Copper based brazing Rod

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards .This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard (29 CFR 1910.1200). Other government regulations must be reviewed for applicability to these products.

WARNING: PRODUCT COMPONENTS PRESENT HEALTH AND SAFETY HAZARDS. READ AND UNDERSTAND THIS MATERIAL SAFETY DATA SHEET (M.S.DS.). ALSO, FOLLOW YOUR EMPLOYER'S SAFETY PRACTICES. The information contained herein relates only to the specific product. If the product is combined with other materials, all component properties must be considered. **BE SURE TO CONSULT THE LATEST VERSION OF THE MSDS. MATERIAL SAFETY DATA SHEETS ARE AVAILABLE FROM AUFHAUSER CORPORATION.**

STATEMENT OF LIABILITY-DISCLAIMER

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

1. PRODUCT IDENTIFICATION

TRADE NAME (AS LABELED):	**Low Fuming Bronze**
CHEMICAL NAME/CLASS:	Metal Alloy
PRODUCT USE:	Metal Brazing
SUPPLIER/MANUFACTURER'S NAME:	**Aufhauser Corporation**
ADDRESS:	39 West Mall, Plainview, NY 11803
EMERGENCY PHONE:	(516) 694-8696
BUSINESS PHONE:	1-800-645-9486
DATE OF PREPARATION:	June 24, 2002

2. COMPOSITION and INFORMATION ON INGREDIENTS

These products consist of metal rods, some with a thin coating of flux on them. The exact amount of coating on each rod is unknown. It can be reasonably estimated that there is less than 1% of each of the flux constituents present on any given rod when compared to the mass of the rod itself. The composition values given for the flux coating are the composition of the flux when the rods are flux-coated.

CHEMICAL NAME	CAS #	% w/w	EXPOSURE LIMITS IN AIR					
			ACGIH – TLV		OHSA – PEL		IDLH	OTHER
			TWA MG/M^3	STEL MG/M^3	TWA MG/M^3	STEL MG/M^3	MG/M^3	MG/M^3
COMPONENT 1: METAL RODS								
COPPER (EXPOSURE LIMITS ARE FOR COPPER FUME, AS CU)	7440-50-8	56-62	0.2 (FUMES) 1 (DUSTS & MISTS)	NE	0.1 (FUME) 1 (DUSTS & MISTS)	NE	100	NIOSH REL: TWA = 0.1 DFG MAK: TWA = 0.1 (INHALABLE FRACTION) PEAK = 2•MAK 30 MIN., AVG VALUE CARCINOGEN: EPA-D

NE = NOT ESTABLISHED. SEE SECTION 16 FOR DEFINISTIONS OF TERMS USED.

NOTE (1): The ACGIH has an established exposure limit for Welding Fumes, Not Otherwise Classified. The Threshold Limit Value is 5 mg/m3. NIOSH classifies welding fumes as carcinogens. Single values shown are maximum, unless otherwise noted.

NOTE (2): 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.

