

HIGHLAND VALLEY COPPER CONCENTRATE SAFETY DATA SHEET

SECTION 1. IDENTIFICATION

Product Identity: Highland Valley Copper Concentrate

Trade Names and Synonyms: HVC Copper Concentrate

Manufacturer:

Teck Highland Valley Copper Partnership
P.O. Box 1500
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Emergency Telephone: CANUTEC
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Supplier:

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Preparer:

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Date of Last Review: October 17, 2018.

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Product Use: Primary production of copper metal.

SECTION 2. HAZARDS IDENTIFICATION

CLASSIFICATION:

Health	Physical	Environmental
Acute Toxicity (Oral, Inhalation) – Does not meet criteria Skin Corrosion/Irritation – Does not meet criteria Eye Damage/Eye Irritation – Does not meet criteria Respiratory or Skin Sensitization – Does not meet criteria Mutagenicity – Does not meet criteria Carcinogenicity – Category 1 Reproductive Toxicity – Does not meet criteria Specific Target Organ Toxicity: Acute Exposure – Does not meet criteria Chronic Exposure – Category 1	Does not meet criteria for any Physical Hazard	Aquatic Toxicity – Short Term (Acute) Category 2

LABEL:

<p>Symbols:</p> 	<p>Signal Word:</p> <p style="text-align: center;">DANGER</p>
<p style="text-align: center;"><u>Hazard Statements</u></p> <p>DANGER! Causes damage to the respiratory system through prolonged or repeated inhalation of fine respirable dust. May cause cancer through inhalation of dust. Toxic to aquatic life.</p>	<p style="text-align: center;"><u>Precautionary Statements:</u></p> <p>Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe dust. Do not eat, drink or smoke when using this product. Wear protective gloves/protective clothing. Wash thoroughly after handling. Avoid release to the environment. If exposed or concerned or you feel unwell: get medical advice/attention.</p>

Emergency Overview: A green to red-brown, finely-ground material that is not flammable or combustible under normal conditions of transport and storage. However, when heated strongly in air for a sufficient time it will burn, releasing toxic and irritating sulphur dioxide gas as well as possible copper and iron oxide fumes. Contact with strong acids will generate flammable

and highly toxic hydrogen sulphide gas. Inhalation or ingestion of copper concentrate dust or copper oxide fume may produce irritation of the upper airways. Possible cancer hazard due to the silica content. Full face piece SCBA and protective clothing are required for fire emergency response personnel due to the potential for release of high concentrations of sulphur dioxide from burning concentrate. The metals content in this product have low direct bioavailability and pose little immediate ecological risk.

Potential Health Effects: Concentrate dust may be irritating to the nose, throat and respiratory tract. Inhalation or ingestion of copper may cause nausea, vomiting, headaches, dizziness, and gastrointestinal irritation. Inhalation of high concentrations of copper oxide fume may cause irritation of the upper respiratory tract and may result in a form of metal fume fever, characterized by flu-like symptoms such as chills, fever, nausea, and vomiting. Crystalline silica is classified as a Group 1 Carcinogen by IARC and as an A2 Carcinogen by the ACGIH (see Toxicological Information, Section 11).

Potential Environmental Effects: Copper concentrate is relatively insoluble in water, and therefore its constituent metals have low direct bioavailability. However, extended exposure of the concentrate in the aquatic and terrestrial environments can lead to the release of constituent metals in more bioavailable forms; these forms have the potential to cause adverse effects on biota (see Ecological Information, Section 12).

SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

COMPONENTS	CAS Registry No.	CONCENTRATION (% wt/wt)
Copper (present as Sulphides/Oxides)	1317-40-4 / 1344-70-3	30 – 60%
Sulphur (present as Mineral Sulphides)	7704-34-9	25 – 35%
Iron (present as Sulphides/Oxides)	1317-37-9 / 1332-37-2	10 – 30%
Silica (Amorphous and/or Crystalline)	60676-86-0 / 14808-60-7	3 – 7%
Alumina (Aluminum Oxide)	1344-28-1	0.5 – 1.5%

Note: See Section 8 for Occupational Exposure Guidelines.

