MATERIAL SAFETY DATA SHEET

Revision No.: 8
Revision Date: 1/1/04
Supercedes: 1/1/03

1. PRODUCT IDENTIFICATION

Product Name: Copper Sheet
Chemical Name: Metal Alloy
Synonyms: High Copper, UNS/CDA Alloy Nos. C16000 - C16999, C18000 - C19999, WRM 194-9

Chemical Family: Copper
Formula: Not applicable - mixture
Product Use: Metallurgical Products

2. COMPOSITION/INFORMATION ON INGREDIENTS

CAS Number	Components	% By Weight	EINECS/ ELINCS #	EU Classification	
				Symbol	R-Phrase
7440-50-8	Copper	98 - 100	231-159-6	None	None
7439-89-6	Iron	0 - 3.0	231-096-4	None	None
7440-66-6	Zinc	0 - 5.0	231-096-4	None	None
7440-48-4	Cobalt	0 - 2.7	231-158-0	Xn	R 42/43
7440-02-0	Nickel	0 - 3.0	231-111-4	Xn	R 40-43
7440-47-3	Chromium (non-Hexavalent)	0 - 1.5	231-157-5	None	None
7440-31-5	Tin	0 - 2.5	231-141-8	None	None
7440-43-9	Cadmium	0 - 0.6	231-152-8	None	None
7439-92-1	Lead	0 - 3.5	231-100-4	None	None
7439-95-4	Magnesium	0 - 1.0	231-104-6	None	None

OSHA REGULATORY STATUS: In solid form, not hazardous. Dust or fume: carcinogen, irritant, lung, blood, kidney, reproductive and developmental toxin, neurotoxin, sensitizer

In solid form, this material is not hazardous. Dust and fumes are hazardous materials.

3. HAZARDS IDENTIFICATION

WARNING!

EXPOSURE TO DUST OR FUMES CAN CAUSE EYE, SKIN AND RESPIRATORY TRACT IRRITATION. EXPOSURE TO DUST OR FUMES CAN CAUSE RESPIRATORY SYSTEM DAMAGE. CONTAINS A MATERIAL WHICH MAY CAUSE BLOOD, KIDNEY, REPRODUCTIVE AND NEUROLOGICAL EFFECTS. MAY CAUSE AN ALLERGIC SKIN AND/OR RESPIRATORY REACTION. CONTAINS MATERIALS WHICH MAY CAUSE CANCER. USE ONLY WITH ADEQUATE VENTILATION. AVOID CONTACT WITH EYES, SKIN AND CLOTHING. WASH THOROUGHLY AFTER HANDLING.

HAZARD RATINGS (for dust or fume)

	Degree of hazard (0 = low, 4 = extreme)		
Hazardous Materials Identification System (HMIS)	Health: 2*	Flammability: 0	Physical Hazard: None
National Fire Protection Association (NFPA)	Mixture. Not rated.		

HUMAN THRESHOLD RESPONSE DATA

Odor Threshold:	Unknown
Irritation Threshold:	Unknown
Immediately Dangerous to Life or Health (IDLH) Value(s):	The IDLH for this product is not known. The IDLH for nickel is 10 mg/m^3. The IDLH for cobalt is 20 mg/m^3. The IDLH for copper, lead and tin is 100 mg/m^3. The IDLH for chromium is 250 mg/m^3.

POTENTIAL HEALTH EFFECTS

ACUTE EFFECTS

Eye:	Dust or fume can cause irritation consisting of redness, swelling, and pain. May cause conjunctivitis with repeated exposures.
Skin:	Material not expected to be absorbed through the skin. Contact with dust may cause mild irritation consisting of redness and/or swelling.
Inhalation:	Harmful if inhaled. Inhalation of high concentrations of powder, dust, or fume may cause severe respiratory and nasal irritation, coughing, and difficulty breathing. Inhalation of high concentrations of metallic copper dusts or fumes may cause nasal irritation and/or nausea, vomiting and stomach pain. The metal fume may also produce influenza-like symptoms, known as metal fume fever. Symptoms of this reaction may include metallic taste, runny nose, nausea, fever and chills. These effects usually disappear within 24 hours, but may be delayed in onset. Exposure to high concentrations of chromium dusts or fumes can cause severe respiratory and nasal irritation.
Ingestion:	Ingestion of large amounts of dust may cause nausea, diarrhea and or stomach pain.