2. NOMINAL COMPOSITION and INFORMATION ON INGREDIENTS (continued)

CHEMICAL NAME	CAS #	% W/W	EXPOSURE LIMITS IN AIR					
			ACGIH – TLV		OHSA – PEL		IDLH	OTHER
			TWA MG/M³	STEL MG/M³	TWA MG/M³	STEL MG/M³	MG/M³	MG/M³
COMPONENT 1 (CONTINUED): METAL RODS								
ZINC (EXPOSURE LIMITS GIVEN ARE FOR ZINC OXIDE, FUME)	7440-66-6	BALANCE	5 (FUME) 10 (DUST)	10 (FUME)	5 (FUME) 5 (TOTAL DUST) 15 (DUST, RESPIRABLE DUST) 5 (DUST, RESPIRABLE DUST, VACATED 1989 PEL)	10 (FUME, VACATED 1989 PEL)	500	NIOSH REL: TWA = 5 (FUME & DUST) STEL = 10 (FUME); 15 (CEILING, 15 MINUTES, DUST) DFG MAKS: TWA = 1.5 (RESPIRABLE FRACTION, FUME) CARCINOGEN: EPA-D
TIN	7440-31-5	0.30-1.5	2	NE	2	NE	100	NIOSH REL: 2
MANGANESE (EXPOSURE LIMITS ARE FOR MANGANESE, ELEMENTAL, INORGANIC COMPOUNDS, AND FUME, AS MANGANESE)	7439-96-5	0.50	0.2	NE	1 (VACATED 1989 PEL)	5 (CEILING) 3 (VACATED 1989 PEL)	500	NIOSH REL: TWA = 1 STEL = 3 DFG MAK: TWA = 0.5 (INHALABLE FRACTION) PEAK = 10=MAK, 30 MIN., AVG VALUE DFG MAK PREGNANCY RISK CLASSIFICATION: C CARCINOGEN: EPA-D
IRON (EXPOSURE LIMITS ARE FOR IRON OXIDE DUST AND FUME [FE2O3], AS FE)	7439-89-6	1.0	5, A4 (NOT CLASSIFIABLE AS A HUMAN CARCINOGEN)	NE	10	NE	2500	NIOSH REL: TWA = 5 DFG MAK: TWA = 6 (RESPIRABLE FRACTION) CARCINOGEN: IARC-3, TLV-A4
SILICON	7440-21-3	0.50	10	NE	15 (TOTAL DUST) 5 (RESPIRABLE FRACTION) 10 (TOTAL DUST) (VACATED 1989 PEL)	NE	NE	NIOSH REL: TWA = 10 (TOTAL DUST); 5 (RESPIRABLE FRACTION)

COMPONENT 2: FLUX COATING ON RODS

Chemical name	CAS #	% w/w	EXPOSURE LIMITS IN AIR					
			ACGIH – TLV		OHSA – PEL		IDLH	OTHER
			TWA MG/M³	STEL MG/M³	TWA MG/M³	STEL MG/M³	MG/M³	MG/M³
BORIC ACID	10043-35-3	50-80	NE	NE	NE	NE	NE	NE

NE = NOT ESTABLISHED. SEE SECTION 16 FOR DEFINISTIONS OF TERMS USED.

NOTE (1): The ACGIH has an established exposure limit for Welding Fumes, Not Otherwise Classified. The Threshold Limit Value is 5 mg/m3. NIOSH classifies welding fumes as carcinogens. Single values shown are maximum, unless otherwise noted.

NOTE (2): ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format.

COMPONENT 2: FLUX COATING ON RODS (CONTINUED)

Chemical name	CAS #	% w/w	EXPOSURE LIMITS IN AIR					
			ACGIH – TLV		OHSA – PEL		IDLH	OTHER
			TWA MG/M^3	STEL MG/M^3	TWA MG/M^3	STEL MG/M^3	MG/M^3	MG/M^3
METHACRYLATE/APLIPHATIC & NAPHTHENIC HYDROCARBON COMPOUND	PROPRIETARY		NE	NE	NE	NE	NE	NE
BORAX GLASS (THE EXPOSURE LIMITS ARE FOR BORATES, ANHYDROUS)	1303-96-4	10-30	1	NE	10 (VACATED 1989 PEL)	NE	NE	NIOSH REL: 1