SECTION 4. FIRST AID MEASURES

Eye Contact: *Symptoms:* Dust in the eyes, mild irritation. Do not allow victim to rub eye(s). Let the eye(s) water naturally for a few minutes. If particle/dust does not dislodge, flush with lukewarm, gently flowing water for 5 minutes or until particle/dust is removed, while holding eyelid(s) open. If irritation persists, immediately obtain medical attention. DO NOT attempt to manually remove anything stuck to the eye.

Skin Contact: *Symptoms:* Soiling and possible irritation. Remove contaminated clothing, shoes and leather goods (e.g., watchbands, belts). Quickly and gently blot or brush away excess concentrate. Wash gently and thoroughly with lukewarm flowing water and non-abrasive soap for 5 minutes. If irritation persists, repeat flushing and obtain medical advice. Completely decontaminate clothing, shoes and leather goods before reuse or else discard.

Inhalation: *Symptoms:* Coughing, tingling sensation, sneezing. Remove source of contamination or move victim from exposure area to fresh air immediately.

Ingestion: *Symptoms:* Nausea, diarrhea, metallic taste. Rinse mouth. Get medical advice/attention if you are concerned or feel unwell.

SECTION 5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Copper concentrate is not considered a fire or explosion hazard. However, it may burn if heated strongly enough and for sufficient time in a fire situation. When burning, it releases toxic and highly irritating sulphur dioxide gas (SO₂). Contact with strong acids may also generate flammable and highly toxic hydrogen sulphide gas (H₂S). Long term storage may result in oxidation and under certain conditions, spontaneous combustion may occur.

Extinguishing Media: Use any means of extinction appropriate for the surrounding fire conditions such as water spray, carbon dioxide, dry chemical, or foam.

Fire Fighting: Highly irritating and toxic fumes of sulphur dioxide (SO₂) will be released by burning copper concentrate. Fire fighters must be fully trained and wear full protective clothing including an approved, self-contained breathing apparatus which supplies a positive air pressure within a full face piece mask.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures for Cleanup: Control source of spillage if possible to do so safely. Restrict access to the area until completion of clean up. Clean up spilled material immediately, observing precautions in Section 8, Personal Protection and using methods which will minimize dust generation (e.g., vacuum solids, dampen material and shovel or wet sweep). Return uncontaminated spilled material to the process if possible. Place contaminated material in suitable labelled containers for later recovery or disposal. Treat or dispose of waste material in accordance with all local, regional, and national requirements.

Personal Precautions: Persons responding to an accidental release should wear coveralls or other protective clothing, gloves and a respirator (see also Section 8). Close-fitting safety goggles may be necessary in some circumstances to prevent eye contact with dust. Workers should wash and change clothing following cleanup of a spill to prevent personal contamination.

Environmental Precautions: The handling, shipment, storage and processing of this material requires appropriate controls and care to prevent spillage or gradual accumulation in aquatic and terrestrial environments. Any spilled material should be promptly cleaned up.

SECTION 7. HANDLING AND STORAGE

Precautions for Safe Handling: Some sulphide concentrates may slowly oxidize in storage and generate sulphur dioxide as well as deplete the oxygen content of a confined space, such as a ship's hold. The atmosphere within confined spaces containing concentrate must be tested before entry and the area thoroughly ventilated or self-contained breathing apparatus used, if conditions warrant.

