
Section 1 - Product and Company Identification
Mask Coating by Lumera Corporation

Product Identification: MRC16**Date of MSDS:** 06/15/2003**Submitter:** DJ**Manufacturer's Information****Manufacturer's Name:** Lumera Corporation**Manufacturer's Address1:** 19910 North Creek Parkway**Manufacturer's Address2:** Bothell, WA 98011**Manufacturer's Country:** US**General Information Telephone:** 425-398-6536; FAX: 425-398-6599/Dan Jin**Emergency Telephone:** 425-985-6970**MSDS Preparer's Name:** Dan Jin**Proprietary:** Y**Item Description****Item Name:** Mask Coating**Unit of Issue Quantity:** x**Type of Container:** xx

Section 2 - Composition/Information on Ingredients

Product Name: MRC16/Proprietary Polymer

<u>Compound</u>	<u>%</u>	<u>CAS #</u>
Toluene	> 95	108-88-3
Proprietary	< 5	---

Exposure Limits In Air					
ACGIH		OSHA		IDLH (ppm)	OTHER
TLV (ppm)	STEL (ppm)	PEL (ppm)	STEL (ppm)		
50, Skin	NE	200	300, C	500	NIOSH RELs:
A4, Not Classifiable as Human Carcinogen		100 (Vacated 1989 PEL)	500, 10 min peak per 8 hour shift 150 (vacated 1989 PEL)		TWA: 100 ppm STEL: 150 ppm DFG MAKs: 50 ppm Carcinogen: EPA-D

NE= not established; C = ceiling limit

Section 3 - Hazards Identification, Including Emergency Overview

EMERGENCY OVERVIEW: MRC16 is a colorless, flammable, toxic liquid, with gasoline-like odor. Inhalation of vapors can affect the central nervous system. Symptoms of central nervous system overexposure can include headache, drowsiness, dizziness, fatigue, nausea and weakness. Skin and eye contact can be irritating. This liquid is very flammable; vapors are heavier than air and may travel long distances to source of ignition and flashback. If involved in a fire MRC16 will decompose to produce toxic gases (e.g., carbon monoxide, carbon dioxide, reactive hydrocarbons, acid, and aldehydes). MRC16 is not reactive under normal circumstances. People responding to releases of this product must have adequate fire protection for the specific emergency situation.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: The most significant routes of occupational overexposure for MRC16 are by inhalation, and contact with skin or eyes. The following paragraphs describe symptoms of exposure by route of exposure.


INHALATION: Exposures to high concentrations of vapors of MRC16 can cause central nervous system effects. Symptoms of central nervous system effects are related to exposure concentrations. The effects associated with various levels of MRC16 vapors are as follows:

Concentration	Symptoms of Exposure
~50 ppm	Slight drowsiness and headache.
50-100 ppm	Irritation of the nose, throat and respiratory tract.
Over 100 ppm	Fatigue and dizziness.
Over 200 ppm	Symptoms similar to drunkenness, giddiness, numbness, and mild nausea.
Over 500 ppm	Mental confusion and incoordination, loss of appetite, a bad taste.
10,000 ppm (est)	At this concentration MRC16 causes visual disturbances and further depression of the central nervous system that can result in unconsciousness and death.

In an industrial setting, the most serious overexposures have occurred when vapors of MRC16 have accumulated in small, confined spaces or other poorly-ventilated areas. In cases of sniffing abuse of MRC16 can lead to the three sets of symptoms, as described below:

- o Severe muscle weakness leading to limb paralysis, associated with hypokalemia (deficiency of potassium in the blood) due to renal tubular acidosis. Cardiac arrhythmias often accompany the hypokalemia .
- o Gastrointestinal complaints, including abdominal pain, nausea, vomiting, and hematemesis (vomiting of blood).
- o Neuropsychiatric complaints including:
 - a) lethargy, hallucinations, coma, or
 - b) headache, dizziness, syncope (loss of consciousness due to sudden lack of blood supply to brain), or
 - c) paresthesias (morbid sensations) and peripheral neuropathy (tingling in the extremities), or
 - d) cerebellar ataxia (incoordination of voluntary muscular movements) and other cerebellar signs.

