

# Ammonium tetrathiomolybdate

sc-239242



The Power is Question

## Material Safety Data Sheet

Hazard Alert Code  
Key:

EXTREME

HIGH

MODERATE

LOW

## Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

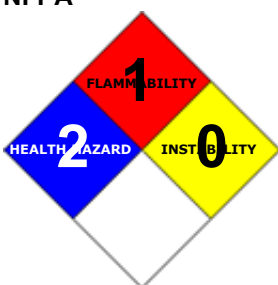
### PRODUCT NAME

Ammonium tetrathiomolybdate

### STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

### NFPA



### SUPPLIER

Company: Santa Cruz Biotechnology, Inc.

Address:

2145 Delaware Ave

Santa Cruz, CA 95060

Telephone: 800.457.3801 or 831.457.3800

Emergency Tel: CHEMWATCH: From within the US and  
Canada: 877-715-9305

Emergency Tel: From outside the US and Canada: +800 2436  
2255 (1-800-CHEMCALL) or call +613 9573 3112

### PRODUCT USE

- Intermediate.

### SYNONYMS

H8-Mo-N2-S4, (NH4)2MoS4, "ammonium molybdenum sulfide"

## Section 2 - HAZARDS IDENTIFICATION

### CANADIAN WHMIS SYMBOLS



### EMERGENCY OVERVIEW

#### RISK

Danger of cumulative effects.

Irritating to eyes, respiratory system and skin.

Very toxic to aquatic organisms.

### POTENTIAL HEALTH EFFECTS

#### ACUTE HEALTH EFFECTS

#### SWALLOWED

- Accidental ingestion of the material may be damaging to the health of the individual.

- Molybdenum, an essential trace element, can in large doses hamper growth and cause loss of appetite, listlessness and diarrhea. Anemia also occurs, and other symptoms include graying of hair, shrinking of the testicles, reduced fertility and milk

production, shortness of breath, incoordination and irritation of the mucous membranes. Symptoms of copper deficiency are also seen.

- If ingested, sulfide salts can form hydrogen sulfide, causing headache, cyanosis, low blood pressure, loss of consciousness, tremors and convulsions.
- Large doses of ammonia or injected ammonium salts may produce diarrhea and may be sufficiently absorbed to produce increased production of urine and systemic poisoning. Symptoms include weakening of facial muscle, tremor, anxiety, reduced muscle and limb control.

#### EYE

- This material can cause eye irritation and damage in some persons.

#### SKIN

- This material can cause inflammation of the skin on contact in some persons.
- The material may accentuate any pre-existing dermatitis condition.
- Skin contact is not thought to have harmful health effects, however the material may still produce health damage following entry through wounds, lesions or abrasions.
- Open cuts, abraded or irritated skin should not be exposed to this material.
- Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

#### INHALED

- The material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage.
- Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled.
- Bronchial and alveolar exudate are apparent in animals exposed to molybdenum by inhalation. Molybdenum fume may produce bronchial irritation and moderate fatty changes in liver and kidney.

#### CHRONIC HEALTH EFFECTS

- Repeated or long-term occupational exposure is likely to produce cumulative health effects involving organs or biochemical systems.

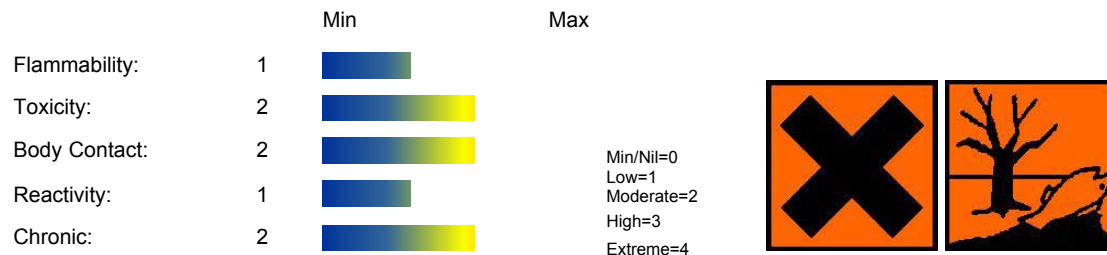
Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems.

Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis; caused by particles less than 0.5 micron penetrating and remaining in the lung. Prime symptom is breathlessness; lung shadows show on X-ray.

High levels of molybdenum can cause joint problems in the hands and feet with pain and lameness. Molybdenum compounds can also cause liver changes with elevated levels of enzymes and cause over-activity of the thyroid gland. A generalized feeling of unwellness can occur, with tiredness, weakness, diarrhea, loss of appetite and weight. Molybdenum has been associated with cancers of the airways, but on the other hand, a low intake of molybdenum may cause an increased risk of developing esophageal cancer.

## Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

#### HAZARD RATINGS



NAME	CAS RN	%
ammonium tetrathiomolybdate	15060-55-6	>98

## Section 4 - FIRST AID MEASURES

#### SWALLOWED

- 
- If swallowed do NOT induce vomiting.
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- Observe the patient carefully.
- Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.
- Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.
- Seek medical advice.

#### EYE

- If this product comes in contact with the eyes:
  - Wash out immediately with fresh running water.
  - Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
  - If pain persists or recurs seek medical attention.
  - Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

#### SKIN

- If skin contact occurs:
  - Immediately remove all contaminated clothing, including footwear
  - Flush skin and hair with running water (and soap if available).

- Seek medical attention in event of irritation.

## **INHALED**

- 
- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.
- Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital, or doctor, without delay.

## **NOTES TO PHYSICIAN**

- For exposures involving sulfides and hydrogen sulfide (including gastric acid decomposition products of alkaline sulfides).
- Hydrogen sulfide anion produces its major toxic effect through inhibition of cytochrome oxidases.
- Symptoms include profuse salivation, nausea, vomiting and diarrhea. Central nervous effects may include giddiness, headache, vertigo, amnesia, confusion and unconsciousness. Tachypnea, palpitation, tachycardia, arrhythmia, sweating, weakness and muscle cramps may also indicate over-exposures.

Treatment involves:

- If respirations are depressed, application of artificial respiration, administration of oxygen (continue after spontaneous breathing is established).
- For severe poisonings administer amyl nitrite and sodium nitrite (as for cyanide poisoning) but omit sodium thiosulfate injection.
- Atropine sulfate (0.6 mg intramuscularly) may contribute symptomatic relief.
- Conjunctivitis may be relieved by installation of 1 drop of olive-oil in each eye and sometimes by 3 drops of epinephrine solution (1:1000) at frequent intervals. Occasionally local anesthetics and hot and cold compresses are necessary to control pain.
- Antibiotics at first hint of pulmonary infection.

[Gosselin et al, Clinical Toxicology of Commercial Products].

## **Section 5 - FIRE FIGHTING MEASURES**

Vapour Pressure (mmHG):	Negligible
Upper Explosive Limit (%):	Not available.
Specific Gravity (water=1):	Not available
Lower Explosive Limit (%):	Not available

## **EXTINGUISHING MEDIA**

- 
- Foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.
- Water spray or fog - Large fires only.

## **FIRE FIGHTING**

- 
- Alert Emergency Responders and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water course.
- Use water delivered as a fine spray to control fire and cool adjacent area.
- DO NOT approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.
- Equipment should be thoroughly decontaminated after use.

## **GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS**

- 
- Combustible solid which burns but propagates flame with difficulty.
- Avoid generating dust, particularly clouds of dust in a confined or unventilated space as dusts may form an explosive mixture with air, and any source of ignition, i.e. flame or spark, will cause fire or explosion. Dust clouds generated by the fine grinding of the solid are a particular hazard; accumulations of fine dust may burn rapidly and fiercely if ignited.
- Dry dust can be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport.
- Build-up of electrostatic charge may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Combustion products include: carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), sulfur oxides (SO<sub>x</sub>), metal oxides, other pyrolysis products typical of burning organic material.

