

## Safety Data Sheet

### 1. Identification

#### 1.1. Product identifier

**Product Identity** VRB Electrolyte Solution  
**Alternate Names** VRB Electrolyte Solution

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

**Intended use** See Technical Data Sheet.  
**Application Method** See Technical Data Sheet.

#### 1.3. Details of the supplier of the safety data sheet

**Company Name:** U.S. Vanadium, LLC  
4285 Malvern Road  
Hot Springs, Arkansas 71901; U.S.A  
(Company Identification)  
**Telephone:** +1-501-262-1270  
**Fax:** +1-501-262-2793  
**Website:**

#### Emergency

**24 hour Emergency Telephone No.** NATIONAL RESPONSE CENTER: +1-800-424-8802  
CHEMTREC U.S. and CANADA: +1-800-424-9300  
CHEMTREC International: +1-202-483-7616 (Collect)

### 2. Hazard(s) identification

#### 2.1. Classification of the substance or mixture

Met. Corr. 1;H290	May be corrosive to metals.
Acute Tox. 4;H302	Harmful if swallowed.
Skin Irrit. 2;H315	Causes skin irritation.
Eye Dam. 1;H318	Causes serious eye damage.
Repr. 2;H361	Suspected of damaging fertility or the unborn child.

#### 2.2. Label elements

Using the Toxicity Data listed in section 11 and 12 the product is labeled as follows.



**Signal Word: Danger**

#### Hazard Statements:

H290 May be corrosive to metals.  
H302 Harmful if swallowed.  
H315 Causes skin irritation.  
H318 Causes serious eye damage.  
H361 Suspected of damaging fertility or the unborn child.

#### [Prevention]:

P201 Obtain special instructions before use.  
P202 Do not handle until all safety precautions have been read and understood.  
P234 Keep only in original container.  
P264 Wash thoroughly after handling.

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P270 Do not eat, drink or smoke when using this product.  
 P280 Wear protective gloves / eye protection / face protection.

**[Response]:**

P301+312 IF SWALLOWED: Call a POISON CENTER or doctor / physician if you feel unwell.  
 P302+352 IF ON SKIN: Wash with plenty of soap and water.  
 P305+351+338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do - continue rinsing.  
 P308+313 IF exposed or concerned: Get medical advice / attention.  
 P310 Immediately call a POISON CENTER or doctor / physician.  
 P321 Specific treatment (see information on this label).  
 P330 Rinse mouth.  
 P332+313 If skin irritation occurs: Get medical advice / attention.  
 P362 Take off contaminated clothing and wash before reuse.

**[Storage]:**

P405 Store locked up.  
 P406 Store in a corrosive resistant / container with a resistant inner liner.

**[Disposal]:**

P501 Dispose of contents / container in accordance with local / national regulations.

### 3. Composition/information on ingredients

This product contains the following substances that present a hazard within the meaning of the relevant State and Federal Hazardous Substances regulations.

Ingredient/Chemical Designations	Weight %	GHS Classification	Notes
Vanadyl sulfate CAS Number: 27774-13-6	< 15%	Met. Corr. 1;H290 Acute Tox. 4;H302 Skin Irrit. 2;H315 Eye Irrit. 2;H319 Repr. 2 (Oral);H361 Aquatic Chronic 3;H412	[1]
Vanadium trisulfate. CAS Number: 13701-70-7	< 15%	Met. Corr. 1;H290 Acute Tox. 4;H302 Skin Irrit. 2;H315 Eye Irrit. 2;H319 Repr. 2 (Oral);H361 Aquatic Chronic 3;H412	[1]
Sulfuric acid CAS Number: 7664-93-9	< 20%	Skin Corr. 1A;H314 (> 15%)	[1][2]

In accordance with paragraph (i) of §1910.1200, the specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret.

[1] Substance classified with a health or environmental hazard.

[2] Substance with a workplace exposure limit.

[3] PBT-substance or vPvB-substance.

\*The full texts of the phrases are shown in Section 16.

