

**ZINC SULFATE MONOHYDRATE
MATERIAL SAFETY DATA SHEET**

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product Identity: Zinc Sulfate Monohydrate

Manufacturer:

Bay Zinc Company Inc.
301 W. Charron Road
P.O. Box 167, Moxee City
Washington 98936
Emergency Telephone: 250-364-4214

Supplier:

Teck Metals Ltd.
Trail Operations
Trail, British Columbia
V1R 4L8

MSDS Preparer:

Teck Metals Ltd.
3300 – 550 Burrard Street
Vancouver, British Columbia
V6C 0B3

Date of MSDS Preparation: July 10, 2009.

Product Uses: (1) The mining industry uses zinc sulfate as a flotation agent in the processing of zinc/lead and zinc/copper ores. (2) The animal feed and fertilizer industries use zinc sulfate as a zinc micronutrient. (3) The cattle industry uses zinc sulfate as a fungicide in hoof bath solutions. Sales for agricultural applications may require appropriate registration and labelling.

SECTION 2. COMPOSITION / INFORMATION ON INGREDIENTS

Ingredient	Approximate Percent by Weight	CAS Number	Occupational Exposure Limits (OELs)	LD ₅₀ /LC ₅₀ Species and Route
Zinc Sulfate Monohydrate	92%	7446-19-7	OSHA PEL (see note below) ACGIH TLV (see note below) NIOSH REL None established	Rat, oral LD ₅₀ – 1,538 mg/kg (Anhydrous)
Manganese Sulfate	1.5%	7785-87-7	OSHA PEL 5 mg Mn/m ³ (Ceiling) ACGIH TLV 0.2 mg Mn/m ³ NIOSH REL 1 mg Mn/m ³ 3 mg Mn/m ³ STEL	Rat, oral LD ₅₀ – 2,150 mg/kg

NOTE: OELs for individual jurisdictions may differ from OSHA PELs. Check with local authorities for the applicable OELs in your jurisdiction.

OSHA PEL – All inert or nuisance dusts, whether mineral, inorganic, or organic not listed specifically by substance name in Tables Z-1 or Z-3 of CFR 1910.1000 are covered by the Particulates Not Otherwise Regulated (PNOR) limit of 15 mg/m³ total dust and 5 mg/m³ respirable fraction.

ACGIH® TLV® - ACGIH® believes that even biologically inert, insoluble, or poorly soluble particles may have adverse effects and recommends that airborne concentrations should be kept below 3 mg/m³ respirable particles and 10 mg/m³ inhalable particles, until such time as a TLV® is set for a particular substance. While zinc sulfate monohydrate does not completely meet the ACGIH® definition of a Particle Not Otherwise Specified (PNOS) due to its solubility, this is still considered to be a valid guideline for this dust.

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.

Trade Names and Synonyms: Zinc Sulphate Monohydrate, ZnSO₄ H₂O, Hydrated Zinc Sulfate

SECTION 3. HAZARDS IDENTIFICATION

Emergency Overview: Colorless, odorless granules. Not flammable or explosive, but will decompose in extreme heat to produce toxic sulphur oxide gas and zinc oxide fume. The granular solid or dust is relatively non-toxic to humans and poses little immediate hazard to emergency response personnel. However, it is freely soluble in water and can pose a threat to watercourses.

Potential Health Effects: May irritate eyes, skin and respiratory tract. If dusty it may cause breathing difficulty and irritation of mucous membranes. Ingestion may cause strong stomach cramps and diarrhea and may induce spontaneous vomiting. Chronic health hazards include stomach irritation, abdominal cramps and nausea. Zinc sulfate monohydrate is not considered a carcinogen by OSHA, NTP, IARC, ACGIH or the EU (see Toxicological Information, Section 11).

Potential Environmental Effects: This product is highly soluble in water and has the potential to be toxic to fish and other aquatic life. It also has the potential to be toxic to plant life and other terrestrial organisms at elevated concentrations in soils (see Ecological Information, Section 12).

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). Flush with lukewarm gently flowing water for 5 minutes. If irritation persists, repeat flushing. Obtain medical advice. Completely decontaminate clothing, shoes and leather goods before reuse or else discard.