CHRONIC EFFECTS: Prolonged or repeated skin contact with dust may cause more severe irritation or dermatitis. Prolonged or repeated inhalation of dust or fume may cause more severe irritation and possibly lung damage. Chronic exposure to dust or fume may also lead to the development of permanent, severe, obstructive or fibrotic lung disease characterized by coughing, wheezing, and shortness of breath. Repeated exposure may cause an allergic skin reaction consisting of itching, redness, swelling, and rash or urticaria (hives) in sensitized individuals. Prolonged or repeated inhalation of dust or fume may cause an allergic type of asthma reaction characterized by wheezing, coughing, and extreme breathing difficulty in sensitized individuals. Ingestion of large amounts of cobalt may affect the heart, but this type of exposure is not anticipated under normal occupational conditions. Prolonged or repeated exposures to chromium dusts or fumes may cause perforation of the nasal septum, bloody nose and other symptoms of severe nasal irritation. Epidemiological studies in humans have shown an association between lung and nasal cancers and prolonged occupational exposures to high concentrations of nickel. Chronic exposure to lead can cause kidney damage, anemia, reproductive effects, developmental effects and permanent nervous system damage in humans including changes in cognitive function. Chronic exposure to cadmium dusts has can cause kidney damage (renal tubular dysfunction and proteinuria), emphysema and chronic bronchitis in workers. Some epidemiological studies of workers have shown an association with increased risk for lung cancer after long-term high exposure. Other studies have not shown this association. Laboratory studies in animals have shown cadmium to produce lung tumors. Based on this evidence, cadmium has been classified as a known human carcinogen.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Exposure to dust or fume may aggravate an existing dermatitis, blood condition, asthma, emphysema, or other respiratory disease.

POTENTIAL ENVIRONMENTAL EFFECTS: None known. Product has not been tested for environmental properties.

4. FIRST AID MEASURES

EYE CONTACT: Immediately flush out fume and dust particles with large amounts of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If eye irritation develops, call a physician at once.

SKIN CONTACT: If exposed to dust or fumes, wash skin with plenty of water. Remove contaminated clothing and shoes and launder before reuse. If skin irritation or rash develops and persists or recurs, get medical attention.

INHALATION: If symptoms of lung irritation occur (coughing, wheezing or breathing difficulty), remove from exposure area to fresh air immediately. If breathing has stopped, perform artificial respiration. Keep affected person warm and at rest. Get medical attention.

INGESTION: Not a likely route of exposure for finished metal alloy. If dust is ingested, immediately drink water to dilute. Consult a physician if symptoms develop.

NOTE TO PHYSICIANS: There is no specific antidote to the active ingredients in this product; use symptomatic treatment.

5. FIRE FIGHTING MEASURES

PROPERTY	*VALUE*	*PROPERTY*	*VALUE*
Explosive	No	Flammable	No
Combustible	No	Pyrophoric	No
Flash Point (?C):	Not applicable	Burning Rate of Material:	Not applicable
Lower Explosive Limit:	Not applicable	Autoignition Temp.:	Not applicable
Upper Explosive Limit:	Not applicable	Flammability Classification: (defined by 29 CFR 1910.1200)	Not applicable

UNUSUAL FIRE AND EXPLOSION HAZARDS: Dust may cause an ignitable and/or an explosive atmosphere.

EXTINGUISHING MEDIA: For localized powder fires, smother with dry sand, dry dolomite, sodium chloride or soda ash. Use fire-extinguishing media appropriate to fight surrounding fire.

SPECIAL FIREFIGHTING PROCEDURES: None required.

6. ACCIDENTAL RELEASE MEASURES

FOR ALL TRANSPORTATION ACCIDENTS, CALL CHEMTREC AT 800-424-9300. In dust form, this product may be an explosion hazard. Remove all sources of ignition. Dust of fume may be suppressed by the use of a local exhaust system. Dispose of per guidelines under Section 13, WASTE DISPOSAL.

7. HANDLING AND STORAGE

HANDLING: Avoid dispersion of dust in air.

STORAGE: No special requirements.

Shelf Life Limitations: None known.

Incompatible Materials for Packaging: None known.

Incompatible Materials for Storage or Transport: None known.

