MATERIAL SAFETY DATA SHEET

Chemical Product

Product Name: Vanadium pentoxide AR

CAS#: 1314-62-1

Synonym: Divanandium pentoxide; Vanadic anhydride; Vanadium Pentaoxide

Chemical Name: Vanadium Pentoxide

Chemical Formula: V2O5

Composition and Information on Ingredients

Name	S.K.U	% by Weight
Vanadium pentoxide AR	GCS-9084	100

Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of ingestion, of inhalation. Hazardous in case of skin contact (irritant), of eye contact (irritant). Slightly hazardous in case of skin contact (permeator). Severe over-exposure can result in death.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to gastrointestinal tract, upper respiratory tract, skin. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

First Aid Measures

Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

Skin Contact: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti- bacterial cream. Seek immediate medical attention.

Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion: If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Not applicable.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances: Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not applicable.

Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Poisonous solid. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Handling and Storage

Precautions:

Do not ingest. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and

eyes.

Storage:

Keep container tightly closed. Keep container in a cool, well-ventilated area.

Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self-contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 0.05 (mg/m3) from ACGIH (TLV) [United States] Respirable. TWA: 0.1 (mg/m3) from OSHA (PEL) [United States] Respirable. CEIL: 0.05 (mg/m3) from NIOSH [United States] Respirable. TWA: 0.05 (mg/m3) [United Kingdom (UK)] Respirable.Consult local authorities for acceptable exposure limits.

Physical and Chemical Properties

Physical state and appearance:	Solid. (Powdered solid.)
Odor:	Odorless.
Taste:	Not available.
Molecular Weight:	181.9 g/mole
Color:	Yellow-Orange.
pH (1% soln/water):	Not available.
Boiling Point:	1750°C (3182°F)
Melting Point:	690°C (1274°F)
Critical Temperature:	Not available.
Specific Gravity:	3.357 (Water = 1)
Vapor Pressure:	Not applicable.
Vapor Density:	Not available.
Volatility:	Not available.
Odor Threshold:	Not available.
Water/Oil Dist. Coeff.:	Not available.
Ionicity (in Water):	Not available.

Dispersion Properties: See solubility in water, acetone.
Solubility: Soluble in acetone. Partially soluble in cold water. Solubility in water: 1 g/125 ml. Soluble in concentrated acids, alkalies. Insoluble in alcohol.

Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, dust generation Incompatibility with various substances: Reactive with oxidizing agents. Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Incompatible with lithium, chlorine trifluoride, peroxyformic acid.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation. Ingestion.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR
EXPOSURE. Acute oral toxicity (LD50): 5 mg/kg [Mouse]. Acute dermal toxicity (LD50): 50 mg/kg [Rabbit]. Acute toxicity of the dust (LC50): 126 mg/m 6 hours [Rat]. 3

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. May cause damage to the following organs: gastrointestinal tract, upper respiratory tract, skin.

Other Toxic Effects on Humans:

Very hazardous in case of ingestion, of inhalation. Hazardous in case of skin contact (irritant). Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects and birth defects (teratogenic). May affect genetic material (mutagenic).

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: It causes skin irritation. It may be absorbed through the skin. Eyes: It causes eye irritation. It is irritating to the eyes at airborn concentrations greater than 0.5 mg/m3 Inhalation: It causes respiratory tract irritation. The major target for Vanadium Pentoxide toxicity is the respiratory tract. It is an irritant of the eyes, nose, throat, and respiratory tract at 0.1 mg/m3 or greater. Bronchitis, nasal discharge, sore throat, shortness of breath or dyspnea, rales, chest pain, and productive cough(phlegm) can occur following acute exposure, with effects sometimes being delayed by several days

