



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):	COPPER NITRATE SOLUTION
CHEMICAL NAME/CLASS:	Copper Nitrate, Aqueous Solution
TECHNICAL BULLETINS:	Not Applicable
PRODUCT USE:	Various Industrial Applications
SUPPLIER/MANUFACTURER'S NAME:	MINERAL RESEARCH AND DEVELOPMENT
ADDRESS:	200 East Woodlawn Road One Woodlawn Green – Suite 250 Charlotte, NC 28217
EMERGENCY PHONE:	CHEMTREC: 1-800-424-9300
BUSINESS PHONE:	1-704-525-2771
MSDS PREPARATION DATE:	November 20, 1998
REVISION DATE:	January 30, 2003

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	% v/v	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA		IDLH mg/m ³	OTHER mg/m ³
			TLV mg/m ³	STEL mg/m ³	PEL mg/m ³	STEL mg/m ³		
Copper Nitrate The following exposure limits are for Copper, dusts and mists	10031-43-3	41-53%	1 (Inhalable Particulates)	NE	1	NE	100	NIOSH REL: TWA = DFG MAK: TWA = 1 (inhalable fraction) PEAK = 2•MAK 30 min., average value Carcinogen: EPA-D
Nitric Acid	7697-37-2	< 1-1.5%	2 ppm	4 ppm	2 ppm	4 ppm (vacated 1989 PEL)	25 ppm	NIOSH RELs: TWA = 2 ppm STEL = 4 ppm DFG MAKs: TWA = 2 ppm PEAK = 2•MAK 5 min., momentary value
Water	7732-18-5	Balance	NE	NE	NE	NE	NE	NE

NE = Not Established

See Section 16 for Definitions of Terms Used

NOTE : ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This product is a medium to dark blue liquid with an acrid odor. The primary health hazard associated with this product is related to its irritancy and potential corrosivity; contact with mists, sprays or liquid product can severely irritate or burn eyes, skin, and other contaminated tissue. This product is not flammable or reactive. In its dry form, Copper Nitrate (a component of this product) may act as an oxidizer to initiate and sustain the combustion of flammable materials; if this product is allowed to evaporate to dryness, the residue can present the hazards of an oxidizer. Emergency responders must wear the personal protective equipment suitable for the situation to which they are responding.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: The primary routes of overexposure for the solution are via inhalation and contact with skin and eyes. The following paragraphs describe the symptoms of overexposure, via route of entry, to this material.

INHALATION: If vapors, 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 prolonged overexposures or overexposures to high concentrations of this product. Additional inhalation symptoms may include the following: choking, coughing, and difficulty breathing. Severe inhalation overexposures can lead to pulmonary edema, pneumonitis, and death.

CONTACT WITH SKIN or EYES: Depending on the duration of overexposure, contact with the eyes will cause irritation, pain, reddening, and may result in blindness. Depending on the duration of skin contact, skin overexposures will cause reddening, discomfort, irritation, ulceration, and chemical burns. Repeated skin overexposures can result in dermatitis (inflammation and reddening of the skin).

SKIN ABSORPTION: Skin absorption is not a significant route of overexposure for the components of this product.

INGESTION: If this product is swallowed, irritation and burns of the mouth, throat, esophagus, and other tissues of the digestive system will occur immediately upon contact. Symptoms of such overexposure can include drowsiness, confusion, difficulty swallowing, a burning sensation in the esophagus and stomach, intense thirst, nausea, abdominal pain, vomiting, diarrhea, stomach perforation, bloody stools or urine, convulsions, and collapse. Ingestion of large volumes of this product may be fatal.

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

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

ACUTE: This product is an irritant. Depending on the duration of contact, overexposures can mildly to severely irritate the eyes, skin, mucous membranes, and any other exposed tissue. If inhaled, irritation of the respiratory system may occur, with coughing, and difficulty breathing. Skin contact may cause blisters and scars. Eye contact may cause blindness. Severe inhalation and ingestion overexposures may be fatal.

CHRONIC: Prolonged or repeated skin contact can lead to dermatitis. Prolonged inhalation exposure may result in lung disorders. See Section 11 (Toxicology Information) for additional data.

TARGET ORGANS: ACUTE: Skin, eyes, respiratory system.

CHRONIC: Skin, respiratory system.

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

4. FIRST-AID MEASURES

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

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.




HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH	(BLUE)	3
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FLAMMABILITY	(RED)	0
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REACTIVITY	(YELLOW)	0
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PROTECTIVE EQUIPMENT	D/H
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EYES	RESPIRATORY	HANDS	BODY
	SEE SECTION 8		

For routine industrial applications

See Section 16 for Definition of Ratings

4. FIRST-AID MEASURES (Continued)

EYE EXPOSURE: If the liquid or vapors of this product 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. Victim must seek immediate medical attention.

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. If conscious, have victim rinse mouth with water. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or unable to swallow.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing dermatitis, other skin disorders, and respiratory diseases may be aggravated by overexposure to this product.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate overexposure. Be observant for signs of pulmonary edema in the event of severe inhalation overexposures.

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

Foam: YES

Halon: YES

Carbon Dioxide: YES

Dry Chemical: YES

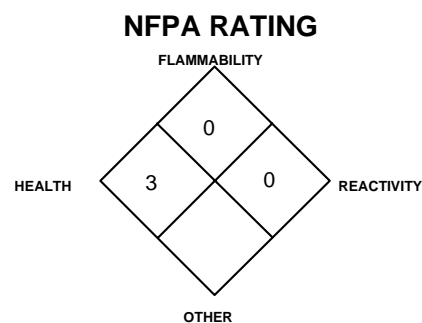
Other: Any "ABC" Class.

UNUSUAL FIRE AND EXPLOSION HAZARDS: This product is potentially corrosive and presents a contact hazard to fire-fighters. When involved in a fire, this material may decompose and produce acidic vapors, copper compounds, and nitrogen oxides. Though not anticipated to be a significant hazard associated with this product, due to the fact this is a solution, it is important to note that in its dry form, Copper Nitrate is an oxidizer, which can act to initiate and sustain the combustion of flammable materials.

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. Chemical resistant clothing may be necessary. Move containers from fire area if they have not been exposed to heat and if it can be done without risk to personnel. If this product is involved in a fire, fire run-off water should be contained to prevent possible environmental damage. Rinse contaminated equipment thoroughly before returning to service.



**See Section 16 for
Definition of Ratings**

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, and protect people.

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. If necessary, neutralize area and equipment with sodium bicarbonate or other neutralizer suitable for acids. Decontaminate the area thoroughly. Place all spill residue in a suitable container and seal. Dispose of in accordance with U.S. Federal, State, and local hazardous waste disposal regulations, or the appropriate Canadian standards (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, drink, smoke or apply cosmetics while handling this product. All work practices should minimize the generation of splashes and aerosols. Remove contaminated clothing immediately.

7. HANDLING and STORAGE (Continued)

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.

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. 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 that application equipment is locked and tagged-out safely. Collect all rinsates and dispose of according to applicable U.S. Federal, State, or local procedures or the applicable standards of Canada.

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), if applicable. Exhaust directly to the outside. Use local exhaust ventilation and process enclosure, if necessary, to control mist formation. Supply sufficient replacement air to make-up for air removed by system. 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 necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134) or equivalent U.S. State standards, and Canadian CSA Standard Z94.4-93. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998). The following are NIOSH recommendations for Nitric Acid and Copper (Dusts and Mists) are provided for further information:

CONCENTRATION

Up to 25 ppm:

RESPIRATORY EQUIPMENT FOR NITRIC ACID

Supplied-Air Respirator (SAR) operated in a continuous-flow mode; or full-facepiece chemical cartridge respirator with cartridge(s) to protect against nitric acid; or gas mask with canister to protect against nitric acid; or full-facepiece SCBA; or full-facepiece SAR.

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

Escape:

Gas mask with canister to protect against nitric acid; or escape-type SCBA.

NOTE:

The IDLH concentration for nitric acid is 25 ppm.

CONCENTRATION

Up to 5 mg/m³:

RESPIRATORY EQUIPMENT FOR COPPER DUSTS AND MISTS

Dust and mist respirator.

Up to 10 mg/m³:

Dust and mist respirator except single-use and quarter-mask respirator (if not present as a fume); or SAR.

Up to 25 mg/m³:

Powered air-purifying respirator with dust and mist filter(s); or SAR in a continuous-flow mode.

Up to 50 mg/m³:

Full-facepiece respirator with high-efficiency particulate filter(s); or full-facepiece SCBA; or full-facepiece SAR; or powered air-purifying respirator with tight-fitting facepiece and high-efficiency particulate filter.

Up to 100 mg/m³:

Positive pressure, full-facepiece SAR.

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with auxiliary positive pressure SCBA.