Conditions for Safe Storage: Store in a dry, well-ventilated area away from sources of combustion, acids and strong oxidizers. Some sulphide concentrates may also oxidize and generate heat which accumulates in storage piles. If material is to be stored for an extended period, the temperature of storage piles should be monitored.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Guidelines: (*Time-Weighted Average (TWA) concentration over 8 hr. unless otherwise indicated.*)

Component	ACGIH TLV	OSHA PEL	NIOSH REL
Copper (present as Sulphides/Oxides)	1 mg Cu/m ³	1 mg Cu/m ³	1 mg Cu/m ³
Iron (present as Sulphides/Oxides)	None established†	None established†	None established†
Silica (assumed to be Crystalline alpha-Quartz)	0.025 mg SiO ₂ /m ³ (Respirable Dust)	3.3 mg/m ³ (Total Concentrate Dust)‡ 1.1 mg/m ³ (Respirable Concentrate)‡	0.05 mg SiO ₂ /m ³ (Respirable Dust)
Alumina (Aluminum Oxide)	1 mg/m ³ (Respirable Dust)	15 mg/m ³ (Total Dust) 5 mg/m ³ (Respirable Dust)	10 mg/m ³ (Total Dust) 5 mg/m ³ (Respirable Dust)
Sulphur (potentially present as SO ₂)	None established*	None established*	None established*

NOTE: OEGs for individual jurisdictions may differ from those given above. Check with local authorities for the applicable OEGs in your jurisdiction.

ACGIH - American Conference of Governmental Industrial Hygienists; OSHA - Occupational Safety and Health Administration; NIOSH - National Institute for Occupational Safety and Health. TLV – Threshold Limit Value, PEL – Permissible Exposure Limit, REL – Recommended Exposure Limit.

* While there are no established OELs for sulphur as such, there are OELs for sulphur dioxide which will be formed during any combustion processes. The OSHA PEL for SO₂ is a time-weighted average concentration (TWA) of 5 ppm and the NIOSH REL is 2 ppm TWA and 5 ppm STEL. In 2008 the ACGIH significantly reduced their TLV® to a short term exposure limit (STEL) of 0.25 ppm over any 15 minute exposure.

† While there is no established Occupational Exposure Limit for iron as such, there are OELs for iron oxides which may be formed during burning, welding or other fuming processes. The OSHA PEL for iron oxide fume is 10 mg/m³. The NIOSH REL for iron oxide dust and fume is 5 mg/m³ (as Fe) and the ACGIH TLV is 5 mg/m³ of iron oxide dust/fume (respirable fraction).

‡ The OSHA PEL for quartz (crystalline silica) applies to the total airborne concentrate dust concentration and has been calculated based on the maximum percent SiO₂ in the sample using the formula: Total Dust PEL = 30 mg/m³ / (%SiO₂ + 2) and Respirable Dust = 10 mg/m³ / (%SiO₂ + 2). The NIOSH and ACGIH limits apply to the actual amount of respirable quartz or silica in the workplace air.

NOTE: The selection of the necessary level of engineering controls and personal protective equipment will vary depending upon the conditions of use and the potential for exposure. The following are therefore only general guidelines that may not fit all circumstances. Control measures to consider include:

Ventilation: Use adequate local or general ventilation to maintain the concentration of copper concentrate dust in the working environment well below recommended occupational exposure limits. Supply sufficient replacement air to make up for air removed by the exhaust system.

Protective Clothing: Coveralls or other work clothing, safety glasses, and gloves are recommended to prevent prolonged or repeated direct skin and eye contact. Close-fitting safety goggles may be required to prevent eye contact if excessive dust is generated. Workers should wash immediately when skin becomes heavily contaminated as well as at the end of each work shift.

Respirators: Where copper concentrate dust and/or sulphur dioxide gas is generated and cannot be controlled to within acceptable levels by engineering means, use appropriate NIOSH-approved respiratory protection equipment (a minimum of a combination N-100 or P-100 particulate filter / acid gas cartridge) in an air purifying respirator (APR) or powered air purifying respirator (PAPR). A full face piece chemical cartridge respirator or even a self-contained breathing apparatus may be required for higher concentrations of sulphur dioxide gas that could also result in significant eye irritation.

