

Molybdenum(IV) sulfide

sc-286310

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(IV) sulfide

STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

NFPA



SUPPLIER

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EMERGENCY

ChemWatch
Within the US & Canada: 877-715-9305
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(1-800-CHEMCALL) or call +613 9573 3112

SYNONYMS

Mo-S₂, "molybdenum (IV) sulfide", "mopol S", "molybdic sulfide", molybdenite

Section 2 - HAZARDS IDENTIFICATION

CHEMWATCH HAZARD RATINGS

		Min	Max
Flammability:	0		
Toxicity:	2		
Body Contact:	2		
Reactivity:	0		
Chronic:	2		

Min/Nil=0
Low=1
Moderate=2
High=3
Extreme=4



CANADIAN WHMIS SYMBOLS



EMERGENCY OVERVIEW

RISK

Danger of cumulative effects.

Irritating to eyes, respiratory system and skin.

Repeated exposure may cause skin dryness and cracking.

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.

■ If ingested, sulfide salts can form hydrogen sulfide, causing headache, cyanosis, low blood pressure, loss of consciousness, tremors and convulsions.

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.

■ Repeated exposure may cause skin cracking, flaking or drying following normal handling and use.

■ 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.

■ Inhalation of dusts, generated by the material during the course of normal handling, may be damaging to the health of the individual.

■ 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.

■ Effects on lungs are significantly enhanced in the presence of respirable particles.

■ 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.

Prolonged or repeated skin contact may cause drying with cracking, irritation and possible dermatitis following.

Overexposure to respirable dust may cause coughing, wheezing, difficulty in breathing and impaired lung function. Chronic symptoms may include decreased vital lung capacity, chest infections

Repeated exposures, in an occupational setting, to high levels of fine-divided dusts may produce a condition known as pneumoconiosis which is the lodgement of any inhaled dusts in the lung irrespective of the effect. This is particularly true when a significant number of particles less than 0.5 microns (1/50,000 inch), are present. Lung shadows are seen in the X-ray. Symptoms of pneumoconiosis may include a progressive dry cough, shortness of breath on exertion (exertional dyspnea), increased chest expansion, weakness and weight loss. As the disease progresses the cough produces a stringy mucous, vital capacity decreases further and shortness of breath becomes more severe. Other signs or symptoms include altered breath sounds, diminished lung capacity, diminished oxygen uptake during exercise, emphysema and pneumothorax (air in lung cavity) as a rare complication.

Removing workers from possibility of further exposure to dust generally leads to halting the progress of the lung abnormalities. Where worker-exposure potential is high, periodic examinations with emphasis on lung dysfunctions should be undertaken

Dust inhalation over an extended number of years may produce pneumoconiosis. Pneumoconiosis is the accumulation of dusts in the lungs and the tissue reaction in its presence. It is further classified as being of noncollagenous or collagenous types. Noncollagenous pneumoconiosis, the benign form, is identified by minimal stromal reaction, consists mainly of reticulin fibres, an intact alveolar architecture and is potentially reversible.

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.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
molybdenum disulfide	1317-33-5	>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.

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.

SKIN

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

INHALED

· If fumes or combustion products are inhaled remove from contaminated area. · Lay patient down. Keep warm and rested.

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.

Section 5 - FIRE FIGHTING MEASURES

Vapour Pressure (mmHG):	Negligible
Upper Explosive Limit (%):	Not applicable
Specific Gravity (water=1):	4.80 @ 14 deg.C
Lower Explosive Limit (%):	Not applicable

EXTINGUISHING MEDIA

· Water spray or fog.
· Foam.

FIRE FIGHTING

· Alert Emergency Responders and tell them location and nature of hazard.
· Wear breathing apparatus plus protective gloves for fire only.
When any large container (including road and rail tankers) is involved in a fire, consider evacuation by 100 metres in all directions.

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: sulfur oxides (SOx), metal oxides.

FIRE INCOMPATIBILITY

‡ None known.

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FIRE INCOMPATIBILITY

‡ None known.

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.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.

RECOMMENDED STORAGE METHODS

- Polyethylene or polypropylene container.
- Check all containers are clearly labelled and free from leaks.