Inhalation: If symptoms are experienced, remove source of contamination or move victim to fresh air. Obtain medical advice.

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. Zinc sulfate is an emetic and may cause vomiting. 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: Zinc sulfate does not burn or support combustion.

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: When involved in an intense fire this product may thermally decompose at temperatures above about 600°C (1200°F), producing toxic fumes of sulfur dioxide gas. As with any fire, fire fighters should 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. Do not use water directly on material as it is highly water soluble. Do not allow water run-off to enter sewers or watercourses.

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 release if possible to do so safely. Clean up spilled material immediately observing precautions in Section 8, Personal Protection. Powder or dust should be cleaned up using methods that will minimize dust generation (e.g., vacuum solids or dampen material and wet sweep/shovel, etc.). Return uncontaminated spilled material to the process if possible. Place contaminated material in suitable containers for later recovery or disposal. Treat or dispose of waste material in accordance with all local, state/provincial, and national requirements.

Personal Precautions: Gloves and coveralls or other protective clothing are recommended for persons responding to an accidental release (see also Section 8). Close-fitting safety goggles may be necessary in some circumstances to prevent eye contact.

Environmental Precautions: This product can pose a threat to the environment. Contamination of soil and water should be prevented. Keep spillage and runoff from storage areas from entering soil, streams or sewers.

SECTION 7. HANDLING AND STORAGE

Store in cool, dry, well-ventilated area away from incompatible substances. Protect from physical damage. It is good practice to keep container closed when not in use. Avoid generating dust and the release of dust into the workplace. Good housekeeping is important to prevent accumulations of 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.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Protective Clothing: The hazard potential of this material is low. Where there is large scale use of this material and significant potential for worker contact, gloves and long sleeved work clothes or disposable coveralls may be necessary. Eye protection should be worn where dust is generated and there is a potential that eye contact may occur.

Ventilation: Use adequate local or general ventilation where necessary to maintain the concentrations of zinc sulfate dust well below the recommended occupational exposure limits for general Particulates, Not Otherwise Specified (PNOS).

Respirators: Where dust or fumes are generated and cannot be controlled to within acceptable levels by engineering means, use appropriate NIOSH-approved respiratory protection equipment (a 42CFR84 Class N, R or P-95 particulate filter cartridge).

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Colorless, odorless granules	Odor: None	Physical State: Solid	pH: 5.0 @ 10% solution 4.5 @ saturated solution
Vapor Pressure: Negligible @ 20°C	Vapor Density: Not Applicable	Boiling Point/Range: Not Applicable	Melting Point/Range: Loses water at 238°C Decomposes at 680°C (1256°F)
Specific Gravity: 3.28	Evaporation Rate: Not Applicable	Coefficient of Water/Oil Distribution: Log p(oct) = -0.07 (estimated)	Odor Threshold: Not Applicable
Solubility in Water: 53.8 g/100 ml at 20 °C 89.5 g/100 ml at 100°C			

SECTION 10. STABILITY AND REACTIVITY

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

Incompatibilities: None have been identified to date. Avoid excessive heating that may lead to decomposition of the material.

Hazardous Decomposition Products: High temperature operations such as oxy-acetylene cutting, electric arc welding or severe overheating will generate zinc oxide fume which, on inhalation in sufficient quantity, can produce metal fume fever. Under such conditions, sulfur dioxide will also be generated and can cause respiratory distress.

SECTION 11. TOXICOLOGICAL INFORMATION

General: In the form in which this product is sold it is relatively non-toxic. The major route of exposure would be through the generation and inhalation of airborne dust and especially the generation of zinc oxide fume through thermal decomposition.

Acute:

Skin/Eye: Direct contact may cause local irritation of the eyes or skin but would not cause tissue damage. Eye contact with solutions (>1%) may cause the appearance of white flecks on the lens of the eye. Dust or fume from burning or welding operations may also cause local irritation.

