

Material Safety Data Sheet

Tungsten-Copper

Date of Preparation: 11/8/2006

MSDS No. 2.410

Revision No. 2

Section 1 - Chemical Product and Company Identification

Product/Chemical Name: Tungsten-Copper

Chemical Family: Elemental Metal Composite

Chemical Formula: WCu

Trade Name: Elkonite® 0W3, Elkonite® 1W3, Elkonite® 3W3, Elkonite® 5W3, Elkonite® 10W3, Elkonite® 20W3, Elkonite® 30W3, Elkonite® 40W3, Elkonite® 50W3, Elkonite® 2050C, Thermkon® 109, Thermkon® 83, Thermkon® 76, Thermkon® 93

Manufacturer:

CMW Inc.
70 S. Gray St.
Indianapolis, IN 46201

Telephone: 317-634-8884

FAX: 317-638-2706

Website: www.cmwinc.com

Section 2 - Composition/Information on Ingredients

| Ingredient Name | CAS Number | % Weight |
|-----------------|------------|----------|
| Tungsten | 7440-33-7 | 50-90 |
| Copper | 7440-50-8 | 10-50 |

| Ingredient | OSHA PEL | | ACGIH TLV | | NIOSH REL | | NIOSH IDLH |
|------------|-----------------------------------|-------------|---|----------------------|---------------------|---------------------|-----------------------------|
| | TWA | STEL | TWA | STEL | TWA | STEL | |
| Tungsten | none estab. | none estab. | 5 mg/m ³ | 10 mg/m ³ | 5 mg/m ³ | 5 mg/m ³ | none estab. |
| Copper | 0.1 mg/m ³ as Cu fume. | none estab. | 0.2 mg/m ³ as Cu fume 1 mg/m ³ as Cu dust & mist | none estab. | 1 mg/m ³ | none estab. | 100 mg/m ³ as Cu |

Section 3 - Hazards Identification

Hazard Rating Systems:

HMIS: Health 2 Flammability 0 Reactivity 0

NFPA: Health 2 Flammability 0 Reactivity 0

★★★★ Emergency Overview ★★★★★

Solid Tungsten-Copper presents no significant health hazard. Grinding, heating, welding of tungsten-copper may result in airborne particles or fumes. Dusts can form explosive mixtures in air. Avoid breathing dust. Keep away from strong acids, bases, gases, oxidizers, mercury, ammonia and acetylene.

Tungsten:**Primary Entry Routes:** Inhalation, skin contact, ingestion**Target Organs:** Insoluble compounds: skin, respiratory system; Soluble compounds: skin, respiratory system, central nervous system (CNS), gastrointestinal (GI) tract, eyes, liver, kidneys**Acute Effects:****Inhalation:** The dust may cause upper respiratory tract irritation.**Eye:** The dust may cause eye discomfort and irritation due to mechanical abrasion.**Skin:** May cause mild skin irritation after prolonged or repeated exposure to particulates or dust.**Ingestion:** Not normally a hazard due to the physical form of the material. Large amounts of dust or particulates may cause gastrointestinal effects.**Carcinogenicity:** IARC, NTP and OSHA do not list tungsten as a carcinogen.**Medical Conditions Aggravated by Long-Term Exposure:** None established.**Chronic Effects:** No human data available.**Copper:****Primary Entry Routes:** Inhalation, ingestion**Target Organs:** Respiratory system, skin, eyes, liver and kidneys**Acute Effects:****Inhalation:** Exposure from airborne dust or fumes may result from welding, grinding or sanding operations or during repair or maintenance on contaminated equipment. Symptoms may include irritation of upper respiratory tract, lungs, cough, metallic taste in mouth, fever, fatigue, nausea, bronchitis, chills, "metal fume fever", asthma-like symptoms, headache, profuse sweating, diarrhea, excessive urination, general malaise.**Eye:** Dust or fumes may cause mild irritation.**Skin:** Particles or dust may be abrasive to the skin.**Ingestion:** Kidney and liver damage may result if large quantities are ingested.**Carcinogenicity:** IARC, NTP, OSHA, ACGIH, and NIOSH do not list copper as a carcinogen.**Medical Conditions Aggravated by Long-Term Exposure:** Allergic reaction or sensitivity to metals. Exposure may aggravate conditions such as impaired pulmonary function, asthma, emphysema, chronic bronchitis, pre-existing kidney, liver or nervous system damage. A person with Wilson's Disease (a rare metabolic disorder characterized by retention of copper in the liver, brain, kidneys) is at increased risk from copper exposure and may develop liver cirrhosis, brain damage, CNS damage or kidney disease.**Chronic Effects:** Chronic exposure to copper dust or fumes may result in irritation of mucous membranes, nasal septum perforation, skin and hair discoloration.**Section 4 - First Aid Measures****Inhalation:** Remove to fresh air. Seek medical attention if respiratory irritation develops or breathing becomes difficult.**Eye Contact:** Flush eyes with water for at least 15 minutes. Seek medical attention if irritation persists.**Skin Contact:** Wash affected areas with soap and water. Seek medical attention if irritation persists.

