

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): **C-473**

CHEMICAL NAME/CLASS: Hydrochloric Acid Solution

PRODUCT CODE NUMBER: 2904

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 4, 2006

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	% w/w	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA			OTHER
			TLV mg/m ³	STEL mg/m ³	PEL mg/m ³	STEL mg/m ³	IDLH mg/m ³	
Hydrochloric Acid	7647-01-0	10-20	NE	C 7.5	NE	C 7	76	NIOSH REL: STEL = C 7 DFG MAK: TWA = 7 IARC-3
Stannous Chloride	7772-99-8	30-35	2 (Tin, inorganic compounds)	NE	2 (Tin, inorganic compounds)	NE	100 (Tin, inorganic compounds)	NIOSH REL: TWA = 2 (Tin, inorganic compounds) DFG MAK: TWA = 2 (Tin, inorganic compounds)
Water and other low hazard constituents. The other low hazard constituents are each present in less than 1 percent in 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 dark-brown, pungent-smelling liquid is highly corrosive. Over-exposure to the vapors, mists, and liquid of this product can result in severe irritation and chemical burns. Persons who respond to releases of this product must protect themselves from inhalation of the acid vapors and mists, especially in areas which are downwind of the spill. Hydrogen (a flammable gas) may be generated by contact with metals. Extreme caution must be used when responding to spills. Emergency responders must wear the proper personal protective suitable (and appropriate fire protection) 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: Inhalation of vapors of this product may lead to irritation of the nose and throat. Exposure to concentrations of the main component of this solution, Hydrochloric Acid, in concentrations greater than 35 ppm causes irritation of the throat after short exposures. Severe inhalation over-exposures (1000-2000 ppm Hydrochloric Acid) can result in pulmonary edema (a potentially life-threatening fluid accumulation in the lungs). Repeated inhalation over-exposures to Hydrochloric Acid mists can cause dental erosion and tooth discoloration.

CONTACT WITH SKIN or EYES: Contact of the product with the skin can lead to severe burns or dermatitis (red, cracked, irritated skin) and ulceration, depending upon concentration and duration of exposure. This product can burn the skin and yes. Eye over-exposures can lead to blindness.

SKIN ABSORPTION: Direct skin absorption is not a significant route of exposure for any component of this solution.




INGESTION: Ingestion is not anticipated to be a likely route of exposure to this product. If ingestion does occur this product causes severe burns to the mouth, throat, and esophagus. Aspiration of this product can lead to severe damage of lung tissue. Ingestion of large quantities of this solution can be fatal.

INJECTION: Injection of this product can lead to redness and irritation of the surrounding tissue.

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

ACUTE: This solution is corrosive. Depending on the duration of contact, over-exposures can irritate or burn the eyes, skin, mucous membranes, and any other exposed tissue. If inhaled, irritation of the respiratory system may occur, with coughing, and breathing difficulty. Skin contact can cause blisters and scars. Eye contact can cause blindness. Severe inhalation and ingestion over-exposures may be fatal.

CHRONIC: Persistent irritation and dermatitis may result from repeated skin over-exposures to this solution. Repeated inhalation over-exposures to Hydrochloric Acid mists can cause dental erosion and tooth discoloration. Refer to Section 11 (Toxicological Information) for additional chronic exposure information on this product.

HAZARDOUS MATERIAL INFORMATION SYSTEM			
HEALTH		(BLUE)	3
FLAMMABILITY		(RED)	0
REACTIVITY		(YELLOW)	1
PROTECTIVE EQUIPMENT			H
EYES	RESPIRATORY	HANDS	BODY
	SEE SECTION 8		
For routine industrial applications			

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. Do not interrupt flushing. 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 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. Do not interrupt flushing. Victim must seek immediate medical attention.

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. Victim must seek immediate medical attention.

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 large quantities of water. If milk is available, victim should drink it after drinking 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, °C (method): Not flammable.

AUTOIGNITION TEMPERATURE, °C: Not flammable.

FLAMMABLE LIMITS (in air by volume, %): Lower (LEL): Not applicable.

Upper (UEL): Not applicable.

