

# Molybdenum(VI) tetrachloride oxide

sc-250412

## Material Safety Data Sheet



The Power to Question

Hazard Alert Code  
Key:

EXTREME

HIGH

MODERATE

LOW

## Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

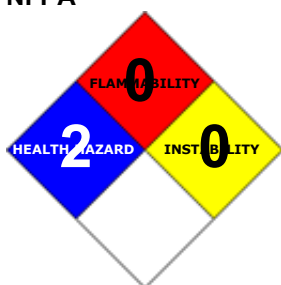
### PRODUCT NAME

Molybdenum(VI) tetrachloride oxide

### 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

Cl<sub>4</sub>-Mo-O, Mo-O-Cl<sub>4</sub>, Mo-O-Cl<sub>4</sub>, "molybdenum (VI) oxychloride", "molybdenum (VI) oxychloride"

## Section 2 - HAZARDS IDENTIFICATION

### CANADIAN WHMIS SYMBOLS



### EMERGENCY OVERVIEW

#### RISK

Danger of cumulative effects.

Irritating to eyes, respiratory system and skin.

### 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.

#### 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.
- Not normally a hazard due to non-volatile nature of product.
- 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.

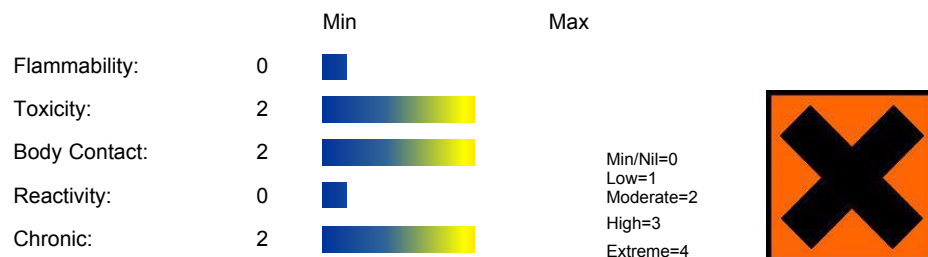
Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems.

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	%
molybdenum(VI) tetrachloride oxide	13814-75-0	>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

- Treat symptomatically.

### Section 5 - FIRE FIGHTING MEASURES

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

#### EXTINGUISHING MEDIA

- 
- There is no restriction on the type of extinguisher which may be used.

Use extinguishing media suitable for surrounding area.

#### FIRE FIGHTING

- 
- Alert Emergency Responders and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves for fire only.
- Prevent, by any means available, spillage from entering drains or water course.
- Use fire fighting procedures suitable for surrounding 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

- 
- Non combustible.
- Not considered to be a significant fire risk, however containers may burn.

Decomposition may produce toxic fumes of: hydrogen chloride, metal oxides.

May emit poisonous fumes.

May emit corrosive fumes.

#### FIRE INCOMPATIBILITY

- None known.

#### 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.

#### MAJOR SPILLS

- 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.

#### 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

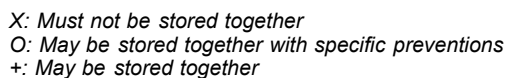
AEGL 3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

## PROCEDURE FOR HANDLING

- ## RECOMMENDED STORAGE METHODS

- ## STORAGE REQUIREMENTS

- ## SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



## EXPOSURE CONTROLS

[illegible]

Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) - Total dust)	15		
Canada - Ontario Occupational Exposure Limits	molybdenum(VI) tetrachloride oxide (Molybdenum, as molybdenum Metal and insoluble compounds - inhalable)	10		
Canada - Ontario Occupational Exposure Limits	molybdenum(VI) tetrachloride oxide (Molybdenum, as molybdenum Metal and insoluble compounds - respirable)	3		
US - Minnesota Permissible Exposure Limits (PELs)	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) - Insoluble compounds - Total dust)	10		
Canada - Alberta Occupational Exposure Limits	molybdenum(VI) tetrachloride oxide (Molybdenum, as Mo - Metal and insoluble compounds, total)	10		
Canada - British Columbia Occupational Exposure Limits	molybdenum(VI) tetrachloride oxide (Molybdenum - Metal and insoluble compounds, Respirable)	3		
Canada - British Columbia Occupational Exposure Limits	molybdenum(VI) tetrachloride oxide (Molybdenum - Metal and insoluble compounds, Inhalable)	10		
US - Minnesota Permissible Exposure Limits (PELs)	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) - Insoluble compounds - Respirable fraction)	5		
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) Insoluble compounds Total dust)	10		
US - California Permissible Exposure Limits for Chemical Contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum, insoluble compounds, as Mo - Total dust)	10		
US - California Permissible Exposure Limits for Chemical Contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum, insoluble compounds, as Mo - Respirable fraction (n))	3		
US - Idaho - Limits for Air Contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) Soluble compounds)	5 á		
Canada - Alberta Occupational Exposure Limits	molybdenum(VI) tetrachloride oxide (Molybdenum, as Mo - Metal and insoluble compounds, respirable)	3		
US - Alaska Limits for Air Contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) Insoluble compounds - Total dust)	10		
US - Hawaii Air Contaminant Limits	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) Insoluble compounds - Total dust)	10	20	
US - Michigan Exposure Limits for Air Contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum, (as Mo) Insoluble compounds)	10		
US - Alaska Limits for Air Contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) Insoluble compounds - Respirable fraction)	5		
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	molybdenum(VI) tetrachloride oxide (Molybdenum, (as Mo): Metal and insoluble compounds, (inhalable fraction++ ))	10	20	
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	molybdenum(VI) tetrachloride oxide (Molybdenum, (as Mo): Metal and insoluble compounds, (respirable fraction++))	3	6	
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) - Insoluble compounds)	- 10	- 20	
US - Washington Permissible exposure limits of air contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) - Insoluble compounds)	10	20	
US - Oregon Permissible Exposure Limits (Z1)	molybdenum(VI) tetrachloride oxide (Molybdenum (insoluble compounds))	10		*

US OSHA Permissible Exposure Levels (PELs) - Table Z1	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) - Insoluble compounds; Total dust)	15		
Canada - Prince Edward Island Occupational Exposure Limits	molybdenum(VI) tetrachloride oxide (Molybdenum - Insoluble compounds (as Mo))	3		TLV Basis: lower respiratory tract irritation
US ACGIH Threshold Limit Values (TLV)	molybdenum(VI) tetrachloride oxide (Molybdenum - Insoluble compounds (as Mo))	3		TLV Basis: lower respiratory tract irritation
US ACGIH Threshold Limit Values (TLV)	molybdenum(VI) tetrachloride oxide (Molybdenum - Insoluble compounds (as Mo))	10		TLV Basis: lower respiratory tract irritation
Canada - Nova Scotia Occupational Exposure Limits	molybdenum(VI) tetrachloride oxide (Molybdenum - Insoluble compounds (as Mo))	10		TLV Basis: lower respiratory tract irritation
Canada - Northwest Territories Occupational Exposure Limits (English)	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) Insoluble compounds)	10	20	
Canada - Prince Edward Island Occupational Exposure Limits	molybdenum(VI) tetrachloride oxide (Molybdenum - Insoluble compounds (as Mo))	10		TLV Basis: lower respiratory tract irritation
Canada - Nova Scotia Occupational Exposure Limits	molybdenum(VI) tetrachloride oxide (Molybdenum - Insoluble compounds (as Mo))	3		TLV Basis: lower respiratory tract irritation
US - Idaho - Limits for Air Contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) Insoluble compounds)	5		
US - California Permissible Exposure Limits for Chemical Contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum, soluble compounds, as Mo)	0.5		(TWA (n))
US - Minnesota Permissible Exposure Limits (PELs)	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) - Soluble compounds)	5		
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) - Soluble compounds)	5		
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) - Soluble compounds)	5		
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) Soluble compounds)	5		
US ACGIH Threshold Limit Values (TLV)	molybdenum(VI) tetrachloride oxide (Molybdenum - Soluble compounds (as Mo))	0.5		TLV Basis: lower respiratory tract irritation
US - Alaska Limits for Air Contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) Soluble compounds)	5		
US - Michigan Exposure Limits for Air Contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum, (as Mo) Soluble compounds)	5		

