

HIGHLAND VALLEY MOLYBDENUM CONCENTRATE MATERIAL SAFETY DATA SHEET

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product Identity: Highland Valley Molybdenum Concentrate

Manufacturer:

Teck Highland Valley Copper Partnership

P.O. Box 1500

Logan Lake, British Columbia

V0K 1W0

Emergency Telephone: CANUTEC

(613) 996-6666

Supplier:

Teck Highland Valley Copper Partnership

P.O. Box 1500

Logan Lake, British Columbia

V0K 1W0

MSDS Preparer:

Teck Metals Ltd.

Suite 3300 – 550 Burrard Street

Vancouver, British Columbia

V6C 0B3

Date of Last MSDS Revision/Edit: June 15, 2010.

Product Use: Mine concentrate suitable for the recovery of molybdenum by smelting.

SECTION 2. COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous Ingredients	Approximate Percent by Weight	CAS Number	Occupational Exposure Limits (OELs)		LD ₅₀ / LC ₅₀ Species and Route
Molybdenum (Sulphides/Oxides)	30 – 60%	1317-33-5 / 1313-27-5	OSHA PEL ACGIH TLV NIOSH REL	15 mg/m ³ (Total dust) 10 mg/m ³ (Inhalable) 3 mg/m ³ (Respirable) None established	LD ₅₀ , rat, oral >6,000 mg/kg (MoS ₂)
Iron (Sulphides/Oxides)	1 – 5%	1317-37-9 / 1332-37-2	OSHA PEL ACGIH TLV NIOSH REL	None established† None established† None established†	LD ₅₀ , rat, oral 984 mg/kg (FeS)
Silica (Amorphous and Crystalline)	3 – 7%	60676-86-0 / 14808-60-7	OSHA PEL ACGIH TLV NIOSH REL	3.3 mg/m ³ (Total Concentrate Dust) ‡ 0.025 mg/m ³ (Resp) 0.05 mg/m ³ (Resp)	LD ₅₀ , rat, oral No Data
Alumina (Aluminum Oxide)	1 – 5%	1344-28-1	OSHA PEL ACGIH TLV NIOSH REL	15 mg/m ³ (Total) 5 mg/m ³ (Resp) 1 mg/m ³ (Resp) 1.5 mg/m ³ (Resp)	LD ₅₀ , rat, oral No Data

NOTE: OELs for individual jurisdictions may differ from OSHA PELs. Check with local authorities for the applicable OELs in your jurisdiction. OSHA - Occupational Safety and Health Administration; ACGIH - American Conference of Governmental Industrial Hygienists; NIOSH - National Institute for Occupational Safety and Health. OEL – Occupational Exposure Limit, PEL – Permissible Exposure Limit, TLV – Threshold Limit Value, REL – Recommended Exposure Limit.

† 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). The NIOSH and ACGIH limits apply to the actual amount of respirable quartz or silica in the workplace air.

Trade Names and Synonyms: None.

SECTION 3. HAZARDS IDENTIFICATION

Emergency Overview: A grey, finely-ground material that is not flammable or combustible under normal conditions of transport and storage. However, when heated strongly in air it will burn, releasing toxic and irritating sulphur dioxide gas as well as possible molybdenum and iron oxide fumes. Contact with strong oxidizers will generate flammable and highly toxic hydrogen sulphide gas. Acute inhalation of molybdenum concentrate dust or 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 possibility of release of high concentrations of sulphur dioxide from burning concentrate. The metals content in this product has low direct bioavailability and poses little immediate ecological risk.

Potential Health Effects: Inhalation of molybdenum concentrate dust may be irritating to the nose, throat and respiratory tract. It may cause irritation of the upper respiratory tract with symptoms of coughing, wheezing, shortness of breath, etc. Crystalline silica is classified as a Group 1 Carcinogen by IARC and as an A2 Carcinogen by the ACGI. (See Toxicological Information, Section 11)

Potential Environmental Effects: Molybdenum 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 (see Ecological Information, Section 12).

EU Risk Phrase(s): R20 – Harmful by inhalation; R32 – Contact with acids liberates very toxic gas, R40 – Limited evidence of a carcinogenic effect; R36/37 – Irritating to eyes and respiratory system.

SECTION 4. FIRST AID MEASURES

Eye Contact: 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: Remove contaminated clothing, shoes and leather goods (e.g. watchbands, belts). Gently blot or brush away excess concentrate dust. Wash gently and thoroughly with lukewarm water and non-abrasive soap for 5 minutes. If irritation persists, repeat flushing and obtain medical advice.

Inhalation: Remove victim from exposure area to fresh air immediately. If breathing has stopped, trained personnel should begin artificial respiration. Medical oxygen may be administered by trained personnel, where breathing is difficult. Obtain medical assistance immediately.

Ingestion: NEVER give anything by mouth if victim is rapidly losing consciousness, or is unconscious or convulsing. Have victim rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. Have victim drink 2 – 8 oz. (60 – 240 ml) of water. If vomiting occurs naturally, have victim rinse mouth with water again. Obtain medical advice and bring a copy of this MSDS.