## **FIRE INCOMPATIBILITY**

- Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

## **PERSONAL PROTECTION**

Glasses:

Chemical goggles.

Gloves:

Respirator:

Particulate

## Section 6 - ACCIDENTAL RELEASE MEASURES

### MINOR SPILLS



- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid contact with skin and eyes.
- Control personal contact by using protective equipment.
- Use dry clean up procedures and avoid generating dust.
- Place in a suitable, labelled container for waste disposal.

Environmental hazard - contain spillage.

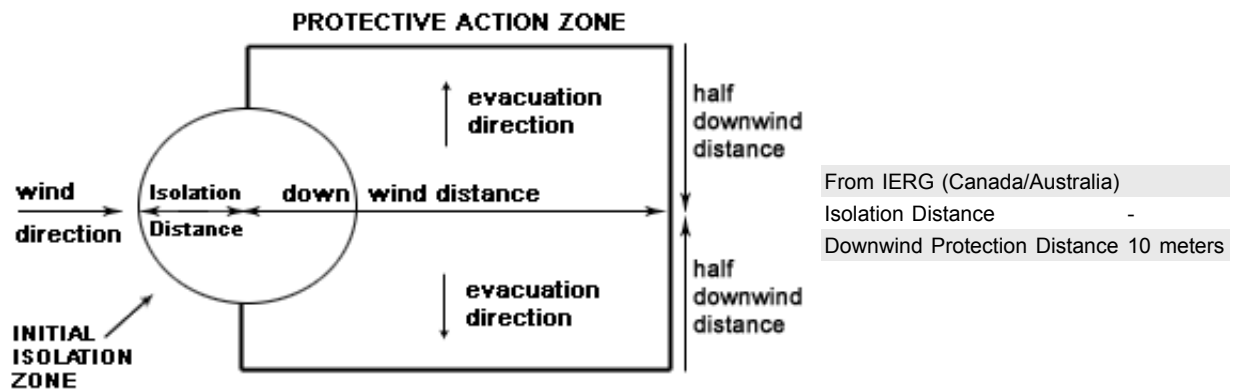
### MAJOR SPILLS

■ Environmental hazard - contain spillage.

Moderate hazard.

- CAUTION: Advise personnel in area.
- Alert Emergency Responders and tell them location and nature of hazard.
- Control personal contact by wearing protective clothing.
- Prevent, by any means available, spillage from entering drains or water courses.
- Recover product wherever possible.
- IF DRY: Use dry clean up procedures and avoid generating dust. Collect residues and place in sealed plastic bags or other containers for disposal. IF WET: Vacuum/shovel up and place in labelled containers for disposal.
- ALWAYS: Wash area down with large amounts of water and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services.

### PROTECTIVE ACTIONS FOR SPILL



### FOOTNOTES

1 PROTECTIVE ACTION ZONE is defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the downwind protective action distance.

2 PROTECTIVE ACTIONS should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/or incurring serious or irreversible health effects.

3 INITIAL ISOLATION ZONE is determined as an area, including upwind of the incident, within which a high probability of localised wind reversal may expose nearly all persons without appropriate protection to life-threatening concentrations of the material.

4 SMALL SPILLS involve a leaking package of 200 litres (55 US gallons) or less, such as a drum (jerrican or box with inner containers). Larger packages leaking less than 200 litres and compressed gas leaking from a small cylinder are also considered "small spills". LARGE SPILLS involve many small leaking packages or a leaking package of greater than 200 litres, such as a cargo tank, portable tank or a "one-tonne" compressed gas cylinder.

5 Guide 171 is taken from the US DOT emergency response guide book.

6 IERG information is derived from CANUTEC - Transport Canada.

### ACUTE EXPOSURE GUIDELINE LEVELS (AEGL) (in ppm)

AEGL 1: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

AEGL 2: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

AEGL 3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

## Section 7 - HANDLING AND STORAGE

### PROCEDURE FOR HANDLING



- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.



