

DOCKETED

Docket Number:	03-AFC-02C
Project Title:	Los Esteros Phase II Compliance
TN #:	227801
Document Title:	Record of Conversation between Project Owner and Staff
Description:	Record of Conversation regarding clarification on proposed vanadium flow battery chemistry
Filer:	Jonathan Fong
Organization:	California Energy Commission
Submitter Role:	Commission Staff
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Siting, Transmission
 and Environmental
 Protection Division

FILE:

PROJECT TITLE: Los Esteros Critical Energy Facility
 Docket: 03-AFC-02C

TECHNICAL AREA(S): Hazardous Materials Management

Email Meeting Location:

NAME: Brett Fooks DATE: 3/13/19, 3/25/19 TIME: Various

WITH: Barbara McBride, Calpine

SUBJECT: Clarification on Proposed Vanadium Flow Battery Chemistry

COMMENTS:

The petitioner alerted staff that the chemistry of the proposed vanadium flow battery could be changing. In response, staff asked the following clarifying questions via email:

- Are the properties of the electrolytes for the vanadium flow batteries changing chemicals or just concentrations? And when do you hope to have the new electrolyte information?

Please see attached Safety Data Sheet (SDS) for the Titanium Manganese electrolyte.

- Please confirm that both the lithium-ion and vanadium flow battery energy storage systems will be UL 9540 rated.

The current cell stacks of the flow battery have UL1973 certification which includes UL9540 certification. For the new cell stacks of our flow battery, we will also get the UL1973 certification upon completion of the development. All other component/parts used in the system besides the cell stacks will be UL certified products.

- Per Data Request A21 response for the vanadium flow battery – “If a fire alarm is required, it will be placed in the battery cell container as identified in the drawing.” Please confirm that the fire alarm will be installed.

Yes, the fire alarm will be installed within the battery cell container.

In addition, the petitioner submitted the SDS for the titanium manganese electrolyte.

cc:	Date:	Signed:
	3/26/19	<i>Brett Fooks</i>
	9	Name Brett Fooks

Safety Data Sheet

1. Identification of the substance/mixture and of the company/undertaking

Product name :

Product name: IS342F

Recommended use and restrictions on use

Recommended use : Batteries and Accumulators

Details of the supplier of the safety data sheet

Name of supplier : TAYCA CORPORATION

Address : 3-6-13, KITAHAMA, CHUO-KU, OSAKA, JAPAN

Division : SALES DEPARTMENT

Phone : +81-6-6208-6411

FAX : +81-6-6208-6422

Address : 3-8-2, NIHONBASHI, CHUO-KU, TOKYO, JAPAN

Division : TOKYO BRANCH

Phone : +81-3-3275-0815

FAX : +81-3-3275-0859

Emergency phone : OKAYAMA FACTORY +81-86-946-8311

2. Hazards identification

GHS classification and label elements of the product

Classification of the substance or mixture

HEALTH HAZARDS

Acute toxicity Inhalation: Category 3

Skin corrosion/irritation: Category 1

Serious eye damage/eye irritation: Category 1

Germ cell mutagenicity: Category 2

Reproductive toxicity: Category 2

Specific target organ toxicity – single exposure: Category 1

Specific target organ toxicity – repeated exposure: Category 1

ENVIRONMENT HAZARDS

Hazardous to the aquatic environment – acute hazard: Category 3

(Note) GHS classification without description: Not applicable/Out of classification/Not classifiable

Label elements



Signal word: Danger

HAZARD STATEMENT

Toxic if inhaled

Causes severe skin burns and eye damage

Causes serious eye damage

Suspected of causing genetic defects

Suspected of damaging fertility or the unborn child

Causes damage to organs

Causes damage to organs through prolonged or repeated exposure

Harmful to aquatic life

PRECAUTIONARY STATEMENT

Prevention

- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.
- Avoid release to the environment.
- Do not breathe dust/fume/gas/mist/vapors/spray.
- Avoid breathing dust/fume/gas/mist/vapors/spray.
- Use only outdoors or in a well-ventilated area.
- Wash contaminated parts thoroughly after handling.
- Wear protective gloves/protective clothing/eye protection/face protection.
- Do not eat, drink or smoke when using this product.