FIRE EXTINGUISHING MATERIALS:

Water Spray: YES

Foam: YES

Halon: YES

Carbon Dioxide: YES

Dry Chemical: YES

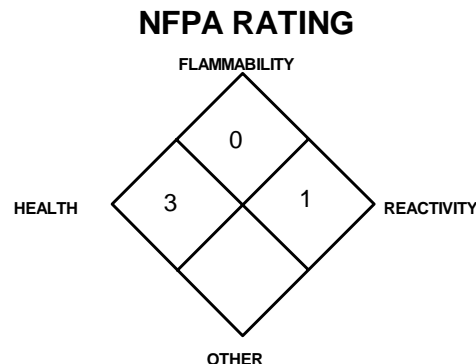
Other: Any "ABC" Class.

UNUSUAL FIRE AND EXPLOSION HAZARDS: This product is corrosive, and presents a significant contact and inhalation hazard to fire-fighters. When involved in a fire, this material may decompose and produce irritating and toxic vapors, hydrogen chloride and tin oxide compounds. Hydrochloric Acid (a component of this product) can react with common metals to produce flammable hydrogen gas.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

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



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-incident 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. Neutralize residue with sodium bicarbonate or other acid neutralizing agent. Decontaminate the area thoroughly. Place all spill residue in a double plastic bag and seal immediately. 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 solution. 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 stable surface. Containers of this product must be properly labeled.

7. HANDLING and STORAGE (Continued)

STORAGE AND HANDLING PRACTICES (Continued): 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. Use corrosion-resistant structural materials, lighting, and ventilation systems in the storage area. Floors should be sealed to prevent absorption of this material. 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 application equipment is locked and tagged-out safely. Always use this product in areas where adequate ventilation is provided. Decontaminate equipment using acid neutralizing agent, followed by a triple-rinse with water, before maintenance begins. Hydrochloric Acid will corrode steel. 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: Maintain airborne contaminant concentrations below exposure limits listed in Section 2 (Composition and Information on Ingredients). If respiratory protection is needed (i.e. air-purifying respirator with an acid gas cartridge), use only protection authorized in 29 CFR 1910.134, or applicable State regulations. Use supplied air respiration protection during response procedures to non-incident releases and if oxygen levels are below 19.5% or are unknown.

EYE PROTECTION: Splash goggles or safety glasses. Face shields recommended when using quantities of this solution in excess of 1 gallon.

HAND PROTECTION: Wear Neoprene Rubber 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): 1.4

SOLUBILITY IN WATER: Completely soluble.

VAPOR PRESSURE, mm Hg @ 20 °C: 18

ODOR THRESHOLD: Not available.

LOG OIL/WATER DISTRIBUTION COEFFICIENT: Not available.

EVAPORATION RATE (n-BuAc = 1): Similar to water.

FREEZING/MELTING POINT: < 0 °C

BOILING POINT: 104 °C

pH: < 2

APPEARANCE AND COLOR: This product is a dark brown solution with a pungent odor.

HOW TO DETECT THIS SUBSTANCE (warning properties): Litmus paper will turn red upon contact with this solution.

10. STABILITY and REACTIVITY

STABILITY: Stable.

CONDITIONS TO AVOID: Extreme heat may cause product to decompose, producing toxic fumes (i.e. chloride compounds, tin oxides),

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Hydrochloric Acid is not compatible with bases, amines, alkali metals, copper, copper alloys, and aluminum. Stannous Chloride has a potentially explosive reaction with metal nitrates and is also incompatible with strong oxidizers and alkali metals. This product is not compatible with water reactive materials.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Extreme heat and contact with incompatible chemicals.

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 is provided below.

HYDROCHLORIC ACID:

Eye Irritancy (rabbit) = 1% solution/ 20 seconds; corneal scarring

Eye Irritancy (rabbit) = 5 mg/ 30 seconds; mild

Skin Irritancy (rabbit) = 0.5 mL/ 17% solution/ 4 hours; corrosive burns

LC₅₀ (inhalation, mouse) = 1180 ppm, 60 min

LC₅₀ (inhalation, mouse) = 2142 ppm, 30 min; 2644 ppm, 30 min

LC₅₀ (inhalation, mouse) = 13,745 ppm, 5 min; 11238 ppm, 5 min

LC₅₀ (inhalation, rat) = 3124 ppm, 60 min

HYDROCHLORIC ACID (continued):

LC₅₀ (inhalation, rat) = 4701 ppm, 30 min; 5666 ppm, 30 min

LC₅₀ (inhalation, rat) = 30,000 ppm, 5 min; 31,008 ppm

LD₅₀ (oral, rabbit) = 900 mg/kg.