Occupational Exposure Limits	(Molybdenum - Metal and insoluble compounds, Respirable)	3				
Canada - British Columbia Occupational Exposure Limits	ammonium tetrathiomolybdate (Molybdenum - Metal and insoluble compounds, Inhalable)	10				
US - Minnesota Permissible Exposure Limits (PELs)	ammonium tetrathiomolybdate (Molybdenum (as Mo) - Insoluble compounds - Respirable fraction)	5				
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	ammonium tetrathiomolybdate (Molybdenum (as Mo) Insoluble compounds Total dust)	10				
US - California Permissible Exposure Limits for Chemical Contaminants	ammonium tetrathiomolybdate (Molybdenum, insoluble compounds, as Mo - Total dust)	10				
US - California Permissible Exposure Limits for Chemical Contaminants	ammonium tetrathiomolybdate (Molybdenum, insoluble compounds, as Mo - Respirable fraction (n))	3				
US - Idaho - Limits for Air Contaminants	ammonium tetrathiomolybdate (Molybdenum (as Mo) Soluble compounds)	5 á				
Canada - Alberta Occupational Exposure Limits	ammonium tetrathiomolybdate (Molybdenum, as Mo - Metal and insoluble compounds, respirable)	3				
US - Alaska Limits for Air Contaminants	ammonium tetrathiomolybdate (Molybdenum (as Mo) Insoluble compounds - Total dust)	10				
US - Hawaii Air Contaminant Limits	ammonium tetrathiomolybdate (Molybdenum (as Mo) Insoluble compounds - Total dust)	10	20			
US - Michigan Exposure Limits for Air Contaminants	ammonium tetrathiomolybdate (Molybdenum, (as Mo) Insoluble compounds)	10				
US - Alaska Limits for Air Contaminants	ammonium tetrathiomolybdate (Molybdenum (as Mo) Insoluble compounds - Respirable fraction)	5				
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	ammonium tetrathiomolybdate (Molybdenum, (as Mo): Metal and insoluble compounds, (inhalable fraction++ ))	10	20			
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	ammonium tetrathiomolybdate (Molybdenum, (as Mo): Metal and insoluble compounds, (respirable fraction+++))	3	6			
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	ammonium tetrathiomolybdate (Molybdenum (as Mo) - Insoluble compounds)	-	10	-	20	
US - Washington Permissible exposure limits of air contaminants	ammonium tetrathiomolybdate (Molybdenum (as Mo) - Insoluble compounds)	10	20			
US - Oregon Permissible Exposure Limits (Z1)	ammonium tetrathiomolybdate (Molybdenum (insoluble compounds))	10				*
US OSHA Permissible Exposure Levels (PELs) - Table Z1	ammonium tetrathiomolybdate (Molybdenum (as Mo) - Insoluble compounds; Total dust)	15				
Canada - Prince Edward Island Occupational Exposure Limits	ammonium tetrathiomolybdate (Molybdenum - Insoluble compounds (as Mo))	3				TLV Basis: lower respiratory tract irritation
US ACGIH Threshold Limit Values (TLV)	ammonium tetrathiomolybdate (Molybdenum - Insoluble compounds (as Mo))	3				TLV Basis: lower respiratory tract irritation
US ACGIH Threshold Limit Values (TLV)	ammonium tetrathiomolybdate (Molybdenum - Insoluble compounds (as Mo))	10				TLV Basis: lower respiratory tract