US - Hawaii Air Contaminant Limits	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) Soluble compounds)	5	10	
US - Washington Permissible exposure limits of air contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) - Soluble compounds)	5	10	
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	molybdenum(VI) tetrachloride oxide (Molybdenum, (as Mo): Soluble compounds, (respirable fraction++))	0.5	1.5	
Canada - Prince Edward Island Occupational Exposure Limits	molybdenum(VI) tetrachloride oxide (Molybdenum - Soluble compounds (as Mo))	0.5		TLV Basis: lower respiratory tract irritation
US OSHA Permissible Exposure Levels (PELs) - Table Z1	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) - Soluble compounds)	5		
Canada - Nova Scotia Occupational Exposure Limits	molybdenum(VI) tetrachloride oxide (Molybdenum - Soluble compounds (as Mo))	0.5		TLV Basis: lower respiratory tract irritation
US - Oregon Permissible Exposure Limits (Z1)	molybdenum(VI) tetrachloride oxide (Molybdenum (soluble compounds))	5		*
Canada - Northwest Territories Occupational Exposure Limits (English)	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo) Soluble compounds)	5	10	
Canada - Alberta Occupational Exposure Limits	molybdenum(VI) tetrachloride oxide (Molybdenum, as Mo - Soluble compounds, respirable)	0.5		
Canada - British Columbia Occupational Exposure Limits	molybdenum(VI) tetrachloride oxide (Molybdenum - Soluble compounds, as Mo, Respirable)	0.5		
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo)- Soluble compounds)	5		
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	molybdenum(VI) tetrachloride oxide (Molybdenum (as Mo): Soluble compounds)	5		

#### EMERGENCY EXPOSURE LIMITS

Material	Revised IDLH Value (mg/m3)	Revised IDLH Value (ppm)
molybdenum(VI) tetrachloride oxide	5,000	

#### MATERIAL DATA

##### MOLYBDENUM(VI) TETRACHLORIDE OXIDE:

■ 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.

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.

#### 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.
  - 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

Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively 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	253.75
Melting Range (°F)	Not available	Viscosity	Not Applicable
Boiling Range (°F)	Not available	Solubility in water (g/L)	Partly miscible
Flash Point (°F)	Not applicable	pH (1% solution)	Not available
Decomposition Temp (°F)	Not available	pH (as supplied)	Not applicable
Autoignition Temp (°F)	Not applicable	Vapour Pressure (mmHG)	Negligible
Upper Explosive Limit (%)	Not Applicable	Specific Gravity (water=1)	Not available
Lower Explosive Limit (%)	Not Applicable	Relative Vapor Density (air=1)	Not Applicable
Volatile Component (%vol)	Negligible	Evaporation Rate	Not applicable

### APPEARANCE

Solid; does not mix well with water.

## Section 10 - CHEMICAL STABILITY

### CONDITIONS CONTRIBUTING TO INSTABILITY

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

### STORAGE INCOMPATIBILITY

■ Metals and their oxides or salts may react violently with chlorine trifluoride. Chlorine trifluoride is a hypergolic oxidizer. It ignites on contact (without external source of heat or ignition) with recognized fuels - contact with these materials, following an ambient or slightly elevated temperature, is often violent and may produce ignition. The state of subdivision may affect the results.

- WARNING: Avoid or control reaction with peroxides. All transition metal peroxides should be considered as potentially explosive. For example transition metal complexes of alkyl hydroperoxides may decompose explosively.
- The pi-complexes formed between chromium(0), vanadium(0) and other transition metals (haloarene-metal complexes) and mono- or poly-fluorobenzene show extreme sensitivity to heat and are explosive.
- Avoid reaction with borohydrides or cyanoborohydrides

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

## Section 11 - TOXICOLOGICAL INFORMATION

molybdenum(VI) tetrachloride oxide

## 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

## Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

### MOLYBDENUM(VI) TETRACHLORIDE OXIDE:

■ Although inorganic chloride ions are not normally considered toxic they can exist in effluents at acutely toxic levels (chloride >3000 mg/l). the resulting salinity can exceed the tolerances of most freshwater organisms.

Inorganic chlorine eventually finds its way into the aqueous compartment and as such is bioavailable. Incidental exposure to inorganic chloride may occur in occupational settings where chemicals management policies are improperly applied. The toxicity of chloride salts depends on the counter-ion (cation) present; that of chloride itself is unknown. Chloride toxicity has not been observed in humans except in the special case of impaired sodium chloride metabolism, e.g. in congestive heart failure. Healthy individuals can tolerate the intake of large quantities of chloride provided that there is a concomitant intake of fresh water.

