Pioneer Creek Drive
Maple Plain MN 55359

EMERGENCY PHONE: 1-800-424-9300 (**CHEMTREC**)
BUSINESS PHONE: 763-479-2008
DATE OF REVISION: December 5, 2006

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	% w/w	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA			
			TLV ppm	STEL ppm	PEL ppm	STEL ppm	IDLH ppm	OTHER ppm
Hydrogen Peroxide	7722-84-1	40-52	1, A3 (Animal Carcinogen)	NE	1	NE	75	NIOSH REL: TWA = 1 DFG MAK: TWA = 1 Carcinogen: IARC-3
Water and other low hazard constituents. The other low hazard constituents are each present in less than 1 percent concentration.		Balance	NE	NE	NE	NE	NE	NE

NE = Not Established. C = Ceiling Limit. See Section 16 for Definitions of Terms Used.

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This clear, colorless solution has a slightly pungent odor. This product is corrosive and can irritate, redden, and burn exposed tissue (depending on the duration of over-exposure). Additionally, this product can bleach contaminated skin. This product is an oxidizer and can act to initiate and sustain the combustion of combustible materials. Although mixtures of Hydrogen Peroxide and organic materials do not explode upon contact, the resultant combination can detonate when exposed to fire or upon impact. This material releases oxygen upon decomposition. Emergency responders must wear personal protective equipment suitable for the situation to which they are responding.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant routes of occupational over-exposure are inhalation and contact with skin and eyes. The symptoms of over-exposure to this product are as follows:

INHALATION: If mists or sprays of this product are inhaled, they may irritate the nose, throat, and lungs. Damage to the tissues of the respiratory system may occur, especially after severe inhalation over-exposures or exposures to high concentrations of this product. Such over-exposures can result in pulmonary edema (a potentially fatal fluid build-up in the lungs). Additional inhalation symptoms may include laryngitis, headache, nausea, and vomiting.

CONTACT WITH SKIN or EYES: Contact with the eyes will cause irritation, pain, and reddening. Depending on duration and concentration of over-exposure, eye contamination may cause corneal damage and blindness. The eyes are particularly sensitive to over-exposure, but effects can be delayed for a week or more after initial exposure. Skin contact may cause reddening, discomfort, and irritation. Depending on duration and concentration of over-exposure, contact can cause blistering of the skin and chemical burns. Additionally, skin contact can result in whitening and bleaching of the skin and hair.

SKIN ABSORPTION: Skin absorption is not anticipated to be a significant route of over-exposure for any component of this product.

INGESTION: Ingestion is not anticipated to be a likely route of occupational exposure to this product. If this product is swallowed, it will irritate and burn the mouth, throat, esophagus, and other tissues of the digestive system. Ingestion of large volumes of this product can be fatal (in part, due to the production of large quantities of oxygen in the digestive system, which can cause severe damage by physical pressure).

INJECTION: Accidental injection of this product, via laceration or puncture by a contaminated object may cause pain and irritation in addition to the wound.

HAZARDOUS MATERIAL INFORMATION SYSTEM

HEALTH	(BLUE)	3
FLAMMABILITY	(RED)	0
REACTIVITY	(YELLOW)	1
PROTECTIVE EQUIPMENT		D

EYES	RESPIRATORY	HANDS	BODY
	SEE SECTION 8		

For routine industrial applications

See Section 16 for Definition of Ratings

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in **Lay Terms**. In the event of over-exposure, the following symptoms may be observed:

ACUTE: This product can be severely irritating and potentially corrosive to contaminated tissue (i.e. eyes, skin, mucous membranes). Eye contact can result in blindness. Skin contact can result in chemical burns. This product can bleach contaminated skin and hair. If inhaled, irritation of the respiratory system may occur, and tissues of the nose, throat and lungs can be damaged. Severe inhalation and ingestion over-exposures can be fatal.

CHRONIC: Persistent irritation may result from repeated exposures to this product. The eyes are particularly sensitive to over-exposure of this product, but effects can be delayed for a week or more after initial exposure.

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

4. FIRST-AID MEASURES

SKIN EXPOSURE: If this product contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention.

EYE EXPOSURE: If this product's liquid or vapors enter the eyes, open victim's eyes while under gently running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes.