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This product consists of bare or coated, odorless, solid bronze rods. There are no immediate health hazards associated with this product. This product is not flammable nor reactive. If involved in a fire, this product may generate irritating fumes and a variety of metal oxides. Emergency responders must wear personal protective equipment suitable for the situation to which they are responding.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE:
During brazing operations, the most significant route of over-exposure is via inhalation of fumes.
INHALATION: Inhalation is not anticipated to be a significant route of over-exposure to the rods. Inhalation of large amounts of particulates generated by this product during metal processing operations may result in irritation. Inhalation of copper oxide and zinc oxide fumes can cause metal fume fever. Initial symptoms of metal fume fever can include a metallic or sweet taste in the mouth, dryness or irritation of the throat, and coughing. Later symptoms (after 4-48 hours) can include sweating, shivering, headache, fever, chills, thirstiness, muscle aches, nausea, vomiting, weakness, and tiredness. Repeated over-exposures, via inhalation, to the dusts or fumes generated by this product during brazing operations may have adverse effects on the lungs with possible pulmonary edema and emphysema (life threatening lung injuries). Chronic over exposure to Copper dust may cause tiredness, stuffiness, diarrhea, and vomiting. Refer to Section 10 (Stability and Reactivity) for information on the specific composition of brazing fumes and gases.
CONTACT WITH SKIN or EYES: Contact of the rod form of this product with the skin is not anticipated to be irritating. Rare cases of allergic contact dermatitis have been reported in people working with copper dust. Contact with the rod form of this product can be physically damaging to the eye (i.e., foreign object). Fumes generated during brazing operations can be irritating to the skin and eyes. Symptoms of skin over-exposure may include irritation and redness; prolonged or repeated skin over-exposures may lead to allergic contact dermatitis. Contact with the molten rods will burn contaminated skin or eyes.
SKIN ABSORPTION: Skin absorption is not known to be a significant route of over-exposure for any component of this product.
INGESTION: Ingestion is not anticipated to be a route of occupational exposure for this product.
INJECTION: Though not a likely route of occupational exposure for this product, injection (via punctures or lacerations in the skin) may cause local reddening, tissue swelling, and discomfort.
HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Symptoms associated with overexposure to this product and the fumes generated during brazing operations are as follows:
ACUTE: The chief acute health hazard associated with this product would be the potential for irritation of contaminated skin and eyes when exposed to fumes during brazing operations. Inhalation of large amounts of particulates generated by this product during metal processing operations may result in irritation. Inhalation of copper oxide and zinc oxide fumes can cause metal fume fever. Inhalation of large amounts of particulates generated by this product during metal processing operations can result in pneumoconiosis (a disease of the lungs). Contact with the molten material will burn contaminated skin or eyes. Severe ingestion over-exposure to Copper (a component of this product) may be fatal.
CHRONIC: Chronic skin over-exposure to the fumes of this product during brazing operations may produce dermatitis (red, inflamed skin). Chronic over-exposure to Copper dust may cause tiredness, stuffiness, diarrhea, vomiting, discoloration of the skin and eyes, and kidney and liver disorder. Additionally, rare cases of allergic contact dermatitis have been reported in people working with copper dust. Refer to Section 11 (Toxicological Information) for further information. **TARGET ORGANS:** For fumes: Skin, eyes, respiratory system, kidney and liver.

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 dusts or particulates generated by the flux coating on the flux coated products or fumes generated by brazing operations involving these products contaminate the skin, begin decontamination with running water. If molten material contaminates the skin, immediately begin decontamination with cold, running water. Minimum flushing is for 15 minutes. Victim must seek medical attention if any adverse reaction occurs.
EYE EXPOSURE: If dusts or particulates generated by the flux coating on the flux coated products or fumes generated by brazing operations involving these products 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 dusts or particulates generated by the flux coating on the flux coated products or fumes generated by brazing operations involving these products are inhaled, remove victim to fresh air. If necessary, use artificial respiration to support vital functions.
INGESTION: If swallowed call physician immediately! Do not induce vomiting unless directed by medical personnel. Rinse mouth with water if person is conscious. Never give fluids or induce vomiting if person is unconscious, having convulsions, or not breathing.
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Skin, respiratory, pancreas and kidney disorders may be aggravated by prolonged over-exposures to the dusts or fumes generated by these products.
RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate overexposure.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not flammable.
AUTOIGNITION TEMPERATURE: Not flammable.
FLAMMABLE LIMITS (in air by volume, %):
Lower (LEL): Not applicable.
Upper (UEL): Not applicable.
FIRE EXTINGUISHING MATERIALS:
Water Spray: YES Carbon Dioxide: YES
Halon: YES Foam: YES
Dry Chemical: YES Other: Any "ABC" Class
UNUSUAL FIRE AND EXPLOSION HAZARDS: When involved in a fire, this product may generate irritating fumes and a variety of metal compounds. The molten material can present a significant thermal hazard to firefighters.
Explosion Sensitivity to Mechanical Impact: Not sensitive.
Explosion Sensitivity to Static Discharge: Not sensitive.
SPECIAL FIRE-FIGHTING PROCEDURES: Not applicable for these products.

