

**ANDACOLLO COPPER CONCENTRATE
SAFETY DATA SHEET**

SECTION 1. IDENTIFICATION

Product Identity: Andacollo Copper Concentrate

Trade Names and Synonyms: Chalcopyrite, Chalcosine, Covelline, Copper Pyrite

Manufacturer:

Compañía Minera Teck Carmen de Andacollo
Camino a Chepiquilla s/n
Andacollo
Región de Coquimbo, Chile

Supplier:

Compañía Minera Teck Carmen de Andacollo
Camino a Chepiquilla s/n
Andacollo
Región de Coquimbo, Chile

Preparer:

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Date of Last Review: August 27, 2015.

Date of Last Edit: August 27, 2015.

Product Use: Copper concentrate is the starting material for the 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 – Does not meet criteria Reproductive Toxicity – Does not meet criteria Specific Target Organ Toxicity: Acute Exposure – Does not meet criteria Chronic Exposure – Does not meet criteria	Does not meet criteria for any Physical Hazard	Aquatic Toxicity – Short Term (Acute) Category 2

LABEL:

Symbols: None	Signal Word: None
Hazard Statements Toxic to aquatic life.	Precautionary Statements: Avoid release to the environment.

Emergency Overview: A dark grey, 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. 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 has low direct bioavailability and pose little immediate health or ecological risk.

Potential Health Effects: Inhalation of dust may result in respiratory 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. Ingestion of copper may cause nausea, vomiting, headaches, dizziness, and

gastrointestinal irritation. Copper and iron sulphides are not listed as carcinogens by OSHA, the NTP, the ACGIH, IARC, or the EU (see Toxicological Information, Section 11).

Potential Environmental Effects: Copper concentrate is insoluble in water and its metals content has low direct bioavailability. However, extended exposure in the aquatic and terrestrial environment can lead to the release of contained metals in bioavailable forms. These can cause toxic impacts in organisms (see Ecological Information, Section 12).

SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENTS	CAS Registry No.	CONCENTRATION (% wgt/wgt)
Copper (present as copper sulphides)	7440-50-8	24 – 28% typical
Sulphur (present as iron & copper sulphides)	7704-34-9	25 - 30% typical
Iron (present as iron sulphides)	7439-89-6	23 - 25 % typical

Note: See Section 8 for Occupational Exposure Guidelines.

SECTION 4. FIRST AID MEASURES

Eye Contact: *Symptoms:* Mild irritation, dust in eyes. 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:* Skin soiling and possible irritation. Remove contaminated clothing, shoes and leather goods (e.g., watchbands, belts). Quickly and gently blot or brush away excess chemical. Wash gently and thoroughly with lukewarm, gently flowing water and non-abrasive soap for 5 minutes. If irritation persists, repeat flushing. 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 attention/advice 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, concentrate may burn if heated strongly enough and for a sufficient time, such as in a fire situation. When burning, it releases large volumes of toxic and highly irritating sulphur dioxide gas (SO₂). Contact with strong acids may generate flammable and highly toxic hydrogen sulphide gas (H₂S).

Extinguishing Media: Use any means of extinction appropriate for surrounding fire conditions such as water spray, carbon dioxide, dry chemical, or foam. Use water spray or fog to cool fire-exposed containers and to knock down large fires.

Fire Fighting: Toxic fumes of sulphur dioxide will result from combustion of 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 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 the terrestrial and aquatic environments. Spilled material should be promptly cleaned up.

SECTION 7. HANDLING AND STORAGE

Store in a dry, well-ventilated area away from sources of combustion, acids and 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.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Guidelines:

<u>Component</u>	<u>Chilean LPP</u>	<u>OSHA PEL</u>
Copper (present as copper sulphides)	0.8 mg Cu/m ³ (Dust) 0.16 mg Cu/m ³ (Fume)	1 mg Cu/m ³ (Dust)
Sulphur (present as iron & copper sulphides)	None Established (see note below)	None Established (see note below)
Iron (present as iron sulphides)	4 mg Fe/m ³	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.

NOTE: 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. However, in 2008 the ACGIH® significantly reduced their TLV® to a short term exposure limit (STEL) of 0.25 ppm over 15 minutes' exposure.

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 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 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.