Although excessive intake of drinking-water containing sodium chloride at concentrations.

above 2.5 g/litre has been reported to produce hypertension, this effect is believed to be related to the sodium ion concentration.

Chloride concentrations in excess of about 250 mg/litre can give rise to detectable taste in water, but the threshold depends upon the associated cations. Consumers can, however, become accustomed to concentrations in excess of 250 mg/litre. No health-based guideline value is proposed for chloride in drinking-water.

In humans, 88% of chloride is extracellular and contributes to the osmotic activity of body fluids. The electrolyte balance in the body is maintained by adjusting total dietary intake and by excretion via the kidneys and gastrointestinal tract. Chloride is almost completely absorbed in normal individuals, mostly from the proximal half of the small intestine. Normal fluid loss amounts to about 1.5?2 liters/day, together with about 4 g of chloride per day. Most (90 - 95%) is excreted in the urine, with minor amounts in faeces (4- %) and sweat (2%).

Chloride increases the electrical conductivity of water and thus increases its corrosivity. In metal pipes, chloride reacts with metal ions to form soluble salts thus increasing levels of metals in drinking-water. In lead pipes, a protective oxide layer is built up, but chloride enhances galvanic corrosion. It can also increase the rate of pitting corrosion of metal pipes.

■ 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.

■ DO NOT discharge into sewer or waterways.

## 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.

For small quantities:

- Dissolve the material (in water or acid solution as appropriate) or convert it to a water soluble state with appropriate oxidizing agent.
- Precipitate as the sulfide, adjusting the pH to neutral to complete the precipitation.
- Filter off sulfide solids for recovery or disposal to approved land-fill.
- Destroy excess sulfide in solution with, for example, sodium hypochlorite, neutralize, and flush to sewer (subject to local regulation).
- Recycle wherever possible or consult manufacturer for recycling options.
- Consult Waste Management Authority for disposal.
- Bury residue in an authorized landfill.
- Recycle containers where possible, or dispose of in an authorized landfill.

## Section 14 - TRANSPORTATION INFORMATION

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: DOT, IATA, IMDG

## Section 15 - REGULATORY INFORMATION

**molybdenum(VI) tetrachloride oxide (CAS: 13814-75-0) is found on the following regulatory lists;**

"Canada - Alberta Occupational Exposure Limits","Canada - British Columbia Occupational Exposure Limits","Canada - Northwest Territories Occupational Exposure Limits (English)","Canada - Nova Scotia Occupational Exposure Limits","Canada - Ontario Occupational Exposure Limits","Canada - Prince Edward Island Occupational Exposure Limits","Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits","Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances","US - Alaska Limits for Air Contaminants","US - California Permissible Exposure Limits for Chemical Contaminants","US - Connecticut Hazardous Air Pollutants","US - Hawaii Air Contaminant Limits","US - Idaho - Limits for Air Contaminants","US - Michigan Exposure Limits for Air Contaminants","US - Minnesota Permissible Exposure Limits (PELs)","US - Oregon Permissible Exposure Limits (Z1)","US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants","US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants","US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants","US - Washington Permissible exposure limits of air contaminants","US ACGIH Threshold Limit Values (TLV)","US OSHA Permissible Exposure Levels (PELs) - Table Z1"

## Section 16 - OTHER INFORMATION

### LIMITED EVIDENCE

- Ingestion may produce health damage\*.

\* (limited evidence).

*Reasonable care has been taken in the preparation of this information, but the author makes no warranty of merchantability or any other warranty, expressed or implied, with respect to this information. The author makes no representations and assumes no liability for any direct, incidental or consequential damages resulting from its use. For additional technical information please call our toxicology department on +800 CHEMCALL.*

- 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.

*This document is copyright. Apart from any fair dealing for the purposes of private study, research, review or criticism, as permitted under the Copyright Act, no part may be reproduced by any process without written permission from CHEMWATCH. TEL (+61 3) 9572 4700.*

Issue Date: Feb-4-2010

Print Date: Apr-22-2010