Response

- Get medical advice/attention if you feel unwell.
- IF exposed or concerned: Get medical advice/attention.
- Immediately call a POISON CENTER or doctor/physician.
- Call a POISON CENTER or doctor/physician.
- IF exposed or concerned: Call a POISON CENTER or doctor/physician.
- IF INHALED: Remove person to fresh air and keep comfortable for breathing.
- IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
- Wash contaminated clothing before reuse.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.

Storage

- Store in a well-ventilated place. Keep container tightly closed.
- Store locked up.

Disposal

- Dispose of contents/container in accordance with local/national regulation.

3. Composition/information on ingredients

Mixture/Substance selection:

Mixture

Ingredient name	Content(%)	CAS No.	Chemicals No, Japan
Titanyl sulfate	10 - 20	13825-74-6	1-540
Manganese sulfate	5 - 15	7785-87-7	1-477
Sulfuric acid	15 - 25	7664-93-9	1-430
Phosphoric acid	0.1 - 10	7664-38-2	1-422
Additive	0.1 - 10	Trade Secret	Trade Secret
Water	45 - 55	7732-18-5	-

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

4. First-aid measures

Descriptions of first-aid measures

General measures

- Get medical attention/advice if you feel unwell.
- IF exposed or concerned: Get medical attention/advice.
- Immediately call a POISON CENTER or doctor/physician.
- IF exposed or concerned: Call a POISON CENTER or doctor/physician.

IF INHALED

Remove person to fresh air and keep comfortable for breathing.

Call a POISON CENTER or doctor/physician if you feel unwell.

IF ON SKIN (or hair)

Take off immediately all contaminated clothing. Rinse skin with water/shower.

Wash with plenty of soap and water.

If skin irritation or rash occurs: Get medical advice/attention.

IF IN EYES

Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

If eye irritation persists: Get medical advice/attention.

IF SWALLOWED

Rinse mouth. Do NOT induce vomiting.

Call a POISON CENTER or doctor/physician if you feel unwell.

Keep casualty at rest and seek medical advice immediately.

Protective measures for first aid

Protect yourself by wearing rubber gloves and air-tight safety goggles.

5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media

Use appropriate extinguishing media suitable for surrounding facilities.

This product is non-flammable.

6. Accidental release measures

Personnel precautions, protective equipment and emergency procedures

Keep unauthorized personnel away.

Wear proper protective equipment.

Environmental precautions

Avoid release to the environment.

Methods and materials for containment and cleaning up

Absorb spill with inert material (dry sand, earth, et al), then place in a chemical waste container.

For large spill, dike for later disposal.

Preventive measures for secondary accident

Collect spillage.

Stop leak if safe to do so.

Prevent entry into waterways, sewers, basements or confined areas.

7. Handling and storage

Precautions for safe handling

Preventive measures

(Exposure Control for handling personnel)

Do not breathe dust/mist.

Exhaust/ventilator

Exhaust/ventilator should be available.

Safety treatments

Avoid contact with skin.

Avoid contact with eyes.

Safety Measures/Incompatibility

Obtain special instructions before use.

Do not handle until all safety precautions have been read and understood.

- Use only outdoors or in a well-ventilated area.
- Wear protective gloves/protective clothing/eye protection/face protection.
- Wash hands et al thoroughly after handling.
- Do not eat, drink or smoke when using this product.

Conditions for safe storage, including any incompatibilities

Recommendation for storage

- Store in a well-ventilated place. Keep container tightly closed.
- Store locked up.
- Storage temperature upper limit: 40°C
- Storage temperature lower limit: 5°C
- Avoid high stacking

Recommendation on container and packaging materials

- Put into closed-type packaging or container (There are no limit for packaging and container).

