1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Vanadium(V) oxide
Product Number : 204854
Brand : Aldrich
Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103 USA
Telephone : +1 800-325-5832
Fax : +1 800-325-5052
Emergency Phone #: (314) 776-6555
Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards
Target Organ Effect, Highly toxic by inhalation, Highly toxic by ingestion, Highly toxic by skin absorption, Irritant, Carcinogen, Teratogen

Target Organs
Lungs

GHS Classification
Acute toxicity, Inhalation (Category 2)
Acute toxicity, Dermal (Category 1)
Acute toxicity, Oral (Category 2)
Eye irritation (Category 2A)
Germ cell mutagenicity (Category 2)
Reproductive toxicity (Category 2)
Specific target organ toxicity - single exposure (Category 3)
Specific target organ toxicity - single exposure (Category 2)
Acute aquatic toxicity (Category 1)
Chronic aquatic toxicity (Category 2)

GHS Label elements, including precautionary statements

Pictogram

Signal word : Danger

Hazard statement(s)
H300 + H310 Fatal if swallowed or in contact with skin
H319 Causes serious eye irritation.
H330 Fatal if inhaled.
H335 May cause respiratory irritation.
H341 Suspected of causing genetic defects.
H361 Suspected of damaging fertility or the unborn child.
H371 May cause damage to organs.
H400 Very toxic to aquatic life.
H411 Toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P260 Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash hands thoroughly after handling.
P273 Avoid release to the environment.
P280 Wear protective gloves/ protective clothing.
P284 Wear respiratory protection.
P302 + P350 IF ON SKIN: Gently wash with plenty of soap and water.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310 Immediately call a POISON CENTER or doctor/ physician.

HMIS Classification
Health hazard: 3
Chronic Health Hazard: *
Flammability: 0
Physical hazards: 0

NFPA Rating
Health hazard: 3
Fire: 0
Reactivity Hazard: 0

Potential Health Effects
Inhalation May be fatal if inhaled. Causes respiratory tract irritation.
Skin May be fatal if absorbed through skin. Causes skin irritation.
Eyes Causes eye irritation.
Ingestion May be fatal if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula: O$_5$V$_2$
Molecular Weight: 181.88 g/mol

<table>
<thead>
<tr>
<th>Component</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanadium pentoxide</td>
<td></td>
</tr>
<tr>
<td>CAS-No.</td>
<td>1314-62-1</td>
</tr>
<tr>
<td>EC-No.</td>
<td>215-239-8</td>
</tr>
<tr>
<td>Index-No.</td>
<td>023-001-00-8</td>
</tr>
</tbody>
</table>

4. FIRST AID MEASURES

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Special protective equipment for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products
Hazardous decomposition products formed under fire conditions. - Vanadium/vanadium oxides

6. ACCIDENTAL RELEASE MEASURES

Personal precautions
Wear respiratory protection. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE

Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. Normal measures for preventive fire protection.

Conditions for safe storage
Keep container tightly closed in a dry and well-ventilated place.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

<table>
<thead>
<tr>
<th>Components</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanadium pentoxide</td>
<td>1314-62-1</td>
<td>TWA</td>
<td>0.05 mg/m³</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td>Remarks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TWA</td>
<td>USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TWA</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irritation Lung Adopted values or notations enclosed are those for which changes are proposed in the NIC See Notice of Intended Changes (NIC) Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>0.1 mg/m³</td>
<td></td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
<td></td>
</tr>
<tr>
<td>Ceiling limit is to be determined from breathing-zone air samples.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.5 mg/m³</td>
<td></td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
<td></td>
</tr>
<tr>
<td>Ceiling limit is to be determined from breathing-zone air samples.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Upper Respiratory Tract irritation Lower Respiratory Tract irritation Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed animal carcinogen with
unknown relevance to humans

<table>
<thead>
<tr>
<th>C</th>
<th>0.05 mg/m³</th>
<th>USA. NIOSH Recommended Exposure Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 minute ceiling value</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Personal protective equipment

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove’s outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance
- Form: solid
- Colour: no data available

Safety data
- pH: no data available
- Melting point/freezing point: Melting point/range: 690 °C (1,274 °F) - lit.
- Boiling point: no data available
- Flash point: not applicable
- Ignition temperature: no data available
- Autoignition temperature: no data available
- Lower explosion limit: no data available
- Upper explosion limit: no data available
- Vapour pressure: no data available
- Density: 3.35 g/mL at 25 °C (77 °F)
- Water solubility: no data available
- Partition coefficient: n-octanol/water: no data available
Relative vapour density | no data available
Odour | no data available
Odour Threshold | no data available
Evaporation rate | no data available

10. STABILITY AND REACTIVITY

Chemical stability
Stable under recommended storage conditions.