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Not Applicable.

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 thoroughly after handling this product. Do not eat or drink while handling this product. Use in a well ventilated location. Use ventilation and other engineering controls to minimize potential exposure to this product.
STORAGE AND HANDLING PRACTICES: All employees who handle this material should be trained to handle it safely. Avoid breathing fumes of this product during brazing operations. Open containers on a stable surface. Packages of this product must be properly labeled. When this product is used during brazing operations, follow the requirements of the Federal Occupational Safety and Health Welding and Cutting Standard (29 CFR 1910 Subpart Q) and the safety standards of the American National Standards Institute for welding and cutting (ANSI Z49.1).
STORAGE AND HANDLING PRACTICES (continued): Store packages in a cool, dry location. Storage in an atmosphere that is wet, moist, or highly humid may lead to corrosion of this product. Store away from incompatible materials (see Section 10, Stability and Reactivity).
PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Not applicable.

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). Prudent practice is to ensure eyewash/safety shower stations are available near areas where this product is used.
RESPIRATORY PROTECTION: Maintain airborne contaminant concentrations below guidelines listed in Section 2 (Composition and Information on Ingredients). If respiratory protection is needed (i.e., a Weld Fume Respirator or Air-Line Respirator for brazing in confined spaces), use only protection authorized in 29 CFR 1910.134 or applicable State regulations. Respiratory Protection is recommended to be worn during brazing operations. Use supplied air respiration protection if oxygen levels are below 19.5% or are unknown. The following are NIOSH recommendations for respirator selection for welding fumes (which would also be applicable for brazing operations), based on NIOSH REL:

CONCENTRATION RESPIRATORY EQUIPMENT FOR WELDING FUMES

At Concentrations above the NIOSH REL, or where there is no REL, at any Detectable Concentration: Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode; or any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary selfcontained breathing apparatus operated in pressure-demand or other positive-pressure mode.

Escape: Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having a high-efficiency particulate filter; or any appropriate escape-type, self-contained breathing apparatus

NOTE: IDLH Concentration: Potential NIOSH carcinogen. [Not determined yet].

EYE PROTECTION: Safety glasses. When these products are used in conjunction with Brazing, wear safety glasses, goggles, or face-shield with filter lens of appropriate shade number (per ANSI Z49.1-1988, "Safety in Welding and Cutting"). If necessary, refer to U.S. OSHA 29 CFR 1910.133, or appropriate Canadian Standards.
HAND PROTECTION: Wear gloves for routine industrial use. When these products are used in conjunction with Brazing, wear gloves that protect from sparks and flame (per ANSI Z49.1-1988, "Safety in Welding and Cutting"). If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.
BODY PROTECTION: Use body protection appropriate for task. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, as described in U.S. OSHA 29 CFR 1910.136.

9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for copper, a main component of this product, unless otherwise indicated:

RELATIVE VAPOR DENSITY (air = 1): N/A
EVAPORATION RATE (nBuAc = 1): N/A
SPECIFIC GRAVITY @ 20°C (water = 1): 8.3-8.5 g/cc
FREEZING/MELTING POINT: 1600-1900°C (871-1038°F)
SOLUBILITY IN WATER: Insoluble
pH: Not Applicable
VAPOR PRESSURE, mm Hg @ 1284°C: N/A
BOILING POINT @ 24 mm Hg: 2595°C (4703°F)
ODOR THRESHOLD: Not Applicable
COEFFICIENT OF OIL/WATER DISTRIBUTION (PARTITION COEFFICIENT): Not Applicable

The following information is for zinc, a main component of this product:

RELATIVE VAPOR DENSITY (air = 1): N/A
EVAPORATION RATE (nBuAc = 1): N/A
SPECIFIC GRAVITY @ 20°C (water = 1): 7.14
FREEZING/MELTING POINT: 419°C (786°F)
SOLUBILITY IN WATER: Insoluble
pH: Not Applicable
VAPOR PRESSURE, mm Hg @ 1284°C: 1
BOILING POINT @ 24 mm Hg: Approx. 907°C (1665°F)
ODOR THRESHOLD: Not Applicable
COEFFICIENT OF OIL/WATER DISTRIBUTION (PARTITION COEFFICIENT): Not Applicable

The following information is for the products:

APPEARANCE AND COLOR: This product consists of bare or coated, odorless bronze rods.
HOW TO DETECT THIS SUBSTANCE (warning properties): The appearance is a distinctive characteristic of this product.

