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

1.1 Product identifiers

Product name: Vanadium(V) oxide
Product Number: 221899
Brand: Aldrich
Index-No.: 023-001-00-8
CAS-No.: 1314-62-1

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company: Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES
Telephone: +1 314 771-5765
Fax: +1 800 325-5052

1.4 Emergency telephone

Emergency Phone #: 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 3), H301
Acute toxicity, Inhalation (Category 2), H330
Germ cell mutagenicity (Category 2), H341
Carcinogenicity (Category 1B), H350
Reproductive toxicity (Category 2), H361
Effects on or via lactation, H362
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Specific target organ toxicity - repeated exposure, Inhalation (Category 1), Respiratory Tract, H372
Long-term (chronic) aquatic hazard (Category 2), H411

Aldrich - 221899

The life science business of Merck KGaA, Darmstadt, Germany operates as MilliporeSigma in the US and Canada
For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal Word: Danger

Hazard statement(s)
- H301: Toxic if swallowed.
- H330: Fatal if inhaled.
- H335: May cause respiratory irritation.
- H341: Suspected of causing genetic defects.
- H350: May cause cancer.
- H361: Suspected of damaging fertility or the unborn child.
- H362: May cause harm to breast-fed children.
- H372: Causes damage to organs (Respiratory Tract) through prolonged or repeated exposure if inhaled.
- H411: Toxic to aquatic life with long lasting effects.

Precautionary statement(s)
- P201: Obtain special instructions before use.
- P202: Do not handle until all safety precautions have been read and understood.
- P260: Do not breathe dust.
- P262: Avoid contact during pregnancy/while nursing.
- P263: Wash skin thoroughly after handling.
- P270: Do not eat, drink or smoke when using this product.
- P271: Use only outdoors or in a well-ventilated area.
- P273: Avoid release to the environment.
- P280: Wear protective gloves/protective clothing/eye protection/face protection.
- P284: Wear respiratory protection.
- P304 + P340 + P310: IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/doctor.
- P308 + P313: IF exposed or concerned: Get medical advice/attention.
- P391: Collect spillage.
- P403 + P233: Store in a well-ventilated place. Keep container tightly closed.
- P405: Store locked up.
- P501: Dispose of contents/container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

<table>
<thead>
<tr>
<th>Formula</th>
<th>( \text{O}_5\text{V}_2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular weight</td>
<td>181.88 g/mol</td>
</tr>
<tr>
<td>CAS-No.</td>
<td>1314-62-1</td>
</tr>
</tbody>
</table>
EC-No. : 215-239-8
Index-No. : 023-001-00-8

<table>
<thead>
<tr>
<th>Component</th>
<th>Classification</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>vanadium pentoxide</td>
<td>Acute Tox. 3; Acute Tox. 2; Muta. 2; Carc. 1B;</td>
<td>&lt;= 100 %</td>
</tr>
<tr>
<td></td>
<td>Repr. 2; Lact. ; STOT SE 3; STOT RE 1; Aquatic Chronic 2; H301, H330,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H341, H350, H361, H362, H335, H372, H411</td>
<td></td>
</tr>
</tbody>
</table>

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
First aiders need to protect themselves. Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Immediately call in physician. If breathing stops: immediately apply artificial respiration, if necessary also oxygen.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
If swallowed: give water to drink (two glasses at most). Seek medical advice immediately. In exceptional cases only, if medical care is not available within one hour, induce vomiting (only in persons who are wide awake and fully conscious), administer activated charcoal (20 - 40 g in a 10% slurry) and consult a doctor as quickly as possible.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available
SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Vanadium/vanadium oxides
Not combustible.
Ambient fire may liberate hazardous vapours.

