

Tower Underflow Solids

PRODUCT INFORMATION

Tower Underflow Solids Sample

Vale Inco Limited
 200 Bay Street, Royal Bank Plaza
 Suite 1600, South Tower, P.O. Box 70
 Toronto, Ontario, Canada M5J 2K2

Chemtrec 24 hr Emergency No. 1-800-424-9300

Use: Recovery of metal values

WHMIS Class: Class D1: Poisonous and Infectious Material
 Class E: Corrosive Material

HAZARDOUS INGREDIENTS

This material is registered on the Canadian Domestic Substance List as CAS #124222-18-0 "Residues, precious metals-refining".

Hazardous Ingredients	% DRY WT.	C.A.S. No.	Oral LD ₅₀ -rat	TLV ^{1,2} -mg/m ³
Copper Sulphate (CuSO ₄)	40 – 50	7758-98-7	300 mg/kg	1.0 mg/m ³ (dust) 0.2 mg/m ³ (fume)
Copper Telluride (Cu ₂ Te)	20 - 25	12019-23-7	N/A	0.1 mg/m ³ (as Te)
Copper Selenide (Cu ₂ Se)	8 - 10	20405-64-5	N/A	0.2 mg/m ³ (as Se)
Bismuth Arsenate (BiAsO ₄)	5 – 8	13702-38-0	N/A	0.01 mg/m ³ (as As)
Tin Arsenate (SnAsO ₄ (OH))	4 - 6	N/A	N/A	0.01 mg/m ³ (as As)
Nickel Sulphate (NiSO ₄)	3 – 5	7786-81-4	0.5 g/kg	0.1 mg/m ³ (as Ni)*
Cobalt Sulphate (CoSO ₄)	2 – 4	10026-24-1	582 mg/kg	0.02 mg/m ³ (as Co)
Sulphuric Acid (H ₂ SO ₄)	1 – 5	7664-93-9	2140 mg/kg	0.2 mg/m ³ **
Iron Sulphate (FeSO ₄)	1 - 3	7720-78-7	319 mg/kg	1 mg/m ³ (as Fe)
Silver Telluride (Ag ₂ Te)	1 – 2	12002-99-2	N/A	0.1 mg/m ³ (as Te)
Copper (Cu)	1 - 2	7440-50-8	N/A	1.0 mg/m ³ (dust) 0.2 mg/m ³ (fume)
Lead Sulphate (PbSO ₄)	0.5	7446-14-2	282 mg/kg	0.05 mg/m ³ (as Pb)

*Inhalable fraction

** Thoracic fraction

PHYSICAL DATA

Dark blue/black odourless slurry; 35-40 % moisture.

Material

Safety

Data

Sheet

Ingredient	Mol. wt.	mp °C	bp °C	Sol. in H ₂ O g/100ml
CuSO ₄	159.6	N/A	N/A	14 cold / 75 hot
Cu ₂ Te	254.98	N/A	N/A	N/A
Cu ₂ Se	206.05	1103	N/A	Insoluble
BiAsO ₄	347.9	N/A	N/A	N/A
SnAsO ₄ (OH)	274.64	N/A	N/A	N/A
NiSO ₄	154.16	N/A	N/A	29.3 cold / 87.3 hot
CoSO ₄	281.10	96.8	735	60.4 cold
H ₂ SO ₄	98.08	10.49	276	Infinite
FeSO ₄	242.135	64	90	Soluble
Ag ₂ Te	341.34	955	N/A	N/A
Cu	63.54	1083	2567	Insoluble
PbSO ₄	303.25	1170	N/A	Soluble

Density	N/A
Specific gravity (H ₂ O = 1)	
Vapor pressure (mm mercury)	N/A
Vapor density (air = 1)	N/A
Percent volatiles by volume	N/A
Evaporation rate	N/A
Coefficient of water/oil distribution	N/A
Odor threshold (ppm)	odourless
Corrosiveness (to common metals)	highly corrosive
pH	<0.5

FIRE OR EXPLOSION HAZARD

Conditions of flammability: Mixture is not flammable

Flash point: N/A

Flammable limits(%): lower: N/A
upper: N/A

Auto ignition temperature: N/A

Extinguishing media: use water on combustibles burning in vicinity of this material.