STORAGE REQUIREMENTS

- ‡ Observe manufacturer's storing and handling recommendations.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m ³	STEL ppm	STEL mg/m ³	Peak ppm	Peak mg/m ³	TWA F/CC	Notes
Canada - Nova Scotia Occupational Exposure Limits	molybdenum disulfide (Particles Insoluble or Poorly Soluble) [NOS] Respirable particles)		3						See Appendix B current TLV/BEI Book
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	molybdenum disulfide (Particulates Not Otherwise Classified (PNOC))		10						
Canada - Nova Scotia Occupational Exposure Limits	molybdenum disulfide (Particles Insoluble or Poorly Soluble) [NOS] Inhalable particles)		10						See Appendix B current TLV/BEI Book
US - Washington Permissible exposure limits of air contaminants	molybdenum disulfide (Particulates not otherwise regulated - Total particulate)		10		20				

US - Washington Permissible exposure limits of air contaminants	molybdenum disulfide (Particulates not otherwise regulated - Respirable fraction)	5	10	
US ACGIH Threshold Limit Values (TLV)	molybdenum disulfide (Particles (Insoluble or Poorly Soluble) [NOS] Respirable particles)	3		See Appendix B current TLV/BEI Book
US ACGIH Threshold Limit Values (TLV)	molybdenum disulfide (Particles (Insoluble or Poorly Soluble) [NOS] Inhalable particles)	10		See Appendix B current TLV/BEI Book
Canada - Alberta Occupational Exposure Limits	molybdenum disulfide (Particulate Not Otherwise Regulated - Respirable)	3		
Canada - Prince Edward Island Occupational Exposure Limits	molybdenum disulfide (Particles (Insoluble or Poorly Soluble) [NOS] Respirable particles)	3		See Appendix B current TLV/BEI Book
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	molybdenum disulfide (Molybdenum (as Mo) - Soluble compounds)	- 5 -	10	
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	molybdenum disulfide (Molybdenum (as Mo) - Total dust)	15		
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	molybdenum disulfide (Molybdenum (as Mo) - Total dust)	10		
US - Idaho - Limits for Air Contaminants	molybdenum disulfide (Molybdenum (as Mo) Soluble compounds)	5 á		
US - Minnesota Permissible Exposure Limits (PELs)	molybdenum disulfide (Molybdenum (as Mo) - Insoluble compounds -	5		

	Respirable fraction)					
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	molybdenum disulfide (Molybdenum (as Mo) Insoluble compounds Total dust)	10				
US - Alaska Limits for Air Contaminants	molybdenum disulfide (Molybdenum (as Mo) Insoluble compounds - Total dust)	10				
US - Hawaii Air Contaminant Limits	molybdenum disulfide (Molybdenum (as Mo) Insoluble compounds - Total dust)	10			20	
US - Michigan Exposure Limits for Air Contaminants	molybdenum disulfide (Molybdenum, (as Mo) Insoluble compounds)	10				
US - Alaska Limits for Air Contaminants	molybdenum disulfide (Molybdenum (as Mo) Insoluble compounds - Respirable fraction)	5				
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	molybdenum disulfide (Molybdenum (as Mo) - Insoluble compounds)	-	10	-	20	
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	molybdenum disulfide (Molybdenum, (as Mo): Metal and insoluble compounds, (respirable fraction++))		3		6	
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	molybdenum disulfide (Molybdenum, (as Mo): Metal and insoluble compounds, (inhalable fraction++))		10		20	
Canada - Northwest Territories Occupational Exposure Limits (English)	molybdenum disulfide (Molybdenum (as Mo) Insoluble compounds)		10		20	

Canada - British Columbia Occupational Exposure Limits	molybdenum disulfide (Molybdenum - Metal and insoluble compounds, Respirable)	3	
Canada - Alberta Occupational Exposure Limits	molybdenum disulfide (Molybdenum, as Mo - Metal and insoluble compounds, total)	10	
US - Minnesota Permissible Exposure Limits (PELs)	molybdenum disulfide (Molybdenum (as Mo) - Insoluble compounds - Total dust)	10	
Canada - British Columbia Occupational Exposure Limits	molybdenum disulfide (Molybdenum - Metal and insoluble compounds, Inhalable)	10	
Canada - Nova Scotia Occupational Exposure Limits	molybdenum disulfide (Molybdenum - Insoluble compounds (as Mo))	3	TLV Basis: lower respiratory tract irritation
Canada - Nova Scotia Occupational Exposure Limits	molybdenum disulfide (Molybdenum - Insoluble compounds (as Mo))	10	TLV Basis: lower respiratory tract irritation
US OSHA Permissible Exposure Levels (PELs) - Table Z1	molybdenum disulfide (Molybdenum (as Mo) - Insoluble compounds; Total dust)	15	
US ACGIH Threshold Limit Values (TLV)	molybdenum disulfide (Molybdenum - Insoluble compounds (as Mo))	3	TLV Basis: lower respiratory tract irritation
US ACGIH Threshold Limit Values (TLV)	molybdenum disulfide (Molybdenum - Insoluble compounds (as Mo))	10	TLV Basis: lower respiratory tract irritation
US - California Permissible Exposure Limits for Chemical Contaminants	molybdenum disulfide (Molybdenum, insoluble compounds, as Mo Respirable fraction)	3	(n)