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Advice for non-emergency personnel: Avoid generation and inhalation of dusts in all circumstances. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert. For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling
Advice on safe handling
Work under hood. Do not inhale substance/mixture.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance. For precautions see section 2.2.
7.2 **Conditions for safe storage, including any incompatibilities**

**Storage conditions**
Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

**Storage class**
Storage class (TRGS 510): 6.1A: Combustible, acute toxic Cat. 1 and 2 / very toxic hazardous materials

7.3 **Specific end use(s)**
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

### SECTION 8: Exposure controls/personal protection

8.1 **Control parameters**

<table>
<thead>
<tr>
<th>Component</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>Confirmed animal carcinogen with unknown relevance to humans</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>0.1 mg/m³</td>
<td></td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>0.5 mg/m³</td>
<td></td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td>PEL</td>
<td></td>
<td>0.05 mg/m³</td>
<td></td>
<td>California permissible exposure limits for chemical contaminants (Title 8, Article 107)</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>0.05 mg/m³</td>
<td></td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>0.05 mg/m³</td>
<td></td>
<td>USA. NIOSH Recommended Exposure Limits</td>
</tr>
<tr>
<td>TWA</td>
<td></td>
<td>0.05 mg/m³</td>
<td></td>
<td>USA. Table Z-1-A Limits for Air Contaminants (1989 vacated values)</td>
</tr>
<tr>
<td>TWA</td>
<td></td>
<td>0.05 mg/m³</td>
<td></td>
<td>USA. Table Z-1-A Limits for Air Contaminants (1989 vacated values)</td>
</tr>
</tbody>
</table>

8.2 **Exposure controls**

**Appropriate engineering controls**
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
**Personal protective equipment**

**Eye/face protection**
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

**Skin protection**
This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: KCL 741 Dermatril® L

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: KCL 741 Dermatril® L

**Body Protection**
protective clothing

**Respiratory protection**
Recommended Filter type: Filter type P3
The entrepreneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

**Control of environmental exposure**
Do not let product enter drains.

---

**SECTION 9: Physical and chemical properties**

**9.1 Information on basic physical and chemical properties**

<table>
<thead>
<tr>
<th>a)</th>
<th>Appearance</th>
<th>Form: solid</th>
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</thead>
<tbody>
<tr>
<td>b)</td>
<td>Odor</td>
<td>No data available</td>
</tr>
<tr>
<td>c)</td>
<td>Odor Threshold</td>
<td>No data available</td>
</tr>
<tr>
<td>d)</td>
<td>pH</td>
<td>No data available</td>
</tr>
</tbody>
</table>
e) Melting point/freezing point
Melting point/range: 690 °C (1274 °F) - lit.

f) Initial boiling point and boiling range
ca.1,750 °C ca.3,182 °F - (decomposition)

g) Flash point
() Not applicable

h) Evaporation rate
No data available

i) Flammability (solid, gas)
No data available

j) Upper/lower flammability or explosive limits
No data available

k) Vapor pressure
No data available

l) Vapor density
No data available

m) Density
3.35 g/cm3 at 25 °C (77 °F) - lit.
Relative density 3.6521.7 °C - OECD Test Guideline 109

n) Water solubility
515 g/l at 20 °C (68 °F) - OECD Test Guideline 105 - soluble

o) Partition coefficient: n-octanol/water
Not applicable for inorganic substances

p) Autoignition temperature
No data available

q) Decomposition temperature
No data available

r) Viscosity
No data available

s) Explosive properties
No data available

t) Oxidizing properties
none

9.2 Other safety information
Solubility in other solvents
Ethanol - insoluble

SECTION 10: Stability and reactivity

10.1 Reactivity
No data available

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature).

