

1. PRODUCT AND COMPANY IDENTIFICATION

| | |
|---|---|
| Product Name | Vanadium(V) oxide, Enriched Vanadium |
| Chemical Formula | V ₂ O ₅ |
| Molecular Weight | 181.88 g/mol |
| CAS No. | 1314-62-1 |
| EC SNo. | 215-239-8 |
| Supplier Address* | ISOFLEX USA PO Box 472615 San Francisco CA 94147 United States |
| Telephone | +1 415-440-4433 |
| Fax | +1 415-563-4433 |
| Emergency Phone Number (both supplier and manufacturer) | Infotrac/ +1 800-535-5053 *May include subsidiaries or affiliate companies/divisions |
| Email | iusa@isoflex.com |
| Website | www.isoflex.com |
| Preparation Information | ISOFLEX USA Product Safety +1 415-440-4433 |

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

Harmful. Flammable (USA) Highly Flammable (EU)

Limited evidence of a carcinogenic effect. May cause sensitization by skin contact.

Possible Carcinogen (US). Target organ(s): Lungs. Nose. Calif. Prop. 65 carcinogen.

NFPA Ratings: (0 = Minimal; 1 = Slight; 2 = Moderate; 3 = Serious; 4 = Severe)

Health Hazard = 3 Flammability = 0 Reactivity = 0



HMIS Ratings: (0 = Minimal; 1 = Slight; 2 = Moderate; 3 = Serious; 4 = Severe)

Health Hazard = 3 Flammability = 0 Physical Hazard = 0

| | |
|------------------------|----------|
| HEALTH HAZARD | 3 |
| FLAMMABILITY | 0 |
| PHYSICAL HAZARD | 0 |

Potential Health Effects

| | |
|-------------------|---|
| <i>Inhalation</i> | May be fatal if inhaled; causes respiratory tract irritation |
| <i>Skin</i> | Causes skin irritation; may be fatal if absorbed through skin |
| <i>Eyes</i> | Causes eye irritation |
| <i>Ingestion</i> | May be fatal if swallowed |

3. COMPOSITION / INFORMATION ON INGREDIENTS

| | |
|-------------------|-------------------------------|
| Chemical Name: | Vanadium(V) oxide |
| CAS No.: | 1314-62-1 |
| Chemical Formula: | V ₂ O ₅ |
| Molecular Weight: | 181.88 g/mol |

4. FIRST AID MEASURES

| | |
|----------------------------|---|
| <i>General Advice</i> | Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area. |
| <i>Inhalation Exposure</i> | If breathed in, move person into fresh air. If not breathing give artificial respiration Consult a physician. |
| <i>Dermal Exposure</i> | Wash off with soap and plenty of water. Consult a physician. |
| <i>Eye Exposure</i> | Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. |
| <i>Oral Exposure</i> | 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.

Firefighting

Protective Equipment Wear self-contained breathing apparatus for firefighting if necessary.

6. ACCIDENTAL RELEASE MEASURES

| | |
|----------------------------------|---|
| <i>Personal Precautions</i> | Use personal protective equipment. Avoid dust formation. Avoid breathing dust. Ensure adequate ventilation. Evacuate personnel to safe areas. |
| <i>Environmental Precautions</i> | Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided. |
| <i>Methods for Cleaning Up</i> | Pick up and arrange disposal without creating dust. Keep in suitable, closed containers for disposal. |

7. HANDLING AND STORAGE

Handling

Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. Normal measures for preventive fire protection.

Storage

Keep container tightly closed in a dry and well-ventilated place.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

| Components | CAS-No. | Value | Control Parameters | Update | Basis |
|--|--|-------|------------------------|------------|---|
| Vanadium pentoxide | 1314-62-1 | TWA | 0.05 mg/m ³ | 2007-01-01 | USA - ACGIH Threshold Limit Values (TLV) |
| Remarks | 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: Agents which cause concern that they could be carcinogenic for humans but which cannot be assessed conclusively because of a lack of data. In vitro or animal studies do not provide indications of carcinogenicity which are sufficient to classify the agent into one of the other categories. | | | | |
| | | TWA | 0.05 mg/m ³ | 1989-01-19 | USA - OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000 |
| | | TWA | 0.05 mg/m ³ | 2008-01-01 | USA - ACGIH Threshold Limit Values (TLV) |
| | 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: Agents which cause concern that they could be carcinogenic for humans but which cannot be assessed conclusively because of a lack of data. In vitro or animal studies do not provide indications of carcinogenicity which are sufficient to classify the agent into one of the other categories. | | | | |
| | | C | 0.1 mg/m ³ | 2007-01-01 | USA - Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants |
| Ceiling limit is to be determined from breathing-zone air samples. | | | | | |

Personal Protective Equipment

| | |
|---------------------------------|---|
| <i>Respiratory Protection</i> | 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). |
| <i>Hand Protection</i> | Handle with gloves |
| <i>Eye Protection</i> | Face shield and safety glasses |
| <i>Skin and Body Protection</i> | Choose body protection according to the amount and concentration of the dangerous substance at the work place. |
| <i>Hygiene Measures</i> | Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product. |