8. Exposure controls/personal protection

Control parameters

Adopted value

- (Phosphoric acid)
- ACGIH(1992) TWA: 1mg/m³;
- STEL: 3mg/m³ (URT, eye & skin irr)

- (Sulfuric acid)
- ACGIH(2000) TWA: 0.2mg/m³(T) (Pulm func)

- (Manganese sulfate)
- ACGIH(2012) TWA: 0.02mg-Mn/m³(R);
- TWA: 0.1mg-Mn/m³(I) (CNS impair)

OSHA-PEL

- (Sulfuric acid)
- TWA: 1mg/m³
- (Manganese sulfate)
- STEL: C 5mg-Mn/m³
- (Phosphoric acid)
- TWA: 1mg/m³

Exposure controls

Appropriate engineering controls

- Exhaust/ventilator should be available.
- Eye wash station should be available.
- Washing facilities should be available.

Individual protection measures

Respiratory protection

- Wear respiratory protection.

Hand protection

- Wear protective gloves.

Eye protection

- Wear eye/face protection.

Skin and body protection

- Wear protective clothing.

Safety and Health measures

- Wash hands et al thoroughly after handling.
- Do not eat, drink or smoke when using this product.
- Wash contaminated clothing before reuse.

9. Physical and Chemical Properties

Information on basic physical and chemical properties

Physical properties

Appearance: Liquid
Color: Transparent brown
Odor: Characteristic odor
pH: Strongly acidic
Specific gravity/Density: 1.3 – 1.6g/cm³

10. Stability and Reactivity

Chemical stability

Stable under normal storage/handling conditions.
When stored for a long time at high temperature (60 ° C. or higher), crystals of titanyl sulfate or manganese sulfate may be precipitated in some cases.

Conditions to avoid

When alkali is added, heat is generated, and titanium oxide or manganese oxide may precipitate in some cases.

Incompatible materials

Bases, Strong bases

11. Toxicological Information

Information on toxicological effects

Acute toxicity

Acute toxicity (Oral)

[base data and/or Rationale for the classification]

(Phosphoric acid)

rat LD50 = 1250 mg/kg (RTECS2006).

(Sulfuric acid)

rat LD50 = 2140 mg/kg (SIDS, 2001).

(Manganese sulfate)

rat LD50 =782 mg/kg (ATSDR(2000)).

Acute toxicity (Dermal)

[base data and/or Rationale for the classification]

(Phosphoric acid)

rabbit LD50 = 2740 mg/kg (RTECS2006, IUCLID2000, HSDB2006).

Acute toxicity (Inhalation)

[base data and/or Rationale for the classification]

(Phosphoric acid)

Classification not possible:

There was data that rat LC50 (1 hour) value was >0.85mg/L (4-hour equivalent >0.21mg/L) (RTECS (2006)). But the category could not be specified only by this data. Therefore, it cannot be classified since data is insufficient.

(Sulfuric acid)

mist : rat LC50=0.347 mg/L/4hr (SIDS, 2001).

Irritant properties

Skin corrosion/irritation

[base data and/or Rationale for the classification]

(Phosphoric acid)

Category 1A-1C:

Although it was the effects of exposure for 24 hours, there are description that caustic was admitted in the test which applied 75-85% aqueous solutions to the rabbit skin (IUCLID

(2000)), and pH of 0.1N aqueous solutions was strong acids of 1.5.

(Sulfuric acid)

Since pH of concentrated sulfuric acid was 1 or less, it was judged to be a corrosive substances with the GHS classification standards, and classified as Category 1A-1C.

(Manganese sulfate)

Classification not possible:

IUCLID (2000) presents epidemiological evidence of "moderate irritation" in humans.

However, classification is not possible in the absence of study detail.

Serious eye damage /irritation

[base data and/or Rationale for the classification]

(Phosphoric acid)

Category 1:

Since it had skin corrosiveness, it was categorized as Category 1.

(Sulfuric acid)

From description that the critical damage to the eye accompanied by solutions of anterior chamber of eye was acknowledged in example of accident in human (ATSDR, 1998), and from description that moderate irritation with 5% liquid and severe irritation with 10% liquid were acknowledged to the eye of a rabbit (SIDS, 2001), and since pH of this product was two or less. So it was set as Category 1.