OTHER PRECAUTIONS: Do not shake clothing, rags or other items to remove dust. Dust should be removed by washing or HEPA vacuuming.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

CAS #	*CHEMICAL NAME*	*ACGIH TLV*	*OSHA PEL*	*INTERNATIONAL OELS*
7440-50-8	Copper	0.2 mg/m³ (fume), 1 mg/m³ (dusts and mists)	0.1 mg/m³ (fume) 1 mg/m³ (dusts and mists)	Austria, Belgium, Canada: 0.2 mg/m³ (fumes), 1 mg/m³ (dusts) Denmark: 1.0 mg/m³ (dust and powder) Germany (MAK): 0.1 mg/m³ (fume), 1 mg/m³ (dusts and mists)
7439-89-6	Iron	None established	None established	None established
7440-66-6	Zinc	None established	None established	None established
7440-48-4	Cobalt	0.02 mg/m³	0.1 mg/m³	Austria: Group A2 carcinogen, skin & resp. sensitizer Canada (BC): 0.02 mg/m³, K3, Z, A Canada (Alberta & others): 0.05 mg/m³ Denmark: 0.02 mg/m³ Germany: MAK - 2 (Sah)
7440-47-3	Chromium	0.5 mg/m³	1 mg/m³	Finland: 0.1 mg/m³ Belgium, Denmark, France, Netherlands, Norway, Poland, Sweden, U.K.: 0.5 mg/m³
7440-31-5	Tin	2 mg/m³	2 mg/m³	U.K. (LTEL): 5 mg/m³ Austria & Germany (MAK), Belgium, Finland, Denmark, The Netherlands, Poland, Switzerland: 2 mg/m³ Hungary, Norway: 1 mg/m³
7440-02-0	Nickel	1.5 mg/m³ (inhalable)	1 mg/m³	Germany, MAK = 1 mg/m³ Canada (B.C.), Czechoslovakia, Denmark, Norway - 0.05 mg/m³, K1, sensitizer Poland = 0.25 mg/m³ Ireland, Sweden, Switzerland, U.K. = 0.5 mg/m³ Belgium, Canada (Alberta & others), Finland, Japan, Mexico, Netherlands - 1 mg/m³ Portugal = 1.5 mg/m³
7439-92-1	Lead	0.05 mg/m³	0.05 mg/m³	Austria, Denmark, Germany, Sweden, Switzerland: 0.1 mg/m³ Norway, Poland: 0.05 mg/m³
7440-43-9	Cadmium	0.01 mg/m³ (inhalable) 0.002 mg/m³ (respirable)	0.005 mg/m³	Austria, Germany: Carcinogen Denmark, Sweden, U.K.: 0.01 mg/m³ Finland, Netherlands, Poland: 0.02 mg/m³ Belgium, France, Norway, Switzerland: 0.05 mg/m³
7439-95-4	Magnesium	None established	None established	None established

If this product is heated and fumes are generated, zinc oxide fumes could be formed. The ACGIH TLV and OSHA PEL for zinc oxide fume is 5 mg/m³.

ENGINEERING CONTROLS: Local exhaust ventilation is recommended if significant dusting occurs or fumes are generated. Otherwise, use general exhaust ventilation.

EYE / FACE PROTECTION: Use safety glasses.

SKIN PROTECTION: Wear impervious (cut-resistant) gloves and other protective clothing (aprons, coveralls) as appropriate to prevent skin contact when using this product. If generating a dust, wash thoroughly after handling, especially before eating, drinking, or smoking.

RESPIRATORY PROTECTION: Respiratory protection not normally needed. If dusting occurs or fumes are generated above the PEL/TLV, use a NIOSH-approved half-face or full-face respirator equipped with High Efficiency Particulate (HEPA) filter cartridges.

GENERAL HYGIENE CONSIDERATIONS: Do not eat, drink, or smoke while using this product in dust form.

9. PHYSICAL AND CHEMICAL PROPERTIES

PROPERTY	*VALUE*	*PROPERTY*	*VALUE*
Appearance:	Red metallic	*Vapor Density (air = 1):*	Not applicable
Odor:	None	*Boiling Point (?F):*	No data
Molecular Weight:	Not applicable - Mixture	*Melting point:*	L:1080-1090°C (1976-1995°F) S:965-1085°C (1769-1985°F)
Physical State:	Solid	*Specific gravity (g/cc):*	8.94
pH:	Not applicable	*Bulk Density*	8.94 g/cc
Vapor Pressure (mm Hg):	Not applicable	*Viscosity (cps):*	Not applicable
Vapor Density	Not applicable	*Decomposition Temperature:*	Not applicable
Solubility in Water (20 ?C):	Negligible	*Evaporation Rate:*	Not Applicable
Volatiles, Percent by volume:	Not applicable	*Octanol/water partition coefficient:*	Unknown

10. STABILITY AND REACTIVITY

STABILITY: Stable under normal temperatures and pressure.

CONDITIONS TO AVOID: Not affected by mechanical impact or shock or by electrical discharge.

MATERIALS TO AVOID: Acetylene, chlorine

HAZARDOUS DECOMPOSITION PRODUCTS: When heated to decomposition, may produce metal oxides and fumes. Inhalation of high concentrations of metal fumes may cause a condition known as "metal fume fever" which is characterized by flu-like symptoms.