4. FIRST-AID MEASURES (Continued)

INHALATION: If vapors, mists, or sprays of this product are inhaled, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Remove or cover gross contamination to avoid exposure to rescuers.

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. Rinse mouth with water immediately. Victim should drink milk, egg whites, or large quantities of water. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or who cannot swallow.

Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to physician or health professional with victim.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not flammable.
AUTOIGNITION TEMPERATURE: Not flammable.
FLAMMABLE LIMITS (in air by volume, %): Lower (LEL): Not applicable.
Upper (UEL): Not applicable.

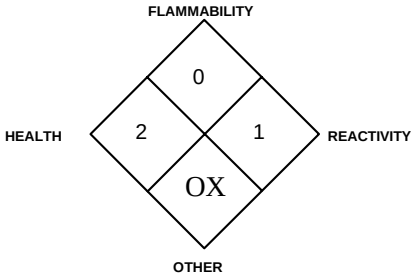
FIRE EXTINGUISHING MATERIALS:

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

UNUSUAL FIRE AND EXPLOSION HAZARDS: This product is corrosive and presents a contact hazard to firefighters. When involved in a fire, this material may decompose and release oxygen, carbon dioxide, and carbon monoxide. This product is an oxidizer, which can act to initiate and sustain the combustion of flammable materials, especially if the solution is allowed to evaporate to dryness on combustibles. Although mixtures of Hydrogen Peroxide and organic materials do not explode upon contact, the resultant combination can detonate when exposed to fire or upon impact.

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

NFPA RATING



See Section 16 for Definition of Ratings

SPECIAL FIRE-FIGHTING PROCEDURES: Prevent the spread of any released product to combustible objects. Incipient fire responders should wear eye protection. Structural fire fighters must wear Self-Contained Breathing Apparatus and full protective equipment. If this product is involved in a fire, fire run-off water should be contained to prevent possible environmental damage.

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a large spill, clear the affected area, protect people, and respond with trained personnel.

In the event of a non-incidental release, minimum Personal Protective Equipment should be **Level B: triple-gloves (rubber gloves and nitrile gloves, over latex gloves), chemically resistant suit and boots, hard-hat, and Self Contained Breathing Apparatus).** Absorb spilled liquid with polypads or other suitable absorbent materials. Test area with Starch-Iodide paper. If Starch-Iodide paper becomes discolored, neutralize area with 5% sodium thiosulfate solution. Decontaminate the area thoroughly. Place all spill residue in an appropriate container and seal. Dispose of in accordance with Federal, State, and local hazardous waste disposal regulations (see Section 13, Disposal Considerations).

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

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash hands after handling this product. Do not eat or drink while handling this product. All work practices should minimize the generation of splashes and aerosols. Remove contaminated clothing immediately.

STORAGE AND HANDLING PRACTICES: All employees who handle this material should be trained to handle it safely. Avoid breathing vapors or mists generated by this product. Use in a well-ventilated location. Open containers slowly on a

7. HANDLING and STORAGE (Continued)

stable surface. Containers of this product must be properly labeled. Do not use wood or combustible materials in the construction of ventilation systems associated with the handling of this product.

STORAGE AND HANDLING PRACTICES (continued): All equipment that may contact this product should be cleaned thoroughly to avoid potential reactions with organic contaminants. Empty containers may contain residual liquid or vapors; therefore, empty containers should be handled with care.

Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Store away from incompatible materials (see Section 10, Stability and Reactivity). Material should be stored in secondary containers, or in a diked area, as appropriate. Keep container tightly closed when not in use. Wash thoroughly after using this material. Storage areas should be made of fire-resistant materials. If appropriate, post warning signs in storage and use areas. Inspect all incoming containers before storage, to ensure containers are properly labeled and not damaged.

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 using 5% sodium thiosulfate solution. Follow neutralization with a triple-rinse with water before maintenance begins. Collect all rinsates and dispose of according to applicable Federal, State, or local procedures.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

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

RESPIRATORY PROTECTION: Respiratory protection is not generally needed when using this product. Maintain airborne contaminant concentrations below exposure limits listed in Section 2 (Composition and Information on Ingredients). If respiratory protection is needed, use only protection authorized in 29 CFR 1910.134 or applicable State regulations. Use supplied air respiration protection during response procedures to non-incidental releases and if oxygen levels are below 19.5% or are unknown. The following respiratory selection guidelines from NIOSH for Hydrogen Peroxide are presented below, for further information.