Ingestion: Rinse mouth with water. Seek medical attention if irritation persists.
After first aid, get appropriate in-plant, paramedic, or community medical support.

Section 5 - Fire-Fighting Measures

Flash Point: N/A

Burning Rate: N/A

Autoignition Temperature: N/A

LEL: N/A

UEL: N/A

Extinguishing Media: Do NOT use water. Sand or dry powder extinguishers should be used to smother dust fires.

Unusual Fire or Explosion Hazards: If the metal is reduced to powder form it may burn. Blanket material to exclude air and do not disturb until completely extinguished and cool. Explosion may result if burning dust is stirred into a cloud, by providing oxygen to a large surface area. Avoid contact with acetylene, ammonium nitrate, barium bromate, chlorate and iodate, bromates, phosphorus, potassium chlorate, potassium iodate, potassium peroxide, sodium azide, sodium chlorate and iodate, sodium peroxide, sulfur, chlorates, nitric acid and other strong acids and bases.

Fire-fighting instructions: Do not release runoff from fire control methods to sewers or waterways. Contact fire department and tell them location and nature of hazard. Tungsten-Copper in metallic form is not combustible.

Fire-fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately. Avoid contact with skin and eyes.

Wear impervious gloves and safety glasses. Use dry clean-up procedures and avoid generating dust. Vacuum up or sweep up. Place spilled material in clean, dry sealable, labeled container.

Large Spills: Clear area of personnel and move upwind. Use dry clean-up procedures. Avoid generating dust. If inhalation risk of exposure exists, wear NIOSH-approved dust respirator. Collect recoverable material into labeled containers for recycling.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1010.220)

Section 7 - Handling and Storage

Handling Precautions: Limit all unnecessary personal contact. Use in a well-ventilated area. When handling, DO NOT eat, drink or smoke. Always wash hands with soap and water after handling.

Storage Methods: Store in a cool, dry, well-ventilated area away from incompatibles.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls/Personal Protection

Engineering Controls: Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses.

Hands: Recommend hand protection when handling metals for prevention of cuts from slivers and edges.

Respiratory Protection: Use NIOSH-approved respirator if TLV is exceeded or over-exposure is likely. Pressure demand airline respirators or self contained breathing apparatus is recommended for jobs with high exposure potential to copper dust or fumes

Section 9 - Physical and Chemical Properties

Appearance/General Information: Copper-grey metallic solid. Odorless. Very slightly soluble in nitric acid, sulfuric acid and aqua regia. Soluble in a mixture of hydrofluoric acid and nitric acid.

Vapor Pressure (kPa): 0

Vapor Density (Air=1): N/A

Specific Gravity (H₂O=1, at 4°C): 12.02-17.17 g/cc

Volatile Component (% Vol): 0

Water Solubility: Insoluble

pH: N/A

pH (1% Solution): N/A

Boiling Point Range: Tungsten: 5900°C (10652°F) at 760 mm Hg

Copper: 2567°C (4703°F)

Freezing/Melting Point Range: Tungsten: 3410°C (6171°F)

Copper: 1083°C (1763°F)

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Tungsten-copper metal is considered stable. Hazardous polymerization will not occur. Melting may generate harmful fumes.