SECTION 5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Molybdenum concentrate is not considered a fire or explosion hazard. However, it may burn violently if mixed with finely ground metals such as aluminum or magnesium and 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 oxidizers such as hydrogen peroxide may also generate flammable and highly toxic hydrogen sulphide gas (H₂S).

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: Toxic fumes of sulphur dioxide will result from combustion. 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.

Flashpoint and Method: Not Applicable.

Upper and Lower Flammable Limit: Not Applicable.

Autoignition Temperature: Not Applicable.

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

Store in a dry, well-ventilated area away from strong oxidizers. 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. 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.

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.

EU Safety Phrase(s): S22 – Do not breathe dust; S36/37 – Wear suitable protective clothing and gloves; S45 – In case of accident, or if you feel unwell, seek medical advice immediately (show the label where possible).

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

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.

Ventilation: Use adequate local or general ventilation to maintain the concentration of molybdenum 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.

Respirators: Where molybdenum 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.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Grey with green tones in colour	Odour: Odourless	Physical State: Extremely fine powder	pH: Not Applicable
Vapour Pressure: <1 mm Hg @ 25°C	Vapour Density: Not Applicable	Boiling Point/Range: No Data	Melting Point/Range: >450°C (Sublimation point)
Specific Gravity: >2	Evaporation Rate: Not Applicable	Coefficient of Water/Oil Distribution: Not Applicable	Odour Threshold: Not Applicable
Solubility: Relatively insoluble in water	Percent Volatile by Weight: Not Applicable	Other Information:	

SECTION 10. STABILITY AND REACTIVITY

Stability & Reactivity: This material 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 hydrogen peroxide or concentrated nitric acid. Other incompatible compounds include: strong acids such as hydrochloric and sulphuric acids, alkalis, hot chlorinated rubber, chlorine trifluoride, ethylene oxide, potassium nitrate, catechol, and iodine monochloride.

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 toxic molybdenum and iron oxide fumes as well as large volumes of 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 MSDS 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.

Inhalation: Acute inhalation of dusts may 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.

Ingestion: Molybdenum disulphide, iron sulphide and the other ingredients are poorly absorbed from the gastrointestinal tract, limiting exposure by ingestion. Ingestion of small amounts of molybdenum concentrate is therefore likely to be without ill effect.

Chronic: Prolonged exposure to molybdenum concentrate dust or fume can cause irritation to the upper respiratory tract. Prolonged inhalation of iron oxide fume causes a benign pneumoconiosis called siderosis. Alumina and molybdenum disulphide are considered to be relatively benign compounds 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.

SECTION 12. ECOLOGICAL INFORMATION

Molybdenum 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)

SECTION 15. REGULATORY INFORMATION

U.S.

Ingredients Listed on TSCA Inventory.....	Yes
Hazardous Under Hazard Communication Standard	Yes
CERCLA Section 103 Hazardous Substances	None of the ingredients qualify
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):	Molybdenum Trioxide CAS No. 1313-27-5 Percent by Weight: 30-60%
	Aluminum Oxide CAS No. 1344-28-1 Percent by Weight 1-5%

CANADIAN:

Ingredients Listed on DSL:	Yes
WHMIS Classification:.....	D2A, Material Causing Other Toxic Effects – Very Toxic

EUROPEAN UNION:

Ingredients Listed on the European Inventory of Existing Commercial Chemical Substances (EINECS):	Yes
EU Classification:	Carc. Cat 3, Irritant, Harmful.

SECTION 16. OTHER INFORMATION

The information in this Material 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, 2010, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.
- American Conference of Governmental Industrial Hygienists, 2009, Guide to Occupational Exposure Values
- Bretherick's Handbook of Reactive Chemical Hazards, 20th Anniversary Edition. (P. G. Urben Ed.) 1995.
- Canadian Centre for Occupational Health and Safety CHEMINFO Record No: 500, Molybdenum Disulphide.
- Commission de la santé et la sécurité du travail, Service du répertoire toxicologique, Sulfure de molybdène.
- European Economic Community, Commission Directives 91/155/EEC and 67/548/EEC.
- Industry Canada, SOR/88-66, Controlled Products Regulations, as amended.
- International Agency for Research on Cancer (IARC), Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, 1972 – 2009, (multi-volume work), World Health Organization, Geneva.
- International Labour Office (WHO/ILO) Encyclopaedia of Occupational Health & Safety 4th ed. CD-ROM Version (1998).
- Merck & Co., Inc., 2001, The Merck Index, An Encyclopedia of Chemicals, Drugs, and Biologicals, Thirteenth Edition.
- National Library of Medicine, National Toxicology Information Program, 2010, 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. Department of Health and Human Services, National Institute for Occupational Safety and Health, National Toxicology Program (NTP), 11th Report on Carcinogens, January 2005.
- U.S. Department 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.

Notice to Reader

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