and lasting up to 2 weeks. HIgher exposures can produce bronchopneumonia, and pulmonary edema. Vanadium pentoxide can be absorbed through the lungs. Acute inhalation may also cause liver damage and kidney damage, and affect behavior/central nervous system (ataxia). A green tongue may occur with high-level acute exposure ot Vanadium compounds. Larger acute exposure by inhalation can produce effects on the nervous system, including paralysis, respiratory depression, and convulsions, but these generally occur only in fatal exposures. Vanadium Pentoxide is a powerful vasoconstrictor and can cause renal hypertension. Ingestion: It is not anticipated to be a significant route of overexposure since it is poorly absorbed from the digestive tract. Ingestion of Vanadium Pentoxide can produce gastrointestinal disturbances such as abdominal cramps, nausea, vomiting, and diarrhea. It may also affect behavior/central and cause dizziness, headache, drowsiness,
and unconsciousness. Chronic Potential Health Effects: Repeated exposures by inhalation are associated with respiratory effects similar to those of acute exposure, except that the intensity increases with further exposures and lower doses. Chronic bronchitis, green tongue, conjunctivitis, pharyngitis, rhinitis, rales, chronic productive cough, shortness of breath, wheezing, tightness of the chest,and dermatitis have been reported. Onset of respiratory effects can be followed by systemic effects, including pallor, loss of appetite, anemia, nausea, headache, insomnia, nervousness, hypertension, dizziness, kidney damage, liver damage (fatty liver degeneration), tremor, psychological problems(hysteria, and depression), blindess. Chronic exposure is frequently associated with asthma, but it is not clear if it is the causitive agent.

Toxicological Data on Ingredients:

Vanadium pentoxide: ORAL (LD50): Acute: 10 mg/kg [Rat]. 5 mg/kg [Mouse]. DERMAL (LD50): Acute: 50 mg/kg [Rabbit]. DUST (LC50): Acute: 126 mg/m 6 hours [Rat].

Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Transformation Information

Land transport (ADR-RID)

Proper shipping name: VANADIUM PENTOXIDE, non-fused form
UN N°: 2862
H.I. nr: 60
ADR - Class: 6.1

Sea transport (IMDG) [English only]

Proper shipping name: VANADIUM PENTOXIDE, non-fused form
UN N°: 2862
IMO-IMDG - Class or division: 6.1: Toxic substances.
IMO-IMDG - Packing group: III

Air transport (ICAO-IATA) [English only]

Proper shipping name: VANADIUM PENTOXIDE, non-fused form
UN N°: 2862
IATA - Class or division: 6.1: Toxic substances.
IATA - Packing group: III

Other Regulatory Information

Federal and State Regulations:

Connecticut hazardous material survey.: Vanadium pentoxide Illinois toxic substances disclosure to employee act: Vanadium pentoxide Illinois chemical safety act: Vanadium pentoxide New York release reporting list: Vanadium pentoxide Rhode Island RTK hazardous substances: Vanadium pentoxide Pennsylvania RTK: Vanadium pentoxide Minnesota: Vanadium pentoxide Massachusetts RTK: Vanadium pentoxide Massachusetts spill list: Vanadium pentoxide New Jersey: Vanadium pentoxide New Jersey spill list: Vanadium pentoxide Louisiana RTK reporting list: Vanadium pentoxide Louisiana spill reporting: Vanadium pentoxide TSCA 8(b) inventory: Vanadium pentoxide SARA 302/304/311/312 extremely hazardous substances: Vanadium pentoxide SARA 313 toxic chemical notification and release reporting: Vanadium pentoxide CERCLA: Hazardous Substances: Vanadium pentoxide: 1000 lbs. (453.6 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC).

DSCL (EEC):

R26/27/28- Very toxic by inhalation, in contact with skin and if swallowed. R36/38- Irritating to eyes and skin. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S28- After contact with skin, wash immediately with plenty of water. S37/39- Wear suitable gloves and eye/face Protection. S45- In case of

accident or if you feel unwell, seek medical advice immediately (show the label where possible). S46- If swallowed, seek medical advice immediately and show this container or label.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.): Health: 1

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Additional Information

References: Not available.

Other Special Considerations: Not available.

Disclaimer:

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