The symptoms described above may potentially occur after long-term inhalation overexposures to MRC16 in occupational settings

Hazardous Material Information System			
HEALTH (BLUE)		2	
FLAMMABILITY (RED)		3	
REACTIVITY (YELLOW)		1	
PROTECTIVE EQUIPMENT (BLUE)		C	
EYES	RESPIRATORY	HANDS	BODY
	SEE SECTION 8	GLOVES	SEE SECTION 8
For routine industrial applications			

CONTACT WITH SKIN or EYES: Initial contact with the skin can cause mild irritation. Prolonged contact can result in a burning sensation and reddening of the skin. MRC16 is a defatting agent, removing oils from the skin and causing red cracked and dry skin. Prolonged or repeated contact with the skin will cause dermatitis. Very short exposure (3-5 minutes) to the eyes of vapors of MRC16 at a concentration of 300 ppm causes slight irritation. Longer exposures (6-7 hours) to levels above 100 ppm will cause irritation. Contact of the liquid the eyes will be irritating, but will not cause permanent damage.

SKIN ABSORPTION: MRC16 can be somewhat absorbed through the skin, which may result in irritation at the site of absorption. Symptoms similar to those described for "Inhalation" may also occur, especially in cases of severe exposure.

INGESTION: MRC16 is readily absorbed by the tissues of the digestive system, producing symptoms of central nervous system depression similar to those described in "Inhalation". If ingested, MRC16 presents a potential aspiration hazard. The aspiration of MRC16 into the lungs can result in severe lung irritation, leading to lung damage; death may result. **INJECTION:** Injection is not anticipated to be a significant route of overexposure for MRC16. If MRC16 is "injected" (as may occur through punctures by contaminated, sharp objects), symptoms described in "Inhalation" can occur.

OTHER HEALTH EFFECTS: MRC16 poisoning can lead to anemia and leukopenia (deficiency of blood corpuscle which protects against disease), which, upon biopsy, has shown bone marrow hypoplasia (failure of new bone marrow to mature). Exposure to other solvents (such as benzene and ethanol) slows the rate of clearance from the body, enhancing the toxicity of MRC16. For further information, see Section 11, Toxicological Information. In rare cases, repeated overexposure to very high concentrations of MRC16 has led to enlargement of the liver.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Overexposure to may cause the health effects described below.

ACUTE: Acute inhalation overexposure to MRC16 will initially act as a narcotic, possibly leading to coma in extreme cases. Following exposure to high concentrations, victims may be unconscious, and if exposure continues, death can follow from respiratory failure. Contact with the skin can cause irritation and dermatitis. Contact with the eyes is irritating, causing burning and watering of the eyes. Ingestion of MRC16 will cause gastric distress and possible severe depression of the central nervous system. Aspiration of MRC16 into the lungs, following ingestion can result in severe damage to the lungs; death may result.

CHRONIC: In rare cases, chronic poisoning has led to anemia and other problems with the blood and bone marrow. Chronic MRC16 overexposure may also result in a variety of health problems (e.g., headaches, fatigue, and loss of coordination, memory loss, and optic nerve disorders). See Section 11 (Toxicology Information) for additional data.

TARGET ORGANS: Respiratory system, central nervous systems, heart, kidneys, bone marrow, skin, eyes, reproductive system, and liver.

Section 4 - First Aid Measures

Rescuers should not attempt to retrieve victims of exposure to MRC16 without adequate personal protective equipment. If necessary, a self-contained breathing apparatus should be worn.

INHALATION: If vapors, mists, or sprays of MRC16 are inhaled, remove victim to fresh air. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary. Remove or cover gross

SKIN EXPOSURE: If MRC16 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 medical attention if any adverse reaction occurs.