Storage incompatibilities: Do not store with acetylene, ammonium nitrate, bromates, chlorates, iodates, chlorine, fluorine, chlorine trifluoride, ethylene oxide, hydrazine, hydrozoic acid, hydrogen peroxide, hydrogen sulfide, lead azide, phosphorus, nitric acid, potassium peroxide, sodium azide, sodium peroxide and 1-bromo-1-propylene.

Section 11 - Toxicological Information

Tungsten:

Toxicity: Unknown route (rat) LD₅₀: 2000 mg/kg

Substance has been investigated as a reproductive effector in female rodents-Oral TD_{L0} 1.16 mg/kg.

Irritation: Skin (rabbit) 500mg/24 hr-mild

Eyes (rabbit) 500mg/24 hr-mild

Copper:

Toxicity: Oral (human) TD_{L0}: 0.12 mg/kg

Section 12 - Ecological Information**Tungsten:**

Environmental Fate: No data available

Ecotoxicity: No data available

Copper:

Environmental Fate: Many copper compounds and complexes are readily soluble, therefore copper is among the mobile heavy metals in soil. The mobility of copper is limited by adsorption to organic matter, clays and other materials. Due to the fact that copper is an essential nutrient, it is accumulated by plants and animals.

Ecotoxicity: In freshwater, acute toxicity decreases as hardness increases. At a hardness of 100mg/l, acute NAWQ is 18 $\mu\text{g/l}$ and chronic NAWQ is 12 $\mu\text{g/l}$. In saltwater, acute sensitivities of aquatic life range from 5.8 $\mu\text{g/l}$ for blue mussel to 600 $\mu\text{g/l}$ for green crab. Lowest chronic value for aquatic plants is 1 $\mu\text{g/l}$.

Section 13 - Disposal Considerations

Disposal: Tungsten-Copper is recyclable. Follow applicable local, state and federal regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101)

Shipping Name: None

Hazard Class: None

ID No.: None

Packing Group: None

Label: No class label assigned

Placards: None

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Not listed

CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 5000 lbs Cu

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

This material contains Copper

Copper is subject to the reporting requirements of Section 313 Title III and CFR Part 373

Section 16 - Other Information

Prepared by: Lynne A. Ordell
Laboratory Services Manager
CMW Inc.

The information contained herein is believed to be correct, but no guarantee or warranty with respect to accuracy, completeness, or results is implied and no liability is assumed.

Material Safety Data Sheet

Tungsten Copper Alloy
Date of Preparation: 10/16/2003

MSDS No. 2.411
Revision No. 1

Section 1 - Chemical Product and Company Identification

Product/Chemical Name: Tungsten Copper Alloy
Chemical Family: Metal-Metal Alloy Composite
Chemical Formula: WCuNi
Trade Name: Thermkon® 62, Thermkon® 68, Elkonite® 2140C
Manufacturer: CMW Inc. Telephone: 317-634-8884
 70 S. Gray St. FAX: 317-638-2706
 Indianapolis, IN 46201 Website: www.cmwinc.com

Section 2 - Composition/Information on Ingredients

| Ingredient Name | CAS Number | % Weight |
|-----------------|------------|----------|
| Tungsten (W) | 7440-33-7 | 40-89.86 |
| Copper (Cu) | 7440-50-8 | 10-58 |
| Nickel (Ni) | 7440-02-0 | 0.14-2.0 |

| Ingredient | OSHA PEL | | ACGIH TLV | | NIOSH REL | | NIOSH IDLH |
|------------|-----------------------------------|-------------|---|----------------------|-------------------------|---------------------|-----------------------------|
| | TWA | STEL | TWA | STEL | TWA | STEL | |
| Tungsten | none estab. | none estab. | 5 mg/m ³ | 10 mg/m ³ | 5 mg/m ³ | 5 mg/m ³ | none estab. |
| Copper | 0.1 mg/m ³ as Cu fume. | none estab. | 0.2 mg/m ³ as Cu fume 1 mg/m ³ as Cu dust & mist | none estab. | 1 mg/m ³ | none estab. | 100 mg/m ³ as Cu |
| Nickel | 1 mg/m ³ | none estab. | 1.5 mg/m ³ | none estab. | 0.015 mg/m ³ | none estab. | 10 mg/m ³ |

Section 3 - Hazards Identification

Hazard Rating Systems:

| | | | |
|--------------|----------|----------------|--------------|
| HMIS: | Health 1 | Flammability 0 | Reactivity 0 |
| NFPA: | Health 1 | Flammability 0 | Reactivity 0 |

★★★★ Emergency Overview ★★★★★

Solid material presents no significant health hazard. Grinding or heating may result in airborne particles or fumes. Dusts can form explosive mixtures in air. Avoid breathing dust. Nickel itch or sensitization may result from exposure to dust or fine particles. Keep away from strong acids, bases, gases, oxidizers, mercury, ammonia and acetylene.