					irritation
Canada - Nova Scotia Occupational Exposure Limits	ammonium tetrathiomolybdate (Molybdenum - Insoluble compounds (as Mo))	10			TLV Basis: lower respiratory tract irritation
Canada - Northwest Territories Occupational Exposure Limits (English)	ammonium tetrathiomolybdate (Molybdenum (as Mo) Insoluble compounds)	10	20		
Canada - Prince Edward Island Occupational Exposure Limits	ammonium tetrathiomolybdate (Molybdenum - Insoluble compounds (as Mo))	10			TLV Basis: lower respiratory tract irritation
Canada - Nova Scotia Occupational Exposure Limits	ammonium tetrathiomolybdate (Molybdenum - Insoluble compounds (as Mo))	3			TLV Basis: lower respiratory tract irritation
US - Idaho - Limits for Air Contaminants	ammonium tetrathiomolybdate (Molybdenum (as Mo) Insoluble compounds)	5			
US - California Permissible Exposure Limits for Chemical Contaminants	ammonium tetrathiomolybdate (Molybdenum, soluble compounds, as Mo)	0.5			(TWA (n))
US - Minnesota Permissible Exposure Limits (PELs)	ammonium tetrathiomolybdate (Molybdenum (as Mo) - Soluble compounds)	5			
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	ammonium tetrathiomolybdate (Molybdenum (as Mo) - Soluble compounds)	5			
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	ammonium tetrathiomolybdate (Molybdenum (as Mo) - Soluble compounds)	5			
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	ammonium tetrathiomolybdate (Molybdenum (as Mo) Soluble compounds)	5			
US ACGIH Threshold Limit Values (TLV)	ammonium tetrathiomolybdate (Molybdenum - Soluble compounds (as Mo))	0.5			TLV Basis: lower respiratory tract irritation
US - Alaska Limits for Air Contaminants	ammonium tetrathiomolybdate (Molybdenum (as Mo) Soluble compounds)	5			
US - Michigan Exposure Limits for Air Contaminants	ammonium tetrathiomolybdate (Molybdenum, (as Mo) Soluble compounds)	5			
US - Hawaii Air Contaminant Limits	ammonium tetrathiomolybdate (Molybdenum (as Mo) Soluble compounds)	5	10		
US - Washington Permissible exposure limits of air contaminants	ammonium tetrathiomolybdate (Molybdenum (as Mo) - Soluble compounds)	5	10		
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	ammonium tetrathiomolybdate (Molybdenum, (as Mo): Soluble compounds, (respirable fraction++))	0.5	1.5		
Canada - Prince Edward Island Occupational Exposure Limits	ammonium tetrathiomolybdate (Molybdenum - Soluble compounds (as Mo))	0.5			TLV Basis: lower respiratory tract irritation
US OSHA Permissible Exposure Levels (PELs) - Table Z1	ammonium tetrathiomolybdate (Molybdenum (as Mo) - Soluble compounds)	5			
					TLV Basis:

Canada - Nova Scotia Occupational Exposure Limits	ammonium tetrathiomolybdate (Molybdenum - Soluble compounds (as Mo))	0.5		Basis. lower respiratory tract irritation
US - Oregon Permissible Exposure Limits (Z1)	ammonium tetrathiomolybdate (Molybdenum (soluble compounds))	5		*
Canada - Northwest Territories Occupational Exposure Limits (English)	ammonium tetrathiomolybdate (Molybdenum (as Mo) Soluble compounds)	5	10	
Canada - Alberta Occupational Exposure Limits	ammonium tetrathiomolybdate (Molybdenum, as Mo - Soluble compounds, respirable)	0.5		
Canada - British Columbia Occupational Exposure Limits	ammonium tetrathiomolybdate (Molybdenum - Soluble compounds, as Mo, Respirable)	0.5		
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	ammonium tetrathiomolybdate (Molybdenum (as Mo)- Soluble compounds)	5		
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	ammonium tetrathiomolybdate (Molybdenum (as Mo): Soluble compounds)	5		

#### EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m3)	Revised IDLH Value (ppm)
ammonium tetrathiomolybdate	5,000	

#### MATERIAL DATA

##### AMMONIUM TETRATHIOMOLYBDATE:

■ An increased incidence of non-specific symptoms including headache, weakness, fatigue, anorexia and joint and muscle weakness has been reported to occur in mining and metallurgy workers exposed to 60-600 mg (as Mo). Some investigators have attributed gout and elevated uric acid concentration found in some Armenians to result from exposures to Armenian soils rich in molybdenum, whilst exposure has been implicated as a cause of bone disease amongst Indians. "These involvements are speculative". [US National Research Council]. As far as it is known, the recommended TLV-TWA incorporates a large margin of safety against potential pulmonary or systemic effects.