EYE EXPOSURE: If MRC16 or its vapors enter the eyes, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Victim must seek immediate

INGESTION: If MRC16 is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. If professional advice is not available, do not induce vomiting. Victim should drink milk, egg whites, or large quantities of water. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. 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. Physicians should refer to "Recommendations to Physicians" in Section 11 (Toxicological Information). Take copy of label and MSDS to health professional with victim.

Section 5 - Fire Fighting Measures

FLASH POINT, (Closed Cup): 4.4 °C (40 °F); **AUTOIGNITION TEMPERATURE:** 480 °C (896 °F)

FLAMMABLE LIMITS (in air by volume, %): Lower (LEL): 1.2%; Upper (UEL): 7.1%

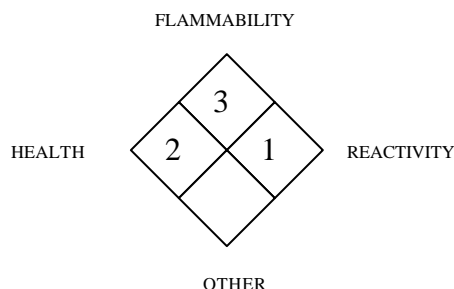
FIRE EXTINGUISHING MATERIALS: Water Spray: YES (for cooling only); Carbon Dioxide: YES

Foam: YES Dry Chemical: YES; Halon: YES Other: Any "B" Class.

UNUSUAL FIRE AND EXPLOSION HAZARDS: MRC16 is a Class IB flammable liquid and presents a serious fire hazard to firefighters. When involved in a fire, this material ignites and produces toxic gases (e.g., carbon monoxide, carbon dioxide, reactive hydrocarbons and aldehydes). The vapors of MRC16 are heavier than air and may spread long distances; distant ignition and flash-back are possible. MRC16 can float on water; therefore, water contaminated with this product can spread the flammable liquid and can spread fire. Containers of MRC16, when involved in fire, may rupture or burst in the heat of the fire. Explosion Sensitivity to Mechanical Impact: Not sensitive. Explosion Sensitivity to Static Discharge: MRC16 can accumulate static charge by flow or agitation; vapors can be ignited by static discharge.

SPECIAL FIRE-FIGHTING PROCEDURES: Eliminate sources of ignition. In the event of fire, cool containers of this product with water to prevent failure. Use a water spray or fog to reduce or direct vapors. Water may not be effective in actually extinguishing a fire involving MRC16, due to its low flash point. Stop the leak or discharge, if possible. For small releases, if it is not possible to stop the leak, and it does not endanger personnel, let the fire burn itself out. Incipient fire responders should wear eye protection. Structural fire fighters must wear Self-Contained Breathing Apparatus and full protective equipment. Large fires should be fought from a distance with an unmanned hose holder or monitor nozzles. If MRC16 is involved in a fire, fire run-off water should be contained to prevent possible environmental damage. If necessary, decontaminate fire-response equipment with soap and water solution. Irritating fumes of hydrogen chloride and organic acid vapors may develop when materials is exposed to water or open flame. For large releases, consider evacuation. Refer to the North American Emergency Response Guidebook (Guide #130) for additional guidance.

NFPA RATING



See Section 16 for Definition of Ratings

Section 6 - Accidental Release Measures

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

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. Monitor the surrounding area for combustible vapor levels. Combustible vapor levels must be below 10% of the LEL for MRC16 (LEL = 1.2%) before personnel are permitted to enter the area. If necessary, ventilate area.

Monitoring should be done for the levels of MRC16 and oxygen. Colorimetric tubes are available to detect the presence of MRC16. Levels of MRC16 should be below levels listed in Section 2 (Composition and Information on Ingredients) and the atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus.

Eliminate all sources of ignition before clean-up operations begin. Use non-sparking tools. Absorb spilled liquid with activated carbon, polypads or other suitable absorbent materials. Prevent material from entering sewer or confined spaces. Decontaminate the area thoroughly. Place all spill residues in an appropriate container and seal. If necessary, decontaminate spill-response equipment with soap and water solution. Dispose of in accordance with Federal, State, and local hazardous waste disposal regulations (see Section 13, Disposal Considerations).