### 4. First aid measures

**4.1. Description of first aid measures**

<b>General</b>	In all cases of doubt, or when symptoms persist, seek medical attention. Never give anything by mouth to an unconscious person.
<b>Inhalation</b>	Remove to fresh air, keep patient warm and at rest. If breathing is irregular or stopped, give artificial respiration. If unconscious place in the recovery position and obtain immediate medical attention. Give nothing by mouth.
<b>Eyes</b>	Causes serious eye damage. Irrigate copiously with clean water for at least 15 minutes, holding the eyelids apart. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.
<b>Skin</b>	Remove contaminated clothing. Wash skin thoroughly with soap and water or use a recognized skin cleanser.
<b>Ingestion</b>	Do NOT induce vomiting. Rinse mouth and slowly drink several glasses of water. Call a physician. Do NOT give anything by mouth to an unconscious or convulsing person.

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### 4.2. Most important symptoms and effects, both acute and delayed

<b>Overview</b>	Eye Contact Redness, swelling, pain, and flood of tears. Possible chemical burns and corneal damage. Skin Contact Irritation with burning, reddening, and itching. Dermatitis. Inhalation Breathing difficulty, irritation of mucous membranes, coughing, acute reaction to vanadium salts and sulfuric-acid mists. Ingestion Chemical and irritation of the intestinal tract. Abdominal discomfort, vomiting, diarrhea, and spasms. See section 2 for further details.
<b>Eyes</b>	Causes serious eye damage.
<b>Skin</b>	Causes skin irritation.
<b>Ingestion</b>	Harmful if swallowed.

## 5. Fire-fighting measures

### 5.1. Extinguishing media

Use media suitable to the surrounding fire, such as water fog, dry chemical, foam, and carbon dioxide.

### 5.2. Special hazards arising from the substance or mixture

Wear appropriate chemically-protective equipment, such as gloves, a faceshield, goggles, and suitable body protection (see Section 8). Level B gear recommended for large releases.

Hazardous decomposition: If heated or involved in a fire, toxic and irritating fumes of sulfur oxides and vanadium oxides may be formed.

Prevent spilled product from entering drains, sewers, waterways, and soil.

Keep only in original container.

### 5.3. Advice for fire-fighters

Wear proper chemically resistant protective equipment and self-contained breathing apparatus (SCBA) operated in positive-pressure mode.

This product may release flammable hydrogen gas on contact with many common metals, which may significantly contribute to the risk of fire and explosion. Fire may result in toxic and irritating fumes.

Move container from fire area if it can be done without risk. Use water spray to keep fire exposed containers cool. Keep run-off water out of sewers and water sources.

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## 6. Accidental release measures

### 6.1. Personal precautions, protective equipment and emergency procedures

Put on appropriate personal protective equipment (see section 8).

Wear appropriate chemically-protective equipment, such as gloves, a face shield, goggles, and suitable body protection (see Section 8). Level B gear recommended for large releases.

### 6.2. Environmental precautions

Prevent spilled product from entering drains, sewers, waterways, and soil.

Do not allow spills to enter drains or waterways.

Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet. Promptly remove soiled clothing and wash thoroughly before reuse.

### 6.3. Methods and material for containment and cleaning up

Wear appropriate chemically-protective equipment, such as gloves, a face shield, goggles, and suitable body protection (see Section 8). Level B gear recommended for large releases.

Ventilate area of release. Stop leak if possible without risk. Do not touch spilled material. Dike far ahead of spill with inert diking materials. For small spills, neutralize with soda ash, absorb spill with inert, non-combustible material such as clay then place in suitable containers. For large spills, contain spill with inert, noncombustible absorbent material such as clay or earth. Remove spilled liquid with pumps into suitable containers, or absorb with dry clay and shovel into polyethylene or plastic containers. Steel or aluminum containers may react with the product and dissolve. Wash thoroughly after dealing with a spillage

## 7. Handling and storage

### 7.1. Precautions for safe handling

Always wear chemically-protective equipment during hand-ling. Use in a well-ventilated area. Do not inhale vapors or mists. Do not allow contact with eyes, skin and clothing. Process and handling equipment must be resistant to dilute acidic solutions. Keep away from metals, bases and other incompatible materials. Wash thoroughly after handling material.

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See section 2 for further details. - [Prevention]:

### 7.2. Conditions for safe storage, including any incompatibilities

Handle containers carefully to prevent damage and spillage.

Store in closed, suitable containers located in a cool, dry, well-ventilated area. Store away from incompatibles.