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#### PERSONAL PROTECTION



Consult your EHS staff for recommendations

#### EYE

- 
- Safety glasses with side shields.
- Chemical goggles.
- Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. DO NOT wear contact lenses.

#### HANDS/FEET

■ Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:

- frequency and duration of contact,
- chemical resistance of glove material,
- glove thickness and
- dexterity

Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739).

- When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374) is recommended.
- When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended.
- Contaminated gloves should be replaced.

Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.

Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.

- polychloroprene
- nitrile rubber



- butyl rubber
- fluorocautchouc
- polyvinyl chloride

Gloves should be examined for wear and/ or degradation constantly.

## OTHER

- 
- Overalls.
- P.V.C. apron.
- Barrier cream.
- Skin cleansing cream.
- Eye wash unit.
- 
- Respirators may be necessary when engineering and administrative controls do not adequately prevent exposures.
- The decision to use respiratory protection should be based on professional judgment that takes into account toxicity information, exposure measurement data, and frequency and likelihood of the worker's exposure - ensure users are not subject to high thermal loads which may result in heat stress or distress due to personal protective equipment (powered, positive flow, full face apparatus may be an option).
- Published occupational exposure limits, where they exist, will assist in determining the adequacy of the selected respiratory . These may be government mandated or vendor recommended.
- Certified respirators will be useful for protecting workers from inhalation of particulates when properly selected and fit tested as part of a complete respiratory protection program.
- Use approved positive flow mask if significant quantities of dust becomes airborne.
- Try to avoid creating dust conditions.

## RESPIRATOR

Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
10 x PEL	P1	-	PAPR-P1
	Air-line*	-	-
50 x PEL	Air-line**	P2	PAPR-P2
100 x PEL	-	P3	-
	-	Air-line*	-
100+ x PEL	-	Air-line**	PAPR-P3

\* - Negative pressure demand \*\* - Continuous flow

Explanation of Respirator Codes:

Class 1 low to medium absorption capacity filters.

Class 2 medium absorption capacity filters.

Class 3 high absorption capacity filters.

PAPR Powered Air Purifying Respirator (positive pressure) cartridge.

Type A for use against certain organic gases and vapors.

Type AX for use against low boiling point organic compounds (less than 65°C).

Type B for use against certain inorganic gases and other acid gases and vapors.

Type E for use against sulfur dioxide and other acid gases and vapors.

Type K for use against ammonia and organic ammonia derivatives

Class P1 intended for use against mechanically generated particulates of sizes most commonly encountered in industry, e.g. asbestos, silica.

Class P2 intended for use against both mechanically and thermally generated particulates, e.g. metal fume.

Class P3 intended for use against all particulates containing highly toxic materials, e.g. beryllium.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required.

Use appropriate NIOSH-certified respirator based on informed professional judgement. In conditions where no reasonable estimate of exposure can be made, assume the exposure is in a concentration IDLH and use NIOSH-certified full face pressure demand SCBA with a minimum service life of 30 minutes, or a combination full facepiece pressure demand SAR with auxiliary self-contained air supply. Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

## ENGINEERING CONTROLS

- 
- Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.
- Exhaust ventilation should be designed to prevent accumulation and recirculation of particulates in the workplace.
- If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered. Such protection might consist of:
  - (a): particle dust respirators, if necessary, combined with an absorption cartridge;
  - (b): filter respirators with absorption cartridge or canister of the right type;
  - (c): fresh-air hoods or masks
- Build-up of electrostatic charge on the dust particle, may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to efficiently remove the contaminant.