10. STABILITY and REACTIVITY

STABILITY: Stable.
DECOMPOSITION PRODUCTS: Thermal decomposition products can include copper and zinc compounds and a variety of metal oxides.
MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong acids, strong oxidizers, some halogenated compounds.
HAZARDOUS POLYMERIZATION: Will not occur.
CONDITIONS TO AVOID: Uncontrolled exposure to extreme temperatures, incompatible materials.

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

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: Presented below are human toxicological data available for the components of these products present in concentration greater than 1%. Other data for animals are available for the components of these products, but are not presented in this Material Safety Data Sheet.

BORIC ACID:
Skin Irritancy (human) = 15 mg/ 3 days/ intermittent; mild
LD (oral, human) = 37 mg/kg/ boron as boric acid
LD (skin, infant) = 210 mg/kg/ boron as boric acid
TDLo (oral, child) = 500 mg/kg; gastrointestinaleffects
LDLo (oral, man) = 429 mg/kg; cardiovascular systemic effects
LDLo (oral, woman) = 200 mg/kg

BORIC ACID (continued):
TDLo (oral, infant) = 800 mg/kg/ 4 weeks/ intermittent
LDLo (oral, infant) = 934 mg/kg
LDLo (skin, infant) = 1200 mg/kg
LDLo (skin, child) = 4000 mg/kg/ 4 days
LDLo (skin, man) = 2430 mg/kg
LDLo (skin, child) = 1500 mg/kg
LDLo (subcutaneous, infant) = 1100 mg/kg
TDLo (unreported, man) = 170 mg/kg; gastrointestinal effects
LDLo (unreported, man) = 147 mg/

COPPER:
TDLo (oral, human) = 120 ∝g/kg; gastrointestinal tract effects

ZINC:
Skin Irritancy (human) = 300 ∝g/ 3 days/ intermittent; mild
TCLo (inhalation, human) = 124 mg/m3/ 50 minutes; pulmonary system, skin effects

SUSPECTED CANCER AGENT: The components of this product are listed as follows:
MANGANESE: EPA-D, Not Classifiable as to Human Carcinogenicity (inadequate human and animal evidence of carcinogenicity or no data available).
COPPER: EPA-D, Not Classifiable as to Human Carcinogenicity (inadequate human and animal evidence of carcinogenicity or no data available).
The other 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.
IRRITANCY OF PRODUCT: This product's dusts or fumes may be irritating to contaminated skin and eyes. Fumes may be irritating to the respiratory system.
SENSITIZATION TO THE PRODUCT: Rare cases of allergic contact dermatitis have been reported in people working with copper dust.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of these products and their constituents on the human reproductive system.

Mutagenicity: These components are not reported to produce mutagenic effects in humans. Animal mutation data are available for Boric Acid and Nickel (constituents of these products); these data were obtained during clinical studies on specific animal tissues exposed to high doses of this compound.

Embryotoxicity: These components are not reported to produce embryotoxic effects in humans.

Teratogenicity: These components are not reported to cause teratogenic effects in humans. Clinical studies on test animals exposed to relatively high doses of Copper and Nickel (constituents of these products) indicate teratogenic effects.

Reproductive Toxicity: These components are not reported to cause reproductive effects in humans. Clinical studies on test animals exposed to relatively high doses of Boric Acid and Copper (constituents of these products) 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.
BIOLOGICAL EXPOSURE INDICES: Currently, there are Biological Exposure Indices (BEIs) determined for the Fluoride Compound component of the Flux Coating (as a Fluoride).

BIOLOGICAL EXPOSURE INDICES: Currently, there are no Biological Exposure Indices (BEIs) associated with the components of this product.
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Skin, respiratory disorders, kidney and liver disorders may be ggravated by prolonged over-exposures to the dusts or fumes generated by this product.
RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate overexposure.