Potential Health Effects

Primary Entry Routes: Inhalation, skin contact

Target Organs: Insoluble compounds: skin, respiratory system; Soluble compounds: skin, respiratory system, central nervous system (CNS), gastrointestinal (GI) tract.

Acute Effects:

Tungsten:

Inhalation: The dust may cause upper respiratory tract irritation.

Eye: The dust may cause eye discomfort and irritation due to mechanical abrasion.

Skin: May cause mild skin irritation after prolonged or repeated exposure to particulates or dust.

Ingestion: Not normally a hazard due to the physical form of the material. Large amounts of dust or particulates may cause gastrointestinal effects.

Carcinogenicity: IARC, NTP and OSHA do not list tungsten as a carcinogen.

Medical Conditions Aggravated by Long-Term Exposure: None established.

Chronic Effects: No human data available.

Copper:

Primary Entry Routes: Inhalation, ingestion

Target Organs: Respiratory system, skin, eyes, liver and kidneys

Acute Effects:

Inhalation: Exposure from airborne dust or fumes may result from welding, grinding or sanding operations or during repair or maintenance on contaminated equipment. Symptoms may include irritation of upper respiratory tract, lungs, cough, metallic taste in mouth, fever, fatigue, nausea, bronchitis, chills, "metal fume fever", asthma-like symptoms, headache, profuse sweating, diarrhea, excessive urination, general malaise.

Eye: Dust or fumes may cause mild irritation.

Skin: Particles or dust may be abrasive to the skin.

Ingestion: Kidney and liver damage may result if large quantities are ingested.

Carcinogenicity: IARC, NTP, OSHA, ACGIH, and NIOSH do not list copper as a carcinogen.

Medical Conditions Aggravated by Long-Term Exposure: Allergic reaction or sensitivity to metals. Exposure may aggravate conditions such as impaired pulmonary function, asthma, emphysema, chronic bronchitis, pre-existing kidney, liver or nervous system damage. A person with Wilson's Disease (a rare metabolic disorder characterized by retention of copper in the liver, brain, kidneys) is at increased risk from copper exposure and may develop liver cirrhosis, brain damage, CNS damage or kidney disease.

Chronic Effects: Chronic exposure to copper dust or fumes may result in irritation of mucous membranes, nasal septum perforation, skin and hair discoloration.

Nickel:

Primary Entry Routes: Inhalation, skin contact, ingestion

Target Organs: Nasal cavities, lungs, skin

Acute Effects:

Inhalation: Dust, mist and fumes may be irritating to the upper respiratory tract. Inhalation of fumes may cause metal fume fever, characterized by flu-like symptoms with metallic taste, fever, chills, cough, weakness, headache, nausea, general malaise. Breathing nickel dusts and fumes may cause a hole to form in the nasal septum.

Eye: May cause eye irritation.

Skin: Exposure may cause contact dermatitis. Nickel is a potent contact allergen and sensitizer.

Ingestion: Not normally a hazard due to the physical form of the material. May cause gastrointestinal irritation.

Carcinogenicity: NTP-Class 2A, anticipated human carcinogen, IARC-Group 2B, possibly carcinogenic to humans., OSHA-possible select carcinogen, NIOSH-potential occupational carcinogen, ACGIH-not listed.

Medical Conditions Aggravated by Long-Term Exposure: Persons with pulmonary conditions, emphysema, chronic bronchitis may be subject to further disability if excessive concentrations of dusts or fumes are inhaled.

Chronic Effects: Prolonged or repeated skin contact may cause contact dermatitis and possible destruction or ulceration. May cause respiratory tract cancer.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air. Seek medical attention if respiratory irritation develops or breathing becomes difficult.