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.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Dark grey, fine powder	Odour: None	Odour Threshold: Not Applicable	pH: Not Applicable
Vapour Pressure: Negligible at 20°C	Vapour Density: Not Applicable	Melting Point/Range: Approx. 1,200°C	Boiling Point/Range: No Data

Relative Density (Water = 1):
1.8 (Bulk Sp. Gr.)

Evaporation Rate:
Not Applicable

**Coefficient of Water/Oil
Distribution:** Not Applicable

Solubility:
Essentially Insoluble

Flash Point:
None

Flammable Limits (LEL/UEL):
Not Flammable

Auto-ignition Temperature:
None

Decomposition Temperature:
None

SECTION 10. STABILITY AND REACTIVITY

Stability & Reactivity: 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 and strong acids such as hydrochloric and sulphuric acids. Also incompatible with zinc, magnesium and cadmium chlorates. 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 toxic copper fumes and sulphur dioxide. The fumes will contain copper oxides, which, on inhalation in sufficient quantity, can produce metal fume fever. This material contains approximately 0.006% (60 ppm) mercury. Mercury vapour may be released during high temperature processing and re-condense on cooler surfaces. It also contains approximately 0.035% arsenic. Under reducing conditions (i.e. any strong acid or base plus an active metal such as metallic zinc) or in the presence of freshly formed hydrogen, traces of highly toxic ARSINE gas might be evolved.

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.

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 (principally copper sulphate in attempted suicides) 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 is a strong emetic and spontaneous vomiting following ingestion usually limits uptake of copper.

Chronic:

Prolonged exposure to copper metal 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. Chronic mercury or arsenic intoxication is unlikely due to their very low content. Copper and iron sulphides are not listed as human carcinogens by the Occupational Safety and Health Administration (OSHA), the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), the American Conference of Governmental Industrial Hygienists (ACGIH) or the European Union (EU).

Animal Toxicity:

Hazardous Ingredient:	Acute Oral Toxicity:	Acute Dermal Toxicity:	Acute Inhalation Toxicity:
Copper Sulphide	>2,500 mg/kg [†]	>2,000 mg/kg*	No data

Iron Sulphide	>2,000 mg/kg [†]	>2,000 mg/kg*	No data
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[†] LD₅₀, Rat, Oral, * - LD50, Rat, Dermal

SECTION 12. ECOLOGICAL INFORMATION

Copper concentrate is insoluble in water and its metals content has low direct bioavailability. However, its processing or extended exposure in the aquatic and terrestrial environments can lead to the release of contained metals in bioavailable forms. These can cause detrimental environmental effects. The mobility of the contained metals in soluble forms is media dependent. They can bind with inorganic and organic ligands, reducing their mobility and bioavailability in soil and water. Bioavailability is also controlled by other factors such as pH and hardness 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.
Chile.....	Not regulated.
Marine Pollutant.....	No
IMO	Metal Sulphide Concentrates, MHB (Materials Hazardous in Bulk), Group A & B

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.

Risks: This material may liquefy if shipped at moisture content in excess of its transportable moisture limit. It may also present chemical hazards. Recommendations set out in Appendix 1 of the International Maritime Solid Bulk Cargo Code should be observed.

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	No
CERCLA Section 103 Hazardous Substances	YesCopper.....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	No hazard categories apply
EPCRA Section 313 Toxic Release Inventory (Supplier Notification):	Copper....CAS No. 7440-50-8 Percent by Weight – 24-28%

CHILE:

National Standards: DS 90, 594, NCH 1114/4.

SECTION 16. OTHER INFORMATION

Date of Original Issue:	April 7, 2010	Version:	01 (First edition)
Date of Latest Revision:	August 27, 2015	Version:	03

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, 2015, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.
- American Conference of Governmental Industrial Hygienists, 2015, 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.
- 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).
- Explosibility of Metal Powders - Murray Jacobson, Austin R. Cooper and John Nagy, United States Dept. of the Interior, Bureau of Mines, Report of Investigation s 6516 - (BuMines RI 6516) - March 1964.
- Health Canada, SOR/2015-17, Hazardous Products Regulations, 30 January 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. 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, 2003, Hazardous Substance Data Bank.
- Patty's Toxicology, Fifth Edition, 2001: E Bingham, B Cahrssen & 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), 13th Report on Carcinogens, October 2014.
- 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.

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