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.
ENVIRONMENTAL STABILITY: The components of this product are expected to persist in the environment for an extended period of time. Copper and Zinc will react with water and air to form a variety of stable oxides. Additional environmental data are available as follows:

ZINC: Solubility: Insoluble in water. Biological Half-Life for normal humans 162-500 days. Bioconcentration: The Bioconcentration Factor in edible ortions of *Crassostrea virgins*, adult oyster) is 16,700 (total zinc).
COPPER: Solubility: Insoluble. There is no evidence of any biotransformation for copper compounds. Copper is accumulated by all plants and animals.
BCF Algae = 12; plants = 1,000; invertebrate = 1,000, fish = 667 and fish =200(Soluble copper salts).

EFFECT OF **MATERIAL ON PLANTS** or **ANIMALS:** This product is not expected to cause adverse effects on plant or animal life. Specific data on test animals are available but are not presented in this Material Safety Data Sheet.
EFFECT OF CHEMICAL ON AQUATIC LIFE: This product may cause adverse effects on aquatic life. Additional environmental data are available as follows:

BORIC ACID:
LC_{50} (trout eggs) = 100 ppm/ soft
LC_{50} (trout eggs) = 79 ppm/ hard
LC_{50} (catfish eggs) = 155 ppm/ soft
LC_{50} (catfish eggs) = 22 ppm/ hard
LC_{50} (goldfish eggs) = 46 ppm/ soft
LC_{50} (goldfish eggs) = 75 ppm/ hard
LC_{50} (*Daphnie magna*) = 133 mg/L/ 48 hours

COPPER: Copper is concentrated by plankton by 1000 or more. Copper may concentrate to toxic levels in the food chain.
ZINC: Odorless zinc poisoning causes inflamed gills in fish. Laboratory studies of Atlantic salmon, rainbow trout, carp, and goldfish have shown avoidance reactions by these fish to zinc in water.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. This product, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local hazardous waste regulatory authority.
EPA WASTE NUMBER: Not applicable to waste consisting only of this product.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS NOT HAZARDOUS (Per 49 CFR 172.101) BY THE U.S. DEPARTMENT OF TRANSPORTATION.
PROPER SHIPPING NAME: Not Applicable
HAZARD CLASS NUMBER and DESCRIPTION: Not Applicable
UN IDENTIFICATION NUMBER: Not Applicable
PACKING GROUP: Not Applicable
DOT LABEL(S) REQUIRED: Not Applicable
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER, 2000: Not Applicable
MARINE POLLUTANT: No component of this product is designated as a marine pollutant by the Department of Transportation (49 CFR 172.101, Appendix B).
TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This material is not considered as dangerous goods, per regulations of Transport Canada.

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:
U.S. SARA REPORTING REQUIREMENTS: The components of these products are 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	No	Yes	Yes
Manganese	No	No	Yes
Zinc	No	Yes	Yes (fume or dust)

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for any component of this product. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

15. REGULATORY INFORMATION (Continued)

U.S. TSCA INVENTORY STATUS: The components of this product are listed on the TSCA Inventory.
U.S. CERCLA REPORTABLE QUANTITY (RQ): Copper = 5000 lbs; Zinc = 1000 lbs. (for metal particles under 100 micrometers in diameter).

Alaska-Designated Toxic and Hazardous Substances: Copper Fume, Dust, & Mist, Manganese, Tin.
California-Permissible Exposure Limits for Chemical Contaminants: Copper, Manganese, Silicon, Tin.
Florida-Substance List: Copper Fume, Dust, & Mist, Manganese, Tin, Zinc.
Illinois-Toxic Substance List: Copper, Manganese, Silicon, Zinc.
Kansas-Section 302/313 List: Copper, Manganese, and Zinc.
Massachusetts-Substance List: Copper, Manganese, Tin, Zinc.
Michigan-Critical Materials Register: Copper.
Minnesota-List of Hazardous Substances: Copper Dust & Mists, Manganese, Silicon, Tin.
Missouri-Employer Information/Toxic Substance List: Copper, Manganese, Silicon, Tin.
New Jersey-Right to Know Hazardous Substance List: Copper, Manganese, Tin, Zinc.
North Dakota-List of Hazardous Chemicals, Reportable Quantities: Copper, Zinc.
Pennsylvania-Hazardous Substance List: Copper, Manganese, Silicon, Tin, Zinc.
Rhode Island-Hazardous Substance List: Copper Fume, Dust, & Mist, Manganese, Silicon, Tin, Zinc.
Texas-Hazardous Substance List: Copper Fume, Manganese.
West Virginia-Hazardous Substance List: Copper Fume, Manganese.
Wisconsin-Toxic and Hazardous Substances: Copper Fume, Manganese.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): WARNING: This product may contain chemicals, and when used for welding or brazing may produce fumes or gases containing chemicals, known to the State of California to cause cancer, and/or birth defects (or other reproductive harm.)