Eye Contact: Flush eyes with water for at least 15 minutes. Seek medical attention if irritation persists.

Skin Contact: Wash affected areas with soap and water. Seek medical attention if irritation persists.

Ingestion: Rinse mouth with water. Seek medical attention if irritation persists.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Section 5 - Fire-Fighting Measures

Flash Point: N/A

Burning Rate: N/A

Autoignition Temperature: N/A

LEL: N/A

UEL: N/A

Extinguishing Media: Do NOT use water. Sand or dry powder extinguishers should be used to smother dust fires.

Unusual Fire or Explosion Hazards: If the metal is reduced to powder form it may burn. Blanket material to exclude air and do not disturb until completely extinguished and cool. Explosion may result if burning dust is stirred into a cloud, by providing oxygen to a large surface area. Avoid contact with acetylene, ammonium nitrate, barium bromate, chlorate and iodate, bromates, phosphorus, potassium chlorate, potassium iodate, potassium peroxide, sodium azide, sodium chlorate and iodate, sodium peroxide, sulfur, chlorates, nitric acid and other strong acids and bases.

Fire-fighting instructions: Do not release runoff from fire control methods to sewers or waterways. Contact fire department and tell them location and nature of hazard. Tungsten-Copper in metallic form is not combustible.

Fire-fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately. Avoid contact with skin and eyes.

Wear impervious gloves and safety glasses. Use dry clean-up procedures and avoid generating dust. Vacuum up or sweep up. Place spilled material in clean, dry sealable, labeled container.

Large Spills: Clear area of personnel and move upwind. Use dry clean-up procedures. Avoid generating dust. If inhalation risk of exposure exists, wear NIOSH-approved dust respirator. Collect recoverable material into labeled containers for recycling.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1010.220)

Section 7 - Handling and Storage

Handling Precautions: Limit all unnecessary personal contact. Use in a well-ventilated area. When handling, DO NOT eat, drink or smoke. Always wash hands with soap and water after handling.

Storage Methods: Store in a cool, dry, well-ventilated area away from incompatibles.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls/Personal Protection

Engineering Controls: Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses or goggles.

Hands: Recommend hand protection when handling metals for prevention of cuts from slivers and edges.

Respiratory Protection: Use NIOSH-approved respirator if TLV is exceeded or over-exposure is likely.

Section 9 - Physical and Chemical Properties

Appearance/General Information: Copper-grey metal. Odorless. Very slightly soluble in nitric acid, sulfuric acid and aqua regia. Soluble in a mixture of hydrofluoric acid and nitric acid.

Vapor Pressure (kPa): N/A

Vapor Density (Air=1): N/A

Specific Gravity (H₂O=1, at 4°C): 10.5-17.17 gms/cc

Volatile Component (% Vol): 0

Water Solubility: Insoluble

pH: N/A

pH (1% Solution): N/A

Boiling Point Range: Tungsten: 5900°C (10652°F) at 760 mm Hg

Copper: 2567°C (4703°F)

Nickel: 2730 °C (4946 °F)

Freezing/Melting Point Range: Tungsten: 3410°C (6171°F)

Copper: 1083°C (1763°F)

Nickel: 1455 °C (2651°F)

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Material is considered stable. Hazardous polymerization will not occur. Melting may generate harmful fumes.

Storage incompatibilities: Do not store with acetylene, ammonium nitrate, bromates, chlorates, iodates, chlorine, fluorine, chlorine trifluoride, ethylene oxide, hydrazine, hydrozoic acid, hydrogen peroxide, hydrogen sulfide, lead azide, phosphorus, nitric acid, potassium peroxide, sodium azide, sodium peroxide and 1-bromo-1-propylene.

Section 11 - Toxicological Information

Tungsten:

Toxicity: Unknown route (rat) LD₅₀: 2000 mg/kg

Substance has been investigated as a reproductive effector in female rodents-Oral TD_{Lo} 1.16 mg/kg.