THIS IS A TOXIC, FLAMMABLE LIQUID: Protection of all personnel and the area must be maintained. All responders must be adequately protected from exposure.

Section 7 - Handling and Storage

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting MRC16 ON YOU or IN YOU. Wash thoroughly after chemicals. Do not eat, drink, smoke or apply cosmetics while handling this material. 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. Containers of this product must be properly labeled. If this product is used in other types of containers, only use portable containers and dispensing equipment (faucet, pump, drip can) approved for flammable liquids. Post "NO SMOKING" signs, where

appropriate in storage and use areas. Store this product in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Do not allow area where containers are stored to exceed 52 °C (125 °F). Material should be stored in secondary containers, or in a diked area, as appropriate. Store containers away from incompatible chemicals. Keep container tightly closed when not in use. Storage areas should be made of fire-resistant materials. Inspect all incoming containers before storage, to ensure containers are properly labeled and not damaged. Empty containers may contain residual flammable liquid or vapors. Therefore, empty containers should be handled with care. Do not expose "empty" containers to welding touches, or any other source of ignition.

SPECIAL PRECAUTIONS FOR HANDLING CONTAINERS: Protect containers of this product against physical damage. If appropriate, containers should be stored in an up-right position. Containers should be firmly secured to prevent falling or being knocked over. Containers can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and containers. Electrical equipment should be non-sparking or explosion proof. The following rules are applicable to situations in which containers are being used:

Before Use: If appropriate, move containers with a suitable hand-truck. Do not drag, slide or roll containers. Do not drop containers or permit them to strike each other. Secure containers firmly. Leave the valve protection cap in-place until container is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat containers by any means to increase the discharge rate of the product from the container. Prevent hazardous backflow into the container. Do not use oils or grease on gas-handling fittings or equipment.

After Use: Close main container valve. Replace valve protection cap. Mark empty containers "EMPTY".

NOTE: Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with this product. Close valve after each use and when empty. Containers must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Bulletin SB-2 "Oxygen Deficient Atmospheres".

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, if necessary. Decontaminate equipment using soapy water before maintenance begins. Collect all rinsates and dispose of according to applicable Federal, State, or local procedures.

Section 8 - Exposure Controls & Personal Protection

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Use a mechanical fan or vent area to outside. Where appropriate, use a non-sparking, grounded ventilation system separate from other exhaust ventilation systems. Ensure eyewash/safety shower stations are available near areas where this product is used.

RESPIRATORY PROTECTION: Maintain exposure levels of MRC16 below the levels listed in Section 2 (Composition and Information on Ingredients) and oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if MRC16 levels exceed exposure limits and if oxygen level is below 19.5% or during emergency response to a release of this product. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent State standards. The NIOSH respiratory protection recommendations for MRC16 are presented on the following page.

CONCENTRATION	RESPIRATORY EQUIPMENT
Up to 500 ppm	Chemical cartridge respirator with organic vapor cartridges; or gas mask with organic vapor canister, or powered, air-purifying respirator with organic vapor cartridges, or Supplied Air Respirator (SAR), or full-facepiece SCBA.

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive-pressure, full facepiece SCBA or positive pressure, full-facepiece Supplied Air Respirator (SAR) with an auxiliary positive pressure SCBA.

Escape: Gas mask with organic vapor cartridge or escape-type SCBA should be used.

Note: The IDLH concentration for MRC16 is 500 ppm.

EYE PROTECTION: Splash goggles or safety glasses. Face-shields should be worn if contact with the liquid is anticipated.

HAND PROTECTION: Wear leather gloves for handling of containers of MRC16. Wear chemically resistant gloves appropriate for MRC16 for industrial use. Gloves should have a resistance to breakthrough greater than 8 hours, such as Teflon™ or Viton™. Butyl rubber, natural rubber, neoprene, nitrile rubber, or polyethylene are not recommended. Use triple gloves for spill response (see Section 6, Accidental Release Measures).