STANNOUS CHLORIDE:

Sex Chromosome Loss and Nondisjunction System (*Saccharomyces cerevisiae*, yeast) = 6 mmol/L

DNA Damage System (leukocyte, human) = 10 μmol/L

TDLo (intratesticular, rat) = 15 mg/kg; reproductive effects

LD₅₀ (oral, rat) = 700 mg/kg

STANNOUS CHLORIDE (continued):

LD₅₀ (intraperitoneal, rat) = 52 mg/kg

LD₅₀ (oral, mouse) = 1200 mg/kg

LD₅₀ (intraperitoneal, mouse) = 105 mg/kg; 41 mg/kg

LD₁₀₀ (intraperitoneal, mouse) = 66 mg/kg

LD₅₀ (intravenous, mouse) = 17.8 mg/kg

LDLo (oral, dog) = 500 mg/kg

LDLo (subcutaneous, dog) = 159 mg/kg

LD₁₀₀ (subcutaneous, dog) = 159 mg/kg

LDLo (intravenous, dog) = 20 mg/kg

LD₅₀ (intravenous, dog) = 22 mg/kg

LD₅₀ (oral, rabbit) = 10000 mg/kg

LDLo (subcutaneous, guinea pig) = 400 mg/kg

SUSPECTED CANCER AGENT: This products ingredient's are not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA and, therefore, are not considered to be, nor suspected to be, cancer causing agents by these agencies. Hydrochloric Acid (a component of this product) is on the IARC-3 (Not Classifiable as to Carcinogenicity to Humans).

IRRITANCY OF PRODUCT: This product is severely irritating and corrosive to contaminated tissue.

SENSITIZATION OF PRODUCT: No component of this product is a sensitizer.

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 produce mutagenic effects in humans. Human mutation data are available for Stannous Chloride (a component of this product); this data was obtained during clinical studies on specific human tissues exposed to high doses of this compound. Animal mutation data are available for Hydrochloric Acid (a component of this product); this data was obtained during clinical studies on specific animal 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. Clinical studies on test animals exposed to relatively high doses of Hydrochloric Acid (a component of this product) indicate teratogenic effects.

Reproductive Toxicity: This product is not reported to cause reproductive effects in humans. Clinical studies on test animals exposed to relatively high doses of Stannous Chloride (a component of this product) indicate adverse reproductive effects.

*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 may be aggravated by over-exposure to this product.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate over-exposure.

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: Hydrochloric Acid is stable and found naturally in the environment (sources include volcanoes). Inorganic tin compounds, such as Stannous Chloride, also occur in nature and have the potential to bioaccumulate in the environment. Additional environmental toxicity data are as follows:

STANNOUS CHLORIDE: Water Solubility (20°C) = 90 g/100mL. Biological Half-Life (from bone) \cong 400 days. Chronic Hazard Level: Mouse given 0.5 mg/kg/day for life; no effect. Rat given 0.7 mg/kg/day for life; significant decrease in longevity and survival. Dog given 23 mg/kg/day; paralysis after 14 months.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Animals exposed to this product will experience tissue damage, burns, and may be killed. Plants contaminated with solutions of low pH, such as this product, may be adversely effected or destroyed.

EFFECT OF CHEMICAL ON AQUATIC LIFE: High concentrations of Hydrochloric Acid have been shown to be detrimental to aquatic life. A release of this product in a river or other body of water will kill fish and other aquatic life. Additional aquatic toxicity data are available as follows:

HYDROCHLORIC ACID:

LC₁₀₀ (trout) = 10 mg/L, 24 hr

LC₅₀ (shrimp) = 100 - 330 ppm, 48 hr (salt water)

LC₅₀ (starfish) = 100 - 300 mg/L, 48 hr

LC₅₀ (cockel) = 330 - 1000 mg/L, 48 hr

TLm (*Gambusia affinis*/mosquito fish) = 282 ppm, 96 hr (fresh water)

LC₅₀ (*Carassium auratus*/goldfish) = 178 mg/L (1-2 hour survival time)

LC₅₀ (shore crab) = 240 mg/L, 48 hr

LC (*Lepomis macrochirus*/bluegill sunfish) = 3.6 mg/L, 48 hr

LC₅₀ (*Lepomis macrochirus*/bluegill sunfish), pH 3.0 - 3.5, 96 hours

TLm (sunfish) = 96 hours/ pH 3.6/ 20°C

TLm (goldfish) = 96 hours/ pH 4/ 20°C

TLm (stickleback) = 96 hours/ pH 4.6/ 20°C

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. This solution, 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: D002 (Characteristic /Corrosive), applicable to wastes consisting only of this solution.