LABELING (Precautionary Statements):

WARNING: PROTECT yourself and others. Read and understand this information.
FUMES AND GASES can be hazardous to your health.
HEAT RAYS (INFRARED RADIATION) from flame or hot metal can injure your eyes.

- Before Use, read and understand the manufacturer's instructions. Material Safety Data Sheets (MSDSs), and your employer's safety policies.
- Keep your head out of the fumes.
- Use enough ventilation, exhaust at the arc, or both, to keep fumes and gases from your breathing zone and the general area.
- Wear correct eye, ear, and body protection.
- See American National Standard Z49.1 *Safety in Welding, Cutting, and Allied Processes*, published by the American Welding Society, 550 N.W. LeJeune Road, Miami, Florida 33126. OSHA Safety and Health Standards, available from the U.S. Government Printing Office, Washington, DC 20402

DO NOT REMOVE THIS INFORMATION.

ADDITIONAL CANADIAN REGULATIONS:
CANADIAN DSL/NDSL INVENTORY STATUS: The components of these products are on the DSL Inventory.
OTHER CANADIAN REGULATIONS: Not applicable.
CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: The components of these products are not on the CEPA Priorities Substances Lists.
CANADIAN WHMIS SYMBOLS: Not applicable.

16. OTHER INFORMATION

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This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard (29 CFR 1910.1200). Other government regulations must be reviewed for applicability to these products. The information contained herein relates only to the specific product. If the product is combined with other materials, all component properties must be considered. To the best of the Aufhauser Corporation's knowledge, the information and recommendations contained in this publication are reliable and accurate as of the date of issue. However, accuracy, suitability, or completeness are not guaranteed, and no warranty, guarantee, or representation, expressed or implied, is made by Aufhauser Corporation as to the absolute correctness or sufficiency of any representation contained in this and other publications; Aufhauser Corporation assumes no responsibility in connection therewith; nor can it be assumed that all acceptable safety measures may not be required under particular or exceptional conditions or circumstances. Data may be changed from time to time. Be sure to consult the latest edition.

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.

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:

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). Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:

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

TOXICOLOGICAL INFORMATION:

Human and Animal Toxicology: Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: LD_{50} - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; LC_{50} - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/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. Coefficient of Oil/Water Distribution is represented by **log K_{ow}** or **log K_{oc}** and is used to assess a substance's behavior in the environment.

REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **U.S.: EPA** is the U.S. Environmental Protection Agency. **DOT** is the U.S. Department of Transportation. **SARA** is the Superfund Amendments and Reauthorization Act. **TSCA** is the U.S. Toxic Substance Control Act. **CERCLA (or Superfund)** refers to the Comprehensive Environmental Response, Compensation, and Liability Act. Labeling is per the American National Standards Institute **(ANSI Z129.1)**.

CANADA:

CEPA is the Canadian Environmental Protection Act. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **TC** is Transport Canada. **DSL/NDSL** are the Canadian Domestic/Non-Domestic Substances Lists. **The CPR is the Canadian Product Regulations.** This section also includes information on the precautionary warnings which appear on the materials package label.

MISCELLANEOUS CHEMICALS
(FIRE EXTINGUISHER CHEMICAL, BATTERY, ANTIFREEZE, SOLVENT, SPRAY PAINT)
Knife Lake Project – Spring 2004 Drill Programme