

## ANDACOLLO COPPER CONCENTRATE MATERIAL SAFETY DATA SHEET

### SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

**Product Identity:** Andacollo Copper Concentrate

**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

**MSDS Preparer:**

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**Date of Last MSDS Revision/Edit:** April 7, 2010.

**Product Use:** Copper concentrate is the starting material for the production of copper metal.

### SECTION 2. COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous Ingredients	Approximate Percent by Weight	CAS Number	Occupational Exposure Limits (OELs)	LD <sub>50</sub> / LC <sub>50</sub> Species and Route
Copper (present as copper sulphides)	24 – 28% typical	7440-50-8	Chilean LPP 0.8 mg Cu/m <sup>3</sup> (Dust) 0.16 mg Cu/m <sup>3</sup> (Fume) OSHA PEL 1 mg Cu/m <sup>3</sup> (Dust)	LD <sub>50</sub> , mouse, oral 5,000 mg/kg
Sulphur (present as iron & copper sulphides)	25 - 30% typical	7704-34-9	Chilean LPP None Established OSHA PEL None Established	No Data
Iron (present as iron sulphides)	23 - 25 % typical	7439-89-6	Chilean LPP 4 mg Fe/m <sup>3</sup> OSHA PEL None Established	LD <sub>50</sub> , rat, oral 30,000 mg/kg

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 SO<sub>2</sub> is a time-weighted average concentration (TWA) of 5 ppm. However, recently the ACGIH significantly reduced their TLV to a short term exposure limit (STEL) of 0.25 ppm over 15 minutes' exposure.

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; OEL – Occupational Exposure Limit, PEL – Permissible Exposure Limit, TLV – Threshold Limit Value, LPP- Weighted Allowed Limits.

**Trade Names and Synonyms:** Chalcopyrite, Chalcosine, Covellite, Copper Pyrite

### SECTION 3. HAZARDS IDENTIFICATION

**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 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 facepiece SCBA and protective clothing are required for fire emergency response personnel due to the 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:** 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 contents have low direct bioavailability. However, extended exposure in the aquatic and terrestrial environments can lead to the release of contained metals in bioavailable forms. These can cause toxic impacts in organisms. (see Ecological Information, Section 12)

**EU Risk Phrase(s):** R38 – Irritating to skin; R32 – Contact with acids liberates very toxic gas.

## 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). 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:** 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. If the heart has stopped, immediately start cardiopulmonary resuscitation (CPR), or automated external defibrillation (AED). Quickly transport victim to an emergency care facility.

**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:** Product is not considered a fire or explosion hazard. However, concentrate will burn if intensely heated, such as in a fire situation, releasing large volumes of toxic and irritating sulphur dioxide gas (SO<sub>2</sub>). Contact with strong acids will generate flammable and highly toxic hydrogen sulphide gas (H<sub>2</sub>S).

**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 may 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 facepiece 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 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. 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):** 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 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 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.

**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 facepiece 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

<b>Appearance:</b> Dark grey, fine powder	<b>Odour:</b> Not Applicable	<b>Physical State:</b> Solid	<b>pH:</b> Not Applicable
<b>Vapour Pressure:</b> Negligible at 20°C	<b>Vapour Density:</b> Not Applicable	<b>Boiling Point/Range:</b> No Data	<b>Melting Point/Range:</b> ~ 1,200°C
<b>Specific Gravity:</b> 1.8 (Bulk Sp. Gr.)	<b>Evaporation Rate:</b> Not Applicable	<b>Coefficient of Water/Oil Distribution:</b> Not Applicable	<b>Odour Threshold:</b> Not Applicable
<b>Solubility:</b> Essentially Insoluble	<b>Percent Volatile by Weight:</b> Not Applicable	<b>Other Information</b>	

## 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 acid. 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 SO<sub>2</sub>. May release highly toxic and flammable hydrogen sulphide (H<sub>2</sub>S) 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 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 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.

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 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 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 intoxication is unlikely due to the very low mercury 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).

## 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 .....	MHB (Materials Hazardous in Bulk)

**Risk:** This material may liquefy if shipped at moisture content in excess of its transportable moisture limit. Restrictions set out in Appendix A of the IMO Code of Safe Practice for Solid Bulk Cargoes must be observed. Pre-shipment certificate: State; product name; port of loading; vessel; sampling date; tonnage of lot; transportable moisture limit; moisture content; flow moisture point; angle of repose; stowage factor.

## 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..... 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%

### CANADIAN:

Ingredients Listed on DSL: .....	Yes
WHMIS Classification:.....	Not a controlled product under WHMIS legislation.

### EUROPEAN UNION:

Ingredients Listed on the European Inventory of Existing Commercial Chemical Substances (EINECS): .....	Yes
EU Classification: .....	Irritant (for sulphur content)

### CHILE:

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

## 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, 2009, 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: 2073, Copper - Last Revised 2005-03.
- Commission de la santé et la sécurité du travail, Service du répertoire toxicologique, Cuivre, 2001-07.
- 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 4<sup>th</sup> 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 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), 11<sup>th</sup> 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.

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