(Manganese sulfate)

Classification not possible:

IUCLID(2000) presents epidemiological evidence of "irritation" in humans. However,

classification is not possible in the absence of study detail.

Germ cell mutagenicity

[base data and/or Rationale for the classification]

(Manganese sulfate)

Category 2:

Based on the absence of data on multi-generation mutagenicity tests, germ cell mutagenicity tests in vivo and germ cell genotoxicity tests in vivo, and positive data on somatic cell mutagenicity tests in vivo (micronucleus tests and chromosome aberration tests), described in DFGOT vol.12 (1999) and CICAD 12 (1999).

(Sulfuric acid)

For in vivo, any test data could not be found for which the productive cells and the somatic cells were used, and for in vitro mutagenicity tests, we found the positive result only in the test system with the single indicator (chromosomal aberration test) (ATSDR, 1998). And we found the negative results in other indices. Therefore we presupposed that we could not classify it.

Carcinogenicity

[base data and/or Rationale for the classification]

(Sulfuric acid)

Professional exposure of the mist of the inorganic strong acid including sulfuric acids is classified into group 1 according to IARC (1992), into A2 according to ACGIH (2004), and into K according to NTP (2005). And respecting evaluation of IARC and evaluation of the latest NTP, it is classified into category 1. However, sulfuric acids itself was classified into the category 4 according to DFGOT (vol.15, 2001). Also, none of those institutions has not carried out the carcinogenic classification, it was presupposed that it cannot be classified.

(Manganese sulfate)

Classification not possible:

Based on expert judgment in the absence of existing classification.

(Sulfuric acid)

IARC-Gr.1 : Carcinogenic to humans

(Manganese sulfate)

ACGIH-A4(2012) : Not Classifiable as a Human Carcinogen (Inorganic Mn)

(Sulfuric acid)

ACGIH-A2(2000) : Suspected Human Carcinogen

Reproductive toxicity

[base data and/or Rationale for the classification]

(Manganese sulfate)

Category 2:

Based on the evidence of sperm malformation, described in CICAD 12 (1999), though no data are available on parental toxicity.

(Sulfuric acid)

Since it is not observed of fetotoxicity and teratogenicity at the dose causing no maternal toxicity in inhalation test fetal period organogenesis rabbit and mouse (SIDS, 2001) and it was judged of no concern of reproductive toxicity because in chronic toxicity study and carcinogenicity tests, the effects on the reproductive organ of both sexes is not observed and the effect by irritation/caustic is main toxicity directly (SIDS, 2001), it was considered as on the outside of Category.

(Phosphoric acid)

Classification not possible:

Lack of data.

Delayed and immediate effects and also chronic effects from short- and long-term exposure

STOT

STOT-single exposure

[cat.1]

[base data and/or Rationale for the classification]

(Manganese sulfate)

respiratory apparatus/system (Category 1:

Acute inhalation exposure to high concentrations of manganese dusts (specifically MnO₂ and Mn₃O₄) can cause an inflammatory response in the lung, which, over time, can result in impaired lung function. Lung toxicity is manifested as an increased susceptibility to infections such as bronchitis and can result in manganic pneumonia (CICAD 12 (1999)).

(Sulfuric acid)

Based on the descriptions that in the inhalation exposure of low concentration by humans, airway irritation such as cough and breath shortness is identified (DFGOT, 2001), and at high exposure levels, acute effects such as cough, breath shortness and hemoptysis shedding etc., and permanent effects such as functional depression of lungs, fibrosis and emphysema were identified (ATSDR, 1998), and that hemorrhage in lungs and dysfunction were identified by 8-hour inhalation exposure in guinea pigs (ATSDR, 1998). So it was referred to as Category 1 (respiratory systems).