Irritation: Skin (rabbit) 500mg/24 hr-mild

Eyes (rabbit) 500mg/24 hr-mild

Copper:

Toxicity: Oral (human) TD_{Lo}: 0.12 mg/kg

Nickel:

Toxicity: Oral (rat) LD₅₀: 5000 mg/kg

Section 12 - Ecological Information

Tungsten and Nickel:

Environmental Fate: No data available

Ecotoxicity: No data available

Copper:

Environmental Fate: Many copper compounds and complexes are readily soluble, therefore copper is among the mobile heavy metals in soil. The mobility of copper is limited by adsorption to organic matter, clays and other materials. Due to the fact that copper is an essential nutrient, it is accumulated by plants and animals.

Ecotoxicity: In freshwater, acute toxicity decreases as hardness increases. At a hardness of 100mg/l, acute NAWQ is 18 µg/l and chronic NAWQ is 12 µg/l. In saltwater, acute sensitivities of aquatic life range from 5.8 µg/l for blue mussel to 600 µg/l for green crab. Lowest chronic value for aquatic plants is 1 µg/l.

Section 13 - Disposal Considerations

Disposal: Material is recyclable. Follow applicable local, state and federal regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101)

Shipping Name: None

Placards: None

Hazard Class: None

ID No.: None

Packing Group: None

Label: No class label assigned

Section 15 - Regulatory Information**EPA Regulations:****RCRA 40 CFR:** Listed**CERCLA 40 CFR 302.4:** Listed per CWA Section 307(a) 100 lb Ni, 5000 lbs Cu**SARA 40 CFR 372.65:** Listed**SARA EHS 40 CFR 355:** Not listed**TSCA:** Listed

This material contains Copper and Nickel

Copper and Nickel are subject to the reporting requirements of Section 313 Title III and CFR Part 373

Section 16 - Other Information

Prepared by: Lynne A. Ordell
Laboratory Services Manager
CMW Inc.

The information contained herein is believed to be correct, but no guarantee or warranty with respect to accuracy, completeness, or results is implied and no liability is assumed.

Material Safety Data Sheet

Molybdenum-Copper
Date of Preparation: 10/31/2003

MSDS No. 2.610
Revision No. 1

Section 1- Chemical Product and Company Identification

Product/Chemical Name: Molybdenum-Copper
Chemical Family: Elemental Metal Composite
Chemical Formula: MoCu
Trade Name: Thermkon® 70 M, Thermkon® 65M
Manufacturer: CMW Inc. **Telephone:** 317-634-8884
 70 S. Gray St. **FAX:** 317-638-2706
 Indianapolis, IN 46201 **Website:** www.cmwinc.com

Section 2 - Composition/Information on Ingredients

| Ingredient Name | CAS Number | % Weight |
|-----------------|------------|----------|
| Molybdenum (Mo) | 7439-98-7 | 80-85 |
| Copper (Cu) | 7440-50-8 | 15-20 |

| Ingredient | OSHA PEL | | ACGIH TLV | | NIOSH REL | | NIOSH IDLH |
|------------|---|-------------|--|-------------|-------------------------|-------------|-----------------------------|
| | TWA | STEL | TWA | STEL | TWA | STEL | |
| Molybdenum | 10 mg/m ³ <small>(vacated 1989 limit)</small> | none estab. | 10 mg/m ³ inhalable | none estab. | 0.015 mg/m ³ | none estab. | 5000 mg/m ³ |
| Copper | 0.1 mg/m ³ as Cu fume. | none estab. | 0.2 mg/m ³ as Cu fume 1 mg/m ³ as Cu dust & mist | none estab. | 1 mg/m ³ | none estab. | 100 mg/m ³ as Cu |

Section 3 - Hazards Identification

Hazard Rating Systems:

HMIS: Health 1 Flammability 0 Reactivity 0
NFPA: Health 1 Flammability 0 Reactivity 0

★★★★ Emergency Overview ★★★★★

Dust and fumes are irritating to eyes and respiratory system. Molybdenum-copper metal is stable but if reduced to powder or dust can be flammable and explosive if exposed to heat or ignition sources. Keep away from strong acids, bases, gases, oxidizers, mercury, ammonia and acetylene

Potential Health Effects

Molybdenum:

Primary Entry Routes: Inhalation, ingestion, skin or eye contact

Target Organs: Eyes, skin, respiratory and nervous system, liver, kidneys and blood.

Acute Effects:

Inhalation: Dust or fumes may cause upper respiratory tract irritation.