NIOSH RECOMMENDATIONS FOR HYDROGEN PEROXIDE CONCENTRATIONS IN AIR:

UP TO 10 ppm: Supplied Air Respirator (SAR)
UP TO 25 ppm: SAR in continuous flow mode.
UP TO 50 ppm: Full-face pieces Self-Contained Breathing Apparatus (SCBA); or full face-pieces SAR.
UP TO 75 ppm: Positive pressure, full-face pieces SAR.

EMERGENCY OR PLANNED ENTRY INTO UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS: Positive pressure, full face-piece SAR with an auxiliary positive pressure SCBA.

ESCAPE: Gas mask with canister to protect against Hydrogen Peroxide; or escape-type SCBA.

EYE PROTECTION: Splash goggles or safety glasses. Wear face shields when using more than 1 gallon of this product.

HAND PROTECTION: Wear Neoprene Rubber or Vinyl gloves for routine industrial use. Use triple gloves for spill response, as stated in Section 6 (Accidental Release Measures) of this MSDS.

BODY PROTECTION: Use body protection appropriate for task. An apron or other impermeable body protection is suggested. Full-body chemical protective clothing is recommended for emergency response procedures.

9. PHYSICAL and CHEMICAL PROPERTIES

RELATIVE VAPOR DENSITY (air = 1): Equal to water.
SPECIFIC GRAVITY (water = 1): 1.2
SOLUBILITY IN WATER: Completely soluble.
VAPOR PRESSURE, mm Hg @20°C: Approximately 18.
ODOR THRESHOLD: Not available.
LOG WATER/OIL DISTRIBUTION COEFFICIENT: Not available.

EVAPORATION RATE (n-BuAc = 1): Similar to water.
FREEZING/MELTING POINT: < 0°C
BOILING POINT: 114°C
pH: 1–3

APPEARANCE AND COLOR: This product is a clear, colorless solution with a slightly pungent odor.
HOW TO DETECT THIS SUBSTANCE (warning properties): Starch-Iodide test paper will be discolored upon contact with this product.

10. STABILITY and REACTIVITY

STABILITY: Not stable in the presence of heat, sunlight, and organic matter.

DECOMPOSITION PRODUCTS: Carbon monoxide, carbon dioxide, oxygen, water.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Organic materials, oxidizing agents, metals, mineral acids.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Heat, flame, sunlight, contact with incompatible materials.

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

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: Additional toxicology information for components greater than 1 percent in concentration are provided below.

HYDROGEN PEROXIDE:

DNA Damage System (human cells) = 100 μmol/L

DNA Repair System (human cells) = 1200 μmol/L

Eye Irritancy (rabbit) = 1 drop/ 5-30% solution; surface clouding

TDLo (oral, mouse) = 144000 mg/kg/ 26 weeks; equivocal tumerogenic agent

LD_{50} (skin, rat) = 4060 mg/kg

LC_{50} (multiple, rat) = 2000 mg/m^3/ 4 hours

LD_{50} (oral, mouse) = 2000 mg/kg

LD_{50} (intravenous, rabbit) = 15000 mg/kg

LDLo (skin, pig) = 2000 mg/kg

EFFECTS OF LONG-TERM EXPOSURE: Dogs were exposed 6 hours/day, 5 days/week for 6 months to an average vapor concentration of 7 ppm. Autopsy showed thickened skin, but no hair follicle destruction. The lungs were irritated, but there were no significant changes in blood or urinary components.

EFFECTS ON EYES: A drop of 5-30% hydrogen peroxide in rabbit eyes causes surface clouding, which is persistent when concentration is greater than 10%. In some cases, 5% solution caused severe corneal damage. Rabbits exposed daily for 3 months to vapors at 22 ppm showed no eye injury, although the hair was bleached and irritation was noted around the nose.

SUSPECTED CANCER AGENT: Hydrogen Peroxide is found on the following list:

IARC Group 3, Not Classifiable as to Carcinogenicity to Humans.