Type of Contaminant:	Air Speed:
direct spray, spray painting in shallow booths, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)	1-2.5 m/s (200-500 f/min.)
grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).	2.5-10 m/s (500-2000 f/min.)
Within each range the appropriate value depends on:	
Lower end of the range	Upper end of the range
1: Room air currents minimal or favorable to capture	1: Disturbing room air currents

2: Contaminants of low toxicity or of nuisance value only	2: Contaminants of high toxicity
3: Intermittent, low production.	3: High production, heavy use
4: Large hood or large air mass in motion	4: Small hood-local control only

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 4-10 m/s (800-2000 f/min) for extraction of crusher dusts generated 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

## Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

### PHYSICAL PROPERTIES

Solid.

Does not mix with water.

State	Divided solid	Molecular Weight	260.27
Melting Range (°F)	Not available	Viscosity	Not Applicable
Boiling Range (°F)	Not available	Solubility in water (g/L)	Partly miscible
Flash Point (°F)	Not available	pH (1% solution)	Not applicable
Decomposition Temp (°F)	Not available	pH (as supplied)	Not applicable
Autoignition Temp (°F)	Not available	Vapour Pressure (mmHG)	Negligible
Upper Explosive Limit (%)	Not available.	Specific Gravity (water=1)	Not available
Lower Explosive Limit (%)	Not available	Relative Vapor Density (air=1)	Not Applicable
Volatile Component (%vol)	Negligible	Evaporation Rate	Not applicable

### APPEARANCE

Dark-red crystalline powder.

## Section 10 - CHEMICAL STABILITY

### CONDITIONS CONTRIBUTING TO INSTABILITY

- 
- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerization will not occur.

### STORAGE INCOMPATIBILITY

- - Sulfides are incompatible with acids, diazo and azo compounds, halocarbons, isocyanates, aldehydes, alkali metals, nitrides, hydrides, and other strong reducing agents.
  - Many reactions of sulfides with these materials generate heat and in many cases hydrogen gas.
  - Many sulfide compounds may liberate hydrogen sulfide upon reaction with an acid.
- Avoid reaction with oxidizing agents.

For incompatible materials - refer to Section 7 - Handling and Storage.

## Section 11 - TOXICOLOGICAL INFORMATION

ammonium tetrathiomolybdate

### TOXICITY AND IRRITATION

- unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.
- Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.

No significant acute toxicological data identified in literature search.

### CARCINOGEN

Molybdenum - Soluble compounds (as Mo)	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category A3
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## Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

AMMONIUM TETRATHIOMOLYBDATE:

■ Very toxic to aquatic organisms.

■ Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.

Wastes resulting from use of the product must be disposed of on site or at approved waste sites.

■ Based on the high concentration of molybdenum in all analysed waste types, the exposure of the environment to molybdenum is regarded as significant. The limited amount of data regarding its toxicity makes it impossible to evaluate the potential for adverse environmental and health effects from molybdenum exposure.

Molybdenum cause adverse effects in ruminant animals. Livestock have been injured by forage grown on soils with excessive geochemically-derived molybdenum. Soil molybdenum is a potentially toxic element, but no cases have been reported of molybdenum toxicity to animals from consumption of forage grown on sludge-amended soils. In pot studies, where clover was grown on alkaline soils containing up to 16 kg of molybdenum per ha, concentrations in the plant tissue reached levels that could be harmful to animals if the clover were to make up a substantial portion of the diet for an extended period of time.

Molybdenum is generally found in two oxidation states in nature, Mo(IV) and Mo(VI). In oxidising environments Mo(VI) dominates and it is commonly present as the oxyanion molybdate (MoO<sub>4</sub>,2-)

In a laboratory experiment it was found that Mo was lost from solution under reducing conditions and remobilised under oxidizing conditions, and hypothesised that MoS<sub>2</sub>, a low-solubility mineral, formed in the system.

In this study it was also found that Fe minerals were important sinks for Mo accumulation in reducing sediments. It has been proposed that under reducing conditions and with the reduction of sulfate, molybdate is converted to thiomolybdate (MoS<sub>4</sub>,2-) which then binds to Fe, Al, and organic matter phases a via sulfur bridges. This mechanism could also account for decreased Mo solubility under reducing conditions.