General Hygiene Considerations: Minimize dust generation and accumulation. Avoid breathing dust. Always practice good personal hygiene. Refrain from eating, drinking, or smoking in work areas. Thoroughly wash hands after handling and before eating, drinking, or smoking in appropriate designated areas only. Remove contaminated clothing and wash before reuse.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Greenish, coppery, reddish or brassy with blue tones.	Odour: Odourless	Odour Threshold: Not Applicable	pH: Not Applicable
Vapour Pressure: <1 mm Hg @ 25°C	Vapour Density: Not Applicable	Melting Point/Range: Not Available	Boiling Point/Range: >2200°C
Relative Density (Water = 1): 2.2	Evaporation Rate: Not Applicable	Coefficient of Water/Oil Distribution: Not Applicable	Solubility: Insoluble in water
Flammability: Non-combustible solid	Flammable Limits (LEL/UEL): Not Applicable	Auto-ignition Temperature: Not Applicable	Decomposition Temperature: Not Available

SECTION 10. STABILITY AND REACTIVITY

Stability & Reactivity: This concentrate is stable and not considered reactive under normal temperatures and pressures. Hazardous polymerization or runaway reactions will not occur.

Incompatibilities: Incompatible with strong oxidizing agents such as ammonium nitrate, ammonium peroxodisulfate, chlorates, chlorine trifluoride, chloroformadanium nitrate, sodium acetylide, chlorine, dinitrogen tetraoxide, liquid fluorine, nitryl fluoride and heat, peroxy formic and potassium dichromate, oxygen difluoride, hot chlorinated rubber, strong acids such as hydrochloric and sulphuric acid. Also incompatible with sodium azide, acetylene, calcium hypochlorite and sodium peroxide. Vigorous reactions with iodine monochloride and hydrogen peroxide. May be ignited by open flames or other high temperature sources.

Hazardous Decomposition Products: Many sulphides react violently and explosively with powerful oxidizers, at the same time releasing large volumes of highly irritating and toxic SO₂. May release highly toxic and flammable hydrogen sulphide (H₂S) gas on contact with strong acids. High temperature operations such as oxy-acetylene cutting, electric arc welding or arc-air gouging may generate irritating copper and iron oxide fumes as well as large volumes of toxic and irritating sulphur dioxide gas. Long term storage may result in oxidation and under certain conditions, spontaneous combustion may occur.

SECTION 11. TOXICOLOGICAL INFORMATION

General: NOTE: The toxicological properties of this material have not been fully investigated. The information contained in this SDS is therefore based on information in the technical and scientific literature about the material's constituent components.

Acute:

Skin/Eye: Contact with the eyes may cause local irritation due to direct abrasive action of the particles but would not cause tissue damage. Direct contact with the skin may also cause local mechanical irritation but is not known to be irritating or corrosive.

Inhalation: Acute inhalation of dusts will result in irritation of the nose, throat and upper respiratory passages. Symptoms may include discomfort, coughing, tingling sensation, sneezing and/or shortness of breath and wheezing as well as metallic taste. However, the metals are present predominantly as sulphides that are relatively insoluble and poorly absorbed within the body. An intense, short-term exposure to fumes from cutting or welding, etc. could result in the condition called metal fume fever. The symptoms of metal fume fever generally occur within 3 to 10 hours. They may include immediate dryness and irritation of the throat, tightness of the chest, and coughing that may later be followed by flu-like symptoms of fever, malaise, perspiration, frontal headache, muscle cramps, low back pain, occasionally blurred vision, nausea, and vomiting. Those experiencing a single acute episode of metal fume fever generally recover without apparent residual effects.