Inhalation: Acute inhalation may result in irritation but is not expected to cause significant harmful effects. Symptoms may include discomfort, coughing, tingling sensation, sneezing and/or shortness of breath and wheezing. Extreme heating of zinc sulfate monohydrate will generate zinc oxide fume. If inhaled, this fume can result in the condition called metal fume fever. The symptoms of metal fume fever will occur within 3 to 10 hours of exposure, and include immediate dryness and irritation of the throat, tightness of the chest, and coughing which 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. The symptoms are temporary and generally disappear, without medical intervention, within 24 to 48 hours of onset. There are no recognized complications, after effects, or chronic effects that result from this condition.

Ingestion: Ingestion of large doses can cause anemia and stomach symptoms. Zinc sulfate is very astringent, and when ingested in excessive quantities, can irritate the stomach, resulting in abdominal pain, nausea, diarrhea and spontaneous vomiting.

Chronic: In general, zinc is considered to be a low toxicity metal. Zinc is a very important trace element for humans and the body regulates the amount of zinc stored by decreasing absorption and increasing excretion when intake is increased. Industrial experience has not identified any significant chronic effects from zinc sulfate to date. Zinc and manganese sulfate are not listed as 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

This product is highly soluble in water. Its zinc and manganese contents are directly bioavailable. Zinc, in particular, may be toxic to aquatic organisms, especially fish, at elevated concentrations; water hardness, pH and dissolved organic carbon concentrations are significant regulating factors in zinc toxicity. In terrestrial environments, the mobility of both zinc and manganese in soil, and their degree of bioaccumulation in organisms depends on the chemical characteristics of the soil.

SECTION 13. DISPOSAL CONSIDERATIONS

Do not wash down drain. Put uncontaminated material back into the process if at all possible. Place contaminated material in suitable, labeled containers for disposal. Dispose of waste material consistent with the requirements of waste disposal authorities.

SECTION 14. TRANSPORT INFORMATION

TRANSPORT CANADA CLASSIFICATION.....	Not regulated
US DOT HAZARD CLASSIFICATION	Class 9, Packing Group III (RQ) (Regulated only if transported in containers containing 1,000 (RQ) or more lbs. of zinc sulfate.)
SHIPPING NAME U.S. DOT	Environmentally Hazardous Substance, Solid, n.o.s. (contains Zinc Sulfate)
DOT REPORTABLE QUANTITY	1000 lbs. per container
US DOT PRODUCT IDENTIFICATION NUMBER.....	UN3077
MARINE POLLUTANT (U.S.).....	No
IMO CLASSIFICATION.....	Not regulated

SECTION 15. REGULATORY INFORMATION

U.S.

INGREDIENTS LISTED ON TSCA INVENTORY	Yes
HAZARDOUS UNDER HAZARD COMMUNICATION STANDARD.....	Yes
CERCLA SECTION 103 HAZARDOUS SUBSTANCES	Zinc Sulfate..... RQ: 1,000lbs. Manganese Compounds... RQ: None Listed
EPCRA SECTION 302 EXTREMELY HAZARDOUS SUBSTANCE	No Ingredients Qualify
EPCRA SECTION 311/312 HAZARD CATEGORIES.....	None.
EPCRA SECTION 313 TOXIC RELEASE INVENTORY.....	Zinc Compounds (Zinc Sulfate) CAS No. 7446-19-7 Percent by Weight..... 92%
	Manganese Compounds (Manganese Sulfate) CAS No. 7785-87-7 Percent by Weight 1.5%

CANADIAN:

INGREDIENTS LISTED ON DSL.....	Yes
WHMIS CLASSIFICATION:	Not a Controlled Product

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. Urban Ed.) 1995.
- Canadian Centre for Occupational Health and Safety (CCOHS) CHEMINFO Chemical Substance Data Base, Record 486 – Zinc Sulphate.
- Commission de la santé et la sécurité du travail, Service du répertoire toxicologique, Sulfate de zinc monohydrate, 1994-05.
- European Economic Community, Commission Directives 91/155/EEC and 67/548/EEC and 88/379/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 Chemical Safety Cards (WHO/IPCS/ILO), ICSC: 0349–Zinc Sulphate Heptahydrate (Revised Oct 2001).
- 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. (on-line version).
- Patty's Toxicology, 5th Edition, (E Bingham, B Cohrssen & C H Powell, ed.) 2001.
- 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, NIOSH Pocket Guide to Chemical Hazards. CD-ROM Edition, September 2005.
- 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.

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