1 Identification of the substance/mixture and of the company/undertaking

Product identifier
- Product name: Molybdenum(VI) oxide
- Stock number: A11159
- CAS Number: 1313-27-5
- EC number: 215-204-7
- Index number: 042-001-00-9

Relevant identified uses of the substance or mixture and uses advised against.
- Sector of Use: SU24 Scientific research and development

Details of the supplier of the safety data sheet
- Manufacturer/Supplier: Alfa Aesar, A Johnson Matthey Company
  Johnson Matthey Catalog Company, Inc.
  30 Bond Street
  Ward Hill, MA 01835-8099
  Tel: 800-343-0660
  Fax: 800-322-4757
  Email: tech@alfa.com
  www.alfa.com
- Information Department: Health, Safety and Environmental Department
- Emergency telephone number: During normal hours the Health, Safety and Environmental Department at (800) 343-0660. After normal hours call Carechem 24 at (866) 928-0789.

2 Hazards identification

Classification of the substance or mixture
- Classification according to Regulation (EC) No 1272/2008

GHS06 Skull and crossbones
- Acute Tox. 1 H300 Fatal if swallowed.

GHS08 Health hazard
- Carc. 2 H351 Suspected of causing cancer.

GHS07
- Eye Irrit. 2 H319 Causes serious eye irritation.
- STOT SE 3 H335 May cause respiratory irritation.

GHS18 Signal Word: Danger

Classification according to Directive 67/548/EEC or Directive 1999/45/EC

T; Toxic
- R25: Toxic if swallowed.

Xn; Harmful
- R40: Limited evidence of a carcinogenic effect.

Xi; Irritant
- R36/37: Irritating to eyes and respiratory system.

Carc. Cat. 3

Information concerning particular hazards for human and environment: Not applicable

Label elements
- Labelling according to Regulation (EC) No 1272/2008
  The substance is classified and labelled according to the CLP regulation.
Safety Data Sheet
According to OSHA and ANSI

Product name: Molybdenum(VI) oxide

Hazard pictograms

GHS06  GHS08

Signal word Danger

Hazard statements
H300 Fatal if swallowed.
H319 Causes serious eye irritation.
H351 Suspected of causing cancer.
H335 May cause respiratory irritation.

Precautionary statements
P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
P301+P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P321 Specific treatment (see on this label).
P405 Store locked up.
P501 Dispose of contents/container in accordance with local/regional/national/international regulations.

Hazard description:
WHMIS classification
D1A - Very toxic material causing immediate and serious toxic effects
D2B - Toxic material causing other toxic effects

Classification system
HMIS ratings (scale 0-4)
(Hazardous Materials Identification System)

<table>
<thead>
<tr>
<th></th>
<th>HEALTH</th>
<th>FIRE</th>
<th>REACTIVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health (acute effects) = 2</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Flammability = 0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reactivity = 1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other hazards

Results of PBT and vPvB assessment
PBT: Not applicable.
vPvB: Not applicable.

3 Composition/information on ingredients

Chemical characterization: Substances
CAS# Description:
1313-27-5 Molybdenum(VI) oxide
Identification number(s):
EC number: 215-204-7
Index number: 042-001-00-9

4 First aid measures

Description of first aid measures

General information
Immediately remove any clothing soiled by the product.
In case of irregular breathing or respiratory arrest provide artificial respiration.

After inhalation
Supply fresh air. If required, provide artificial respiration. Keep patient warm.
Seek immediate medical advice.

After skin contact
Immediately wash with water and soap and rinse thoroughly.
Seek immediate medical advice.

After eye contact
Rinse opened eye for several minutes under running water. Then consult a doctor.

After swallowing Do not induce vomiting; immediately call for medical help.
5 Firefighting measures

Information for doctor
Most important symptoms and effects, both acute and delayed
No further relevant information available.

Indication of any immediate medical attention and special treatment needed
No further relevant information available.

5 Firefighting measures

Extinguishing media
Suitable extinguishing agents
Product is not flammable. Use fire fighting measures that suit the surrounding fire.