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION

POTENTIAL EXPOSURE ROUTES: For dust: ingestion, inhalation, and eye contact. For fume: inhalation and eye contact. The finished alloy metal is not hazardous.

ACUTE ANIMAL TOXICITY DATA:

For Product:		For Components									
		Copper	Iron	Zinc	Cobalt	Lead	Cadmium	Magne-sium	Chrom-ium	Tin	Nickel
Oral LD_{50}	Believed to be > 5 g/kg	3.5 mg/kg (mouse, intra-periton-eal)	30 g/kg (rat)	No data	6.171 g/kg (rat)	No data	2330 mg/kg (rat)	No data	27.5 mg/kg (rat)	No data	> 5 g/kg (rat)

For Product:		For Components									
		Copper	Iron	Zinc	Cobalt	Lead	Cadmium	Magnesium	Chromium	Tin	Nickel
Dermal LD_{50}	Believed to be > 2 g/kg	375 mg/kg (rabbit, subcutaneous)	No data	No data	No data	No data	6 mg/kg (rabbit, subcutaneous)	No data	No data	No data	> 7.5 g/kg (rabbit subcutaneous)
Inhalation LC_{50}	Believed to be slightly to moderately toxic	No data	No data	No data	165 mg/m^3 (30-min., rat, cobalt oxides)	No data	25 mg/m^3 (30 min., rat)	No data	87 mg/m^3 (4 hrs, rat)	No data	> 12 mg/kg (rat, intratracheal)
Irritation	Eye and respiretory irritant, sensitizer	Respiratory irritant	Eye irritant	Eye irritant	Respiratory irritant, skin and respiratory sensitizer	Not irritating	Respiratory irritant	No data	Respiratory and nasal irritant	No data	Respiratory irritant, skin sensitizer

SUBCHRONIC/ CHRONIC TOXICITY: No information for product. Lead has caused blood, kidney and nervous system damage in laboratory animals. Cadmium has cause liver and kidney damage in laboratory animals.

CARCINOGENICITY: IARC lists cobalt and cobalt compounds as possibly carcinogenic to humans, Group 2B. The International Agency for Research on Cancer (IARC) lists lead as possibly carcinogenic to humans, group 2B. In laboratory animal studies, chronic exposure to high concentrations of nickel has caused an increase in lung and nasal tumors. The International Agency for Research on Cancer (IARC) has classified nickel as possibly carcinogenic to humans, group 2B. The National Toxicology Program (NTP) classifies nickel as a known human carcinogen. Cadmium has caused cancer in laboratory animals when administered by inhalation. Cadmium is listed as a known human carcinogen by IARC (Group 1), OSHA, NTP and EPA.

MUTAGENICITY: This product is not known or reported to be mutagenic. Nickel has been shown to be mutagenic in in vitro studies. Cadmium has tested positive in a variety of in vitro and in vivo mutagenicity assays. Lead has been shown to be mutagenic in several *in vitro* assays.

REPRODUCTIVE, TERATOGENICITY, OR DEVELOPMENTAL EFFECTS: This product is not known or reported to cause reproductive or developmental effects. Lead has been shown to affect fetal development including birth defects and reduce male reproductive function in laboratory animals. Exposure of male rats to high concentrations of nickel caused testicular degeneration. However, symptoms of systemic toxicity, including severe weight loss, were also observed at the same concentrations indicating that the testicular effects were secondary to the frank toxicity. Animals studies have produce conflicting results in terms of cadmium's ability to cause reproductive effects. The majority of the evidence indicates that cadmium is not a reproductive toxin. Cadmium has produced developmental effects in laboratory animals at very high doses. Exposure at these levels is highly unlikely under normal working conditions.

NEUROLOGICAL EFFECTS: This product is not known or reported to cause neurological effects. Lead has caused peripheral and central nervous system damage and behavioral effects in laboratory animals.

INTERACTIONS WITH OTHER CHEMICALS WHICH ENHANCE TOXICITY: None known or reported.

12. ECOLOGICAL INFORMATION

ECOTOXICITY: No data is available on this product. Individual constituents are as follows:

Copper: The toxicity of copper to aquatic organisms varies significantly not only with the species, but also with the physical and chemical characteristics of the water, such as its temperature, hardness, turbidity and carbon dioxide content. Copper concentrations varying from 0.1 to 1.0 mg/l have been found by various investigators to be not toxic for most fish. However, concentrations of 0.015 to 3.0 mg/l have been reported as toxic, particularly in soft water to many kinds of fish, crustaceans, mollusks, insects, and plankton.