BODY PROTECTION: Use body protection appropriate for task. Transfer of large quantities under pressure may require protective equipment appropriate to protect employees from splashes of liquefied product. Safety shoes are recommended when handling containers.

Section 9 - Physical & Chemical Properties

RELATIVE VAPOR DENSITY (air = 1): 3.1	pH: Not applicable.
SPECIFIC GRAVITY @ 20 °C (68 °F) (water = 1): 0.86	FREEZING/MELTING POINT: -95 °C (-139 °F)
SOLUBILITY IN WATER @ 25 °C (77 °F): 54-58 mg/100 mL	BOILING POINT: 110.6 °C (231.1°F)
EVAPORATION RATE: 2.24	ODOR THRESHOLD: Not available.
EXPANSION RATIO: Not applicable.	SPECIFIC VOLUME: Not applicable.
LOG COEFFICIENT WATER/OIL DISTRIBUTION: Log P (oct) = 2.11-2.80	
VAPOR PRESSURE @ 20 °F (68°F) 22 mm Hg: 2.93 kPa	
APPEARANCE AND COLOR: Colorless, flammable liquid, with a strong, gasoline-like odor.	
HOW TO DETECT THIS SUBSTANCE (warning properties): a variation of odor threshold values. The smell of MRC16 may not be noticed after short exposure.	

Section 10 - Stability & Reactivity Data

STABILITY: stable in sealed containers stored under a dry inert atmosphere.

DECOMPOSITION PRODUCTS: If MRC16 is involved in a fire, it may ignite to yield toxic fumes of carbon monoxide, carbon dioxide, reactive hydrocarbons and aldehydes.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: MRC16 is incompatible with strong oxidizers, which increase the risk of fire and explosion. MRC16 reacts to water, acid, alcohol, and sulfur dichloride. When combined with sulfuric acid, an exothermic reaction will occur. MRC16 will react vigorously with uranium hexafluoride. When mixed with silver perchlorate MRC16 forms explosive complexes and with tetranitromethane MRC16 forms a sensitive, highly explosive mixture.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Avoid contact with incompatible materials, sparks, flame static discharge and other sources of ignition. Avoid exposing containers to extremely high temperatures, which could cause the containers to rupture or burst.

Section 11 - Toxicological Information

TOXICITY DATA: The following information is available for MRC16.

Eye effects-Human 300 ppm	Inhalation-Human TClO: 200 ppm: BRN, Central nervous system effects, Blood effects
Skin-Rabbit, adult 435 mg Mild irritation effects	Inhalation-Man TClO: 100 ppm: Central nervous system effects
Skin-Rabbit, adult 500 Moderate irritation effects	Oral-Rat LD50 :5000 mg/kg
Eye effects-Rabbit, adult 870 µg Mild irritation effects	Inhalation-Rat LClO: 4000 ppm/4 hours
Eye effects-Rabbit, adult 2 mg/24 hours Severe irritation effects	Intraperitoneal-Rat LD50: 1332 mg/kg
Eye effects-Rabbit, adult 100 mg/30S rns Mild irritation effects	Intravenous-Rat LD50: 1960 mg/kg
oms -grasshopper-Inhalation 562 mg/L	Unreported-Rat LD50: 6900 mg/kg
Cytogenetic Analysis -Rat-Subcutaneous 12 g/kg/12 days - Intermittent	Intraperitoneal-Mouse LD50: 59 mg/kg
Inhalation-Mouse TClO :400 ppm/7 hours (female 7-16 days post): Reproductive effects	Subcutaneous-Mouse LD50: 2250 mg/kg
Oral-Mouse TDLo: 9 g/kg (female 6-15 days post): Teratogenic effects	Unreported-Mouse LD50: 2 g/kg
Oral-Human LDLo :50 mg/kg	Intraperitoneal-Mouse LD50: 640 mg/kg
	Inhalation-Rabbit, adult LClO: 55,000 ppm/40 minutes
	Skin-Rabbit, adult LD50: 12,124 mg/kg

SUSPECTED CANCER AGENT: MRC16 is listed as follows:

ACGIH-A4 (Not Classifiable as a Human Carcinogen)
 EPA-D (Not Classifiable as to Human Carcinogenicity)
 IARC-3 (Not Classifiable as to Human Carcinogenicity).