Escape:

Full-facepiece respirator with high-efficiency particulate filter(s); or escape-type SCBA.

NOTE:

The IDLH for copper dusts and mists is 100 mg/m³, as Cu.

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

HAND PROTECTION: Wear Neoprene or 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

VAPOR DENSITY: Not established

SPECIFIC GRAVITY: 1.440-1.650

SOLUBILITY IN WATER: Completely

VAPOR PRESSURE: Not established.

ODOR THRESHOLD: Not applicable.

LOG WATER/OIL DISTRIBUTION COEFFICIENT: Not available.

APPEARANCE, ODOR AND COLOR: This product is a medium to dark blue, aqueous liquid with an acrid odor.

HOW TO DETECT THIS SUBSTANCE (warning properties): The appearance is a distinguishing characteristic of this product. Litmus paper will turn red on contact with this solution.

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

FREEZING POINT or RANGE: -5°C (23°F)

BOILING POINT: Not established.

pH: 0.0-0.6

10. STABILITY and REACTIVITY

STABILITY: Stable.

DECOMPOSITION PRODUCTS: Copper compounds and nitrogen oxides.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong bases, active metals (e.g., sodium, potassium), cyanide compounds, flammable and combustible materials, strong reducing agents, finely powdered metals.

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: Toxicology data for the components of this product specifically listed in Section 2 (Composition and Information on Ingredients) and greater than 1 percent in concentration are provided below.

COPPER NITRATE:

LD₅₀ (Oral-rat) 940 mg/kg

Cytogenetic analysis-rat Ascites tumor: 600 mg/kg

NITRIC ACID:

LDLo (Oral-Human) 430 mg/kg

LDLo (Unreported-Man) 110 mg/kg

TDLo (Oral-Rat) 2345 mg/kg (female 18 days post): Reproductive effects

TDLo (Oral-Rat) 21,150 mg/kg (female 1-21 days post): Teratogenic effects

NITRIC ACID (continued):

TCLo (Inhalation-rat) 50 µg/m³/4 hours/3 days-intermittent: Lungs, Thorax, or Respiration: respiratory depression

TCLo (Inhalation-rat) 1071 µg/m³/24 hours/84 days-continuous: Behavioral: muscle contraction or spasticity; Kidney, Urethra, Bladder: other changes in urine composition; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: true cholinesterase

SUSPECTED CANCER AGENT: The components of this product are not found on the following lists: FEDERAL OSHA Z LIST, NTP, IARC, and CAL/OSHA and therefore are not considered to be, nor suspected to be, cancer causing agents by these agencies. Copper compounds are listed as follows: EPA-D (Not Classifiable as a Human Carcinogen).

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

SENSITIZATION OF PRODUCT: This product contains no known skin or respiratory sensitizers.

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.

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

Teratogenicity: This product is not reported to cause teratogenic effects in humans. Animal data from clinical tests indicate that the Nitric Acid component of this product has teratogenic effects.

Reproductive Toxicity: This product is not reported to cause reproductive toxicity effects in humans. Animal data from clinical tests indicate that the Nitric Acid component of this product has reproductive effects; this data may be related to the corrosivity of Nitric Acid.

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.

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

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

ENVIRONMENTAL STABILITY: The components of this product are relatively stable under ambient, environmental conditions. Additional environmental data for compounds which can be released from this product are available as follows:

NITRIC ACID:

Persistence: Acid will slowly be neutralized, but nitrate can persist indefinitely.

Abiotic Degradation: Nitric acid will be gradually neutralized by hardness minerals (calcium and magnesium) in water. The nitrate ion may persist longer but will ultimately be consumed as a plant nutrient.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Due to the low pH associated with this product, plants contaminated with this product may be adversely affected or destroyed. Animals contaminated with this solution may be severely injured or killed.

EFFECT OF CHEMICAL ON AQUATIC LIFE: Due to the low pH associated with this product, a release of this product in a river or other body of water (especially in large volumes) may kill fish and other aquatic life. Copper compounds are toxic to aquatic life. Additional specific aquatic toxicity data are available for Nitric Acid as follows:

NITRIC ACID:

LC₅₀ (shore crab) 48 hours = 180 mg/L

LC₅₀ (cockle) 48 hours = 330-1000 mg/L

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

TLm (mosquito fish) 96 hours = 72 ppm; fresh water

NITRIC ACID (continued):

Acute Hazard Level: Toxic to fish. NO₃ is toxic to animal life even after neutralization.