10.3 Possibility of hazardous reactions
Exothermic reaction with:
Alkali metals
halogen-halogen compounds
Acids
Risk of explosion with:

Aldrich - 221899
performic acid
Risk of ignition or formation of inflammable gases or vapours with:
- Alkaline earth metals
- Highly flammable solvents
- Oxidisable substances
- Sulfur
  (in the presence of atmospheric oxygen and/or moisture)

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
No data available

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
Acute toxicity estimate Oral - 220 mg/kg
(Acute toxicity estimate according to Regulation (EC) No. 1272/2008)
Remarks: Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)
Inhalation: Irritating to respiratory system.
Acute toxicity estimate Inhalation - 0.05 mg/l - dust/mist
(Acute toxicity estimate according to Regulation (EC) No. 1272/2008)
Remarks: Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)
LC50 Dermal - Rat - male and female - > 2,500 mg/kg
(OECD Test Guideline 402)

Skin corrosion/irritation
Skin - in vitro test
Result: No skin irritation - 15 min
Remarks: (ECHA)

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
Maximization Test - Guinea pig
Result: negative
(OECD Test Guideline 406)

Germ cell mutagenicity
Suspected of causing genetic defects.

Test Type: Micronucleus test
Species: Mouse
Cell type: Red blood cells (erythrocytes)
Application Route: Inhalation
Method: OECD Test Guideline 474
Result: negative

Test Type: Transgenic rodent somatic cell gene mutation assay
Species: Mouse

Application Route: Inhalation
Method: OECD Test Guideline 488
Result: negative

Test Type: comet assay
Species: Mouse

Application Route: Inhalation

Result: negative
Remarks: (ECHA)

Carcinogenicity
Presumed to have carcinogenic potential for humans
IARC: 2B - Group 2B: Possibly carcinogenic to humans (vanadium pentoxide)
NTP: No ingredient 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 on OSHA’s list of regulated carcinogens.

Reproductive toxicity
Suspected of damaging the unborn child.
Suspected of damaging fertility.
Studies indicating a hazard to babies during the lactation period

Specific target organ toxicity - single exposure
Inhalation - May cause respiratory irritation. - Respiratory Tract
Remarks: Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)

Specific target organ toxicity - repeated exposure
Inhalation - Causes damage to organs through prolonged or repeated exposure.
- Respiratory Tract
Remarks: Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)

Aspiration hazard
No data available

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

Vanadium and its compounds generally cause irritations after eye and skin contact and mucosal irritations, coughing, and dyspnoea after inhalation. After absorption of toxic quantities changes in the blood picture, loss of weight, cardiovascular complaints.

Other dangerous properties can not be excluded.

This substance should be handled with particular care.
SECTION 12: Ecological information

12.1 Toxicity
Toxicity to fish (Chronic toxicity)  
Growth inhibition NOEC - Pimephales promelas (fathead minnow) - 0.24 mg/l - 28 d  
Remarks: (ECOTOX Database)

12.2 Persistence and degradability
The methods for determining biodegradability are not applicable to inorganic substances.

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods
Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

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

IMDG
Aldrich - 221899
SECTION 15: Regulatory information

### SARA 302 Components

<table>
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<th>Proper shipping name</th>
<th>CAS-No.</th>
<th>Revision Date</th>
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<td>1314-62-1</td>
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### SARA 313 Components

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<td>1314-62-1</td>
<td>1989-08-11</td>
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The following components are subject to reporting levels established by SARA Title III, Section 313:

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<tbody>
<tr>
<td>vanadium pentoxide</td>
<td>1314-62-1</td>
<td>1989-08-11</td>
</tr>
</tbody>
</table>

### SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

#### Massachusetts Right To Know Components

<table>
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<tr>
<th>Proper shipping name</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>vanadium pentoxide</td>
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</table>

#### Pennsylvania Right To Know Components

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<th>Revision Date</th>
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<tbody>
<tr>
<td>vanadium pentoxide</td>
<td>1314-62-1</td>
<td>1989-08-11</td>
</tr>
</tbody>
</table>

#### California Prop. 65 Components

, which is/are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.vanadium pentoxide

<table>
<thead>
<tr>
<th>Proper shipping name</th>
<th>CAS-No.</th>
<th>Revision Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>vanadium pentoxide</td>
<td>1314-62-1</td>
<td>2007-09-28</td>
</tr>
</tbody>
</table>

SECTION 16: Other information

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of
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Version: 6.11 Revision Date: 08/27/2023 Print Date: 09/27/2023