Hydrogen Peroxide and the other components of this product are not found on the following lists: FEDERAL OSHA Z LIST, NTP, and CAL/OSHA and therefore are not considered to be, nor suspected to be, cancer causing agents by these agencies.

IRRITANCY OF PRODUCT: This product is irritating and potentially corrosive to contaminated tissue, especially after prolonged contact.

SENSITIZATION TO THE PRODUCT: The components of this product are not known to be sensitizers with repeated or prolonged use.

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

Mutagenicity: This product is not reported to cause mutagenic effects in humans. Human mutation data are available for Hydrogen Peroxide (a component of this product); these data were obtained during clinical studies on specific human tissues exposed to high doses of this compound.

Embryotoxicity: This product is not reported to produce embryotoxic effects in humans.

Teratogenicity: This product is not reported to cause teratogenic effects in humans.

Reproductive Toxicity: This product is not reported to cause reproductive toxicity effects in humans.

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

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing dermatitis and respiratory conditions may be aggravated by over-exposure to this product.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate over-exposure. Be observant for signs of pulmonary edema, as well as delayed effects to the eyes.

BIOLOGICAL EXPOSURE INDICES: Currently, there are no Biological Exposure Indices (BEIs) associated with the components of this product.

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

ENVIRONMENTAL STABILITY: Hydrogen Peroxide (a component of this product) will decompose to release water and oxygen; sunlight accelerates decomposition.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Due to its corrosive and oxidizing properties, this product can be harmful to plant and animal life if it is released into the environment. Refer to Section 11 (Toxicology Information) for additional information on the product's components and their effects on test animals.

EFFECT OF CHEMICAL ON AQUATIC LIFE: Due to its corrosive and oxidizing properties, this product can adversely affect aquatic environments if large quantities are released into water.

13. DISPOSAL CONSIDERATIONS

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

EPA WASTE NUMBER: D001 (Characteristic /Ignitability) and D002 (Characteristic /Corrosivity), applicable to wastes consisting only of this product.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME:	Hydrogen peroxide, aqueous solutions
HAZARD CLASS NUMBER and DESCRIPTION:	5.1 (8)
UN IDENTIFICATION NUMBER:	UN 2014
PACKING GROUP:	II
DOT LABEL(S) REQUIRED:	Oxidizer, Corrosive

EMERGENCY RESPONSE GUIDEBOOK NUMBER (2006): 140

MARINE POLLUTANT: This product does not contain any components which are designated by the Department of Transportation to be Marine Pollutants (per 49 CFR 172.101, Appendix B).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Refer to information above for Canadian Shipments.

15. REGULATORY INFORMATION

SARA REPORTING REQUIREMENTS: The components of the product are not subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act.

SARA Threshold Planning Quantity: Not applicable.

TSCA INVENTORY STATUS: All components of this product are listed on the TSCA Inventory.

CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

OTHER FEDERAL REGULATIONS: Not applicable.

STATE REGULATORY INFORMATION: Components of this product are covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Hydrogen Peroxide.
California - Permissible Exposure Limits for Chemical Contaminants: Hydrogen Peroxide.
Florida - Substance List: Hydrogen Peroxide.
Illinois - Toxic Substance List: Hydrogen Peroxide.
Kansas - Section 302/313 List: Hydrogen Peroxide.
Massachusetts - Substance List: Hydrogen Peroxide.
Minnesota - List of Hazardous Substances: Hydrogen Peroxide.
Missouri - Employer Information/Toxic Substance List: Hydrogen Peroxide.
New Jersey - Right to Know Hazardous Substance List: Hydrogen Peroxide.
North Dakota - List of Hazardous Chemicals, Reportable Quantities: None.
Pennsylvania - Hazardous Substance List: Hydrogen Peroxide.
Rhode Island - Hazardous Substance List: Hydrogen Peroxide.
Texas - Hazardous Substance List: Hydrogen Peroxide.
West Virginia - Hazardous Substance List: Hydrogen Peroxide.
Wisconsin - Toxic and Hazardous Substances: Hydrogen Peroxide.

CALIFORNIA PROPOSITION 65: No component of this product is on the California Proposition 65 lists.

LABELING (Precautionary Statements): **DANGER!** OXIDIZER. CORROSIVE. MAY BE FATAL IF SWALLOWED.