Chronic Hazard Level: Nitrate can feed algal blooms causing eutrophication.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate U.S. Federal, State, and local regulations, or the applicable standards of Canada and its Provinces. 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.

U.S. EPA WASTE NUMBER: D002, applicable to wastes consisting only of this product.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS, PER THE U.S. DEPARTMENT OF TRANSPORTATION (49 CFR 172.101)

PROPER SHIPPING NAME: Corrosive liquid, acidic, inorganic, n.o.s. (Copper Nitrate, Nitric Acid)

HAZARD CLASS NUMBER and DESCRIPTION: 8 (Corrosive)

UN IDENTIFICATION NUMBER: UN 3264

PACKING GROUP: II

DOT LABEL(S) REQUIRED: Corrosive

NORTH AMERICAN EMERGENCY RESPONSE GUIDE NUMBER (1996): 154

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, per regulations of Transport Canada. Refer to information above for shipments to Canada.

15. REGULATORY INFORMATION

ADDITIONAL UNITED STATES REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: This product 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)
COPPER NITRATE	NO	YES (as a Copper Compound)	YES (as a Copper Compound)
NITRIC ACID	YES	YES	YES

U.S. SARA THRESHOLD PLANNING QUANTITY: Nitric Acid = 1000 lb (454 kg)

U.S. CERCLA REPORTABLE QUANTITY (RQ): Nitric Acid = 1000 lb (454 kg); Copper Nitrate (Not established for Copper Compounds as a generic class, although the class is a CERCLA Hazardous Substance).

U.S. TSCA INVENTORY STATUS: The components of this material are listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Not applicable.

15. REGULATORY INFORMATION (Continued)

ADDITIONAL UNITED STATES REGULATIONS (continued):

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

Alaska - Designated Toxic and Hazardous Substances: Copper (fume, dust and mist), Nitric Acid.

California - Permissible Exposure Limits for Chemical Contaminants: Copper, Nitric Acid.

Florida - Substance List: Nitric Acid.

Illinois - Toxic Substance List: Copper Compounds, Nitric Acid.

Kansas - Section 302/313 List: Nitric Acid.

Massachusetts - Substance List: Copper, Nitric Acid.

Michigan - Critical Materials Register: None.

Minnesota - List of Hazardous Substances: Nitric Acid.

Missouri - Employer Information/Toxic Substance List: Copper, Nitric Acid.

New Jersey - Right to Know Hazardous Substance List: Copper, Nitric Acid.

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

Pennsylvania - Hazardous Substance List: Copper, Nitric Acid.

Rhode Island - Hazardous Substance List: Copper (fume, dust, mist), Nitric Acid.

Texas - Hazardous Substance List: Copper (fume), Nitric Acid.

West Virginia - Hazardous Substance List: Copper (fume), Nitric Acid.

Wisconsin - Toxic and Hazardous Substances: Copper (fume), Nitric Acid.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): No component of this product is on the California Proposition 65 lists.

ANSI LABELING (per Z129.1) (Precautionary Statements): **DANGER!** CAUSES BURNS AND IRRITATION TO SKIN, AND EYES RESPIRATORY SYSTEM. MAY BE FATAL IF SWALLOWED. CAUSES SKIN AND EYE BURNS. HARMFUL IF INHALED. Do not taste or swallow. Do not get on skin or in eyes. Avoid breathing vapors or mists. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Wear gloves, goggles, face-shield, suitable body protection, and NIOSH/MSHA approved respirator as necessary. **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 inert material or neutralizing agent for acids. Place residue in suitable container. Consult Material Safety Data Sheet for additional information.

ADDITIONAL CANADIAN REGULATIONS:

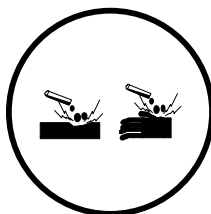
CANADIAN DSL INVENTORY: The components of this product are on the DSL Inventory.

OTHER CANADIAN REGULATIONS: Not applicable.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: The components of this product are not on the CEPA Priorities Substances Lists.

CANADIAN WHMIS SYMBOLS:

Class E: Corrosive



16. OTHER INFORMATION

PREPARED BY:

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DATE OF PRINTING:

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The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Mineral Research and Development Corporations Inc. assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, Mineral Research and Development Corp. assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

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.

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 C: Hand, eye, and appropriate 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: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m³** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **Cancer Information:** The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. **Other Information:** **BEI** - ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. **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/NDL** are the Canadian Domestic/Non-Domestic Substances Lists.