Special fire fighting procedures: N/A

Hazardous combustion products (exposure limit): N/A

Fire and explosion hazards: N/A

REACTIVITY DATA

Stability: Stable

Hazardous polymerization: Will not occur

Incompatibility: Avoid contact with strong alkalis, strong oxidizers

Conditions of reactivity: N/A

Conditions to avoid: N/A

Volatile products given off at room temperature (exposure limit): None/atmosphere

Hazardous decomposition products - thermal and others (exposure limit): SO_x fume (5 mg/m³ SO₂), H₂ (simple asphyxiants), CuO (0.2 mg/m₃ (fume))

Specific information on incompatibility of this material is not available; however sulphates are generally incompatible with aluminium & magnesium. H₂SO₄ attacks many metals releasing hydrogen, which may form an explosive.

TOXICOLOGICAL PROPERTIES³

Copper Sulphate

Acute toxicity: Poisonings resulting from the ingestion of excessive quantities of copper sulphate may produce death. The symptoms are vomiting of blue-green fluid and blood (hematemesis), high arterial blood pressure (hypertension), dark stools (melena), coma and jaundice.

Exposure to aerosols of copper sulphate can result in temporary inflammation and pus (purulence) in the eye, eventually inducing a discoloration of the eye. Very low concentrations of copper sulphate affect the pre-corneal tear film without injuring the cornea nor appearing to cause discomfort.

Chronic Toxicity: Chronic exposure to dusts of mixed copper salts, basic copper nitrate and sulphate, copper silicate and copper oxide has been reported to result in inflammation of the mucous membranes of the nose (rhinitis), metallic taste, runny nose and irritation of the mucous membranes in the mouth and eyes. A few instances of allergic contact dermatitis have been reported, as has liver disease in vineyard workers using bordeaux mixture (essentially a mixture of basic copper sulphates).

Copper

Copper metal dust, mist and fume may be irritating to the respiratory tract in user operations where copper fume is generated. Inhalation can result in symptoms of metal fume fever such as chills fever and sweating. A few instances of allergic skin rashes have been reported in workers exposed in metallic copper. As molten blister copper the primary hazard is severe burns.

Copper metal as a foreign body in the eye can produce an inflammatory reaction resulting in pus formation in the conjunctiva, cornea or sclera. The lowest observed toxic oral dose of copper is 120 micrograms/kg in humans; this dose caused gastrointestinal effects.

Wilson's disease can occur in certain individuals with a rare inherited metabolic disorder characterized by retention of excessive amounts of copper in the liver, brain, kidneys and corneas. These deposits eventually lead to tissue necrosis and fibrosis, causing a variety of clinical effects, especially liver (i.e. hepatic) disease and neurological changes. Wilson's disease is progressive and, if untreated, leads to fatal liver failure.

Selenium

Some selenium compounds are highly toxic but elemental selenium is relatively inert. Contact of metallic selenium with the skin is likely to cause irritation or rash. The acidic nature of selenium cake causes skin and eye irritation. Chronic exposures by inhalation of small amounts of selenium metal may result in upper respiratory tract irritation, metallic taste, nausea, vomiting, dizziness and a garlic aroma to the breath and sweat. Severe irritation of the respiratory tract can lead to pulmonary edema, bronchitis and pneumonia. Industrial exposure to selenium most often occurs when selenium is heated to form selenium oxide. Industrial exposure to hydrogen selenide can occur when metal selenides react with acid or water.

Copper Telluride

Soluble tellurium can be absorbed through the skin, as well as inhaled or ingested as a fume. Exposure can produce mild gastrointestinal distress, garlic odor of the breath, dryness of the mouth, metallic taste, and drowsiness. Specific information regarding toxicology of copper telluride species is not available in the literature.

Tellurium

Soluble tellurium compounds can be absorbed through the skin, as well as inhaled or ingested as a fume. Exposure can produce mild gastrointestinal distress, garlic odor of the breath, dryness of the mouth, metallic taste and drowsiness.

Bismuth Arsenate

There was no specific information in the literature regarding bismuth arsenate. See Bismuth below.

Bismuth

Bismuth and its salts can cause kidney damage, although the degree of such damage is usually mild. Large doses can be fatal. Industrially, it is considered one of the less toxic of the heavy metals. Industrial bismuth poisoning has not been reported, although bismuth absorbed in industrial cases may complicate a diagnosis of plumbism, since the dark line in the gums, which is often present in lead poisoning, is also produced by bismuth.