MRC16 is not found on the following lists: NTP, OSHA, CAL/OSHA; therefore is not considered to be, nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: MRC16 is mildly irritating to the skin, eyes, and other contaminated tissue.

SENSITIZATION OF PRODUCT: MRC16 is not known to cause respiratory system or skin sensitization in humans. Cardiac sensitization to stimulants (e.g., epinephrine, ephedrine) is a possible result of severe or chronic overexposure.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of MRC16 on the human reproductive system.

Mutagenicity: MRC16 was not mutagenic in most of the numerous in vivo and in vitro tests. There is some evidence that it can cause chromosome damage in vivo when administered to mice by injection, although conflicting results have been obtained.

Embryotoxicity: MRC16 is not reported to cause embryotoxic effects in humans. However, there is some evidence of embryotoxic effects in animals during clinical studies. Refer to "Teratogenicity" for additional information.

Teratogenicity: MRC16 is not reported to cause teratogenic effects in humans. Many studies have been conducted on rats, mice, and rabbits (primarily through inhalation exposure). MRC16 did not cause birth defects, but exposures of pregnant rats to concentrations greater than 500 ppm resulted in fetotoxicity effects (e.g., reduced birth weights, delay in bone formation)

Reproductive Toxicity: Data on reproductive effects are available from clinical studies involving test animals exposed to relatively high doses of MRC16,

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation 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 respiratory conditions, central nervous system, liver, kidney, and cardio-vascular conditions may be aggravated by severe or chronic overexposure to this product. disorders may also be aggravated by exposures to MRC16.

RECOMMENDATIONS TO PHYSICIANS: The following guidelines are derived from "Clinical Toxicology of Commercial Chemical Products" (5th edition, 1984).

- Check for signs of impending pulmonary edema.
- Because of the aspiration hazard, avoid emetic drugs, whenever practical.
- For ingestion overexposures in which MRC16 contains another toxic component and induction of emesis is advisable: If the patient is not drowsy, comatose, or in respiratory difficulty, induce vomiting. If necessary, as an alternative treatment, remove MRC16 from the stomach via gastric lavage. One or two ounces of mineral oil may be instilled and left in the stomach at the completion of lavage.
- Avoid epinephrine because of its possible adverse effect on the sensitized myocardium. Avoid all digestible fats, oils and alcohol, which may promote the absorption of MRC16 in the intestinal system.
- If eyes or skin are affected, wash thoroughly and apply a bland analgesic ointment.
- Because of the possibility of ventricular fibrillation, monitor the ECG continuously and be prepared to administer external cardiac massage.
- In chronic solvent abusers, correct dehydration, acidosis, hypokalemia and hypophosphatemia. Usually toxic signs and symptoms (except those due to neuropathies and to cerebellar lesions) disappear within a few days after fluid and electrolyte abnormalities are corrected.

BIOLOGICAL EXPOSURE INDICES (BEIs): The following Biological Exposure Indices (BEIs) are currently applicable for MRC16.

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CHEMICAL DETERMINANT	SAMPLING TIME	BEI
• Hippuric acid in urine	• End of shift	• 2.5 g/g creatinine
• MRC16 in venous blood	• Last 4 hours of shift	• 1 mg/L
• MRC16 in end-exhaled air	• End of shift	• Refer to current TLV list.

Section 12 - Ecological Information

ENVIRONMENTAL STABILITY: MRC16 will be degraded over time into other organic compounds. The following environmental data are available for MRC16.