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

| | |
|----------------|-------|
| Physical State | Solid |
|----------------|-------|

Safety Data

| | | | |
|------------------------|-------------------|------------------------|----------------------------|
| pH: | No data available | Density: | 3.35 g/mL at 25 °C (77 °F) |
| Melting Point: | 690 °C (1274 °F) | Boiling Point: | No data available |
| Flash Point: | Not applicable | Ignition Temperature: | No data available |
| Lower Explosion Limit: | No data available | Upper Explosion Limit: | No data available |
| Water Solubility: | No data available | | |

10. STABILITY AND REACTIVITY

| | |
|---|---|
| <i>Stability</i> | Stable under recommended storage conditions |
| <i>Conditions to Avoid</i> | No data available |
| <i>Materials to Avoid</i> | Strong acids |
| <i>Hazardous Decomposition Products</i> | Hazardous decomposition products formed under fire conditions; vanadium/vanadium oxides |

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

| | |
|--|--|
| <i>LD50 Oral (Rat)</i> | 10 mg/kg Remarks: Behavioral: Coma. |
| <i>LC50 Inhalation (Rat)</i> | 6 h - 126 mg/m ³ Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste): Eye: Other. Behavioral: Ataxia. Lungs, Thorax, or Respiration: Dyspnea. |
| <i>LD50 Dermal (Rabbit)</i> | 50 mg/kg Remarks: Liver: Other changes. Kidney, Ureter, Bladder: Other changes. |
| <i>Skin Corrosion/Irritation</i> | Serious eye damage/eye irritation: Eyes - Rabbit - Moderate eye irritation - 24 h |
| <i>Respiratory or Skin Sensitization</i> | No data available |
| <i>Germ Cell Mutagenicity</i> | Laboratory experiments have shown mutagenic effects. In vitro tests showed mutagenic effects. |

Carcinogenicity

| | |
|--|--|
| <i>IARC</i> | 2B - Group 2B: Possibly carcinogenic to humans (Vanadium pentoxide) |
| <i>ACGIH</i> | 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. |
| <i>NTP</i> | 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. |
| <i>OSHA</i> | 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. |
| <i>Reproductive Toxicity</i> | Possible risk of congenital malformation in the fetus. Suspected human reproductive toxicant |
| <i>Specific Target Organ Toxicity / Single Exposure (Globally Harmonized System)</i> | May cause damage to organs; may cause respiratory irritation |
| <i>Specific Target Organ Toxicity / Repeated Exposure (Globally Harmonized System)</i> | No data available |
| <i>Aspiration Hazard</i> | No data available |
| <i>Signs and Symptoms of Exposure</i> | To the best of our knowledge, the chemical, physical and toxicological properties have not been thoroughly investigated. |

12. ECOLOGICAL INFORMATION

Toxicity

| | |
|--|---|
| <i>Toxicity to Fish</i> | LC50 - <i>Oncorhynchus mykiss</i> (rainbow trout) - 5.2 mg/l - 96.0 h |
| <i>Toxicity to Daphnia and Other Aquatic Invertebrates</i> | EC50 - <i>Daphnia magna</i> (Water flea) - 0.94 mg/l - 48 h |
| <i>Persistence and Degradability</i> | No data available |
| <i>Bioaccumulative Potential</i> | No data available |
| <i>Mobility in Soil</i> | No data available |
| <i>PBT and vPvB Assessment</i> | No data available |
| <i>Other Adverse Effects</i> | An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Toxic to aquatic organisms; may cause long-term adverse effects in the aquatic environment. |

13. DISPOSAL CONSIDERATIONS

| | |
|-------------------------------|---|
| <i>Product</i> | Observe all federal, state and local environmental regulations. 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. |
| <i>Contaminated Packaging</i> | Dispose of as unused product. |

14. TRANSPORT INFORMATION**DOT**

| | |
|---------------------------------|--------------------|
| <i>Proper Shipping Name</i> | Vanadium pentoxide |
| <i>UN No.</i> | 2862 |
| <i>Class</i> | 6.1 |
| <i>Packing Group</i> | III |
| <i>Reportable Quantity (RQ)</i> | 1000 lbs |
| <i>Marine Pollutant</i> | No |
| <i>Poison Inhalation Hazard</i> | No |

IMDG

| | |
|-----------------------------|--------------------|
| <i>Proper Shipping Name</i> | Vanadium pentoxide |
| <i>UN No.</i> | 2862 |
| <i>Class</i> | 6.1 |
| <i>Packing Group</i> | III |
| <i>EMS No.</i> | F-A, S-A |
| <i>Marine Pollutant</i> | No |

IATA

| | |
|-----------------------------|--------------------|
| <i>Proper Shipping Name</i> | Vanadium pentoxide |
| <i>UN No.</i> | 2862 |
| <i>Class</i> | 6.1 |
| <i>Packing Group</i> | III |

