1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: Vanadium Oxide Nanowires, Research Grade
Catalog Number: NovaWire-VO-40
Formula: \( \text{V}_2\text{O}_5 \)
Diameter: ~ 40 nm
Length: > 100 \( \mu \)m

Supplier: Novarials Corporation
800 W Cummings Park, Suite 4600
Woburn, MA 01801
Telephone: +1 617-276-5642
Fax: +1 781-995-0388

2. HAZARDS IDENTIFICATION

Emergency Overview

**GHS Classification**
Acute toxicity, Oral (Category 2), H300
Acute toxicity, Inhalation (Category 2), H330
Serious eye damage (Category 1), H318
Germ cell mutagenicity (Category 2), H341
Reproductive toxicity (Category 2), H361
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Specific target organ toxicity - repeated exposure (Category 1), H372
Acute aquatic toxicity (Category 2), H401
Chronic aquatic toxicity (Category 2), H411

**GHS Label elements, including precautionary statements**

<table>
<thead>
<tr>
<th>Pictogram</th>
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<tr>
<th>Signal word</th>
<th>Danger</th>
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<table>
<thead>
<tr>
<th>Hazard statement(s)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>H300 + H330</td>
<td>Fatal if swallowed or if inhaled</td>
</tr>
<tr>
<td>H318</td>
<td>Causes serious eye damage.</td>
</tr>
<tr>
<td>H335</td>
<td>May cause respiratory irritation.</td>
</tr>
</tbody>
</table>
H341 Suspected of causing genetic defects.
H361 Suspected of damaging fertility or the unborn child.
H372 Causes damage to organs through prolonged or repeated exposure.
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/fume/gas/mist/vapors/spray.
P264 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/eye protection/face protection.
P284 Wear respiratory protection.
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P304 + P340 IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
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.
P320 Specific treatment is urgent (see supplemental first aid instructions on this label).
P330 Rinse mouth.
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.

NFPA Ratings
Health Hazard: 3
Fire Hazard: 0
Reactivity Hazard: 0

HMIS Ratings
Health Hazard: 4
Chronic Health Hazard: *
Flammability: 0
Physical Hazard: 0

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms: Divanadium pentoxide
Formula: \( V_2O_5 \)
Molecular Weight: 181.88 g/mol
### Component Data

<table>
<thead>
<tr>
<th>Component</th>
<th>Concentration</th>
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<tbody>
<tr>
<td>Divanadium pentaoxide</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>
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<tr>
<td>Water</td>
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<tr>
<td>CAS-No.</td>
<td>7732-18-5</td>
</tr>
<tr>
<td>EC-No.</td>
<td>231-791-2</td>
</tr>
</tbody>
</table>

### 4. FIRST AID MEASURES

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

**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. Consult a physician.

**In case of eye contact**
Rinse thoroughly with plenty of water and consult a physician.

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

**Most important symptoms and effects, both acute and delayed**
The most important known symptoms and effects are described in the labeling (see section 2).

**Indication of any immediate medical attention and special treatment needed**
No data available

### 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 firefighting 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. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs. Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.

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

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

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/Face 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).

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.

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

9. PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>APPEARANCE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Form</td>
<td>suspension</td>
</tr>
<tr>
<td>Color</td>
<td>orange</td>
</tr>
</tbody>
</table>
Safety data
- pH: no data available
- Melting point/freezing point: no data available
- Boiling point: no data available
- Flash point: no data available
- Ignition temperature: no data available
- Auto ignition temperature: no data available
- Lower explosion limit: no data available
- Upper explosion limit: no data available
- Vapour pressure: no data available
- Density: no data available
- Water solubility: no data available
- Partition coefficient: 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

Reactivity
no data available

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
LC50 Dermal - rat - > 2,500 mg/kg
(OECD Test Guideline 402)
Skin corrosion/irritation
no data available

Serious eye damage/eye irritation
Eyes - rabbit
Result: Risk of serious damage to eyes.
(OECD Test Guideline 405)

Respiratory or skin sensitization
no data available

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

Carcinogenicity
no data available

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Vanadium pentoxide).
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
Possible risk of congenital malformation in the fetus.
Suspected human reproductive toxicant
no data available

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

Additional Information
RTECS: Not available

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

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

Toxicity
Toxicity to fish
LC50 - Oncorhynchus mykiss (rainbow trout) - 5.2 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates

**LC50 - Daphnia magna (Water flea) - 1.52 mg/l - 48 h**

**Persistence and degradability**
no data available

**Bioaccumulative potential**
no data available

**Mobility in soil**
no data available

**PBT and vPvB assessment**
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted.

**Other adverse effects**
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Toxic to aquatic life with long lasting effects

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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.

**Contaminated packaging**
Dispose of as unused product.

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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  
EMS-No: F-A, S-A  
Proper shipping name: Vanadium pentoxide  
Marine pollutant: No

**IATA**

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

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15. **REGULATORY INFORMATION**

**SARA 302 Components**
The following components are subject to reporting levels established by SARA Title III, Section 302:
Vanadium pentoxide  
CAS-No.1314-62-1

**SARA 313 Components**
The following components are subject to reporting levels established by SARA Title III, Section 313:

**Vanadium pentoxide**  
CAS-No.1314-62-1

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

**Massachusetts Right To Know Components**
Vanadium pentoxide  
CAS-No.1314-62-1

**Pennsylvania Right To Know Components**
Vanadium pentoxide  
CAS-No.1314-62-1
Water  
CAS-No. 7732-18-5

**New Jersey Right To Know Components**
Vanadium pentoxide  
CAS-No.1314-62-1
Water  
CAS-No. 7732-18-5

**California Prop. 65 Components**
WARNING! This product contains a chemical known to the State of California to cause cancer.  
Vanadium pentoxide  
CAS-No.1314-62-1

16. DISCLAIMER

Novarials Corporation believes that the information in this Safety Data Sheet is accurate and represents the best and most current information available to us. Novarials Corporation makes no representations or warranties either express or implied, regarding the suitability of the materials for any purpose or the accuracy if the information contained within this document. Accordingly, Novarials Corporation and its affiliates shall not be held liable for any damage resulting from shipping, handling, storage, use of the above product.