14. TRANSPORTATION INFORMATION

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

PROPER SHIPPING NAME: Corrosive liquid, acidic, inorganic, n.o.s. (Hydrochloric Acid, Stannous Chloride)

HAZARD CLASS NUMBER and DESCRIPTION: 8 (Corrosive)

UN IDENTIFICATION NUMBER: UN 3264

PACKING GROUP: II

DOT LABEL(S) REQUIRED: Corrosive

EMERGENCY RESPONSE GUIDEBOOK NUMBER, 2004: 154

MARINE POLLUTANT: This product does not contain any components which are designated by the Department of Transportation to be Marine Pollutants (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 this product are subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

COMPONENT	SARA 302	SARA 304	SARA 313
Hydrochloric Acid	No	Yes	Yes (Aerosol Form Only)
Stannous Chloride	No	No	No

SARA Threshold Planning Quantity: Not applicable.

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

CERCLA REPORTABLE QUANTITIES (RQ): 5000 lbs (for Hydrochloric Acid).

OTHER FEDERAL REGULATIONS: Not applicable.

STATE REGULATORY INFORMATION: The components of the product are covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: Hydrochloric Acid, Tin (inorganic compounds).

California - Permissible Exposure Limits for Chemical Contaminants: Hydrochloric Acid, Tin (inorganic compounds).

Florida - Substance List: Hydrochloric Acid.

Illinois - Toxic Substance List: Hydrochloric Acid, Tin (inorganic compounds).

Kansas - Section 302/313 List: Hydrochloric Acid.

Massachusetts - Substance List: Hydrochloric Acid.

Minnesota - List of Hazardous Substances: Hydrochloric Acid.

Missouri - Employer Information/Toxic Substance List: Hydrochloric Acid, Stannous Chloride.

New Jersey - Right to Know Hazardous Substance List: Hydrochloric Acid, Stannous Chloride.

North Dakota - List of Hazardous Chemicals, Reportable Quantities: Hydrochloric Acid.

Pennsylvania - Hazardous Substance List: Hydrochloric Acid.

Rhode Island - Hazardous Substance List: Hydrochloric Acid.

Texas - Hazardous Substance List: Hydrochloric Acid, Tin (inorganic compounds).

West Virginia - Hazardous Substance List: Hydrochloric Acid, Tin (inorganic compounds).

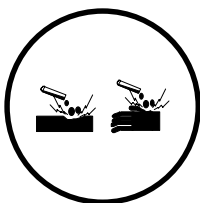
Wisconsin - Toxic and Hazardous Substances: Hydrochloric Acid, Tin (inorganic compounds).

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

LABELING (Precautionary Statements): **DANGER!** MAY BE FATAL IF SWALLOWED. CAUSES SKIN AND EYE BURNS. HARMFUL IF INHALED. Do not taste or swallow. Do not get in eyes, on skin or clothing. Avoid breathing vapors or mist. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Wear gloves, goggles, face-shield, suitable body protection, and NIOSH/MSHA-approved respiratory protection, as appropriate. **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, CO₂, or "alcohol" foam. **IN CASE OF SPILL:** Absorb spill with neutralizing agent appropriate for acids and place in suitable container. Consult Material Safety Data Sheet for additional information.

TARGET ORGANS: Respiratory system, skin, eyes.

WHMIS SYMBOLS



16. OTHER INFORMATION

PREPARED BY: Electrochemicals, Inc.

DATE OF PRINTING: December 4, 2006

16. OTHER INFORMATION (Continued)

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 for computer-related searching.

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**. Skin adsorption 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 (RELs)**. When no exposure guidelines are established, an entry of **NE** is made for reference.

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the **National Fire Protection Association (NFPA)**. **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:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m³** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. 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 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 death. **BEI** - 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.

REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Other acronyms used are: **Superfund Amendments and Reauthorization Act (SARA)**; the **Toxic Substance Control Act (TSCA)**; Marine Pollutant status according to the **DOT**; California's Safe Drinking Water Act (**Proposition 65**); the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund)**; and various state regulations. This section also includes information on the precautionary warnings which appear on the material's package label.