15. REGULATORY INFORMATION (Continued)

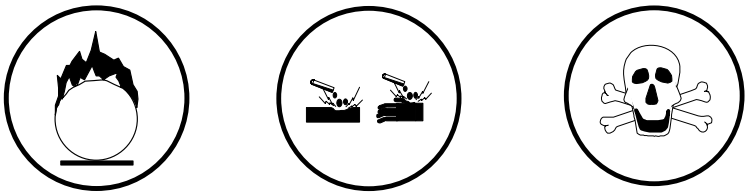
CAUSES SKIN AND EYE BURNS. HARMFUL IF INHALED. BLEACHES SKIN, HAIR, CLOTHING. Do not taste or swallow.

Do not get on skin or in eyes. Avoid contact with hair or clothing. Avoid breathing vapors or mist. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Wear gloves, goggles, face-shield, and suitable body protection. FIRST-AID: In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. If inhaled, remove to fresh air. If ingested, do not induce vomiting. Get medical attention. IN CASE OF FIRE: Use water fog, dry chemical, CO_2, or "alcohol" foam. IN CASE OF SPILL: Absorb spill with inert material. Place residue in suitable container and seal. Consult Material Safety Data Sheet for additional information.

TARGET ORGANS: Respiratory system, skin, eyes.

WHMIS SYMBOLS:

Class C: Oxidizing Material
Class E: Corrosive Material
Class D1: Poisonous Material- Causing Serious Toxic Effects



16. OTHER INFORMATION

PREPARED BY: Electrochemicals, Inc.

DATE OF PRINTING: December 5, 2006

All statements, technical information and recommendations herein are based on tests we believe to be reliable, but the accuracy or completeness thereof is not guaranteed. **THE FOLLOWING IS MADE IN LIEU OF ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PURPOSE.** Seller's and manufacturer's only obligation shall be to replace such quantity of the product proved to be defective. Before using, user shall determine the suitability of the product for its intended use, and user assumes all risks and liability whatsoever in connection therewith.

NEITHER SELLER NOR MANUFACTURER SHALL BE LIABLE EITHER IN TORT OR IN CONTRACT FOR ANY LOSS OR DAMAGE, DIRECT, INCIDENTAL OR CONSEQUENTIAL, ARISING OUT OF THE USE OR THE INABILITY TO USE THE PRODUCT.

DEFINITIONS OF TERMS

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

CAS #: This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used as a unique identifier of the chemical.

EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV -** Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average **(TWA)**, the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level **(C)**. Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration.

PEL - Permissible Exposure Limit - 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 which was vacated by Court Order. **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. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **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**). NIOSH issues exposure guidelines called Recommended Exposure Levels (**REL**s). When no exposure guidelines are established, an entry of **NE** is made for reference.

HAZARD RATINGS:

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: This rating system was developed by the National Paint and Coating Association and has been adopted by industry to identify the degree of chemical hazards. Health Hazard: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]. Reactivity Hazard: **0** (normally stable); 1 (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures). PPE Rating D: Hand, eye, face, and body protection is required for routine chemical use.

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major residual injury). Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:

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

TOXICOLOGICAL INFORMATION:

Human and Animal Toxicology: Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD_{50}** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC_{50}** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m^3** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **Cancer Information:** The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. **Other Information: BEI** - ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. **Ecological Information:** EC is the effect concentration in water. **BCF** = Bioconcentration Factor, which is used to determine if a substance will concentrate in lifeforms which consume contaminated plant or animal matter. **TL_m** = median threshold limit; Coefficient of Oil/Water Distribution is represented by **log K_{ow}** or **log K_{oc}** and is used to assess a substance's behavior in the environment.

REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **U.S.: EPA** is the U.S. Environmental Protection Agency. **DOT** is the U.S. Department of Transportation. **SARA** is the Superfund Amendments and Reauthorization Act. **TSCA** is the U.S. Toxic Substance Control Act. **CERCLA (or Superfund)** refers to the Comprehensive Environmental Response, Compensation, and Liability Act. Labeling is per the American National Standards Institute (**ANSI Z129.1**). **CANADA: CEPA** is the Canadian Environmental Protection Act. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **TC** is Transport Canada. **DSL/NDSL** are the Canadian Domestic/Non-Domestic Substances List.