15. REGULATORY INFORMATION

| | |
|---|--|
| OSHA Hazards | Target Organ Effect, Highly toxic by inhalation, Highly toxic by ingestion, Highly toxic by skin absorption, Irritant, Carcinogen, Teratogen |
| DSL Status | All components of this product are on the Canadian DSL list. |
| 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 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 the State of California to cause cancer, birth defects, or any other reproductive harm. |

16. OTHER INFORMATION

| | |
|------------------------|---|
| <i>Prepared By</i> | ISOFLEX USA PO Box 472615 San Francisco CA 94147 United States |
| <i>Issuing Date</i> | January 12, 2014 |
| <i>Revision Date</i> | October 19, 2024 |
| <i>Revision Number</i> | 4 |
| <i>Revision Note</i> | Update supplier address |

ISOFLEX USA's Commonly Used Abbreviations and Acronyms*

| | |
|--------|---|
| ACGIH | American Conference of Governmental Industrial Hygienists |
| ADR | European Agreement Concerning the International Carriage of Dangerous Goods by Road |
| ALARA | As Low As Is Reasonably Achievable |
| AMU | Atomic Mass Unit |
| ANSI | American National Standards Institute |
| BLS | Basic Life Support |
| CAM | Continuous Air Monitor |
| CAS | Chemical Abstracts Service (division of the American Chemical Society) |
| CEN | European Committee for Standardization |
| CERCLA | Comprehensive Environmental Response Compensation and Liability Act |
| CLP | Classification, Labelling and Packaging (European Union) |
| CPR | Controlled Products Regulations (Canada) |
| CWA | Clean Water Act (USA) |
| DAC | Derived Air Concentration (USA) |
| DOE | United States Department of Energy (USA) |
| DOT | United States Department of Transportation (USA) |
| DSL | Domestic Substances List (Canada) |
| EC50 | Half Maximal Effective Concentration |
| EINECS | European Inventory of Existing Commercial Chemical Substances |
| EHS | Environmentally Hazardous Substance |
| ELINCS | European List of Notified Chemical Substances |
| EMS | Emergency Response Procedures for Ships Carrying Dangerous Goods |
| EPA | Environmental Protection Agency (USA) |
| EPCRA | Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 |
| GHS | Globally Harmonized System |
| HMIS | Hazardous Materials Identification System (USA) |
| IARC | International Agency for Research on Cancer |
| IATA | International Air Transport Association |
| IBC | Intermediate Bulk Containers |
| ICAO | International Civil Aviation Organization |
| IDLH | Immediately Dangerous to Life or Health |
| IMDG | International Maritime Code for Dangerous Goods |
| LC50 | Lethal concentration, 50 percent |
| LD50 | Lethal dose, 50 percent |
| LDLO | Lethal Dose Low |
| LOEC | Lowest-Observed-Effective Concentration |
| MARPOL | International Convention for the Prevention of Pollution from Ships |
| MSHA | Mine Safety and Health Administration (USA) |
| NCRP | National Council on Radiation Protection & Measurements (USA) |
| NDSL | Non-Domestic Substances List (Canada) |
| NFPA | National Fire Protection Association (USA) |

| | |
|--------|---|
| NIOSH | National Institute for Occupational Safety and Health (USA) |
| NOEC | No Observed Effect Concentration |
| N.O.S. | Not Otherwise Specified |
| NRC | Nuclear Regulatory Commission (USA) |
| NTP | National Toxicology Program (USA) |
| OSHA | Occupational Safety and Health Administration (USA) |
| PBT | Persistent Bioaccumulative and Toxic Chemical |
| PEL | Permissible Exposure Limit |
| PIH | Poisonous by Inhalation Hazard |
| RCRA | Resource Conservation and Recovery Act (USA) |
| RCT | Radiation Control Technician |
| REACH | Registration, Evaluation, Authorisation and Restriction of Chemicals (Europe) |
| RID | Regulations Concerning the International Transport of Dangerous Goods by Rail |
| RTECS | Registry of Toxic Effects of Chemical Substances |
| SARA | Superfund Amendments and Reauthorization Act (USA) |
| TDG | Transportation of Dangerous Goods (Canada) |
| TIH | Toxic by Inhalation Hazard |
| TLV | Threshold Limit Value |
| TPQ | Threshold Planning Quantity |
| TSCA | Toxic Substances Control Act |
| TWA | Time Weighted Average |
| UN | United Nations (Number) |
| VOC | Volatile Organic Compound |
| vPvB | Very Persistent Very Bioaccumulative Chemical |
| WGK | Wassergefährdungsklassen (Germany: Water Hazard Classes) |
| WHMIS | Workplace Hazardous Materials Information System |

*One or more of the above-listed items may not appear in this document.

General Disclaimer

For terms and conditions, including limitation of liability, please refer to the purchase agreement in effect between ISOFLEX USA (or any of its affiliates and subsidiaries) and the purchaser.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

The above information is believed to be correct but does not purport to be all-inclusive and shall be used only as a guide. ISOFLEX shall not be held liable for any damage resulting from handling or from contact with the above product.