Chromium: *Daphnia magna*, 48 hr. LC_{50} = 0.022 mg/L; Fathead minnow, 96 hr LC_{50} = 39 mg/L

Nickel: 96 hr LC_{50}, rainbow trout =31.7 mg/L; 96 hr LC_{50}, fathead minnow = 3.1 mg/L; 72 hr EC_{50}, freshwater algae (4 species): = 0.1 mg/L; 96 hr LC_{50}, *Daphnia* = 0. 51 mg/L

Cadmium: 96 hr LC_{50}, rainbow trout=2.0-9.1 mg/l;96 hr LC_{50}, fathead minnow=1.1-25.3 mg/l; 48 hr LC_{50}, *Daphnia magna*=14-118 mg/l; 76 hr EC_{50}, algae (*Selenastrum capricornutum*)= 97-452 mg/l

Lead: LC50 (48 hrs.) to bluegill (Lepomis macrochirus) is reported to be 2-5 mg/l. Lead is toxic to waterfowl.

MOBILITY: Dissolved lead may migrate through soil.

PERSISTANCE/DEGRADABILITY: Lead may persist and accumulate in the environment.

BIOACCUMULATION: Chromium, BCF = 10 after 24 days in trout; Cadmium, BCF = 1.1 in trout after 2 weeks, BCF = 22.4 in carp after 40 days.

13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it DOES NOT meet the criteria of a hazardous waste as defined under 40 CFR 261, in that it does not exhibit the characteristics of hazardous waste of Subpart C, nor is it listed as a hazardous waste under Subpart D. Care must be taken to prevent environmental contamination from the use of this material. The user of this material has the responsibility to dispose of unused material, residues and containers in compliance with all relevant local, state and federal laws and regulations regarding treatment, storage and disposal for hazardous and non-hazardous wastes. This product may be a candidate for metal reclamation.

14. TRANSPORT INFORMATION

	U.S. DOT	RID/ADR	IMDG	IATA	IMO	Canada TDG
PROPER SHIPPING NAME:	Not regulated					
HAZARD CLASS:						
UN NO.:						
PACKING GROUP:						
LABEL:						
REPORTABLE QUANTITY:						

15. REGULATORY INFORMATION

US FEDERAL

TSCA	The components of this product are listed on the Toxic Substance Control Act inventory.
CERCLA:	Zinc, R.Q. = 1000 lbs.; Copper, R.Q.= 5000 lbs.; Chromium, R.Q. = 5000 lbs.; Lead, R.Q. = 10 lbs.; Nickel, R.Q. = 100 lbs.; Cadmium, R.Q. = 10 lbs. (No reporting is required if diameter of the pieces of metal is equal to or exceeds 100 micrometers (0.004 inches).
SARA 313:	Copper, Cobalt, Chromium, Nickel, Zinc (fume or dust), Lead

SARA 313 Hazard Class:	*Health*: For dust or fume only	Acute - Yes, Chronic - Yes	*Fire:* None	*Reactivity:* None	*Release of Pressure:* None
SARA 302 EHS List:	None of the components of this product are listed.				

RQ = Reportable Quantity

STATE RIGHT-TO-KNOW STATUS

Component	*CA Prop. 65	New Jersey	Pennsylvania	Massachusetts	Michigan
Copper	Not listed	X	X	X	X
Iron	Not listed	Not listed	Not listed	Not listed	Not listed
Zinc	Not listed	X	Not listed	X	X
Cobalt	X	X	X	X	X
Chromium (not hexavalent)	Not listed	X	X	X	X
Tin	Not listed	Not listed	X	X	Not listed
Nickel	X	X	X	X	X
Cadmium	X	X	X	X	X
Lead	X	X	X	X	X
Magnesium	Not listed	Not listed	X	Not listed	Not listed

*"WARNING: This product contains detectable amounts of a chemical(s) known to the State of California to cause cancer and/or birth defects or other reproductive harm."

EUROPEAN REGULATIONS

Because this material contains nickel at > 0.1%, lead, cadmium and cobalt at > 0.2%, this material is classified as **Xn, Harmful**. However, this material in its massive solid form is not required to be labeled under EC regulations.

German WGK Classification: Unknown

CANADIAN REGULATIONS

DSL LIST: The components of this product are on the DSL or are exempt from reporting under the New Substances Notification Regulations.
IDL: Cobalt, Copper, Tin, Nickel, Lead, Cadmium, and Chromium
WHMIS: This product is considered to be a manufactured article and therefore not subject to WHMIS requirements.

16. OTHER INFORMATION

REVISIONS: Update to composition, 1/1/04

"The information herein is given in good faith, but no warranty, express or implied, is made."