Possibility of hazardous reactions
no data available

Conditions to avoid
no data available

Materials to avoid
Strong acids

Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Vanadium/vanadium oxides
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50
LD50 Oral - rat - 10 mg/kg
Remarks: Behavioral: Coma.

Inhalation LC50
LC50 Inhalation - rat - 6 h - 126 mg/m3

Dermal LD50
LD50 Dermal - rabbit - 50 mg/kg
Remarks: Liver: Other changes. Kidney, Ureter, Bladder: Other changes.

Other information on acute toxicity
no data available

Skin corrosion/irritation
no data available

Serious eye damage/eye irritation
Eyes - rabbit - Moderate eye irritation - 24 h

Respiratory or skin sensitization
no data available

Germ cell mutagenicity
Laboratory experiments have shown mutagenic effects.
In vitro tests showed mutagenic effects

Carcinogenicity

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Vanadium pentoxide)

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

**Reproductive toxicity**

no data available

**Teratogenicity**

Possible risk of congenital malformation in the fetus.

Suspected human reproductive toxicant

**Specific target organ toxicity - single exposure (Globally Harmonized System)**

May cause respiratory irritation.

**Specific target organ toxicity - repeated exposure (Globally Harmonized System)**

Causes damage to organs through prolonged or repeated exposure.

**Aspiration hazard**

no data available

**Potential health effects**

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalation</td>
<td>May be fatal if inhaled. Causes respiratory tract irritation.</td>
</tr>
<tr>
<td>Ingestion</td>
<td>May be fatal if swallowed.</td>
</tr>
<tr>
<td>Skin</td>
<td>May be fatal if absorbed through skin. Causes skin irritation.</td>
</tr>
<tr>
<td>Eyes</td>
<td>Causes eye irritation.</td>
</tr>
</tbody>
</table>

**Signs and Symptoms of Exposure**

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

**Synergistic effects**

no data available

**Additional Information**

RTECS: Not available

### 12. ECOLOGICAL INFORMATION

**Toxicity**

<table>
<thead>
<tr>
<th>Toxicity</th>
<th>LC50 / EC50 / NOEC / 48 h</th>
</tr>
</thead>
<tbody>
<tr>
<td>To fish</td>
<td>Oncorhynchus mykiss</td>
</tr>
<tr>
<td></td>
<td>- 5.2 mg/l - 96.0 h</td>
</tr>
<tr>
<td>To daphnia and</td>
<td>Daphnia magna</td>
</tr>
<tr>
<td>other aquatic</td>
<td>- 0.94 mg/l - 48 h</td>
</tr>
<tr>
<td>invertebrates</td>
<td></td>
</tr>
</tbody>
</table>

**Persistence and degradability**

no data available

**Bioaccumulative potential**

no data available

**Mobility in soil**

no data available

**PBT and vPvB assessment**

no data available

**Other adverse effects**

Very toxic to aquatic life.

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

### 13. DISPOSAL CONSIDERATIONS
Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 2862  Class: 6.1  Packing group: III
Proper shipping name: Vanadium pentoxide
Reportable Quantity (RQ): 1000 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG
UN number: 2862  Class: 6.1  Packing group: III
Proper shipping name: VANADIUM PENTOXIDE
EMS-No: F-A, S-A
Marine pollutant: No

IATA
UN number: 2862  Class: 6.1  Packing group: III
Proper shipping name: Vanadium pentoxide

15. REGULATORY INFORMATION

OSHA Hazards
Target Organ Effect, Highly toxic by inhalation, Highly toxic by ingestion, Highly toxic by skin absorption, Irritant, Carcinogen, Teratogen

SARA 302 Components
Vanadium pentoxide  CAS-No. 1314-62-1  Revision Date 2007-07-01

SARA 313 Components
Vanadium pentoxide  CAS-No. 1314-62-1  Revision Date 2007-07-01

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components
Vanadium pentoxide  CAS-No. 1314-62-1  Revision Date 2007-07-01

Pennsylvania Right To Know Components
Vanadium pentoxide  CAS-No. 1314-62-1  Revision Date 2007-07-01

New Jersey Right To Know Components
Vanadium pentoxide  CAS-No. 1314-62-1  Revision Date 2007-07-01

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Further information