All bismuth compounds do not have equal toxicity. Intoxication has occurred from its use in medicine. The administration of bismuth for medical purposes may result in gingivitis, serious ulcerative stomatitis, malaise, albuminuria, diarrhea, skin reactions and sometimes-serious exodermatitis.

Tin

Elemental tin is not considered toxic. In normal intake of inorganic tin, absorption from the alimentary tract is poor; only small amounts of tin from metallic tin or its inorganic salts pass into the tissues.

Arsenic compounds

Arsenic compounds can be absorbed by inhalation or ingestion. Acute arsenic poisoning can be fatal. Fatal poisoning begins with symptoms of abdominal pain and vomiting, usually within an hour of ingestion.

In some cases, dermatitis and peripheral neuritis follow recovery from acute symptoms. Acute dermatitis starts with erythema associated with burning and itching, giving the skin a mottled appearance. If the dermatitis is on the face, swelling may occur followed by eruptions of the skin.

The international agency for research on cancer (IARC) concluded that there was sufficient evidence that arsenic and arsenic compounds, as a group but not necessarily as individual chemicals, were carcinogenic to humans. An association between exposure to arsenic through contaminated drinking water and cancer has been observed and confirmed. Two cases of bladder cancer were also confirmed. U.S. smelter workers exposed to inorganic arsenic have been shown to have significant and consistent increases in lung cancer.

Chronic skin lesions caused by exposure to arsenic compounds are characterized by cracking, thickening and drying of the skin, warts and excessive sweating. Dermatitis of the face and eyelids can be accompanied by conjunctivitis with redness, swelling and pain.

Nickel Sulphate

Inhalation:

The International Agency for Research on Cancer (IARC) in 1990 and the U.S. Tenth Report on Carcinogens in 2002 concluded there was sufficient evidence that nickel compounds are carcinogenic to humans. Toxicology Excellence for Risk Assessment (TERA) finds that carcinogenic risk from soluble nickel compounds via inhalation cannot be determined (Class D) because the existing evidence is composed of conflicting data.

Epidemiological studies of Norwegian nickel refinery workers showed that an increased risk of respiratory cancer was present in electrolysis plant workers. These workers had mixed exposure to aerosols of nickel sulphate and nickel chloride and to insoluble forms of nickel. Electrolysis plant workers in an Ontario refinery similarly exposed to nickel sulphate and nickel chloride aerosols, but not the dust from matte roasting operations did not show any increased incidence of respiratory cancer.

Exposure to aerosols of nickel sulphate can cause asthma and irritation of the upper respiratory tract. Repeated intraperitoneal injections (50 x 1 mg Ni) of nickel sulphate in rats produced abdominal tumours.

Skin Contact:

Exposure to aerosols and solutions of nickel sulphate can cause skin irritation, nickel sensitivity and allergic skin rashes.

Eye Contact:

May cause irritation.

Wounds:

Neither single nor repeated intramuscular injections of nickel sulphate have resulted in the development of tumours in rodents.

Ingestion:

The U.S. National Institute for Occupational Safety and Health (NIOSH) concluded there is no evidence that nickel and its inorganic compounds are carcinogenic when ingested.

Pre-existing
Conditions:

Skin contact can cause an allergic skin rash and/or asthma in previously sensitized individuals.

Reproductive
Toxicity:

Animal experiments indicate that soluble nickel ingestion causes adverse effects on fetal development at a threshold oral exposure of 2.2 mg/Ni/kg/day by pregnant rats. Data are insufficient to determine if this effect occurs in humans and no regulatory agency has classified soluble forms of nickel as reproductive risks for humans.

Cobalt Sulphate

A literature search found no toxicological information for cobalt sulphate heptahydrate. Toxicology is expected

to be similar to cobalt oxide.

Cobalt Oxide

Oral LD₅₀ >5000 mg/kg

Inhalation: Some workers engaged long-term in the production of cobalt oxides showed symptoms of chronic bronchitis. Inhalation experiments show that cobalt oxide accumulated in the lymph nodes of dogs suggesting it is tissue insoluble.

Sulphuric Acid

Inhalation: Causes severe irritation of the respiratory tract. It may cause increased pulmonary resistance, transient cough and broncho-constriction. Severe overexposure may result in lung collapse and pulmonary edema, which can be fatal. Prolonged or repeated exposure may result in impaired lung function or discoloration and erosion of teeth.

Skin Contact: Corrosive and may cause severe burns. Prolonged or repeated exposure to dilute solutions may cause irritation and dermatitis.

Eye Contact: May result in severe damage causing burns or blindness.

Ingestion: May cause severe pain, ulceration and scarring of the digestive tract. Sulphuric acid mist inhalation studies with normal human subjects have shown that concentrations below 1 mg/m³ could not be detected by odor, taste or irritation. A concentration of 3 mg/m³ was noticed by all; for 2 individuals 1 mg/m³ was the threshold and 5 mg/m³ was very objectionable to some but less so than others. A deep breath at the latter concentrations usually produced coughing (ACGIH).

If the material is present as a mist in the workroom atmosphere the following information is provided to assist operations in the selection of controls to minimize worker exposures. The international agency for research on cancer (IARC) classified strong inorganic acid mists containing sulphuric as carcinogenic to humans. This classification is for mists only and does not apply to sulphuric acid or sulphuric acid solutions.

Lead Sulphate

Lead sulfate is toxic by inhalation, ingestion and skin contact. It is a cumulative poison, and repeated exposure may lead to anemia, kidney damage, eyesight damage or damage to the central nervous system (especially in children). Some lead salts may cause reproductive defects and cardiovascular disturbances. It is also corrosive - contact with the eyes can lead to severe irritation or burns.

The International Agency for Research on Cancer (IARC) has concluded that this chemical is probably carcinogenic to humans (Group 2A). The American Conference of Governmental Industrial Hygienists (ACGIH) has designated this chemical as an animal carcinogen (A3). The US National Toxicology Program (NTP) has listed this chemical as reasonably anticipated to be a human carcinogen.

PREVENTIVE MEASURES

Procedure when spilled/released: Prevent spread of spill. Flush with water. Dike with inert material (sand, earth, etc.) flush with water into recovery sumps for recycling and reclaiming of values.

Environmental effects: Harmful to aquatic life in low concentrations if it enters water intakes.

Waste disposal method: Waste and spills are recycled to recover values. Disposal does not occur.

Engineering controls: Use with adequate ventilation under normal conditions general area ventilation is

adequate. Personal Protection Equipment.

Eye:	Safety glasses. Chemical safety goggles
Hand (glove type):	Polyvinyl chloride. Natural rubber
Respirator type:	Under normal circumstances respiratory protection is not required. Departmental standards may be consulted under any other circumstances.
Other protective equipment:	Wear rubber boots and acid-proof clothing when working in areas where puddles or spills may occur. Wear full protective equipment in accordance with local safety regulations.

FIRST AID MEASURES

Skin contact:	Wash with soap and water. Can burn if splashes are not washed off promptly. For skin splashes or irritation, flush immediately. Use safety showers for large spills on skin or clothing.
Eye contact:	Immediately flush with water for 15 minutes, get immediate medical attention. Can cause severe burns. Use eyewash fountains provided to flush eyes. Hold eyelids open while flushing with water.
Inhalation:	Remove to fresh air for respiratory tract irritation. If symptoms persist, seek medical attention.
Ingestion:	Do not induce vomiting. Get immediate medical attention.

PREPARATION INFORMATION

Vale Inco Ltd: 200 Bay St., Royal Bank Plaza
Suite 1600, South Tower, PO Box 70
Toronto, Ontario, Canada, M5J 2K2

Product Stewardship (416) 361-7801
MSDS available online at www.valeinco.com
msds@valeinco.com

Note:

Vale Inco believes that the information in this Material Safety Data Sheet is accurate. However, Vale Inco makes no express or implied warranty as to the accuracy of such information and expressly disclaims any liability resulting from reliance on such information.

Footnotes:

- ® Trademark of the Vale Inco family of companies.
- 1 Threshold Limit Value of the American Conference of Governmental Industrial Hygienists.
- 2 Exposure Limits for user operations will depend on the relevant governmental regulations.
- 3 Describes possible health hazards of the product supplied. If user operations change it to other chemical forms, whether as end products, intermediates or fugitive emissions, the possible health hazards of such forms must be determined by the user.