Incompatible materials: Acids react with most metals to release hydrogen gas which can form explosive mixtures in air. Water, alkaline solutions, metals, metal powder, carbides, chlorates, fuminates, nitrates, picrates, strong oxidizers, reducers, or combustible organics. Hazardous gases may evolve on contact with chemicals such as cyanides, sulfides, and carbides.

See section 2 for further details. - [Storage]:

### 7.3. Specific end use(s)

No data available.

## 8. Exposure controls and personal protection

### 8.1. Control parameters

#### Exposure

CAS No.	Ingredient	Source	Value
7664-93-9	Sulfuric acid	OSHA	TWA 1 mg/m3
		ACGIH	TWA: 0.2 mg/m3 A1, 1, Revised 2004,
		NIOSH	TWA 1 mg/m3
		Supplier	No Established Limit
27774-13-6	Vanadyl Sulfate	OSHA	No Established Limit
		ACGIH	No Established Limit
		NIOSH	0.05 mg/m3 15-min ceiling for vanadium compounds 0.05 mg/m3 for V2O5 TLV TWA
		Supplier	No Established Limit
13701-70-7	Vanadium trisulfate	OSHA	No Established Limit
		ACGIH	No Established Limit
		NIOSH	0.05 mg/m3 15-min ceiling for vanadium compounds 0.05 mg/m3 for V2O5 TLV TWA
		Supplier	No Established Limit

#### Carcinogen Data

CAS No.	Ingredient	Source	Value
7664-93-9	Sulfuric acid	OSHA	Select Carcinogen: No
		NTP	Known: Yes; Suspected: No
		IARC	Group 1: Yes; Group 2a: No; Group 2b: No; Group 3: No; Group 4: No;
27774-13-6	Vanadyl sulfate	OSHA	Select Carcinogen: No
		NTP	Known: No; Suspected: No
		IARC	Group 1: No; Group 2a: No; Group 2b: No; Group 3: No; Group 4: No;
13701-70-7	Vanadium trisulfate.	OSHA	Select Carcinogen: No
		NTP	Known: No; Suspected: No
		IARC	Group 1: No; Group 2a: No; Group 2b: No; Group 3: No; Group 4: No;

### 8.2. Exposure controls

#### Respiratory

Use respirators approved by NIOSH/MSHA; use SAR for oxygen-deficient atmosphere.

#### Eyes

Use chemical-splash goggles and a full face shield or mask.

#### Skin

Wear chemically-protective clothing. Use chemically-protective gloves.

#### Engineering Controls

Provide adequate ventilation. Where reasonably practicable this should be achieved by the use of local exhaust ventilation and good general extraction. If these are not sufficient to maintain concentrations of particulates and any vapor below occupational exposure limits suitable respiratory protection must be worn.

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**Other Work Practices** Do not inhale vapors or mists. Do not allow contact with eyes, skin and clothing. Do not eat, drink, smoke or use cosmetics while working with this product. Thoroughly wash at the end of each work shift. Immediately remove any clothing that becomes contaminated and launder before re-use. Contaminated shoes should be destroyed. Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet. Promptly remove soiled clothing and wash thoroughly before reuse.

See section 2 for further details. - [Prevention]:

### 9. Physical and chemical properties

<b>Appearance</b>	Dark Blue to Blue-GreenLiquid
<b>Odor</b>	None
<b>Odor threshold</b>	Not determined
<b>pH</b>	Less than 1.
<b>Melting point / freezing point</b>	Not applicable.
<b>Initial boiling point and boiling range</b>	120°C. (248°F).
<b>Flash Point</b>	None.
<b>Evaporation rate (Ether = 1)</b>	Not applicable
<b>Flammability (solid, gas)</b>	Not Applicable
<b>Upper/lower flammability or explosive limits</b>	<b>Lower Explosive Limit:</b> Not applicable <b>Upper Explosive Limit:</b> Not applicable
<b>Vapor pressure (Pa)</b>	Not applicable
<b>Vapor Density</b>	Not applicable
<b>Specific Gravity</b>	1.3 – 1.4 gm/cc
<b>Solubility in Water</b>	Miscible with water at all concentrations.
<b>Partition coefficient n-octanol/water (Log Kow)</b>	Not Measured
<b>Auto-ignition temperature</b>	Not applicable
<b>Decomposition temperature</b>	Not applicable
<b>Viscosity (cSt)</b>	Not Measured
<b>Oxidizing Properties</b>	May act as a catalyst in certain chemical environments.