STOT-repeated exposure

[cat.1]

[base data and/or Rationale for the classification]

(Manganese sulfate)

respiratory apparatus/system; nerve/nervous system (Category 1:

The most commonly occurring manganese-bearing minerals include manganese dioxide, manganese carbonate, manganese silicate and manganese trioxide. In general, the available data indicate that exposure to excess manganese for 14 days or less (acute duration) or up to a year (intermediate duration) has an effect on the respiratory system and the nervous system, with little to no effect on other organ systems (CICAD 63 (2004) and CICAD 12 (1999)).

(Sulfuric acid)

In the 28-day inhalation exposure test using rat, cell proliferation in laryngeal mucosa is acknowledged in guidance value of Category 1(SIDS (2001)), and in the 14 to 139-day repetition inhalation exposure test using the guinea pigs of the concentration of guidance value within the limits of Category 1, respiratory and lung disorder, such as nasal-septum dropsy, pulmonary emphysema, atelectasis, hyperemia, dropsy, bleeding and

thrombosis of bronchioles are recognized (ATSDR(1998)), and further in the 78-week inhalation exposure test using a cynomolgus, histological change as hyperplasia of a cell, the wall thickening, etc. in bronchioles of lungs was acknowledged in the dosage (0.048 mg/L, 23.5 Hr/Day) of the range of the guidance value of Category 1, so it was classified to as Category 1 (respiratory systems).

12. Ecological Information

Ecotoxicity

Aquatic toxicity

Harmful to aquatic life

Aquatic acute toxicity component(s) data

[base data and/or Rationale for the classification]

(Phosphoric acid)

Classification not possible:

Lack of data.

(Manganese sulfate)

Category 3:

Crustacea (Daphnia magna) EC50 = 8.3mg/L/48hr (Manganese II Sulfate Equivalent: 22.8mg/L) (CICAD63, 2004).

(Sulfuric acid)

Fish (bluegill) LC50=16 - 28mg/L/96hr (SIDS, 2003)

Aquatic chronic toxicity component(s) data

[base data and/or Rationale for the classification]

(Phosphoric acid)

Classification not possible:

Lack of data.

(Manganese sulfate)

Category 3:

Since acute toxicity was Category 3 and it was a metallic compound and an underwater action and bio-accumulation were unknown.

(Sulfuric acid)

Toxicity factor is considered to be strong acid as aqueous solution, but toxic effect is eased by the buffer action in the environmental water.

Water solubility

(Phosphoric acid)

very good (ICSC, 2000)

(Sulfuric acid)

miscible (ICSC, 2000)

13. Disposal considerations

Waste treatment methods

Avoid release to the environment.

Dispose of contents/container in accordance with local/national regulation.

Do not dump into sewers, on the ground or into any body of water.

Contaminated packing

This container can be recovered for reuse or recycling after cleaning.

14. Transport Information

UN No. / UN CLASS

UN No : 3264

Proper shipping name :

CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S. (Titanium oxide sulfate and Sulphuric acid, mixture)

UN CLASS : 8

PG : II

ERG GUIDE NO.: 154

Special provisions NO.: 274; A3; A803

Special precautions for user

Avoid temperature above (°C): 40°C

Avoid temperature below (°C): 5°C

Keep dry.

Protect from direct sunlight or rain.

15. Regulatory Information

Safety, health and environmental regulations/legislation specific for the substance or mixture

US major regulations

TSCA

Phosphoric acid; Sulfuric acid; Water; Manganese sulfate; Additive; Titanyl sulfate

Other regulatory information

Ensure this material in compliance with federal requirements and ensure conformity to local regulations.

16. Other information

Reference Book

Globally Harmonized System of classification and labelling of chemicals, (5th ed., 2013), UN Recommendations on the TRANSPORT OF DANGEROUS GOODS 19th edit., 2015 UN Classification, labelling and packaging of substances and mixtures (table3-1 ECNO6182012) 2016 EMERGENCY RESPONSE GUIDEBOOK (US DOT)

2018 TLVs and BEIs. (ACGIH)

<http://monographs.iarc.fr/ENG/Classification/index.php>

Supplier's data/information

NITE; http://www.safe.nite.go.jp/japan/sougou/view/SystemTop_jp.faces

JCDB ezADVANCE

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