US - California Permissible Exposure Limits for Chemical Contaminants	molybdenum disulfide (Molybdenum, insoluble compounds, as Mo Total dust)	10	
Canada - Prince Edward Island Occupational Exposure Limits	molybdenum disulfide (Molybdenum - Insoluble compounds (as Mo))	10	TLV Basis: lower respiratory tract irritation
US - Oregon Permissible Exposure Limits (Z-1)	molybdenum disulfide (Molybdenum (insoluble compounds))	10	Bold print identifies substances for which the Oregon Permissible Exposure Limits (PELs) are different than the federal Limits.
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	molybdenum disulfide (Molybdenum (as Mo)- Insoluble Compounds Total dust)	15	
Canada - Prince Edward Island Occupational Exposure Limits	molybdenum disulfide (Molybdenum - Insoluble compounds (as Mo))	3	TLV Basis: lower respiratory tract irritation

ENDOELTABLE

PERSONAL PROTECTION



RESPIRATOR

•Particulate. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

EYE

- Safety glasses with side shields.
- Chemical goggles.

HANDS/FEET

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

- 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, AS/NZS 2161.1 or national equivalent).

- 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, AS/NZS 2161.10.1 or national equivalent) 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, AS/NZS 2161.10.1 or national equivalent) 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.

ENGINEERING CONTROLS

Local exhaust ventilation usually required. If risk of overexposure exists, wear an approved respirator.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Solid.

Does not mix with water.

Sinks in water.

State	Divided solid	Molecular Weight	160.06
Melting Range (°F)	Sublimes @842F	Viscosity	Not Applicable
Boiling Range (°F)	2165	Solubility in water (g/L)	Immiscible
Flash Point (°F)	Not Applicable	pH (1% solution)	Not applicable.
Decomposition Temp (°F)	>752	pH (as supplied)	Not applicable
Autoignition Temp (°F)	Not available	Vapour Pressure (mmHG)	Negligible
Upper Explosive Limit (%)	Not applicable	Specific Gravity (water=1)	4.80 @ 14 deg.C
Lower Explosive Limit (%)	Not applicable	Relative Vapor Density (air=1)	Not applicable
Volatile Component (%vol)	Negligible	Evaporation Rate	Not applicable

APPEARANCE

Crystalline powder; insoluble in water. Insoluble in dilute acid and concentrated sulfuric acid. Soluble in hot sulfuric acid and aqua regia. Decomposes in air. (SAX)

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

- Presence of incompatible materials.
- Product is considered stable.

STORAGE INCOMPATIBILITY

- 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.
 - Metals and their oxides or salts may react violently with chlorine trifluoride and bromine trifluoride.
 - These trifluorides are hypergolic oxidisers. They ignite on contact (without external source of heat or ignition) with recognised 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.
 - 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 hydrogen peroxide, potassium nitrate and stray oxidisers.
Reacts violently with hydrogen peroxide.

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

Section 11 - TOXICOLOGICAL INFORMATION

molybdenum disulfide

TOXICITY AND IRRITATION

MOLYBDENUM DISULFIDE:

■ 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.

Section 12 - ECOLOGICAL INFORMATION

Very toxic to aquatic organisms.

This material and its container must be disposed of as hazardous waste.

Avoid release to the environment.

Refer to special instructions/ safety data sheets.

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 or consult manufacturer for recycling options.
- Consult Waste Management Authority for disposal.

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: No limit

Passenger aircraft/rail:

Quantity Limitations: Cargo No limit Vessel stowage: Location: A
aircraft only:

Vessel stowage: Other: None

Hazardous materials descriptions and proper shipping names:

Environmentally hazardous substance, solid, n.o.s

Air Transport IATA:

UN/ID Number: 3077 Packing Group: III

Special provisions: A97

Cargo Only

Packing Instructions: 956 Maximum Qty/Pack: 400 kg

Passenger and Cargo Passenger and Cargo

Packing Instructions: Y956 Maximum Qty/Pack: 400 kg

Passenger and Cargo Limited Quantity Passenger and Cargo Limited Quantity

Packing Instructions: 956 Maximum Qty/Pack: 30 kg G

Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID,

N.O.S. *(CONTAINS MOLYBDENUM DISULFIDE)

Maritime Transport IMDG:

IMDG Class: 9 IMDG Subrisk: None

UN Number: 3077 Packing Group: III

EMS Number: F-A,S-F Special provisions: 274 335

Limited Quantities: 5 kg Marine Pollutant: Yes

Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.(contains molybdenum disulfide)

Section 15 - REGULATORY INFORMATION

molybdenum disulfide (CAS: 1317-33-5) is found on the following regulatory lists;

"Canada Domestic Substances List (DSL)", "Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS (English)", "US - New Jersey Right to Know Hazardous Substances", "US DOE Temporary Emergency Exposure Limits (TEELs)", "US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory"

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE

■ Inhalation and/or ingestion may produce health damage*.

* (limited evidence).

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■ Classification of the preparation 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.

■ 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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