#### 9.2. Other information

No other relevant information.

### 10. Stability and reactivity

#### 10.1. Reactivity

This product may release flammable hydrogen gas on contact with many common metals. Generates heat when mixed with alkali.

#### 10.2. Chemical stability

Stable under normal circumstances.

#### 10.3. Possibility of hazardous reactions

Reacts with some bases.

#### 10.4. Conditions to avoid

Keep away from extreme heat and extreme cold.

#### 10.5. Incompatible materials

Acids react with most metals to release hydrogen gas which can form explosive mixtures in air. Water, alkaline solutions, metals, metal powder, carbides, chlorates, fuminates, nitrates, picrates, strong oxidizers, reducers, or combustible organics. Hazardous gases may evolve on contact with chemicals such as cyanides, sulfides, and carbides.

#### 10.6. Hazardous decomposition products

If heated or involved in a fire, toxic and irritating fumes of sulfur oxides and vanadium oxides may be formed.

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### 11. Toxicological information

**Acute toxicity**

Ingredient	Oral LD50, mg/kg	Skin LD50, mg/kg	Inhalation Vapor LC50, mg/L/4hr	Inhalation Dust/Mist LC50, mg/L/4hr	Inhalation Gas LC50, ppm
Vanadyl sulfate. - (27774-13-6)	No data available	No data available	No data available	No data available	No data available
Vanadium trisulfate (13701-70-7)	No data available	No data available	No Data available	No Data available	No Data available
Sulfuric acid - (7664-93-9)	2,140.00, Rat - Category: 5	No data available	No data available	No data available	No data available

Note: When no route specific LD50 data is available for an acute toxin, the converted acute toxicity point estimate was used in the calculation of the product's ATE (Acute Toxicity Estimate).

Classification	Category	Hazard Description
Acute toxicity (oral)	4	Harmful if swallowed.
Acute toxicity (dermal)	---	Not Applicable
Acute toxicity (inhalation)	---	Not Applicable
Skin corrosion/irritation	2	Causes skin irritation.
Serious eye damage/irritation	1	Causes serious eye damage.
Respiratory sensitization	---	Not Applicable
Skin sensitization	---	Not Applicable
Germ cell mutagenicity	---	Not Applicable
Carcinogenicity	---	Not Applicable
Reproductive toxicity	2	Suspected of damaging fertility or the unborn child.
STOT-single exposure	---	Not Applicable
STOT-repeated exposure	---	Not Applicable
Aspiration hazard	---	Not Applicable

### 12. Ecological information

**12.1. Toxicity**

Components of this product can be harmful or fatal to aquatic organisms. The ecotoxic effects of the product itself have not been fully investigated. This material will lower the pH of any environment.

**Aquatic Ecotoxicity**

Ingredient	96 hr LC50 fish, mg/l	48 hr EC50 crustacea, mg/l	ErC50 algae, mg/l
Vanadyl sulfate. - (27774-13-6)	Not Available	Not Available	Not Available
Vanadium trisulfate – (13701-70-7)	Not Available	Not Available	Not Available
Sulfuric acid - (7664-93-9)	42.00, Gambusia affinis	42.50, Pandalus montagui	Not Available

**12.2. Persistence and degradability**

The components of this product will react with other substances or be degraded over time into other inorganic compounds.

**12.3. Bioaccumulative potential**

Not Measured

**12.4. Mobility in soil**

No data available.

**12.5. Results of PBT and vPvB assessment**

This product contains no PBT/vPvB chemicals.

**12.6. Other adverse effects**

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No data available.

### 13. Disposal considerations

#### 13.1. Waste treatment methods

This product must be disposed of as a hazardous waste based on its harmful and irritating properties. Disposal should be made in compliance with Federal, state, and local environmental regulations.

Empty containers must be disposed of as a hazardous waste based on its harmful and irritating properties. Disposal should be made in compliance with Federal, state, and local regulations.