Another study in wetland found that Mo accumulated in the sediments with most of the accumulation occurring in the top 2 cm and decreasing with depth. It appears that Mo accumulation (as well as As and V accumulation) or retention in the surface sediments is dependent on the depth of the overlying water column and correspondingly on redox status.

■ Sulfide ion is very toxic to aquatic life, threshold concentration for fresh or saltwater fish is 0.5ppm. The product therefore is very toxic to aquatic life. The major decomposition product, hydrogen sulfide, is damaging to vegetation at 5ppm for 24 hours.

■ In air ammonia is persistent whilst, in water, it biodegrades rapidly to nitrate, producing a high oxygen demand. Ammonia is strongly adsorbed to soil. Ammonia is non-persistent in water (half-life 2 days) and is moderately toxic to fish under normal temperature and pH conditions. Ammonia is harmful to aquatic life at low concentrations but does not concentrate in the food chain.

Drinking Water Standards:

0.5 mg/l (UK max.)

1.5 mg/l (WHO Levels)

Soil Guidelines: none available.

Air Quality Standards: none available.

■ DO NOT discharge into sewer or waterways.

### Ecotoxicity

Ingredient ammonium tetrathiomolybdate	Persistence: Water/Soil HIGH	Persistence: Air LOW	Bioaccumulation LOW	Mobility HIGH
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## Section 13 - DISPOSAL CONSIDERATIONS

### Disposal Instructions

All waste must be handled in accordance with local, state and federal regulations.

† Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.

A Hierarchy of Controls seems to be common - the user should investigate:

- Reduction
- Reuse
- Recycling
- Disposal (if all else fails)

This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.

DO NOT allow wash water from cleaning equipment to enter drains. Collect all wash water for treatment before disposal.

- Recycle wherever possible.
- Consult manufacturer for recycling options or consult Waste Management Authority for disposal if no suitable treatment or disposal facility can be identified.
- Dispose of by: Burial in a licensed land-fill or Incineration in a licensed apparatus (after admixture with suitable combustible material)
- Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Adjust pH to 7 and treat with sulfide to precipitate for burial. Destroy excess sulfide, neutralise and dispose to drain

## Section 14 - TRANSPORTATION INFORMATION



DOT:

Symbols:	G	Hazard class or Division:	9
Identification Numbers:	UN3077	PG:	III

Label Codes:	9	Special provisions:	8, 146, 335, B54, IB8, IP3, N20, T1, TP33
Packaging: Exceptions:	155	Packaging: Non-bulk:	213
Packaging: Exceptions:	155	Quantity limitations: Passenger aircraft/rail:	No limit
Quantity Limitations: Cargo aircraft only:	No limit	Vessel stowage: Location:	A
Vessel stowage: Other:	None		

Hazardous materials descriptions and proper shipping names:  
Environmentally hazardous substance, solid, n.o.s

#### Air Transport IATA:

ICAO/IATA Class:	9	ICAO/IATA Subrisk:	雜
UN/ID Number:	3077	Packing Group:	III
Special provisions:	A97		

Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. \*(CONTAINS AMMONIUM TETRATHIOMOLYBDATE)

#### Maritime Transport IMDG:

IMDG Class:	9	IMDG Subrisk:	None
UN Number:	3077	Packing Group:	III
EMS Number:	F-A,S-F	Special provisions:	274 909 944
Limited Quantities:	5 kg		

Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.(contains ammonium tetrathiomolybdate)

## Section 15 - REGULATORY INFORMATION

**ammonium tetrathiomolybdate (CAS: 15060-55-6) is found on the following regulatory lists;**

"Canada Non-Domestic Substances List (NDSL)", "US Toxic Substances Control Act (TSCA) - Inventory"

## Section 16 - OTHER INFORMATION

### LIMITED EVIDENCE

■ Ingestion may produce health damage\*.

\* (limited evidence).

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■ Classification of the mixture and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

A list of reference resources used to assist the committee may be found at:  
[www.chemwatch.net/references](http://www.chemwatch.net/references).

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

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