MRC16: $K_{OC} = 2.73$. Water Solubility = 534 mg/L. Biological Half-Life = 0.083 days. Bioconcentration Factors = 13.2 (eels, *Anguilla japonica*); 1.67 (Manila clam (*Tapes semidecussata*)); 4.2 (mussel, *Mytilus edulis*); 380 (algae, *Chorella fusca*); 90 (golden ide fish). MRC16 is rapidly volatilized from water and undergoes moderate biodegradation. The half-life in water is on the order of days to weeks.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: MRC16 may be harmful or fatal to contaminated plant and animal-life (especially if large quantities of MRC16 are released). Refer to Section 11 (Toxicology Information) for information on test animals. The following information is available for MRC16's effects on plant-life.

STUDY # 1: Suspensions of sunflower leaves were prepared from 3-5 week old plants. Two ml of MRC16 was applied to 5 grams of the fresh sunflower leaves. The rate of electrolyte loss caused by this treatment was 435 (min -1 x E-4), while the rate of electrolyte loss in the control groups ranged from 16-21 (min -1 x E-4).

STUDY # 2: Three tomatoes, 20 carrots, and 12 barley seedlings were tested 32, 32, and 14 days after planting. Plants were exposed to 6.4, 12.0, or 24.1 mg/l MRC16 for 1/4, 1/2, 1, and 2 hours. MRC16 was observed to toxic at

concentrations of 6.4 to 12.0 mg/l after 15 minutes of exposure. Fifteen minutes of exposure at 12 mg/l MRC16 produced 50, 0, and 60% injury to tomato, carrot, and barley, respectively. For lethality to occur at 12.0 mg/l, barley required 1 hour, tomato 2 hours, and carrot over 2 hours. At 6.4 mg/l MRC16, percentage of injury to barley after a 2-hour exposure was reduced from 100% to 15% (lethal). MRC16 entered the plant rapidly through the cuticle and stomata. Symptoms of injury included a darkening of the tips of the youngest leaves. This darkening spread to the older leaves. There was a loss of turgor, with draping stems and leaves. In bright sunlight, chlorophyll was destroyed.

STUDY # 3: MRC16 was mixed with Lakeland sand or Davidson soil at rates of 0 ppm, 200 ppm, 2,000 ppm, and 20,000 ppm. The soils were immediately planted with 4 corn, 6 soybean, and fescue seed. Soil was evident at 200 ppm for corn, 800 ppm in soybean and 2,000 ppm in fescue. At 2,000 ppm or more, there was at least 50% or more reduction in the fresh weight of all three crops. There were no visible symptoms of MRC16 toxicity above the critical levels. The critical phytotoxic limit on Lakeland sand was 200 to 2,000 ppm of MRC16 while on the Davidson soil the was 2,000 to 20,000 ppm MRC16.

EFFECT OF CHEMICAL ON AQUATIC LIFE: MRC16 can be harmful or fatal to contaminated aquatic plant and animal life. MRC16 floats on water, and can potentially form slicks that are capable of creating oxygen-deprived waterways which can contaminate coastal and shore life. The following aquatic toxicity data are available for MRC16.

EC50 (*Pimephales promelas*, fathead minnow - embryos/larvae/minnows) = 55-72 mg/L/25-36 mg/L/26-31 mg/L - 96 hours. Effect - loss of equilibrium.