Ingestion: Individuals reported to have ingested large quantities of copper salts (primarily copper sulphate in attempting suicide) have reported gastrointestinal effects including vomiting, diarrhea, nausea, abdominal pain and a metallic taste in the mouth. Effects on the kidneys and liver, and even death, have also been reported in severe cases of copper poisoning. However, copper sulphide is poorly absorbed from the gastrointestinal tract, limiting exposure by ingestion and copper is a strong emetic so spontaneous vomiting following ingestion usually limits uptake of copper.

Chronic:

Prolonged exposure to copper dust or fume can cause irritation to the upper respiratory tract and, occasionally, ulceration and perforation of the nasal septum. A green discoloration of the skin and hair has been reported in some copper workers similar to that caused by wearing jewellery made of copper. A few instances of allergic skin rashes have also been reported in workers exposed to metallic copper. Copper is an essential element, but can become toxic when inhaled or ingested in large doses. Individuals with a rare disorder called “Wilson’s Disease” (estimated prevalence 0.003% of the population) are predisposed to accumulate copper and should not be occupationally exposed. Prolonged inhalation of iron oxide fume causes a benign pneumoconiosis called siderosis. Alumina is considered to be a relatively benign compound with no significant effects on the respiratory system or other body organs. Chronic inhalation of crystalline free silica causes silicosis, a form of disabling, progressive, and sometimes fatal pulmonary fibrosis. Silicotics are also at increased risk of developing tuberculosis and/or lung cancer. IARC has classified crystalline silica of respirable particle size as a *Group 1 Carcinogen (Carcinogenic to Humans)* while ACGIH classifies it as a *Suspected Human Carcinogen (A2)*. The NTP recently reclassified silica as a *Known Human Carcinogen*. OSHA and the EU do not list silica as a carcinogen.

Animal Toxicity:

<u>Hazardous Ingredient:</u>	<u>Acute Oral Toxicity:</u>	<u>Acute Dermal Toxicity:</u>	<u>Acute Inhalation Toxicity:</u>
Copper Sulphide	>2,500 mg/kg [†]	>2,000 mg/kg*	No data
Iron Sulphide	>2,000 mg/kg [†]	>2,000 mg/kg	No data
Silica	No data	No data	No data
Alumina	>15,900 mg/kg [†]	No data	>2.3 mg/L [‡]

[†] LD₅₀, Rat, Oral * LD₅₀, Rat, Dermal [‡] LC₅₀, Rat, Inhal

SECTION 12. ECOLOGICAL INFORMATION

Copper concentrate is relatively insoluble in water, and therefore its constituent metals have low direct bioavailability. However, extended exposure of the concentrate in aquatic and terrestrial environments can lead to the release of the constituent metals in more bioavailable forms; these forms have the potential to cause adverse effects on biota. The mobility of the constituent metals in more soluble forms is media-dependent; they can bind with inorganic and organic ligands, reducing their mobility and bioavailability in both soil and water. Bioavailability is also mediated by other factors (e.g., pH, hardness, total organic carbon) in the aquatic environment.

SECTION 13. DISPOSAL CONSIDERATIONS

If material cannot be returned to process or salvage, dispose of in accordance with applicable regulations. Empty and thoroughly clean all residues from containers before reuse or disposal.

SECTION 14. TRANSPORT INFORMATION

Transport Canada Classification Not regulated
 U.S. DOT Hazard Classification Not regulated
 Marine Pollutant No
 IMO Classification MHB (Material Hazardous in Bulk)

Note that this material has been tested under the United Nations Transport of Dangerous Goods, Manual of Tests and Criteria, Fifth Revised Edition (2009). Test results indicate that the concentrate qualifies neither as a flammable solid under Class 4.1 nor a self-heating substance under Class 4.2.

IMO MARPOL V Classification: Not Harmful to the Marine Environment.

SECTION 15. REGULATORY INFORMATION

U.S.

Ingredients Listed on TSCA Inventory Yes
 Hazardous Under Hazard Communication Standard Yes

CERCLA Section 103 Hazardous Substances Yes.....Copper Compounds RQ: 5,000 lbs. (2270 kg)*
* reporting not required when diameter of the pieces of solid metal released is equal to or exceeds 100 micrometers (0.004 inches).