Special hazards arising from the substance or mixture
If this product is involved in a fire, the following can be released:
Metal oxide fume

Advice for firefighters
Protective equipment:
Wear self-contained respirator.
Wear fully protective impervious suit.

6 Accidental release measures

Personal precautions, protective equipment and emergency procedures
Wear protective equipment. Keep unprotected persons away.
Ensure adequate ventilation

Environmental precautions:
Do not allow material to be released to the environment without proper governmental permits.

Methods and material for containment and cleaning up:
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.

Reference to other sections
See Section 7 for information on safe handling
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

7 Handling and storage

Handling
Precautions for safe handling
Keep container tightly sealed.
Store in cool, dry place in tightly closed containers.
Ensure good ventilation at the workplace.
Prevent formation of dust.

Information about protection against explosions and fires: The product is not flammable

Conditions for safe storage, including any incompatibilities

Storage
Requirements to be met by storerooms and receptacles: No special requirements.
Information about storage in one common storage facility: Store away from oxidizing agents.
Further information about storage conditions:
Keep container tightly sealed.
Store in cool, dry conditions in well sealed containers.
Specific end use(s) No further relevant information available.

8 Exposure controls/personal protection

Additional information about design of technical systems:
Properly operating chemical fume hood designed for hazardous chemicals and having an average face velocity of at least 100 feet per minute.

Control parameters

Components with limit values that require monitoring at the workplace:

<table>
<thead>
<tr>
<th>Component</th>
<th>Limit Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1313-27-5 Molybdenum(VI) oxide (100.0%)</td>
<td>3* 10** mg/m³ as Mo; *respirable **inhalable</td>
</tr>
</tbody>
</table>

Additional information: No data

Exposure controls
Personal protective equipment
General protective and hygienic measures
The usual precautionary measures for handling chemicals should be followed.
Keep away from foodstuffs, beverages and feed.
Product name: Molybdenum(VI) oxide

Remove all soiled and contaminated clothing immediately.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes.
Avoid contact with the eyes and skin.
Maintain an ergonomically appropriate working environment.

Breathing equipment: Use suitable respirator when high concentrations are present.

Protection of hands:
Impervious gloves
Check protective gloves prior to each use for their proper condition.
The selection of suitable gloves not only depends on the material, but also on quality.
Quality will vary from manufacturer to manufacturer.

Eye protection: Safety glasses
Body protection: Protective work clothing.

9 Physical and chemical properties

<table>
<thead>
<tr>
<th>General Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Appearance:</strong></td>
</tr>
<tr>
<td><strong>Color:</strong></td>
</tr>
<tr>
<td><strong>Odor:</strong></td>
</tr>
<tr>
<td><strong>Odor threshold:</strong></td>
</tr>
<tr>
<td><strong>pH-value:</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Change in condition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Melting point/Melting range:</strong></td>
</tr>
<tr>
<td><strong>Boiling point/Boiling range:</strong></td>
</tr>
<tr>
<td><strong>Sublimation temperature / start:</strong></td>
</tr>
<tr>
<td><strong>Flammability (solid, gaseous):</strong></td>
</tr>
<tr>
<td><strong>Ignition temperature:</strong></td>
</tr>
<tr>
<td><strong>Decomposition temperature:</strong></td>
</tr>
<tr>
<td><strong>Auto igniting:</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Danger of explosion:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product does not present an explosion hazard</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Explosion limits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lower:</strong></td>
</tr>
<tr>
<td><strong>Upper:</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vapor pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not applicable</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Density at 20°C (68 °F):</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.692 g/cm³ (39.155 lbs/gal)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relative density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not determined</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Vapor density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Evaporation rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not applicable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Partition coefficient (n-octanol/water):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not determined</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Viscosity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>dynamic:</strong></td>
</tr>
<tr>
<td><strong>kinematic:</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other information</th>
</tr>
</thead>
<tbody>
<tr>
<td>No further relevant information available</td>
</tr>
</tbody>
</table>

10 Stability and reactivity

Reactivity

Chemical stability

Thermal decomposition / conditions to be avoided:
Decomposition will not occur if used and stored according to specifications.