Eye: The dust may cause eye discomfort and irritation due to mechanical abrasion.

Skin: None reported.

Ingestion: Not normally a hazard due to the physical form of the material. Limited human data exists on human ingestion.

Carcinogenicity: IARC, NTP, OSHA, NIOSH, ACGIH, EPA do not list molybdenum as a carcinogen.

Medical Conditions Aggravated by Long-Term Exposure: Susceptibility to gout. Excessive molybdenum can interfere with copper absorption in humans.

Chronic Effects: Long term exposure may result in anemia, hyperthyroidism and abnormal liver function tests. Headache, muscle an/or joint pain, weakness, fatigue, anorexia, impaired pulmonary function, renal dysfunction, skin or hair changes, dry cough and chest pains have been reported following long term inhalation exposure.

Copper:

Primary Entry Routes: Inhalation, ingestion

Target Organs: Respiratory system, skin, eyes, liver and kidneys

Acute Effects:

Inhalation: Exposure from airborne dust or fumes may result from welding, grinding or sanding operations or during repair or maintenance on contaminated equipment. Symptoms may include irritation of upper respiratory tract, lungs, cough, metallic taste in mouth, fever, fatigue, nausea, bronchitis, chills, "metal fume fever", asthma-like symptoms, headache, profuse sweating, diarrhea, excessive urination, general malaise.

Eye: Dust or fumes may cause mild irritation.

Skin: Particles or dust may be abrasive to the skin.

Ingestion: Kidney and liver damage may result if large quantities are ingested.

Carcinogenicity: IARC, NTP, OSHA, ACGIH, and NIOSH do not list copper as a carcinogen.

Medical Conditions Aggravated by Long-Term Exposure: Allergic reaction or sensitivity to metals. Exposure may aggravate conditions such as impaired pulmonary function, asthma, emphysema, chronic bronchitis, pre-existing kidney, liver or nervous system damage. A person with Wilson's Disease (a rare metabolic disorder characterized by retention of copper in the liver, brain, kidneys) is at increased risk from copper exposure and may develop liver cirrhosis, brain damage, CNS damage or kidney disease.

Chronic Effects: Chronic exposure to copper dust or fumes may result in irritation of mucous membranes, nasal septum perforation, skin and hair discoloration.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air and support breathing as needed. Seek medical attention if cough or breathing difficulty develops.

Eye Contact: Flush eyes with water for at least 15 minutes. Seek medical attention if irritation persists.

Skin Contact: Wash affected areas with soap and water. Seek medical attention if irritation persists.

Ingestion: Contact a poison control center.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Section 5 - Fire-Fighting Measures

Flash Point: N/A

Burning Rate: N/A

Autoignition Temperature: N/A

LEL: N/A

UEL: N/A

Extinguishing Media: Use dry chemical, CO₂, water spray or alcohol foam.

Unusual Fire or Explosion Hazards: If molybdenum-copper metal is reduced to dust or powder form it is flammable and dust-air explosion may occur depending on the particulate size and dispersion in air. Avoid contact with acetylene, ammonium nitrate, barium bromate, chlorate and iodate, bromates, phosphorus, potassium chlorate, potassium iodate, potassium peroxide, sodium azide, sodium chlorate and iodate, sodium peroxide, sulfur, chlorates, nitric acid and other strong acids and bases.

Fire-fighting instructions: Do not release runoff from fire control methods to sewers or waterways. Do not scatter the material. After ignition source is removed, the metal may continue to glow until oxidation is complete.

Fire-fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Small Spills: Do not dry sweep. Use a vacuum (with appropriate HEPA filter) or wet method.

Large Spills: Clear area of unnecessary personnel. Use clean non-sparking tools to collect material. Avoid generating dust. If inhalation risk of exposure exists, wear NIOSH-approved respirator and protective clothing. Collect recoverable material into labeled containers for recycling.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1010.220)

Section 7 - Handling and Storage

Handling Precautions: Limit all unnecessary personal contact. Use in a well-ventilated area. When handling, DO NOT eat, drink or smoke. Always wash hands with soap and water after handling. Avoid dust generation. Keep away from ignition sources and physical damage.