EPCRA Section 302 Extremely Hazardous Substance None of the ingredients qualify.

EPCRA Section 311/312 Hazard Categories Delayed (Chronic) Health Hazard - Carcinogen (due to presence of silica)

EPCRA Section 313 Toxic Release Inventory (Supplier Notification): Copper CAS No. 7440-50-8
Percent by Weight: 30-60%
Aluminum Oxide CAS No. 1344-28-1
Percent by Weight 0.5-1.5%

SECTION 16. OTHER INFORMATION

Date of Original Issue: June 15, 2010 **Version:** 01 (*First edition*)

Date of Latest Revision: October 17, 2018 **Version:** 04

The information in this Safety Data Sheet is based on the following references:

- American Conference of Governmental Industrial Hygienists, 2004, Documentation of the Threshold Limit Values and Biological Exposure Indices, Seventh Edition plus updates.
- American Conference of Governmental Industrial Hygienists, 2018, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.
- American Conference of Governmental Industrial Hygienists, 2018, Guide to Occupational Exposure Values.
- Bretherick's Handbook of Reactive Chemical Hazards, 20th Anniversary Edition. (P. G. Urban Ed.) 1995.
- Canadian Centre for Occupational Health and Safety CHEMINFO Record No: 2073, Copper.
- Commission de la santé et la sécurité du travail, Service du répertoire toxicologique, Cuivre, 2010-07.
- European Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures, amending and repealing directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (REACH).
- Health Canada, SOR/2015-17, Hazardous Products Regulations, 11 February 2015.
- International Agency for Research on Cancer (IARC), Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, 1972 – present, (multi-volume work), World Health Organization, Geneva.
- International Labour Office (WHO/ILO) Encyclopaedia of Occupational Health & Safety 4th Ed.
- Merck & Co., Inc., 2001, The Merck Index, An Encyclopedia of Chemicals, Drugs, and Biologicals, Thirteenth Edition.
- National Library of Medicine, National Toxicology Information Program, Hazardous Substance Data Bank.
- Patty's Toxicology, Fifth Edition, 2001: E Bingham, B Cohrssen & C H Powell, Ed.
- Sax, N. Irving & Lewis, Richard J. Sr., 1987, Hawley's Condensed Chemical Dictionary, Eleventh Edition.
- U.S. Dept. of Health and Human Services, National Institute for Occupational Safety and Health, National Toxicology Program (NTP), 14th Report on Carcinogens, November 2016.
- U.S. Dept. of Health and Human Services, National Institute for Occupational Safety and Health, Registry of Toxic Effects of Chemical Substances (RTECS) CCOHS Web Access subscription.
- U.S. Occupational Safety and Health Administration, 1989, Code of Federal Regulations, Title 29, Part 1910.1000 and 1900.1200.

Acronyms not spelled out elsewhere in the SDS:

CAS: Chemical Abstract Service
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
DOT: Department of Transportation
EPCRA: Emergency Planning and Community Right-to-Know Act
IMO: International Maritime Organization
LD50, LC50: Lethal Dose 50%, Lethal Concentration 50%
MSHA: Mine Safety and Health Administration, U.S. Department of Labour
TSCA: Toxic Substances Control Act
Wt.: Weight

Notice to Reader

Although reasonable precautions have been taken in the preparation of the data contained herein, it is offered solely for your information, consideration and investigation. Teck Highland Valley Copper Partnership extends no warranty and assumes no responsibility for the accuracy of the content and expressly disclaims all liability for reliance thereon. This safety data sheet provides guidelines for the safe handling and processing of this product; it does not and cannot advise on all possible situations. Therefore, your specific use of this product should be evaluated to determine if additional precautions are required. Individuals exposed to this product should read and understand this information and be provided pertinent training prior to working with this product.