### 14. Transport information

	DOT (Domestic Surface Transportation)	IMO / IMDG (Ocean Transportation)	ICAO/IATA
<b>14.1. UN number</b>	UN3264	UN3264	UN3264
<b>14.2. UN proper shipping name</b>	UN3264, Corrosive liquid, acidic, inorganic, n.o.s., (Contains sulfuric acid, vanadyl sulfate, Vanadium trisulfate (8) II	Corrosive liquid, acidic, inorganic, n.o.s., (Contains sulfuric acid, vanadyl sulfate, Vanadium trisulfate)	Corrosive liquid, acidic, inorganic, n.o.s., (Contains sulfuric acid, vanadyl sulfate, Vanadium trisulfate)
<b>14.3. Transport hazard class(es)</b>	<b>DOT Hazard Class:</b> 8	<b>IMDG:</b> 8	<b>Air Class:</b> 8
<b>14.4. Packing group</b>	II	II	II
<b>14.5. Environmental hazards</b>			
<b>IMDG</b>	Marine Pollutant: yes		
<b>14.6. Special precautions for user</b>			
	No further information		

### 15. Regulatory information

**Regulatory Overview** The regulatory data in Section 15 is not intended to be all-inclusive, only selected regulations are represented.

**Toxic Substance Control Act (TSCA)** All components of this material are either listed or exempt from listing on the TSCA Inventory.

**WHMIS Classification** D2A E

**US EPA Tier II Hazards**

**Fire:** No

**Sudden Release of Pressure:** No

**Reactive:** Yes

**Immediate (Acute):** Yes

**Delayed (Chronic):** No

**Note:** Strong inorganic acid mists containing sulfuric acid are listed on the California Proposition 65 Carcinogen List. [Sulfuric acid, in and of itself, is not listed under Proposition 65. However, if one has sulfuric acid, which through its intended use generates an acid mist that in turn contains sulfuric acid that would meet the listing. The term "strong" does not refer to the concentration of the acid, but rather the strength of the acid. The basis for the listing of strong inorganic acid mists containing sulfuric acid was the formal identification by the National Toxicology Program (NTP), in its Ninth Report on Carcinogens, that this chemical mixture is "known to be a human carcinogen." (Public notice available at [http://www.oehha.ca.gov/prop65/CRNR\\_notices/admin\\_listing/intent\\_to\\_list/noil19b4.html](http://www.oehha.ca.gov/prop65/CRNR_notices/admin_listing/intent_to_list/noil19b4.html).)]

#### EPCRA 311/312 Chemicals and RQs (lbs):

Sulfuric acid (1,000.00)

Vanadyl sulfate (1,000.00)

Vanadium trisulfate (1,000.00)

#### EPCRA 302 Extremely Hazardous:

Sulfuric acid

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**EPCRA 313 Toxic Chemicals:**

Sulfuric acid  
Vanadyl sulfate  
Vanadium trisulfate

**Proposition 65 - Carcinogens (>0.0%):**

To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

**Proposition 65 - Developmental Toxins (>0.0%):**

To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

**Proposition 65 - Female Repro Toxins (>0.0%):**

To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

**Proposition 65 - Male Repro Toxins (>0.0%):**

To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

**New Jersey RTK Substances (>1%):**

Sulfuric acid  
Vanadyl sulfate  
Vanadium trisulfate

**Pennsylvania RTK Substances (>1%):**

Sulfuric acid  
Vanadyl sulfate  
Vanadium trisulfate

### 16. Other information

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein. We accept no responsibility and disclaim all liability for any harmful effects which may be caused by exposure to our products. Customers/users of this product must comply with all applicable health and safety laws, regulations, and orders.

The full text of the phrases appearing in section 3 is:

H290 May be corrosive to metals.

H302 Harmful if swallowed.

H314 Causes severe skin burns and eye damage.

H315 Causes skin irritation.

H319 Causes serious eye irritation.

H361 Suspected of damaging fertility or the unborn child.

H412 Harmful to aquatic life with long lasting effects.

U.S. Vanadium, LLC believes that the data on this sheet are correct as of the effective date and that the opinions given reflect those of qualified experts. Since U.S. Vanadium, LLC cannot control the product or its use, it is the user's responsibility to use the product safely. The data on this sheet apply only to products sold by corporate subsidiaries of U.S. Vanadium, LLC and may not apply to products sold by others.

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