Storage Methods: Store in a cool, dry, well-ventilated area away from heat and ignition sources and incompatibles.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls/Personal Protection

Engineering Controls: Provide general or local exhaust ventilation if dust is formed.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses or goggles.

Hands: Recommend hand protection when handling metals for prevention of cuts from slivers and edges.

Respiratory Protection: Use NIOSH-approved respirator, making selection based on its suitability to provide adequate worker protection for given working conditions. Pressure demand airline respirators or self contained breathing apparatus is recommended for jobs with high exposure potential to copper dust or fumes

Section 9 - Physical and Chemical Properties

Appearance/General Information: Copper grey metal. Odorless. Soluble in mixture of hydrofluoric and nitric acids.

Vapor Pressure (kPa): N/A

Vapor Density (Air=1): N/A

Specific Gravity (H₂O=1, at 4°C): 9.83-10.10 g/cc

Volatile Component (% Vol): 0

Water Solubility: Insoluble

pH: N/A

pH (1% Solution): N/A

Boiling Point Range: Molybdenum: 4825°C (8717°F) at 760 mm Hg

Copper: 2567°C (4703°F)

Freezing/Melting Point Range: Molybdenum: 2622°C (4752°F)

Copper: 1083°C (1763°F)

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Molybdenum-copper metal is considered stable. Hazardous polymerization will not occur. Melting may generate harmful fumes. Avoid ignition sources. Avoid contact with oxidants, halogens, nitric and sulfuric acids, BrF₃, ClF₃, F₂, and PbO₂

Hazardous Decomposition Products: Thermal oxidative decomposition can produce molybdenum trioxide and molybdenum oxide. Copper fumes will be given off when heated.

Storage incompatibilities: Segregate from strong acids, oxidants, BrF₃, ClF₃, F₂, and PbO₂. Do not store with acetylene, ammonium nitrate, bromates, chlorates, iodates, chlorine, fluorine, chlorine trifluoride, ethylene oxide, hydrazine, hydrozoic acid, hydrogen peroxide, hydrogen sulfide, lead azide, phosphorus, nitric acid, potassium peroxide, sodium azide, sodium peroxide and 1-bromo-1-propylene.

Section 11 - Toxicological Information**Molybdenum:**

Toxicity: Low order of toxicity and is rapidly excreted from the body.

Acute Inhalation Effects:

Rat, inhalation: 19500 µg/m³

Copper:

Toxicity: Oral (human) TD_{Lo}: 0.12 mg/kg

Section 12 - Ecological Information**Molybdenum:**

Environmental Fate: In water molybdenum will precipitate out with natural calcium. Soil levels should not exceed 50 ppm to avoid problems with livestock. Sorption is most likely in soils of low pH and high organic content.

Ecotoxicity: Fathead minnow, LC₅₀: 370 mg/L/96 hrs. Terrestrial plants can contain enough molybdenum to be toxic to animals but still grow normally

Copper:

Environmental Fate: Many copper compounds and complexes are readily soluble, therefore copper is among the mobile heavy metals in soil. The mobility of copper is limited by adsorption to organic matter, clays and other materials. Due to the fact that copper is an essential nutrient, it is accumulated by plants and animals.

Ecotoxicity: In freshwater, acute toxicity decreases as hardness increases. At a hardness of 100mg/l, acute NAWQ is 18 µg/l and chronic NAWQ is 12 µg/l. In saltwater, acute sensitivities of aquatic life range from 5.8 µg/l for blue mussel to 600 µg/l for green crab. Lowest chronic value for aquatic plants is 1 µg/l.

Section 13 - Disposal Considerations

Disposal: Molybdenum-copper is recyclable. Follow applicable local, state and federal regulations.

Section 14 - Transport Information**DOT Transportation Data (49 CFR 172.101)**

Shipping Name: None

Label: No class label assigned

Placards: None

Hazard Class: None

ID No.: None

Packing Group: None

Section 15 - Regulatory Information**EPA Regulations:**

RCRA 40 CFR: Not listed

CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 5000 lbs Cu

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

This material contains Copper

Copper is subject to the reporting requirements of Section 313 Title III and CFR Part 373

Section 16 - Other Information

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CMW Inc.

The information contained herein is believed to be correct, but no guarantee or warranty with respect to accuracy, completeness, or results is implied and no liability is assumed.