LC50 (*Pimephales promelas*, fathead minnow) = 36.2 mg/L/96 hours

LC50 (Bluegill) = 17 mg/L/24 hours; 13 mg/L/96 hours; 21-23 °C

LC50 (*Palaemonetes pugio*, grass shrimp) = 9.5 ppm/96 hours

LC50 (*Cancer magister*, crab larvae) = 28 ppm/96 hours

LC50 (*Crangon franciscorum*, shrimp) = 4.3 ppm. 96 hours

TLm (fathead minnow) = 56-34 mg/L; 24-96 hours

TLm (*Lebistes reticulatus*, guppy): 63-59 mg/L; 24-96 hours

LC50 (Channel Catfish) = 240 mg/L

LC50 (*Pimephales promelas*, fathead minnow) = 534.27 mg/L; 96 hours

LC50 (*Carassium auratus*, goldfish) = 57.68 mg/L; 96 hours

LC50 (*Lebistes reticulatus*, guppy) = 59.30 mg/L; 96 hours

LC50 (*Daphnia magna*, water flea) = 313 mg/L; 48 hours

LC50 (*Nitocra spinipes*, copepod) = 24.2-74.2 mg/L; 24 hours

LC50 (*Artemia salina*, Brine Shrimp) = 33 mg/L; 24 hours

LC50 (*Morone saxatilis*, striped bass) = 7.3 mg/L; 96 hours

LC50 (sheephead minnow) = 277-485 mg/L; 96 hours

LC50 (*Aedes aegypti*) 22 mg/L

LC50 (*Alandra granaria*, grain weevil) = 210 mg/L

Section 13 - Disposal Considerations

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations.

Section 14 - MSDS Transport Information

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

PROPER SHIPPING NAME: MRC16

HAZARD CLASS NUMBER and DESCRIPTION: 3 (Flammable Liquid)

UN IDENTIFICATION NUMBER: UN 1294

PACKING GROUP: PG II

DOT LABEL(S) REQUIRED: Flammable Liquid

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 130

MARINE POLLUTANT: MRC16 is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information, in addition to the following:

HAZARD CLASS NUMBER, DESCRIPTION: 3 (Flammable Liquid), 9.2 (Hazardous to the Environment)

SPECIAL PROVISION: 109

REGULATED LIMIT: 50 kg

Section 15 - Regulatory Information

US. SARA REPORTING REQUIREMENTS: MRC16 is subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

CHEMICAL NAME	SARA 302 (40 CFR 355, APPENDIX A)	SARA 304 (40 CFR TABLE 302.4)	SARA 313 (40 CFR 372.65)
MRC16	NO	YES	YES

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITY (RQ): 1000 lb.

OTHER U.S. FEDERAL REGULATIONS: MRC16 is a toxic pollutant under Section 307(a)(1) of the Clean Water Act and is subject to effluent limitations. MRC16 is not listed in Appendix A as a highly hazardous chemical, per 29 CFR 1910.119: Process Safety Management of Highly Hazardous Chemicals. Under this regulation, however, any

process that involves a flammable liquid on-site, in one location, in quantities of 10,000 lb. (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.

LABELING: WARNING! FLAMMABLE LIQUID AND VAPOR. FLASH POINT = 4.4 °C (40 °F). HARMFUL IF INHALED. PROLONGED OR REPEATED SKIN CONTACT MAY DRY SKIN AND CAUSE IRRITATION. CAN CAUSE CENTRAL NERVOUS SYSTEM EFFECTS. CAN CAUSE ADVERSE EFFECTS ON THE BLOOD SYSTEM. LIVER, KIDNEYS. MAY CAUSE REPRODUCTIVE EFFECTS, BASED ON ANIMAL TESTS. CAN CAUSE DEATH IF TOO MUCH IS BREATHED. ASPIRATION HAZARD IF SWALLOWED - CAN ENTER LUNGS AND CAUSE DAMAGE. Keep away from heat, sparks and flame. Keep container closed. Use only with adequate ventilation. Avoid contact with skin and clothing. Avoid exposure to vapor. Wash thoroughly after handling. **FIRST-AID:** In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if irritation develops or persists. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of fire, use water fog, foam, dry chemical, or CO₂. In case of spill: Absorb spill with inert materials (e.g. activated carbon, dry sand). Residual spill with water. Consult Material Safety Data Sheet for additional information.

Section 16 - Other Information

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

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM:

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).

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).

NATIONAL FIRE PROTECTION ASSOCIATION (Continued): 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:

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 lethal or toxic effects. **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. Ecological Information: EC is the effect concentration in water.

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. Superfund Amendments and Reauthorization Act (**SARA**); the Canadian Domestic/Non-Domestic Substances List (**DSL/NDSL**); the U.S. Toxic Substance Control Act (**TSCA**); Marine Pollutant status

according to the DOT; the Comprehensive Environmental Response,
Compensation, and Liability Act (**CERCLA or Superfund**); and

various state regulations.