Possibility of hazardous reactions No dangerous reactions known

Incompatible materials: Oxidizing agents

Hazardous decomposition products: Metal oxide fume

11 Toxicological information

Information on toxicological effects

Acute toxicity:

<table>
<thead>
<tr>
<th>LD/LC50 values that are relevant for classification:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oral:</strong></td>
</tr>
</tbody>
</table>

Primary irritant effect:

on the skin: May cause irritation
on the eye: Irritating effect.

Sensitization: No sensitizing effects known.

(Contd. on page 5)
Other information (about experimental toxicology): Irritating to respiratory system
Additional toxicological information:
To the best of our knowledge the acute and chronic toxicity of this substance is not fully
known.
No classification data on carcinogenic properties of this material is available from the EPA,
IARC, NTP, OSHA or ACGIH.
The Registry of Toxic Effects of Chemical Substances (RTECS) contains acute and/or other
multiple dose toxicity data for components in this product.
The Registry of Toxic Effects of Chemical Substances (RTECS) contains reproductive and/or
mutation data for components in this product.
The Registry of Toxic Effects of Chemical Substances (RTECS) contains tumorigenic and/or
carcinogenic and/or neoplastic data for components in this product.

12 Ecological information

Toxicity
Aquatic toxicity: No further relevant information available.
Persistence and degradability No further relevant information available.
Behavior in environmental systems:
Bioaccumulative potential No further relevant information available.
Mobility in soil No further relevant information available.
Additional ecological information:
General notes:
Do not allow undiluted product or large quantities of it to reach ground water, water course
or sewage system.
Do not allow material to be released to the environment without proper governmental permits.
Results of PBT and vPvB assessment
PBT: Not applicable.
vPvB: Not applicable.
Other adverse effects No further relevant information available.

13 Disposal considerations

Waste treatment methods
Recommendation Consult state, local or national regulations to ensure proper disposal.
Uncleaned packagings:
Recommendation: Disposal must be made according to official regulations.

14 Transport information

<table>
<thead>
<tr>
<th>UN-Number</th>
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<tbody>
<tr>
<td>DOT, ADR, IMDG, IATA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UN proper shipping name</th>
<th>DOT, IMDG, IATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOXIC SOLID, INORGANIC, N.O.S. (Molybdenum(VI) oxide)</td>
<td>3288 TOXIC SOLID, INORGANIC, N.O.S. (Molybdenum(VI) oxide)</td>
</tr>
</tbody>
</table>

Transport hazard class(es)

<table>
<thead>
<tr>
<th>Class</th>
<th>Label</th>
<th>ADR</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1</td>
<td>Toxic substances.</td>
<td>6.1</td>
</tr>
</tbody>
</table>

Class 6.1 (T5) Toxic substances
15 Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations
All components of this product are listed in the U.S. Environmental Protection Agency Toxic Substances Control Act Chemical substance Inventory.
All components of this product are listed on the Canadian Domestic Substances List (DSL).

Information about limitation of use:
For use only by technically qualified individuals.
This product is subject to the reporting requirements of section 313 of the Emergency Planning and Community Right to Know Act of 1986 and 40CFR372.

Other regulations, limitations and prohibitive regulations
Substances of very high concern (SVHC) according to REACH, Article 57
Substance is not listed.

REACH - Pre-registered substances Substance is listed.

Chemical safety assessment: A Chemical Safety Assessment has not been carried out.

16 Other information

Employers should use this information only as a supplement to other information gathered by them, and should make independent judgement of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

Department issuing MSDS: Health, Safety and Environmental Department.
Contact:
Zachariah C. Holt
Global EHS Manager

Abbreviations and acronyms:
RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)
IATA-DGR: Dangerous Goods Regulations by the "International Air Transport Association" (IATA)
ICAO: International Civil Aviation Organization
ICAO-TI: Technical Instructions by the "International Civil Aviation Organization" (ICAO)
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
HMIS: Hazardous Materials Identification System (USA)
WHMIS: Workplace Hazardous Materials Information System (Canada)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent