

SECTION 1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING**1.1 Product identifier****1.1.1 Commercial Product Name**

Sulphuric acid

1.1.2 Product code

Substance name: Sulphuric acid

CAS-No.: 7664-93-9

EC-No.: 231-639-5

REACH Registration Number

01-2119458838-20-0073

1.2 Relevant identified uses of the substance or mixture and uses advised against**1.2.1 Recommended use**

Industrial uses: Use of sulphuric acid as an intermediate in manufacture of inorganic and organic chemicals including fertilizers, Use of sulphuric acid as a processing aid, catalyst, dehydrating agent, pH regulator, Use of sulphuric acid for extractions and processing of minerals, ores, Use of sulphuric acid in the process of surface treatments, purification and etching, Use of sulphuric acid in electrolytic processes, Use of sulphuric acid in gas purification, scrubbing and flue gas scrubbing, Use of sulphuric acid in industrial cleaning, Mixing, preparation and repackaging of sulphuric acid

Professional uses: Use of sulphuric acid as laboratory chemicals

Uses advised against: None known

1.3 Details of the supplier of the safety data sheet**Supplier**

„Rolling-co“ d.o.o.

Dragoslava Srejevica 53

34000 Kragujevac

T +381 (0) 34 330 331

rollingco@mts.rs - www.rolling-co.rs

1.4 Emergency telephone number**1.4.1 Telephone number, name and address**

Europe-wide emergency number: 112

See section 16.6 for the list of telephone numbers of poison centers in the European Economic Area

SECTION 2. HAZARDS IDENTIFICATION**2.1 Classification of the substance or mixture****1272/2008 (CLP)**

Skin Corr. 1A, H314

2.2 Label elements**1272/2008 (CLP)**

GHS05



Signal word

Danger

Hazard Statements

H314 Causes severe skin burns and eye damage.

Precautionary Statements

P280 Wear protective gloves/protective clothing/eye protection/face protection.

P301+P330+P331 IF SWALLOWED: rinse mouth. Do NOT induce vomiting.

P303+P361+P353 IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.

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.

P363 Wash contaminated clothing before reuse.

2.3 Other hazards

The substance does not fulfil the PBT criteria (not PBT) nor the vPvB criteria (not vPvB).

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS**3.1 Substances**

Mono-constituent substance

CAS	EINECS	Chemical name of the substance	Concentration	Classification
7664-93-9	231-639-5	Sulphuric acid	93-98.5 %	CLP: Skin Corr. 1A; H314

3.3 Other information

Specific concentration limits:
 Skin Irrit. 2; H315: 5% $\geq$ C < 15%
 Eye Irrit. 2; H319: 5% $\geq$ C < 15%
 Skin Corr. 1A; H314: C 15%

SECTION 4. FIRST AID MEASURES**4.1 Description of first aid measures**

Remove soiled, soaked clothing immediately. Medical treatment is necessary if symptoms occur which are obviously caused by skin or eye contact with the product or by inhalation of its vapours. Ensure personal protective measures when giving first aid.

4.1.2 Inhalation

Get medical attention immediately. Move exposed person to fresh air. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. Keep person warm and at rest. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

4.1.3 Skin contact

Get medical attention immediately. Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Continue to rinse for at least 10 minutes. Chemical burns must be treated promptly by a physician. Wash clothing before reuse. Clean shoes thoroughly before reuse.

4.1.4 Eye contact

Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Seek immediate medical attention

4.1.5 Ingestion

Wash out mouth with water. In the event of swallowing, induce patient to drink plenty of water. Get medical attention immediately

4.2 Most important symptoms and effects, both acute and delayed

Causes severe skin burns and eye damage.

4.3 Indication of immediate medical attention and special treatment needed

No data available.

SECTION 5. FIREFIGHTING MEASURES**5.1 Extinguishing media****5.1.1 Suitable extinguishing media**In case of fire, use water spray (fog), foam, dry chemical or CO₂.**5.1.2 Extinguishing media which must not be used for safety reasons**

None known.

5.2 Special hazards arising from the substance or mixture

In a fire or if heated, a pressure increase will occur and the container may burst. Decomposition products may include the following materials: sulfur oxides

5.3 Advice for firefighters

Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

5.4 Specific methods

None known.

SECTION 6. ACCIDENTAL RELEASE MEASURES**6.1 Personal precautions, protective equipment and emergency procedures**

No action shall be taken involving any personal risk or without suitable training. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Avoid breathing vapour or mist. Provide adequate ventilation. Put on appropriate personal protective equipment. Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

6.2 Environmental precautions

Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

6.3 Methods and materials for containment and cleaning up

Large spill : Stop leak if without risk. Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations. The spilled material may be neutralized with sodium carbonate, sodium bicarbonate or sodium hydroxide. Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product.

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble or absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

6.4 Reference to other sections

See also section 8.

SECTION 7. HANDLING AND STORAGE**7.1 Precautions for safe handling**

Put on appropriate personal protective equipment. Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Do not get in eyes or on skin or clothing. Do not breathe vapour or mist. Do not ingest. If during normal use the material presents a respiratory hazard, use only with adequate ventilation or wear appropriate respirator. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Keep away from alkalis. Empty containers retain product residue and can be hazardous.

7.2 Conditions for safe storage, including any incompatibilities

Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well ventilated area, away from incompatible materials and food and drink. Separate from alkalis. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination.

7.3 Specific end use(s)

The first tier assessment of worker exposure to sulphuric acid was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART). The environmental assessments were carried out using the EUSES model.

See further the information provided in the Annexes to this SDS. The technical conditions and measures at process level and technical conditions and measures to control dispersion from source towards the workers are also summarized in sections 7 and 8 of this SDS.

ES 1 Use of sulphuric acid as an intermediate in manufacture of inorganic and organic chemicals including fertilizers

ES 2 Use of sulphuric acid as a processing aid, catalyst, dehydrating agent, pH regulator.

ES 3 Use of sulphuric acid for extractions and processing of minerals, ores

ES 4 Use of sulphuric acid in the process of surface treatments, purification and etching

ES 5 Use of sulphuric acid in electrolytic processes

ES 6 Use of sulphuric acid in gas purification, scrubbing and flue gas scrubbing

ES 7 Use of sulphuric acid as laboratory chemicals

ES 8 Use of sulphuric acid in industrial cleaning

ES 9 Mixing, preparation and repackaging of sulphuric acid

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

8.1.1 Threshold limits

7664-93-9	Sulphuric acid (mist)	0,1 (inhalable aerosol) mg/m ³ (8 h)	0,2 (inhalable aerosol) mg/m ³ (15 min)
		Austria	
7664-93-9	Sulphuric acid (mist)	1 mg/m ³ (8 h)	3 mg/m ³ (15 min)
		Belgium	
7664-93-9	Sulphuric acid (mist)	1 mg/m ³ (8 h)	2 mg/m ³ (15 min)
		Denmark	
7664-93-9	Sulphuric acid (mist)	0,05 (thoracic fraction) mg/m ³ (8 h)	
		European Union	
7664-93-9	Sulphuric acid (mist)	0,05 mg/m ³ (8 h)	0,1 mg/m ³ (15 min)
		Finland	
7664-93-9	Sulphuric acid (mist)	0,05 (thoracic fraction) mg/m ³ (8 h)	
		France	

7664-93-9	Sulphuric acid (mist)	0,1 (inhalable aerosol) mg/m ³ (8 h) Germany (AGS)	0,1 (inhalable aerosol) mg/m ³ (15 min)
7664-93-9	Sulphuric acid (mist)	0,1 (inhalable aerosol) mg/m ³ (8 h) Germany (DFG)	0,1 (inhalable aerosol) mg/m ³ (15 min)
7664-93-9	Sulphuric acid (mist)	1 mg/m ³ (8 h) Hungary	1 mg/m ³ (15 min)
7664-93-9	Sulphuric acid (mist)	0,05 mg/m ³ (8 h) Ireland	
7664-93-9	Sulphuric acid (mist)	0,05 mg/m ³ (8 h) Italy	
7664-93-9	Sulphuric acid (mist)	1 mg/m ³ (8 h) Latvia	
7664-93-9	Sulphuric acid (mist)	1 mg/m ³ (8 h) Poland	3 mg/m ³ (15 min)
7664-93-9	Sulphuric acid (mist)	1 mg/m ³ (8 h) Spain	3 mg/m ³ (15 min)
7664-93-9	Sulphuric acid (mist)	0,1 mg/m ³ (8 h) Sweden	0,2 mg/m ³ (15 min)
7664-93-9	Sulphuric acid (mist)	0,05 (thoracic fraction) mg/m ³ (8 h) The Netherlands	

8.1.3 Limit values in other countriesUSA - NIOSH: 1mg/m³ (8h)USA - OSHA: 1mg/m³ (8h)**8.1.4 DNELs****DNELs for workers:**Acute - local effects, inhalation, DNEL: 0.1 mg/m³. Based on 15 minute STEL of 0.1 mg/m³.Long-term - local effects, inhalation, DNEL: 0.05 mg/m³. Based on 8 -hour TWA limit of 0.05 mg/m³.**8.1.5 PNECs**

PNEC aqua (freshwater): 0.0025 mg/L. Based on NOEC for flagfish: 0.025 mg/L. AF = 10.

PNEC aqua (marine water): 0.00025. Based on NOEC for flagfish: 0.025 mg/L. AF = 100.

PNEC STP: 8.8 mg/L. Based on NOEC (sodium sulphate) for bacteria in sewage sludge: 88 mg/L. AF = 10. Test

8.2 Exposure controls**8.2.1 Appropriate engineering controls**

Ensure sufficient air exchange and/or exhaust in work areas.

8.2.2 Individual protection measures**8.2.2.1 Respiratory protection**

Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

8.2.2.2 Hand protection

Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. After contamination with product change the gloves immediately and dispose of them according to relevant national and local regulations.

8.2.2.3 Eye/face protection

Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts.

8.2.2.4 Skin protection

Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Recommended: chemical-resistant protective suit

8.2.3 Environmental exposure controls

Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

9.1	Important Health Safety and Environmental Information	
9.1.1	Appearance	
	Colourless to brown, viscous liquid	
9.1.2	Odour	No information available
9.1.3	Odour threshold	No information available
9.1.4	pH	No information available
9.1.5	Melting point/freezing point	3°C (98% sulphuric acid)
9.1.6	Initial boiling point and boiling range	190°C (98% sulphuric acid)
9.1.7	Flash point	No information available
9.1.8	Evaporation rate	No information available
9.1.9	Flammability (solid, gas)	Non flammable
9.1.10	Explosive properties	
9.1.10.1	Lower explosion limit	No information available
9.1.10.2	Upper explosion limit	No information available
9.1.11	Vapour pressure	6 Pa at 293 K
9.1.12	Vapour density	No information available
9.1.13	Relative density	1.835 kg/L (20°C, 93 -100% sulphuric acid)
9.1.14	Solubility(ies)	
9.1.14.1	Water solubility	Miscible
9.1.14.2	Fat solubility (solvent - oil to be specified)	No information available
9.1.15	Partition coefficient: n-octanol/water	Not applicable
9.1.16	Auto-ignition temperature	Not applicable
9.1.17	Decomposition temperature	No information available
9.1.18	Viscosity	22.5 mPa · s (dynamic) (95% sulphuric acid, 20°C)
9.1.19	Explosive properties	The substance is an inorganic acid that does not contain any chemical groups associated with explosive properties.
9.1.20	Oxidising properties	Substance does not contain functional groups associated with oxidising properties.
9.2	Other information	
	Dissociation constant: pKa at 20°C: 1.9	

SECTION 10. STABILITY AND REACTIVITY

10.1	Reactivity	The product is stable under normal conditions of storage and use.
10.2	Chemical stability	The product is stable under normal conditions of storage and use.
10.3	Possibility of hazardous reactions	Under normal conditions of storage and use, hazardous reactions will not occur.

- 10.4 Conditions to avoid**
Highly reactive with water and alkalis.
- 10.5 Incompatible materials**
Attacks many metals producing extremely flammable hydrogen gas which can form explosive mixtures with air.
Reactive or incompatible with the following materials: alkalis
- 10.6 Hazardous decomposition products**
Under normal conditions of storage and use, hazardous decomposition products should not be produced.

SECTION 11. TOXICOLOGICAL INFORMATION

- 11.1 Information on toxicological effects**
Primary information is limited to a study of the absorption and kinetics of radiolabelled sulphate following the inhalation of sulphuric acid aerosols. Sulphuric acid immediately dissociates to the hydrogen and sulphate ions, with the hydrogen ion being responsible for the local toxicity (irritation and corrosivity) of sulphuric acid
- 11.1.1 Acute toxicity**
Oral, rat LD50: 2140 mg/kg bw (No information on test methodology)
Inhalation, rat LC50: 375 mg/m³ air (equivalent or similar to OECD Guideline 403)
No classification regarding acute toxicity is required.
- 11.1.2 Irritation and corrosion**
No studies of eye irritation have been performed with the substance and none are proposed, based on scientific considerations and for reasons of animal welfare.
Skin irritation / corrosion: corrosive
Eye irritation: corrosive
- Sulphuric acid is classified as Skin Corr. 1A with the following specific concentration limits:
Skin Irrit. 2; H315: 5% $\leq$ C < 15%
Eye Irrit. 2; H319: 5% $\geq$ C < 15%
Skin Corr. 1A; H314: C 15%
- 11.1.3 Sensitisation**
No classification is proposed for skin sensitisation or respiratory sensitisation based on theoretical considerations and in the absence of any findings in exposed humans following occupational use over a long period of time
- No classification regarding sensitisation is required.
- 11.1.4 Subacute, subchronic and prolonged toxicity**
Repeated dose toxicity:
Inhalation, rat NOAEC: 0.3 mg/m³ (OECD Guideline 412)
No classification regarding repeated dose toxicity is required.
- Mutagenicity:**
Genetic toxicity: negative. Based on the available data of animals and humans no classification is proposed for genotoxicity.
No classification regarding mutagenicity is required.
- Carcinogenicity:**
Based on the available data of animals and humans sulphuric acid does not possess significant carcinogenic potential.
No classification regarding carcinogenicity is required.
- Reproductive toxicity:**
Inhalation, rabbit, mouse NOAEC: 19.3 mg/m³ (equivalent or similar to OECD Guideline 414)
No classification regarding reproductive toxicity is required.
- 11.1.5 STOT-single exposure**
Sulphuric acid has not been classified for STOT SE.

11.1.6 STOT-repeated exposure

Sulphuric acid has not been classified for STOT RE.

11.1.7 Aspiration hazard

Based on the data of the kinematic viscosity of sulphuric acid, no classification regarding aspiration hazard is required.

11.1.8 Other information on acute toxicity

No information available.

SECTION 12. ECOLOGICAL INFORMATION**12.1 Toxicity****12.1.1 Aquatic toxicity**

This substance is not classified as hazardous to the aquatic environment.

Results on aquatic toxicity in freshwater:

Short-term toxicity

Fish, *Lepomis macrochirus*, LC50 (96 h): 16 mg/L (No information on test methodology)

Aquatic invertebrates, *Daphnia magna*, EC50 (48 h): 100 mg/L (OECD Guideline 202)

Algae (growth rate), *Desmodesmus subspicatus*, EC50 (72 h): 100 mg/L (OECD Guideline 201)

Long-term toxicity

Fish, *Jordanella floridae*, NOEC (65 d): 0.025 mg/L (No information on test methodology)

Aquatic invertebrates, *Tanytarsus dissimilis*, NOEC: 0.15 mg/L (No information on test methodology)

12.1.2 Toxicity to other organisms**Toxicity to micro-organisms:**

Activated sludge, NOEC (37 d): 26000 mg/L (No information on test methodology)

12.2 Persistence and degradability**12.2.1 Biodegradation**

Sulphuric acid is a strong mineral acid that dissociates readily in water to hydrogen ions and sulphate ions (at environmentally relevant pH) and is totally miscible with water. The hydrogen ions, although not degraded as such due to their elemental nature, contribute to the pH of the local environment. The sulphate ions are incorporated into the various mineral species present in the environment.

12.2.2 Chemical degradation

Sulphuric acid is a strong mineral acid ($pK_a = 1.92$) that dissociates readily in water to hydrogen ions and sulphate ions (at all environmentally relevant pH levels), and is totally miscible with water. At all environmentally relevant concentrations, the substance will therefore exist as the environmentally ubiquitous sulphate (SO_4^{2-}) anion and hydronium (H_3O^+) cation, that reacts with hydroxyls to form water.

12.3 Bioaccumulative potential

Sulphuric acid is a strong mineral acid that dissociates readily in water to hydrogen ions and sulphate ions (at environmentally relevant pH) and is totally miscible with water. The resulting hydrogen ions and sulphate ions are naturally present in water/sediment and no bioaccumulation of these ions is predicted.

12.4 Mobility in soil

Sulphuric acid is a strong mineral acid that dissociates readily in water to hydrogen ions and sulphate ions (at environmentally relevant pH) and is totally miscible with water. The resulting hydrogen ions and sulphate ions are naturally present in water/sediment. The hydrogen ions will contribute to local pH and are potentially mobile; sulphate ions may be incorporated into naturally occurring mineral species.

12.5 Results of PBT and vPvB assessment

This substance is neither fulfilling the criteria for persistent, bioaccumulative and toxic substances (PBT substances), nor the criteria for very persistent and very bioaccumulative substances (vPvB substances).

12.6 Other adverse effects

No information available.

SECTION 13. DISPOSAL CONSIDERATIONS**13.1 Waste treatment methods**

Examine possibilities for re-utilisation. Product residues and uncleaned empty containers should be packaged, sealed, labelled, and disposed of or recycled according to relevant national and local regulations. Where large quantities are concerned, consult the supplier. When uncleaned empty containers are passed on, the recipient must be warned of any possible hazard that may be caused by residues. For disposal within the EC, the appropriate code according to the European Waste List (EWL) should be used. It is among the tasks of the polluter to assign the waste to waste codes specific to industrial sectors and processes according to the European Waste List (EWL).

SECTION 14. TRANSPORT INFORMATION

- | | | |
|-------------|---|--|
| 14.1 | UN number | 1830 |
| 14.2 | UN proper shipping name | SULPHURIC ACID with more than 51% acid |
| 14.3 | Transport hazard class(es) | 8 |
| 14.4 | Packing group | II |
| 14.5 | Environmental hazards | |
| | | This substance is not classified as environmentally hazardous. |
| 14.6 | Special precautions for users | |
| | | No information available. |
| 14.7 | Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code | |
| | | No data available. |

SECTION 15. REGULATORY INFORMATION

- 15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture (*)**
EU Regulation (EC) No. 1907/2006 (REACH)
Annex XIV - List of substances subject to authorisation, Substances of very high concern: NOT LISTED
Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles: NOT LISTED
- 15.2 Chemical safety assessment**
In accordance with Regulation (EC) No. 1907/2006 (REACH) Article 14, a Chemical Safety Assessment has been carried out for this substance.

SECTION 16. OTHER INFORMATION

- 16.1 Additions, Deletions, Revisions**
Version 3.1, all sections aligned with the REACH Chemical Safety Report.
This safety data sheet is drawn up to comply with the requirements of Regulation (EC) No. 1907/2006 (REACH), as amended by Annex II to Commission Regulation (EU) No. 2015/830 of 28 May 2015. Company name changed to version 3.0 and 3.1.
- 16.2 Key or legend to abbreviations and acronyms**

-AF - Assessment factor
-CLP - Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006
-DNEL - Derived no-effect level
-EC50 - Concentration of the substance that causes 50 % reduction of a certain effect on test organisms
-LC50 - Concentration of the substance that causes 50 % mortality of the test population
-LD50 - Lethal dose of the substance that causes 50 % mortality of the test population
-NIOSH - National Institute for Occupational Safety and Health (USA)
-NOAEC - No observed adverse effect concentration
-NOEC - No observed effect concentration
-OECD - Organisation for Economic Co-operation and Development
-OSHA - Occupational Safety and Health Administration (USA)
-PBT/vPvB - Persistent, bioaccumulative and toxic/ very persistent and very bioaccumulative
-PNEC - Predicted no-effect concentration
-REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals
-STEL - Short term exposure limit
-STOT RE - Specific Target Organ Toxicity, Repeated Exposure
-STOT SE - Specific Target Organ Toxicity, Single Exposure
-STP - Sewage treatment plant
-TWA - Time weighted average

16.3 Key literature references and sources for data

REACH Chemical Safety Report Part B, sulphuric acid.

All referenced studies within this safety data sheet can be found from the original Chemical Safety Report.
GESTIS Database for International Limit Values

16.4 Classification procedure

This substance has a harmonised classification according to Annex VI to Regulation (EC) No. 1272/2008 (CLP).

16.6 Emergency telephone number

Europe-wide emergency number: 112

(*)**Contact a poison control centre. List of Telephone Numbers :**

AUSTRIA (Vienna Wien) +43 1 406 43 43; **BELGIUM** (Brussels Bruxelles) +32 70 245 245; **BULGARIA** (Sofia) +359 2 9154 409; **CZECH REPUBLIC** (Prague Praha) +420 224 919 293; **DENMARK** (Copenhagen) 82 12 12 12; **ESTONIA** (Tallinn) 112; **FINLAND** (Helsinki) +358 9 471 977; **FRANCE** (Paris) +33 1 40 0548 48; **GERMANY** (Berlin) +49 30 19240; **GREECE** (Athens Athina) +30 10 779 3777; **HUNGARY** (Budapest) 06 80 20 11 99; **ICELAND** (Reykjavik) +354 525 111, +354 543 2222; **IRELAND** (Dublin) +353 1 8379964; **ITALY** (Rome) +39 06 305 4343; **LATVIA** (Riga) +371 704 2468; **LITHUANIA** (Vilnius) +370 5 236 20 52 or +370 687 53378; **MALTA** (Valletta) 2425 0000; **NETHERLANDS** (Bilthoven) +31 30 274 88 88; **NORWAY** (Oslo) 22 591300; **POLAND** (Gdansk) +48 58301 65 16 or +48 58 349 2831; **PORTUGAL** (Lisbon Lisboa) 808 250 143; **ROMANIA** (Bucharest) +40 21 3183606 **SLOVAKIA** (Bratislava) +421 2 54 77 4166; **SLOVENIA** (Ljubljana) +386 41 650 500; **SPAIN** (Barcelona) +34 93 227 98 33 or +34 93 227 54 00 bleep 190; **SWEDEN** (Stockholm) 112 or +46 8 33 12 31 (mon-fri 9.00-17.00); **UNITED KINGDOM** (London) 112 or 0845 4647 (NHS Direct).

16.7 Recommended restrictions

DISCLAIMER OF LIABILITY: The information in this SDS was obtained from recent Chemical Safety Report of this substance from REACH registration. However, the information is provided without any warranty, express or implied, regarding its correctness. The conditions or methods of handling, storage, use or disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of the product. This SDS was prepared and is to be used only for this product. If the product is used as a component in another product, this SDS information may not be applicable.

ANNEX TO EXTENDED SAFETY DATA SHEET

Sulphuric acid

Date: 29/06/2020

Previous date: 08/10/2019



Annex to extended Safety Data Sheet

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ANNEX TO EXTENDED SAFETY DATA SHEET

Sulphuric acid

Date: 29/06/2020

Previous date: 08/10/2019

1: Use of sulphuric acid as an Intermediate in manufacture of inorganic and organic chemicals incl. fertilizers

1. Title of Exposure scenario	
Free text title: Use of sulphuric acid as an Intermediate in manufacture of inorganic and organic chemicals incl. fertilizers	CSR-ES 2
Market sector: -	PC: 19
Description of process(es) covered in the Exposure Scenario:	
Environment Industrial use resulting in manufacture of another substance (use of intermediates)	ERC 6a
Worker contributing scenarios	SU: 3, 4, 6b, 8, 9, 14
Use in closed process, no likelihood of exposure	PROC 1
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2
Use in closed batch process (synthesis or formulation)	PROC 3
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9
Description of activities covered in the Exposure Scenario:	
This scenario covers the industrial use of sulphuric acid as an intermediate in manufacture of inorganic and organic chemicals including the use in closed processes and the transfer of substance or preparation.	
2. Conditions of use affecting exposure	
2.1 Control of environmental exposure	
Product characteristics	
<u>Properties of sulphuric acid:</u>	
Molecular Weight	98.08 g/mol
Vapour Pressure (at 20 °C)	0.1 hPa
Water Solubility	Miscible
log Kow	-1 (estimated)
Koc	1 (estimated)
Amounts used	
Annual use at a site:	300 000 t/y
Frequency and duration of use	
Emission days per site: 365 d/y. Frequency at workplace (for one worker): 220 d/year. Duration per day at workplace (for one worker): 8hr/d. Intermittent contact is expected.	
Environment factors not influenced by risk management	
-	
Other given operational conditions affecting environmental exposure	
Discharge volume of sewage treatment plant	2000 m³/d
Available river water volume to receive the emissions from a site	20 000 m³/d
Technical conditions and measures at process level (source) to prevent release	
Technical conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Air emission abatement	Adequate measures in place. Exhaust gases treated by scrubbers.
Onsite pre-treatment of waste water	Chemical pre-treatment or onsite STP. Waste waters are generally treated by on site WWTP which will be neutralised before it reaches the biological tower of the WWTP or will be treated

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	on site by chemical neutralisation methods before release to the municipal STP or to the environment.		
Onsite waste treatment	Complete. The waste water neutralisation process is extremely efficient with almost total neutralisation achieved. pH alarms are in place to ensure that successful neutralisation has taken place.		
Resulting fraction of initially applied amount in waste water released from site to the external sewage system	Varies depending on system. The neutralisation process is extremely efficient and pH monitors are in place to ensure that complete neutralisation and removal have taken place.		
Organizational measures to prevent/limit release from site			
-			
Conditions and measures related to municipal sewage treatment plant			
Discharge rate of effluent	2000 m ³ /d		
Recovery of sludge for agriculture or horticulture	No. All sludge is collected and incinerated or sent to landfill.		
Resulting fraction of initially applied amount in waste water released from site	Less than 0.01%		
Conditions and measures related to external treatment of waste for disposal			
Amount of substances in waste water resulting from identified uses covered in the exposure scenario	0 kg/d		
Type of waste, suitable waste codes	Suitable EWC code(s)		
Conditions and measures related to external recovery of waste			
Type of external treatment aiming at recycling or recovery of substances	None		
Type of external treatment aiming at final disposal of the waste	Incineration or landfill.		
2.2 Control of workers exposure			
Product characteristic			
<u>Assessment approach:</u> The assessment of worker exposure to sulphuric acid used as an intermediate in the manufacture of organic and inorganic chemicals was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART).			
Type of product the information relates to	Substance as such		
Physical form	Liquid		
Concentration of substance in product	N/A		
Molecular weight	98.08 g/mol		
Vapour Pressure	6 Pa		
Frequency and duration of use/exposure and other operational conditions affecting workers exposure			
Contributing scenario	PROC	Exposure duration	Process temperature
Use in closed process, no likelihood of exposure	PROC 1	480 mins	Hot processes (50-150°C)
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2		
Use in closed batch process (synthesis or formulation)	PROC 3		
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4		
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a		Room temperature (15-25°C)

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Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b		
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9		
Technical conditions and measures at process level (source) to prevent release			
Organisational measures to prevent /limit releases, dispersion and exposure			
Handling of sulphuric acid involves special equipment and controlled systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered.			
Contributing scenario	PROC	Containment	
Use in closed process, no likelihood of exposure	PROC 1	Handling reduces contact between product and adjacent air	
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	Handling reduces contact between product and adjacent air	
Use in closed batch process (synthesis or formulation)	PROC 3	Handling reduces contact between product and adjacent air	
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4	Open process, submerged loading	
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a	-	
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	-	
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	Handling reduces contact between product and adjacent air	
Technical conditions and measures to control dispersion from source towards the worker			
Handling of sulphuric acid involves special equipment and controlled systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered.			
Contributing scenario	PROC	Localised controls	Dispersion
Use in closed process, no likelihood of exposure	PROC 1	Vapour recovery systems; LEV	Outdoors not close to buildings
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	Vapour recovery	Outdoors not close to buildings
Use in closed batch process (synthesis or formulation)	PROC 3	Vapour recovery systems; LEV	Outdoors near to buildings
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4	Vapour recovery	Outdoors near to buildings
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a	None	Outdoors not close to buildings
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	Vapour recovery systems; LEV	Outdoors not close to buildings
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	Vapour recovery	Indoors, any sized room, only good natural ventilation

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Conditions and measures related to personal protection, hygiene and health evaluation

Handling of sulphuric acid involves special equipment and controlled systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered. Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimise exposure and risks.

Additional good practise advice beyond the REACH CSA

Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.

3. Exposure estimation and reference to its source

Environment: First tier conservative environmental exposure estimations were carried out using EUSES 2.1 and using the specified defaults. ERC 6A was used to determine the environmental emissions for intermediate use in the first tier with more realistic refined inputs chosen for second tier assessment. Second tier worst case environmental exposure estimations were carried out using EUSES 2.1 to take into account more realistic factors that affect the environmental concentrations and partitioning including degradation and sorption parameters. The tier 1 assessment in EUSES was not considered to give a realistic exposure estimation and so only the results of the refined tier 2 model are shown.

Worker: In the characterisation of the human health risks posed by acute/short term and long-term inhalation exposures to sulphuric acid, the 90th percentile (e.g. worst case) inhalation exposure concentrations derived using the ART model for relevant PROC codes were compared with the DNEL value for acute local respiratory effects and the DNEL value for long-term local respiratory effects respectively.

Environment**Local exposure estimation and risk characterisation**

The predicted exposure concentrations (PEC) are reported in the following table. PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.

Exposure estimation	PEC value		
Freshwater (mg/L)	2×10^{-4}		
Marine water (mg/L)	3×10^{-5}		
Freshwater sediments (mg/kg)	1.8×10^{-6}		
Marine sediments (mg/kg)	2.6×10^{-6}		
Agricultural soil (mg/kg)	9.2×10^{-4}		
Grassland (mg/kg)	3.4×10^{-3}		
Air (mg/m ³)	3.2×10^{-6}		
Risk characterisation	PEC (mg/L)	PNEC (mg/l)	PEC/PNEC
Tier 2 Freshwater	8.8×10^{-4}	0.0025	0.352
Tier 2 Sediment	7.3×10^{-4}	0.002 (EPM)	0.365
Tier 2 Marine sediment	1.03×10^{-4}	0.002 (EPM)	0.051
Tier 2 Marine	1.2×10^{-4}	0.00025	0.48
Tier 2 STP	0	8.8	0

Risk characterisation for man via the environment

Environmental releases are shown to be minimal. Sulphuric acid is readily degradable in atmospheric, aquatic and soil compartments, and does not bioaccumulate. Removal by hydrolysis and by the STP is effective. Therefore it is considered unlikely that humans will be exposed indirectly either by way of contact with the air, surface waters or soils, or by way of drinking water, or through exposure in the food chain.

Worker exposure**Quantitative assessment (long-term, systemic effects, inhalation and dermal route)**

Estimated exposure via inhalation, DNEL values and the corresponding risk characterisation ratios (RCR) are reported in the below table.

Contributing scenario	PROC	Inhalation Acute – local effects			Inhalation Long-term – local effects		
		Exposure concentrations (mg/m ³)	DNEL (mg/m ³)	RCR	Exposure concentrations (mg/m ³)	DNEL (mg/m ³)	RCR

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Use in closed process, no likelihood of exposure	PROC 1	9.3×10^{-9}	0.1	9.2×10^{-7}	9.4×10^{-9}	0.05	1.8×10^{-6}
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	9.2×10^{-8}	0.1	4.2×10^{-3}	9.2×10^{-8}	0.05	8.4×10^{-3}
Use in closed batch process (synthesis or formulation)	PROC 3	4.2×10^{-4}	0.1	1.4×10^{-1}	4.2×10^{-4}	0.05	2.8×10^{-1}
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4	1.4×10^{-2}	0.1	2.3×10^{-1}	1.4×10^{-2}	0.05	4.6×10^{-1}
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a	2.3×10^{-2}	0.1	1.2×10^{-3}	2.3×10^{-2}	0.05	9.6×10^{-5}
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	1.2×10^{-4}	0.1	3.2×10^{-2}	4.8×10^{-6}	0.05	5.6×10^{-2}
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	3.2×10^{-3}	0.1	9.2×10^{-7}	2.8×10^{-3}	0.05	1.8×10^{-6}

Qualitative assessment

The risk to human health due to the corrosive nature of sulphuric acid and the possibility of causing chemical burns when in dermal contact may arise for all the exposure scenarios and is assessed in a qualitative manner. In the industrial setting an acute risk of dermal burns from exposure to sulphuric acid in its concentrated form (or its dilute form) exists due to possible splashing of the liquid acid. This risk would be highest at times of transfer to tankers, filling of barrels and filling of small vessels etc. Though these events are considered unlikely due to the high degree of system closure and control the risk is still protected against in order to eliminate any possible routes of exposure.

To ensure safe use at least three safety aspects should be considered and relevant measures should be applied. These are, firstly, reduction of potential emissions with specialised systems. Secondly reduction of the potential for exposure of workers by means such as segregation and training and thirdly physical protection of the worker with the use of correct PPE. With the combination of these measures it is considered that the risk of chemical burns to workers (be they in large scale industrial production plants, transfer depots or formulation sites) is adequately managed.

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES**Environment**

First tier conservative environmental exposure estimations were carried out using EUSES 2.1 and using the specified defaults. ERC 6A was used to determine the environmental emissions for intermediate use in the first tier with more realistic refined inputs chosen for second tier assessment. Second tier worst case environmental exposure estimations were carried out using EUSES 2.1 to take into account more realistic factors that affect the environmental concentrations and partitioning including degradation and sorption parameters.

Environmental emissions are limited by designated waste treatment process designed to limit environmental exposure to all relevant compartments. Waste gas emissions are scrubbed and may also then be diverted to the wastewater stream. This significantly lessens the possible emission by atmospheric deposition to soil or surface waters. Liquid wastes are treated (neutralisation to neutral pH) prior to emission to remove any sulphuric acid in the waste water and sludge from the waste water treatment plant is sent for incineration or landfill and is not used for agricultural spreading. This precludes any contamination of soil by sludge spreading. Waste water treatment is usually carried out by neutralisation followed by flocculation or decantation

Human health exposure

The assessment of worker exposure to sulphuric acid used as an intermediate in the manufacture of organic and inorganic chemicals was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART).

The predicted acute/short-term and long-term inhalation exposure concentrations derived using the ART model were not found to exceed the DNEL value for acute local respiratory effects or the DNEL value for long-term local respiratory effects respectively for any of the processes. On the basis of the assumptions made in the exposure assessment and this risk characterisation, it can be concluded that inhalation exposures to sulphuric acid that may potentially arise during processes do not pose an unacceptable health risk to workers.

Conforms to Annex II of Regulation (EC) No. 1907/2006 (REACH)

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This exposure scenario does not address consumers or professional workers.

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2: Use of sulphuric acid as a processing aid, catalyst, dehydrating agent, pH regulator

1. Title of Exposure scenario	
Free text title: Use of sulphuric acid as a processing aid, catalyst, dehydrating agent, pH regulator	CSR-ES 3
Market sector: -	PC: 20
Description of process(es) covered in the Exposure Scenario:	
Environment: Industrial use of reactive processing aids	ERC 6b
Worker contributing scenarios	SU: 3, 4, 5, 6b, 8, 9, 11, 23
Use in closed process, no likelihood of exposure	PROC 1
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2
Use in closed batch process (synthesis or formulation)	PROC 3
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9
Treatment of articles by dipping and pouring	PROC 13
Description of activities covered in the Exposure Scenario:	
This exposure scenario covers the industrial use of sulphuric acid as a processing aid, catalyst, dehydrating agent, pH regulator including use in closed processes, transfer of substance or preparation and treatment of articles by dipping and pouring.	
2. Conditions of use affecting exposure	
2.1 Control of environmental exposure	
Product characteristics	
Properties of sulphuric acid:	
Molecular Weight	98.08 g/mol
Vapour Pressure (at 20 °C)	0.1 hPa
Water Solubility	Miscible
log Kow	-1 (estimated)
Koc	1 (estimated)
Amounts used	
Annual use at a site:	100 000 t/y
Frequency and duration of use	
Emission days per site: 365 d/y. Frequency at workplace (for one worker): 220 d/y. Duration per day at workplace (for one worker): 8hr/d. Intermittent contact is expected.	
Environment factors not influenced by risk management	
-	
Other given operational conditions affecting environmental exposure	
Discharge volume of sewage treatment plant	2000 m³/d
Available river water volume to receive the emissions from a site	20 000 m³/d
Technical conditions and measures at process level (source) to prevent release	
Technical conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Onsite pre-treatment of waste water	Chemical pre-treatment or onsite STP. Waste waters are generally treated by on site WWTP which will be neutralised before it reaches the biological tower of the WWTP or will be treated on site by chemical neutralisation methods before release to the municipal STP or to the

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	environment.
Resulting fraction of initially applied amount in waste water released from site to the external sewage system	Varies depending on system. The neutralisation process is extremely efficient and pH monitors are in place to ensure that complete neutralisation and removal have taken place.
Air emission abatement	Adequate measures in place. Exhaust gases treated by scrubbers.
Resulting fraction of applied amount in waste gas released to environment	274 kg/d. Refinement of atmospheric emissions not required for this exposure scenario.
Onsite waste treatment	Complete. The waste water neutralisation process is extremely efficient with almost total neutralisation achieved. pH alarms are in place to ensure that successful neutralisation has taken place.

Organizational measures to prevent/limit release from site

-

Conditions and measures related to municipal sewage treatment plant

Discharge rate of effluent	2000 m ³ /d
Recovery of sludge for agriculture or horticulture	No. All sludge is collected and incinerated or sent to landfill.
Resulting fraction of initially applied amount in waste water released from site	Less than 0.01%

Conditions and measures related to external treatment of waste for disposal

Amount of substances in waste water resulting from identified uses covered in the exposure scenario	0 kg/d
Type of waste, suitable waste codes	Suitable EWC code(s)
Type of external treatment aiming at final disposal of the waste	Incineration or landfill

Conditions and measures related to external recovery of waste

-

2.2 Control of workers exposure**Product characteristic**

Assessment approach: The assessment of worker exposure to sulphuric acid used as a processing aid, catalyst, dehydrating agent, pH regulator was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART).

Type of product the information relates to:	Substance as such
Physical form:	Liquid
Concentration of substance in product:	98%
Molecular weight	98.08 g/mol
Vapour Pressure	6 Pa

Frequency and duration of use/exposure and other operational conditions affecting workers exposure

Contributing scenario	PROC	Exposure duration	Process temperature
Use in closed process, no likelihood of exposure	PROC 1	480 mins	Hot processes (50-150°C)
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2		
Use in closed batch process (synthesis or formulation)	PROC 3		
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4		

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Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a		Room temperature (15-25°C)
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b		
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9		
Treatment of articles by dipping and pouring	PROC 13		

Technical conditions and measures at process level (source) to prevent release**Organisational measures to prevent /limit releases, dispersion and exposure**

Working with sulphuric acid involves special equipment and high controlled systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered.

Contributing scenario	PROC	Containment
Use in closed process, no likelihood of exposure	PROC 1	Handling reduces contact between product and adjacent air
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	Handling reduces contact between product and adjacent air
Use in closed batch process (synthesis or formulation)	PROC 3	Handling reduces contact between product and adjacent air
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4	Open process, submerged loading
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a	-
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	-
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	Handling reduces contact between product and adjacent air
Treatment of articles by dipping and pouring	PROC 13	-

Technical conditions and measures to control dispersion from source towards the worker

Contributing scenario	PROC	Localised controls	Dispersion
Use in closed process, no likelihood of exposure	PROC 1	Vapour recovery systems; LEV	Outdoors not close to buildings
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	Vapour recovery systems; LEV	Outdoors not close to buildings
Use in closed batch process (synthesis or formulation)	PROC 3	Vapour recovery systems; LEV	Outdoors near to buildings
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4	Vapour recovery	Outdoors near to buildings
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a	None	Outdoors not close to buildings
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	Vapour recovery systems; LEV	Outdoors not close to buildings

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Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	Vapour recovery	Indoors, any sized room, only good natural ventilation
Treatment of articles by dipping and pouring	PROC 13	None	Indoors, any sized room, only good natural ventilation

Conditions and measures related to personal protection, hygiene and health evaluation

Working with sulphuric acid involves special equipment and high controlled systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered. Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimise exposure and risks.

Additional good practise advice beyond the REACH CSA

Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.

3. Exposure estimation and reference to its source

Environment: For the tier 1 assessment of environmental releases the release estimation was based on the tonnage data and the ERC defaults. However the initial first tier calculations were not considered to give a reasonable assessment of the actual emission levels (and were not considered sufficient to demonstrate safe use), and so a tier 2 assessment has been carried out.

Worker: In the characterisation of the human health risks posed by acute/short term and long-term inhalation exposures to sulphuric acid, the 90th percentile (e.g. worst case) inhalation exposure concentrations derived using the ART model for relevant PROC codes were compared with the DNEL value for acute local respiratory effects and the DNEL value for long-term local respiratory effects respectively.

Environment**Local exposure estimation and risk characterisation**

The predicted exposure concentrations (PEC) and risk characterisation ratios (RCR) are reported in the following table. PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.

Exposure estimation	PEC value		
Freshwater (mg/L)	5.9×10^{-6}		
Marine water (mg/L)	8.6×10^{-7}		
Freshwater sediments (mg/kg)	5.1×10^{-7}		
Marine sediments (mg/kg)	7.4×10^{-8}		
Agricultural soil (mg/kg)	2.7×10^{-5}		
Grassland (mg/kg)	1.2×10^{-8}		
Air (mg/m ³)	1.2×10^{-11}		
Risk characterisation	PEC (mg/L)	PNEC (mg/L)	PEC/PNEC
Tier 2 Freshwater	5.9×10^{-6}	0.0025	2.3×10^{-3}
Tier 2 Sediment	4.75×10^{-6}	0.002 (EPM)	2.35×10^{-3}
Tier 2 Marine sediment	6.9×10^{-7}	0.002 (EPM)	3.4×10^{-4}
Tier 2 Marine	8.56×10^{-7}	0.00025	3.4×10^{-3}
Tier 2 STP	0	8.8	0

Risk characterisation for man via the environment

Indirect exposure of humans via the environment is expected to be negligible. Sulphuric acid is fully miscible in water and, as such, will not persist in any environmental compartment where indirect exposure of humans could occur. Furthermore none of the uses associated with sulphuric acid involve any targeted environmental emissions or application and the primary receiving compartment is the STP. Removal in the STP is expected to be efficient and so secondary exposure of the other receiving compartments is expected to be minimal. Similarly contamination of food crops or animals used as human food sources is not envisaged.

Worker exposure**Quantitative assessment (long-term, systemic effects, inhalation and dermal route)**

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Estimated exposure via inhalation, DNEL values and the corresponding risk characterisation ratios (RCR) are reported in the below table.

Contributing scenario	PROC	Inhalation Acute-local effects			Inhalation Long-term – local effects		
		Exposure concentration (mg/m ³)	DNEL (mg/m ³)	RCR	Exposure concentration (mg/m ³)	DNEL (mg/m ³)	RCR
Use in closed process, no likelihood of exposure	PROC 1	9.3×10^{-9}	0.1	9.3×10^{-8}	3.6×10^{-9}	0.05	1.9×10^{-7}
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	9.2×10^{-8}	0.1	9.2×10^{-7}	3.6×10^{-8}	0.05	1.8×10^{-6}
Use in closed batch process (synthesis or formulation)	PROC 3	4.2×10^{-4}	0.1	4.2×10^{-3}	1.6×10^{-4}	0.05	8.4×10^{-3}
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4	1.4×10^{-2}	0.1	1.4×10^{-1}	5.4×10^{-3}	0.05	2.8×10^{-1}
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a	2.3×10^{-2}	0.1	2.3×10^{-1}	8.8×10^{-3}	0.05	4.6×10^{-1}
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	1.2×10^{-4}	0.1	1.2×10^{-3}	4.8×10^{-5}	0.05	9.6×10^{-5}
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	3.2×10^{-3}	0.1	3.2×10^{-2}	1.1×10^{-3}	0.05	5.6×10^{-2}
Treatment of articles by dipping and pouring	PROC 13	1.8×10^{-2}	0.1	1.8×10^{-1}	6.2×10^{-3}	0.05	3.2×10^{-1}

Qualitative assessment

The risk to human health due to the corrosive nature of sulphuric acid and the possibility of causing chemical burns when in dermal contact may arise for all the exposure scenarios and is assessed in a qualitative manner. In the industrial setting an acute risk of dermal burns from exposure to sulphuric acid in its concentrated form (or its dilute form) exists due to possible splashing of the liquid acid. This risk would be highest at times of transfer to tankers, filling of barrels and filling of small vessels etc. Though these events are considered unlikely due to the high degree of system closure and control the risk is still protected against in order to eliminate any possible routes of exposure.

To ensure safe use at least three safety aspects should be considered and relevant measures should be applied. These are, firstly, reduction of potential emissions with specialised systems. Secondly reduction of the potential for exposure of workers by means such as segregation and training and thirdly physical protection of the worker with the use of correct PPE. With the combination of these measures it is considered that the risk of chemical burns to workers (be they in large scale industrial production plants, transfer depots or formulation sites) is adequately managed.

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES**Environment**

For the tier 1 assessment of environmental releases the release estimation was based on the tonnage data and the ERC defaults. However the initial first tier calculations were not considered to give a reasonable assessment of the actual emission levels (and were not considered sufficient to demonstrate safe use), and so a tier 2 assessment has been carried out.

Environmental emissions are limited by designated waste treatment process designed to limit environmental exposure to all relevant compartments. Waste gas emissions are scrubbed and may also then be diverted to the wastewater stream. This significantly lessens the possible emission by atmospheric deposition to soil or surface waters. Liquid wastes are treated (neutralisation to neutral pH) prior to emission to remove any sulphuric acid in the waste water and sludge from the waste water treatment plant is sent for incineration or landfill and is not used for agricultural spreading. This precludes any contamination of soil by sludge spreading. Waste water treatment is usually carried out by neutralisation followed by flocculation or decantation.

Human health exposure

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The assessment of worker exposure to sulphuric acid used as a processing aid, catalyst, dehydrating agent, pH regulator was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART).

The predicted acute/short-term and long-term inhalation exposure concentrations derived using the ART model were not found to exceed the DNEL value for acute local respiratory effects or the DNEL value for long-term local respiratory effects respectively for any of the processes. On the basis of the assumptions made in the exposure assessment and this risk characterisation, it can be concluded that inhalation exposures to sulphuric acid that may potentially arise during processes do not pose an unacceptable health risk to workers.

This exposure scenario does not address consumers or professional workers.

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Sulphuric acid

Date: 29/06/2020

Previous date: 08/10/2019

**3: Use of sulphuric acid for extractions and processing of minerals, ores**

1. Title of Exposure scenario	
Free text title: Use of sulphuric acid for extractions and processing of minerals, ores	CSR-ES 3
Market sector: -	PC: 20, 40
Description of process(es) covered in the Exposure Scenario:	
Environment	
Industrial use of processing aids in processes and products, not becoming part of articles	ERC 4
Industrial use of reactive processing aids	ERC 6b
Worker contributing scenarios	SU: 2a, 3, 14
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2
Use in closed batch process (synthesis or formulation)	PROC 3
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4
Description of activities covered in the Exposure Scenario:	
This exposure scenario covers the industrial use of sulphuric acid for extractions and processing of minerals, ores including the use in closed processes.	
2. Conditions of use affecting exposure	
2.1 Control of environmental exposure	
Product characteristics	
<u>Properties of sulphuric acid:</u>	
Molecular Weight	98.08 g/mol
Vapour Pressure (at 20 °C)	0.1 hPa
Water Solubility	Miscible
log Kow	-1 (estimated)
Koc	1 (estimated)
Amounts used	
Annual use at a site:	438 t/y
Frequency and duration of use	
Emission days per site: 365 d/y. Frequency at workplace (for one worker): 220 d/year. Duration per day at workplace (for one worker): 8hr/d. Intermittent contact is expected	
Environment factors not influenced by risk management	
-	
Other given operational conditions affecting environmental exposure	
Discharge volume of sewage treatment plant	2000 m³/d
Available river water volume to receive the emissions from a site	20 000 m³/d
Technical conditions and measures at process level (source) to prevent release	
Technical conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Onsite pre-treatment of waste water	Chemical pre-treatment or onsite STP. Waste waters are generally treated on site by chemical and/or biological methods before release to the municipal STP or to the environment.
Organizational measures to prevent/limit release from site	
-	
Conditions and measures related to municipal sewage treatment plant	
Recovery of sludge for agriculture or horticulture	No. All sludge is collected and processed for residual metal recovery, incinerated or sent to landfill.

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Resulting fraction of initially applied amount in waste water released from site	Less than 0.01%
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Conditions and measures related to external treatment of waste for disposal

Amount of substances in waste water resulting from identified uses covered in the exposure scenario	0 kg/d
Type of waste, suitable waste codes	Suitable EWC code(s)
Type of external treatment aiming at final disposal of the waste	Residual, metal recovery, incineration or landfill.

Conditions and measures related to external recovery of waste

-

2.2 Control of workers exposure**Product characteristic**

Assessment approach: The assessment of worker exposure to sulphuric acid used for extractions and processing of minerals and ores was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART).

Type of product the information relates to	Substance as such
Physical state of product	Liquid
Concentration of substance in product	98 %
Molecular weight	98.08 g/mol
Vapour Pressure	6 Pa

Frequency and duration of use/exposure and other operational conditions affecting workers exposure

Contributing scenario	PROC	Exposure duration	Process temperature
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	480 mins	Hot processes (50-150°C)
Use in closed batch process (synthesis or formulation)	PROC 3		
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4		

Technical conditions and measures at process level (source) to prevent release**Organisational measures to prevent /limit releases, dispersion and exposure**

Working with sulphuric acid involves special equipment and high integrity contained systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered. The heap leaching processes in Europe do not take place in the open air usually.

Contributing scenario	PROC	Containment
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	Handling reduces contact between product and adjacent air
Use in closed batch process (synthesis or formulation)	PROC 3	Handling reduces contact between product and adjacent air
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4	Open process, submerged loading

Technical conditions and measures to control dispersion from source towards the worker

Working with sulphuric acid involves special equipment and high integrity contained systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors.

Contributing scenario	PROC	Localised controls	Dispersion
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	Vapour recovery systems; LEV	Outdoors not close to buildings

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Use in closed batch process (synthesis or formulation)	PROC 3	-	Outdoors near to buildings
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4	Vapour recovery	Outdoors near to buildings

Conditions and measures related to personal protection, hygiene and health evaluation

Working with sulphuric acid involves special equipment and high integrity contained systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors. Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimise exposure and risks.

Additional good practise advice beyond the REACH CSA

Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.

3. Exposure estimation and reference to its source

Environment: First tier conservative environmental exposure estimations were carried out using the EUSES 2.1 tool using the specified defaults. ERC's 4 and 6B were used to determine the environmental emissions for extraction and processing of minerals and ores in the first tier with the worst case ERC being chosen for second tier assessment. Second tier worst case environmental exposure estimations were carried out using EUSES 2.1 to take into account more realistic factors that affect the environmental concentrations and partitioning including degradation and sorption parameters.

Worker: In the characterisation of the human health risks posed by acute/short term and long-term inhalation exposures to sulphuric acid, the 90th percentile (e.g. worst case) inhalation exposure concentrations derived using the ART model for relevant PROC codes were compared with the DNEL value for acute local respiratory effects and the DNEL value for long-term local respiratory effects respectively.

Environment**Local exposure estimation and risk characterisation**

The predicted exposure concentrations (PEC) and risk characterisation ratios (RCR) are reported in the following table. PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.

Exposure estimation	ERC 6b, PEC value	ERC 4, PEC value
Freshwater (mg/L)	2.6×10^{-8}	2.5×10^{-5}
Marine water (mg/L)	3.75×10^{-9}	3.56×10^{-6}
Freshwater sediments (mg/kg)	2.2×10^{-9}	2.12×10^{-6}
Marine sediments (mg/kg)	3.2×10^{-10}	3.08×10^{-7}
Agricultural soil (mg/kg)	1.17×10^{-7}	1.12×10^{-4}
Grassland (mg/kg)	4.3×10^{-7}	4.11×10^{-4}
Air (mg/m ³)	4.2×10^{-10}	3.99×10^{-7}

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Risk characterisation	PEC (mg/L)	PNEC (mg/L)	PEC/PNEC
ERC 6B Tier 2 Freshwater	2.6×10^{-8}	0.0025	1.1×10^{-4}
ERC 6B Tier 2 Sediment	2×10^{-8}	0.002 (EPM)	1×10^{-5}
ERC 6B Tier 2 Marine sediment	3×10^{-9}	0.002 (EPM)	1×10^{-6}
ERC 6B Tier 2 Marine	3.8×10^{-9}	0.00025	1.5×10^{-5}
ERC 6B Tier 2 STP	0	8.8	0
ERC 4 Tier 2 Freshwater	2.5×10^{-5}	0.0025	0.01
ERC 4 Tier 2 Sediment	2×10^{-5}	0.002 (EPM)	0.01
ERC 4 Tier 2 Marine sediment	2.9×10^{-6}	0.002 (EPM)	0.0145
ERC 4 Tier 2 Marine	3.6×10^{-6}	0.00025	0.0144
ERC 4 Tier 2 STP	0	8.8	0

Risk characterisation for man via the environment

Indirect exposure of humans via the environment is expected to be negligible. Sulphuric acid is fully miscible in water and, as such, will not persist in any environmental compartment where indirect exposure of humans could occur. Furthermore none of the uses associated with sulphuric acid involve any targeted environmental emissions or application and the primary receiving compartment is the STP. Removal in the STP is expected to be efficient and so secondary exposure of the other receiving compartments is expected to be minimal. Similarly contamination of food crops or animals used as human food sources is not envisaged.

Worker exposure**Quantitative assessment (long-term, systemic effects, inhalation and dermal route)**

Estimated exposure via inhalation, DNEL values and the corresponding risk characterisation ratios (RCR) are reported in the below table.

Contributing scenario	PROC	Inhalation Acute – local effects			Inhalation Long-term – local effects		
		Exposure concentrations (mg/m ³)	DNEL (mg/m ³)	RCR	Exposure concentrations (mg/m ³)	DNEL (mg/m ³)	RCR
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	9.2×10^{-8}	0.1	9.2×10^{-7}	9.2×10^{-8}	0.05	1.8×10^{-6}
Use in closed batch process (synthesis or formulation)	PROC 3	4.2×10^{-4}	0.1	4.2×10^{-3}	4.2×10^{-4}	0.05	8.4×10^{-3}
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4	1.4×10^{-2}	0.1	1.4×10^{-1}	1.4×10^{-2}	0.05	2.8×10^{-1}

Qualitative assessment

The risk to human health due to the corrosive nature of sulphuric acid and the possibility of causing chemical burns when in dermal contact may arise for all the exposure scenarios and is assessed in a qualitative manner. In the industrial setting an acute risk of dermal burns from exposure to sulphuric acid in its concentrated form (or its dilute form) exists due to possible splashing of the liquid acid. This risk would be highest at times of transfer to tankers, filling of barrels and filling of small vessels etc. Though these events are considered unlikely due to the high degree of system closure and control the risk is still protected against in order to eliminate any possible routes of exposure.

To ensure safe use at least three safety aspects should be considered and relevant measures should be applied. These are, firstly, reduction of potential emissions with specialised systems. Secondly reduction of the potential for exposure of workers by means such as segregation and training and thirdly physical protection of the worker with the use of correct PPE. With the combination of these measures it is considered that the risk of chemical burns to workers (be they in large scale industrial production plants, transfer depots or formulation sites) is adequately managed.

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES**Environment**

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First tier conservative environmental exposure estimations were carried out using the EUSES 2.1 tool using the specified defaults. ERC's 4 and 6B were used to determine the environmental emissions for extraction and processing of minerals and ores in the first tier with the worst case ERC being chosen for second tier assessment. Second tier worst case environmental exposure estimations were carried out using EUSES 2.1 to take into account more realistic factors that affect the environmental concentrations and partitioning including degradation and sorption parameters.

Environmental emissions are limited by designated waste treatment process designed to limit environmental exposure to all relevant compartments. Waste gas emissions proceeding from the closed systems are scrubbed and may also then be diverted to the wastewater stream. Liquid wastes are treated (neutralisation to neutral pH) prior to emission to remove any sulphuric acid in the waste water and sludge from the waste water treatment plant is sent for residual metal recovery, incineration or landfill and is not used for agricultural spreading. This precludes any contamination of soil by sludge spreading. Waste water treatment is usually carried out by neutralisation followed by flocculation or decantation. Downstream treatment may also take place after these procedures

Human health exposure

The assessment of worker exposure to sulphuric acid used for extractions and processing of minerals and ores was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART).

The predicted acute/short-term and long-term inhalation exposure concentrations derived using the ART model were not found to exceed the DNEL value for acute local respiratory effects or the DNEL value for long-term local respiratory effects respectively for any of the processes. On the basis of the assumptions made in the exposure assessment and this risk characterisation, it can be concluded that inhalation exposures to sulphuric acid that may potentially arise during processes do not pose an unacceptable health risk to workers.

This exposure scenario does not address consumers or professional workers.

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4: Use of sulphuric acid in the process of surface treatments, purification and etching

1. Title of Exposure scenario	
Free text title: Use of sulphuric acid in the process of surface treatments, purification and etching	CSR-ES 5
Market sector: -	PC: 14, 15
Description of process(es) covered in the Exposure Scenario:	
Environment: Industrial use of reactive processing aids	ERC 6b
Worker contributing scenarios	SU: 2a, 3, 14, 15, 16
Use in closed process, no likelihood of exposure	PROC 1
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2
Use in closed batch process (synthesis or formulation)	PROC 3
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9
Treatment of articles by dipping and pouring	PROC 13
Description of activities covered in the Exposure Scenario:	
This exposure scenario covers the industrial use of sulphuric acid in the process of surface treatments, purification and etching including the use in closed processes, transfer of substance or preparation and treatment of articles by dipping and pouring.	
2. Conditions of use affecting exposure	
2.1 Control of environmental exposure	
Product characteristics	
Properties of sulphuric acid:	
Molecular Weight	98.08 g/mol
Vapour Pressure (at 20 °C)	0.1 hPa
Water Solubility	Miscible
log Kow	-1 (estimated)
Koc	1 (estimated)
Amounts used	
Annual use at a site:	10 000 t/y
Frequency and duration of use	
Emission days per site: 365 d/y. Frequency at workplace (for one worker): 220 d/year. Duration per day at workplace (for one worker): 8hr/d. Intermittent contact is expected.	
Environment factors not influenced by risk management	
Other given operational conditions affecting environmental exposure	
Discharge volume of sewage treatment plant	2000 m³/d
Available river water volume to receive the emissions from a site	20 000 m³/d
Technical conditions and measures at process level (source) to prevent release	
Technical conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Onsite pre-treatment of waste water	Chemical pre-treatment or onsite STP. Waste waters are generally treated on site by chemical and/or biological methods before release to the municipal STP or to the environment.
Organizational measures to prevent/limit release from site	

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-			
Conditions and measures related to municipal sewage treatment plant			
Recovery of sludge for agriculture or horticulture	No. All sludge is collected and incinerated or sent to landfill.		
Resulting fraction of initially applied amount in waste water released from site	Less than 0.01%		
Conditions and measures related to external treatment of waste for disposal			
Amount of substances in waste water resulting from identified uses covered in the exposure scenario	0 kg/d		
Type of waste, suitable waste codes	Suitable EWC code(s)		
Type of external treatment aiming at final disposal of the waste	Incineration or landfill.		
Conditions and measures related to external recovery of waste			
-			
2.2 Control of workers exposure			
Product characteristic			
<u>Assessment approach:</u> The assessment of worker exposure to sulphuric acid used in the process of surface treatments, purification and etching was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART).			
Type of product the information relates to	Substance as such		
Physical state of product	Liquid		
Concentration of substance in product	98 %		
Molecular weight	98.08 g/mol		
Vapour Pressure	6 Pa		
Frequency and duration of use/exposure and other operational conditions affecting workers exposure			
Contributing scenario	PROC	Exposure duration	Process temperature
Use in closed process, no likelihood of exposure	PROC 1	480 mins	Hot processes (50-150°C)
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2		
Use in closed batch process (synthesis or formulation)	PROC 3		
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4		
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a		Room temperature (15-25°C)
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b		
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9		
Treatment of articles by dipping and pouring	PROC 13		
Technical conditions and measures at process level (source) to prevent release			
Organisational measures to prevent /limit releases, dispersion and exposure			
Working with sulphuric acid involves, special equipment and high integrity contained systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered.			

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Contributing scenario	PROC	Containment
Use in closed process, no likelihood of exposure	PROC 1	Handling reduces contact between product and adjacent air
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	Handling reduces contact between product and adjacent air
Use in closed batch process (synthesis or formulation)	PROC 3	Handling reduces contact between product and adjacent air
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4	Open process, submerged loading
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a	-
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	-
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	Handling reduces contact between product and adjacent air
Treatment of articles by dipping and pouring	PROC 13	-

Technical conditions and measures to control dispersion from source towards the worker

Working with sulphuric acid involves special equipment and high integrity contained systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered.

Contributing scenario	PROC	Localised controls	Dispersion
Use in closed process, no likelihood of exposure	PROC 1	Vapour recovery systems; LEV	Outdoors not close to buildings
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	Vapour recovery systems; LEV	Outdoors not close to buildings
Use in closed batch process (synthesis or formulation)	PROC 3	Vapour recovery systems; LEV	Outdoors near to buildings
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4	Vapour recovery	Outdoors near to buildings
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a	None	Outdoors not close to buildings
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	Vapour recovery systems; LEV	Outdoors not close to buildings
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	Vapour recovery	Indoors, any sized room, only good natural ventilation
Treatment of articles by dipping and pouring	PROC 13	None	Indoors, any sized room, only good natural ventilation

Conditions and measures related to personal protection, hygiene and health evaluation

Working with sulphuric acid involves special equipment and high integrity contained systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered. Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimise exposure and risks.

Additional good practise advice beyond the REACH CSA

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Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.

3. Exposure estimation and reference to its source

Environment: Facilities using sulphuric acid in the process of surface treatments and etching may consume between 50 and 200 tonnes per day, during a working year of some 365 days. First tier conservative environmental exposure estimations were carried out using EUSES 2.1 using the specified defaults. ERC 6B was used to determine the environmental emissions in the first tier. Second tier worst case environmental exposure estimations were carried out using EUSES 2.1 to take into account more realistic factors that affect the environmental concentrations and partitioning including degradation and sorption parameters.

Worker: In the characterisation of the human health risks posed by acute/short term and long-term inhalation exposures to sulphuric acid, the 90th percentile (e.g. worst case) inhalation exposure concentrations derived using the ART model for relevant PROC codes were compared with the DNEL value for acute local respiratory effects and the DNEL value for long-term local respiratory effects respectively.

Environment**Local exposure estimation and risk characterisation**

The predicted exposure concentrations (PEC) and risk characterisation ratios (RCR) are reported in the following table.

Exposure estimation	PEC value		
Freshwater (mg/L)	5.91 x 10 ⁻⁷		
Marine water (mg/L)	8.56 x 10 ⁻⁸		
Freshwater sediments (mg/kg)	5.1 x 10 ⁻⁸		
Marine sediments (mg/kg)	7.4 x 10 ⁻⁹		
Agricultural soil (mg/kg)	2.68 x 10 ⁻⁶		
Grassland (mg/kg)	9.87 x 10 ⁻⁶		
Air (mg/m ³)	9.59 x 10 ⁻⁹		
Risk characterisation	PEC(mg/L)	PNEC(mg/L)	PEC/PNEC
Tier 2 Freshwater	5.9 x 10 ⁻⁷	0.0025	2.3 x 10 ⁻⁴
Tier 2 Sediment	4.75 x 10 ⁻⁷	0.002 (EPM)	2.35 x 10 ⁻⁴
Tier 2 Marine sediment	3 x 10 ⁻⁹	0.002 (EPM)	1 x 10 ⁻⁶
Tier 2 Marine	8.56 x 10 ⁻⁸	0.00025	3.4 x 10 ⁻⁵
Tier 2 STP	0	8.8	0

Risk characterisation for man via the environment

Indirect exposure of humans via the environment is expected to be negligible. Sulphuric acid is fully miscible in water and, as such, will not persist in any environmental compartment where indirect exposure of humans could occur. Furthermore none of the uses associated with sulphuric acid involve any targeted environmental emissions or application and the primary receiving compartment is the STP. Removal in the STP is expected to be efficient and so secondary exposure of the other receiving compartments is expected to be minimal. Similarly contamination of food crops or animals used as human food sources is not envisaged.

Worker exposure**Quantitative assessment (long-term, systemic effects, inhalation and dermal route)**

Estimated exposure via inhalation, DNEL values and the corresponding risk characterisation ratios (RCR) are reported in the below table.

Contributing scenario	PROC	Inhalation Acute – local effects			Inhalation Long-term – local effects		
		Exposure concentrations (mg/m ³)	DNEL (mg/m ³)	RCR	Exposure concentrations (mg/m ³)	DNEL (mg/m ³)	RCR
Use in closed process, no likelihood of exposure	PROC 1	9.3 x 10 ⁻⁹	0.1	9.3 x 10 ⁻⁸	9.4 x 10 ⁻⁹	0.05	8.4 x 10 ⁻³
Use in closed, continuous process with occasional controlled exposure	PROC 2	9.2 x 10 ⁻⁸	0.1	9.2 x 10 ⁻⁷	9.2 x 10 ⁻⁸	0.05	2.8 x 10 ⁻¹

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(including sampling and maintenance)							
Use in closed batch process (synthesis or formulation)	PROC 3	4.2×10^{-4}	0.1	4.2×10^{-3}	4.2×10^{-4}	0.05	4.6×10^{-1}
Use in batch and other process (synthesis) where opportunity for exposure arises	PROC 4	1.4×10^{-2}	0.1	1.4×10^{-1}	1.4×10^{-2}	0.05	9.6×10^{-5}
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a	2.3×10^{-2}	0.1	2.3×10^{-1}	2.3×10^{-2}	0.05	5.6×10^{-2}
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	1.2×10^{-4}	0.1	1.2×10^{-3}	4.8×10^{-6}	0.05	3.2×10^{-1}
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	3.2×10^{-3}	0.1	3.2×10^{-2}	2.8×10^{-3}	0.05	8.4×10^{-3}
Treatment of articles by dipping and pouring	PROC 13	1.8×10^{-2}	0.1	1.8×10^{-1}	1.6×10^{-2}	0.05	2.8×10^{-1}

Qualitative assessment

The risk to human health due to the corrosive nature of sulphuric acid and the possibility of causing chemical burns when in dermal contact may arise for all the exposure scenarios and is assessed in a qualitative manner. In the industrial setting an acute risk of dermal burns from exposure to sulphuric acid in its concentrated form (or its dilute form) exists due to possible splashing of the liquid acid. This risk would be highest at times of transfer to tankers, filling of barrels and filling of small vessels etc. Though these events are considered unlikely due to the high degree of system closure and control the risk is still protected against in order to eliminate any possible routes of exposure.

To ensure safe use at least three safety aspects should be considered and relevant measures should be applied. These are, firstly, reduction of potential emissions with specialised systems. Secondly reduction of the potential for exposure of workers by means such as segregation and training and thirdly physical protection of the worker with the use of correct PPE. With the combination of these measures it is considered that the risk of chemical burns to workers (be they in large scale industrial production plants, transfer depots or formulation sites) is adequately managed.

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES**Environment**

Facilities using sulphuric acid in the process of surface treatments and etching may consume between 50 and 200 tonnes per day, during a working year of some 365 days. First tier conservative environmental exposure estimations were carried out using EUSES 2.1 using the specified defaults. ERC 6B was used to determine the environmental emissions in the first tier. Second tier worst case environmental exposure estimations were carried out using EUSES 2.1 to take into account more realistic factors that affect the environmental concentrations and partitioning including degradation and sorption parameters.

Environmental emissions are limited by designated waste treatment process designed to limit environmental exposure to all relevant compartments. Waste gas emissions are scrubbed and may also then be diverted to the wastewater stream for further treatment. This significantly lessens the possible emission by atmospheric deposition of atmospheric contaminants to soil or surface waters. Liquid wastes are treated (neutralisation to neutral pH) prior to emission to remove any sulphuric acid in the waste water and sludge from the waste water treatment plant is sent for incineration or landfill and is not used for agricultural spreading. This precludes any contamination of soil by sludge spreading. Waste water treatment is usually carried out by neutralisation followed by flocculation or decantation to remove metal contamination that may have been picked up during the etching or surface treatment processes. Downstream treatment may also take place after these procedures.

Human health exposure

The assessment of worker exposure to sulphuric acid used in the process of surface treatments, purification and etching was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART).

The predicted acute/short-term and long-term inhalation exposure concentrations derived using the ART model were not found to exceed the DNEL value for acute local respiratory effects or the DNEL value for long-term local respiratory effects respectively for any of the processes associated with ES 5. On the basis of the assumptions made in the exposure assessment and this risk characterisation, it can be concluded that

Conforms to Annex II of Regulation (EC) No. 1907/2006 (REACH)

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inhalation exposures to sulphuric acid that may potentially arise during processes associated with ES 5 do not pose an unacceptable health risk to workers.

This exposure scenario does not address consumers or industrial workers.

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5: Use of sulphuric acid in electrolytic processes

1. Title of Exposure scenario	
Free text title: Use of sulphuric acid in electrolytic processes	CSR-ES 6
Market sector: -	PC: 14, 20
Description of process(es) covered in the Exposure Scenario:	
Environment:	
Industrial use resulting in inclusion into or onto a matrix	ERC 5
Industrial use of reactive processing aids	ERC 6b
Worker contributing scenarios	SU: 3, 14, 15, 17
Use in closed process, no likelihood of exposure	PROC 1
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9
Treatment of articles by dipping and pouring	PROC 13
Description of activities covered in the Exposure Scenario:	
This exposure scenario covers the industrial use of sulphuric acid in electrolytic processes including the use in closed processes, transfer of substance of preparation and treatment of articles by dipping and pouring.	
2. Conditions of use affecting exposure	
2.1 Control of environmental exposure	
Product characteristics	
<u>Properties of sulphuric acid:</u>	
Molecular Weight	98.08 g/mol
Vapour Pressure (at 20 °C)	0.1 hPa
Water Solubility	Miscible
log Kow	-1 (estimated)
Koc	1 (estimated)
Amounts used	
Annual use at a site:	2 306 t/y
Frequency and duration of use	
Emission days per site: 365 d/y. Frequency at workplace (for one worker): 220 d/year. Duration per day at workplace (for one worker): 8hr/d. Intermittent contact is expected.	
Environment factors not influenced by risk management	
-	
Other given operational conditions affecting environmental exposure	
Discharge volume of sewage treatment plant	2000 m³/d
Available river water volume to receive the emissions from a site	20,000 m³/d
Technical conditions and measures at process level (source) to prevent release	
Technical conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Onsite pre-treatment of waste water	Chemical pre-treatment or onsite STP. Waste waters are generally treated on site by chemical and/or biological methods before release to the municipal STP or to the environment.
Organizational measures to prevent/limit release from site	
-	
Conditions and measures related to municipal sewage treatment plant	
Recovery of sludge for agriculture or horticulture	No. All sludge is collected and processed for metal recovery, incinerated or sent to landfill.

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Resulting fraction of initially applied amount in waste water released from site	Less than 0.01%		
Conditions and measures related to external treatment of waste for disposal			
Amount of substances in waste water resulting from identified uses covered in the exposure scenario	0 kg/d		
Type of waste, suitable waste codes	Suitable EWC code(s)		
Type of external treatment aiming at final disposal of the waste	Metal recovery, incineration or landfill.		
Conditions and measures related to external recovery of waste			
-			
2.2 Control of workers exposure			
Product characteristic			
Assessment approach: The assessment of worker exposure to sulphuric acid used in electrolytic processes was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART).			
Type of product the information relates to	Substance as such		
Physical state of product	Liquid		
Concentration of substance in product	95-98 %		
Molecular weight	98.08 g/mol		
Vapour Pressure	6 Pa		
Frequency and duration of use/exposure and other operational conditions affecting workers exposure			
Contributing scenario	PROC	Exposure duration	Process temperature
Use in closed process, no likelihood of exposure	PROC 1	480 mins	Hot processes (50-150°C)
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2		
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b		Room temperature (15-25°C)
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9		
Treatment of articles by dipping and pouring	PROC 13		
Technical conditions and measures at process level (source) to prevent release			
Organisational measures to prevent /limit releases, dispersion and exposure			
Working with sulphuric acid involves, special equipment and high integrity contained systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors. Electrolysis is most commonly taking place not in the open air. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered.			
Contributing scenario	PROC	Containment	
Use in closed process, no likelihood of exposure	PROC 1	Handling reduces contact between product and adjacent air	
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	Handling reduces contact between product and adjacent air	
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	-	
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	Handling reduces contact between product and adjacent air	

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Treatment of articles by dipping and pouring	PROC 13	-	
Technical conditions and measures to control dispersion from source towards the worker			
Working with sulphuric acid involves special equipment and high integrity contained systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered.			
Contributing scenario	PROC	Localised controls	Dispersion
Use in closed process, no likelihood of exposure	PROC 1	Vapour recovery systems; LEV	Outdoors not close to buildings
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	Vapour recovery	Outdoors not close to buildings
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	Vapour recovery systems; LEV	Outdoors not close to buildings
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	Vapour recovery	Indoors, any sized room, only good natural ventilation (however LEV will be employed when needed).
Treatment of articles by dipping and pouring	PROC 13	LE	Indoors, any sized room, only good natural ventilation (however LEV will be employed when needed).
Conditions and measures related to personal protection, hygiene and health evaluation			
Working with sulphuric acid involves, special equipment and high integrity contained systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered. Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimise exposure and risks.			
Additional good practise advice beyond the REACH CSA			
Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.			
3. Exposure estimation and reference to its source			
Environment: Facilities using sulphuric acid in electrolytic processes may consume up to 10 tonnes per day, during a working year of some 365 days. First tier conservative environmental exposure estimations were carried out using EUSES with the specified defaults. ERC's 5 and 6B were used to determine the environmental emissions during use in electrolytic processes in the first tier with the worst case ERC being chosen for second tier assessment. Second tier worst case environmental exposure estimations were carried out using EUSES 2.1 to take into account more realistic factors that affect the environmental concentrations and partitioning including degradation and sorption parameters.			
Worker: In the characterisation of the human health risks posed by acute/short term and long-term inhalation exposures to sulphuric acid, the 90th percentile (e.g. worst case) inhalation exposure concentrations derived using the ART model for relevant PROC codes were compared with the DNEL value for acute local respiratory effects and the DNEL value for long-term local respiratory effects respectively.			
Environment			
Local exposure estimation and risk characterisation			
The predicted exposure concentrations (PEC) and risk characterisation ratios (RCR) are reported in the following table. PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.			
Exposure estimation	ERC 6b, PEC value		ERC 5, PEC value
Freshwater (mg/L)	1.36 x 10 ⁻⁷		6.81 x 10 ⁻⁵
Marine water (mg/L)	1.97 x 10 ⁻⁸		9.87 x 10 ⁻⁶
Freshwater sediments (mg/kg)	1.18 x 10 ⁻⁸		5.88 x 10 ⁻⁶
Marine sediments (mg/kg)	1.71 x 10 ⁻⁹		8.53 x 10 ⁻⁷
Agricultural soil (mg/kg)	6.18 x 10 ⁻⁷		3.09 x 10 ⁻⁴
Grassland (mg/kg)	2.28 x 10 ⁻⁹		1.14 x 10 ⁻³
Air (mg/m ³)	2.21 x 10 ⁻⁹		1.11 x 10 ⁻⁶

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Risk characterisation	PEC (mg/L)	PNEC (mg/L)	PEC/PNEC
ERC 6B Tier 2 Freshwater	1.36×10^{-7}	0.0025	5.2×10^{-5}
ERC 6B Tier 2 Sediment	1.17×10^{-7}	0.002 (EPM)	5.5×10^{-5}
ERC 6B Tier 2 Marine sediment	1.59×10^{-8}	0.002 (EPM)	7.9×10^{-6}
ERC 6B Tier 2 Marine	1.97×10^{-8}	0.00025	3.8×10^{-4}
ERC 6BTier 2 STP	0	8.8	0
ERC 5Tier 2 Freshwater	6.81×10^{-5}	0.0025	0.039
ERC 5Tier 2 Sediment	4.48×10^{-5}	0.002 (EPM)	0.022
ERC 5Tier 2 Marine sediment	7.94×10^{-6}	0.002 (EPM)	3.9×10^{-3}
ERC 5Tier 2 Marine	9.87×10^{-6}	0.00025	0.039
ERC 5 Tier 2 STP	0	8.8	0

Risk characterisation for man via the environment

Indirect exposure of humans via the environment is expected to be negligible. Sulphuric acid is fully miscible in water and, as such, will not persist in any environmental compartment where indirect exposure of humans could occur. Furthermore none of the uses associated with sulphuric acid involve any targeted environmental emissions or application and the primary receiving compartment is the STP. Removal in the STP is expected to be efficient and so secondary exposure of the other receiving compartments is expected to be minimal. Similarly contamination of food crops or animals used as human food sources is not envisaged.

Worker exposure**Quantitative assessment (long-term, systemic effects, inhalation and dermal route)**

Estimated exposure via inhalation, DNEL values and the corresponding risk characterisation ratios (RCR) are reported in the below table.

*Assumes Respiratory Protective Equipment (95% reduction) is worn.

Contributing scenario	PROC	Inhalation Acute – local effects			Inhalation Long-term – local effects		
		Exposure concentrations (mg/m ³)	DNEL (mg/m ³)	RCR	Exposure concentrations (mg/m ³)	DNEL (mg/m ³)	RCR
Use in closed process, no likelihood of exposure	PROC 1	9.3×10^{-9}	0.1	9.3×10^{-8}	9.4×10^{-9}	0.05	1.9×10^{-7}
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	9.2×10^{-8}	0.1	9.2×10^{-7}	9.2×10^{-8}	0.05	1.8×10^{-6}
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	1.2×10^{-4}	0.1	1.2×10^{-3}	4.8×10^{-6}	0.05	9.6×10^{-5}
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	3.2×10^{-3}	0.1	3.2×10^{-2}	2.8×10^{-3}	0.05	5.6×10^{-2}
Treatment of articles by dipping and pouring	PROC 13	5.4×10^{-1} (3×10^{-2})*	0.1	5.4×10^{-0} (3×10^{-1})*	4.7×10^{-1} (2×10^{-2})*	0.05	9.4×10^{-0} (4×10^{-1})*

Qualitative assessment

The risk to human health due to the corrosive nature of sulphuric acid and the possibility of causing chemical burns when in dermal contact may arise for all the exposure scenarios and is assessed in a qualitative manner. In the industrial setting an acute risk of dermal burns from exposure to sulphuric acid in its concentrated form (or its dilute form) exists due to possible splashing of the liquid acid. This risk would be highest at times of transfer to tankers, filling of barrels and filling of small vessels etc. Though these events are considered unlikely due to the high degree of system closure and control the risk is still protected against in order to eliminate any possible routes of exposure.

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To ensure safe use at least three safety aspects should be considered and relevant measures should be applied. These are, firstly, reduction of potential emissions with specialised systems. Secondly reduction of the potential for exposure of workers by means such as segregation and training and thirdly physical protection of the worker with the use of correct PPE. With the combination of these measures it is considered that the risk of chemical burns to workers (be they in large scale industrial production plants, transfer depots or formulation sites) is adequately managed.

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Environment

Facilities using sulphuric acid in electrolytic processes may consume up to 10 tonnes per day, during a working year of some 365 days. First tier conservative environmental exposure estimations were carried out using EUSES with the specified defaults. ERC's 5 and 6B were used to determine the environmental emissions during use in electrolytic processes in the first tier with the worst case ERC being chosen for second tier assessment. Second tier worst case environmental exposure estimations were carried out using EUSES 2.1 to take into account more realistic factors that affect the environmental concentrations and partitioning including degradation and sorption parameters.

Human health exposure

The assessment of worker exposure to sulphuric acid used in electrolytic processes was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART).

The predicted acute/short-term and long-term inhalation exposure concentrations derived using the ART model were not found to exceed the DNEL value for acute local respiratory effects or the DNEL value for long-term local respiratory effects respectively for the processes indicated by PROC codes 1,2,8b and 9. The predicted acute/short-term and long-term inhalation exposure concentrations derived using the ART model were found to exceed the DNEL value for acute local respiratory effects or the DNEL value for long-term local respiratory effects respectively for PROC 13: treatment of articles by dipping. When the acute/short term and long-term inhalation exposure estimates for PROC 13 were refined to account for wearing of respiratory protective equipment affording (95% efficiency), exposures were not found to exceed the acute/short-term and long-term DNEL values respectively. On the basis of the assumptions made in the exposure assessment and this risk characterisation, it can be concluded that inhalation exposures to sulphuric acid that may potentially arise during processes do not pose an unacceptable health risk to workers.

This exposure scenario does not address consumers or professional workers.

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**6: Use of sulphuric acid in gas purification, scrubbing, flue gas scrubbing**

1. Title of Exposure scenario	
Free text title: Use of sulphuric acid in gas purification, scrubbing, flue gas scrubbing	CSR-ES 7
Market sector: -	PC: 20
Description of process(es) covered in the Exposure Scenario:	
Environment: ERC 7 Industrial use of substances in closed systems	ERC 7
Worker contributing scenarios	SU: 3, 8
Use in closed process, no likelihood of exposure	PROC 1
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b
Description of activities covered in the Exposure Scenario:	
This exposure scenario covers the industrial use of sulphuric acid in gas purification, scrubbing, flue gas scrubbing including the use in closed processes and transfer of substance or preparation.	
2. Conditions of use affecting exposure	
2.1 Control of environmental exposure	
Product characteristics	
Properties of sulphuric acid:	
Molecular Weight	98.08 g/mol
Vapour Pressure (at 20 °C)	0.1 hPa
Water Solubility	Miscible
log Kow	-1 (estimated)
Koc	1 (estimated)
Amounts used	
Annual use at a site:	30 000 t/y
Frequency and duration of use	
Emission days per site: 365 d/y. Frequency at workplace (for one worker): 220 d/year. Duration per day at workplace (for one worker): 8hr/d. Intermittent contact is expected.	
Environment factors not influenced by risk management	
Discharge volume of sewage treatment plant	2000 m³/d
Available river water volume to receive the emissions from a site	20 000 m³/d
Other given operational conditions affecting environmental exposure	
Technical conditions and measures at process level (source) to prevent release	
Technical conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Onsite pre-treatment of waste water	Chemical pre-treatment or onsite STP. Waste waters are generally treated on site by chemical and/or biological methods before release to the municipal STP or to the environment. Spent acid solutions are neutralized to circumneutral pH prior to discharge.
Organizational measures to prevent/limit release from site	
-	
Conditions and measures related to municipal sewage treatment plant	
Recovery of sludge for agriculture or horticulture	No. All sludge is collected and incinerated or sent to landfill for disposal under regulatory requirements.
Resulting fraction of initially applied amount in waste water released from site	Less than 0.01%

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Buffering capacity and flow rate of receiving waters	Dilution of acid emissions. Emissions are to a large river with a considerable buffering capacity and a very high flow rate; spent acid solutions are neutralized to circumneutral pH prior to release to receiving waters as required by water discharge permits.
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Conditions and measures related to external treatment of waste for disposal

Amount of substances in waste water resulting from identified uses covered in the exposure scenario	0 kg/d
Type of waste, suitable waste codes	Suitable EWC code(s)
Type of external treatment aiming at final disposal of the waste	Incineration or landfill.

Conditions and measures related to external recovery of waste

-

2.2 Control of workers exposure**Product characteristic**

Assessment approach: The assessment of worker exposure to sulphuric acid used in gas purification, scrubbing and flue gas scrubbing was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART).

Type of product the information relates to	Substance as such
Physical state of product	Liquid
Concentration of substance in product	98 %
Molecular weight	98.08 g/mol
Vapour Pressure	6 Pa

Frequency and duration of use/exposure and other operational conditions affecting workers exposure

Contributing scenario	PROC	Exposure duration	Process temperature
Use in closed process, no likelihood of exposure	PROC 1	480 mins	Hot processes (50-150°C)
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2		
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b		

Technical conditions and measures at process level (source) to prevent release**Organisational measures to prevent /limit releases, dispersion and exposure**

The processes associated with sulphuric acid involve special equipment and high integrity contained systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered.

Contributing scenario	PROC	Containment
Use in closed process, no likelihood of exposure	PROC 1	Handling reduces contact between product and adjacent air
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	Handling reduces contact between product and adjacent air
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	-

Technical conditions and measures to control dispersion from source towards the worker

Use of sulphuric acid involves special equipment and high integrity contained systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered.

Contributing scenario	PROC	Localised controls	Dispersion
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Use in closed process, no likelihood of exposure	PROC 1	Vapour recovery systems; LEV	Outdoors not close to buildings
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	Vapour recovery	Outdoors not close to buildings
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	Vapour recovery systems; LEV	Outdoors not close to buildings

Conditions and measures related to personal protection, hygiene and health evaluation

Use of sulphuric acid involves special equipment and high integrity contained systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered. Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimise exposure and risks.

Additional good practise advice beyond the REACH CSA

Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.

3. Exposure estimation and reference to its source

Environment: Use of sulphuric acid in industrial facilities in the process of gas purification, scrubbing and flue gas scrubbing may be carried out regularly and throughout the year with possible numbers of emission days approaching the full year of 365 days. First tier conservative environmental exposure estimations were carried out using EUSES and implementing the specified defaults. ERC 7 was used to determine the environmental emissions for this exposure scenario in the first tier. Second tier worst case environmental exposure estimations were carried out using EUSES 2.1 to take into account more realistic factors that affect the environmental concentrations and partitioning including degradation and sorption parameters.

Worker: In the characterisation of the human health risks posed by acute/short term and long-term inhalation exposures to sulphuric acid, the 90th percentile (e.g. worst case) inhalation exposure concentrations derived using the ART model for relevant PROC codes were compared with the DNEL value for acute local respiratory effects and the DNEL value for long-term local respiratory effects respectively.

Environment**Local exposure estimation and risk characterisation**

The predicted exposure concentrations (PEC) and risk characterisation ratios (RCR) are reported in the following table.

Exposure estimation	PEC value		
Freshwater (mg/L)	8.86 x 10 ⁻⁵		
Marine water (mg/L)	1.28 x 10 ⁻⁵		
Freshwater sediments (mg/kg)	7.65 x 10 ⁻⁶		
Marine sediments (mg/kg)	1.11 x 10 ⁻⁶		
Agricultural soil (mg/kg)	0.0029		
Grassland (mg/kg)	0.0014		
Air (mg/m ³)	1.44 x 10 ⁻⁶		
Risk characterisation	PEC (mg/L)	PNEC (mg/L)	PEC/PNEC
Tier 2 Freshwater	8.86 x 10 ⁻⁵	0.0025	0.0352
Tier 2 Sediment	7.13 x 10 ⁻⁵	0.002 (EPM)	0.0355
Tier 2 Marine sediment	1.03 x 10 ⁻⁵	0.002 (EPM)	0.005
Tier 2 Marine	1.28 x 10 ⁻⁵	0.00025	0.048
Tier 2 STP	0	8.8	0

Risk characterisation for man via the environment

Indirect exposure of humans via the environment is expected to be negligible. Sulphuric acid is fully miscible in water and, as such, will not persist in any environmental compartment where indirect exposure of humans could occur. Furthermore none of the uses associated with sulphuric acid involve any targeted environmental emissions or application and the primary receiving compartment is the STP (wastewater treatment facility).

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Because sulphuric acid dissociates completely. Removal in aqueous solutions to the sulphate ion, removal in a STP does not occur. Therefore, secondary exposure of the other receiving compartments is not possible. Similarly contamination of food crops or animals used as human food sources is not envisaged.

Worker exposure**Quantitative assessment (long-term, systemic effects, inhalation and dermal route)**

Estimated exposure via inhalation, DNEL values and the corresponding risk characterisation ratios (RCR) are reported in the below table.

Contributing scenario	PROC	Inhalation Acute – local effects			Inhalation Long-term – local effects		
		Exposure concentrations (mg/m ³)	DNEL (mg/m ³)	RCR	Exposure concentrations (mg/m ³)	DNEL (mg/m ³)	RCR
Use in closed process, no likelihood of exposure	PROC 1	9.3 x 10 ⁻⁹	0.1	9.3 x 10 ⁻⁸	9.4 x 10 ⁻⁹	0.05	1.88 x 10 ⁻⁷
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	9.2 x 10 ⁻⁸	0.1	9.2 x 10 ⁻⁷	9.2 x 10 ⁻⁸	0.05	1.84 x 10 ⁻⁶
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	1.2 x 10 ⁻⁴	0.1	1.2 x 10 ⁻³	4.8 x 10 ⁻⁶	0.05	9.6 x 10 ⁻⁵

Qualitative assessment

The risk to human health due to the corrosive nature of sulphuric acid and the possibility of causing chemical burns when in dermal contact may arise for all the exposure scenarios and is assessed in a qualitative manner. In the industrial setting an acute risk of dermal burns from exposure to sulphuric acid in its concentrated form (or its dilute form) exists due to possible splashing of the liquid acid. This risk would be highest at times of transfer to tankers, filling of barrels and filling of small vessels etc. Though these events are considered unlikely due to the high degree of system closure and control the risk is still protected against in order to eliminate any possible routes of exposure.

To ensure safe use at least three safety aspects should be considered and relevant measures should be applied. These are, firstly, reduction of potential emissions with specialised systems. Secondly reduction of the potential for exposure of workers by means such as segregation and training and thirdly physical protection of the worker with the use of correct PPE. With the combination of these measures it is considered that the risk of chemical burns to workers (be they in large scale industrial production plants, transfer depots or formulation sites) is adequately managed.

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES**Environment**

Use of sulphuric acid in industrial facilities in the process of gas purification, scrubbing and flue gas scrubbing may be carried out regularly and throughout the year with possible numbers of emission days approaching the full year of 365 days. First tier conservative environmental exposure estimations were carried out using EUSES and implementing the specified defaults. ERC 7 was used to determine the environmental emissions for this exposure scenario in the first tier. Second tier worst case environmental exposure estimations were carried out using EUSES 2.1 to take into account more realistic factors that affect the environmental concentrations and partitioning including degradation and sorption parameters.

Environmental emissions are limited by designated waste treatment processes designed to limit environmental exposure to all relevant compartments. Waste gas emissions are scrubbed and the resulting spent acid solution may also then be diverted to the wastewater stream. This significantly lessens the possible emission by atmospheric deposition to soil or surface waters. Liquid wastes are treated (neutralisation to neutral pH) prior to emission to remove any sulphuric acid in the waste water and sludge from the waste water treatment plant is sent for incineration or landfill and is not used for agricultural spreading. This precludes any contamination of soil by sludge spreading. Waste water treatment is usually carried out by neutralisation followed by flocculation or decantation. Downstream treatment may also take place after these procedures.

Human health exposure

The assessment of worker exposure to sulphuric acid used in gas purification, scrubbing and flue gas scrubbing was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART).

The predicted acute/short-term and long-term inhalation exposure concentrations derived using the ART model were not found to exceed the DNEL value for acute local respiratory effects or the DNEL value for long-term local respiratory effects respectively for any of the processes. On the basis of the assumptions made in the exposure assessment and this risk characterisation, it can be concluded that inhalation exposures to sulphuric acid that may potentially arise during processes do not pose an unacceptable health risk to workers.

Conforms to Annex II of Regulation (EC) No. 1907/2006 (REACH)

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This exposure scenario does not address consumers or professional workers.

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7: Use of sulphuric acid as laboratory chemicals

1. Title of Exposure scenario	
Free text title: Use of sulphuric acid as laboratory chemicals	CSR-ES 12
Market sector: -	PC: 21
Description of process(es) covered in the Exposure Scenario:	
Environment:	
Wide dispersive indoor use of processing aids in open systems	ERC 8a
Wide dispersive indoor use of reactive substances in open systems	ERC 8b
Worker contributing scenarios	SU: 22
Use as laboratory reagent	PROC 15
Description of activities covered in the Exposure Scenario:	
This exposure scenario covers the professional use of sulphuric acid as laboratory chemicals.	
2. Conditions of use affecting exposure	
2.1 Control of environmental exposure	
Product characteristics	
Properties of sulphuric acid:	
Molecular Weight	98.08 g/mol
Vapour Pressure (at 20 °C)	0.1 hPa
Water Solubility	Miscible
log Kow	-1 (estimated)
Koc	1 (estimated)
Amounts used	
Annual use at a site:	5,000 t/y
Frequency and duration of use	
Emission days per site: 365 d/y. Frequency at workplace (for one worker): 220 d/year. Duration per day at workplace (for one worker): 8hr/d. Intermittent contact is expected.	
Environment factors not influenced by risk management	
-	
Other given operational conditions affecting environmental exposure	
Discharge volume of sewage treatment plant	2000 m ³ /d
Available river water volume to receive the emissions from a site	20 000 m ³ /d
Technical conditions and measures at process level (source) to prevent release	
Technical conditions and measures to reduce or limit discharges, air emissions and releases to soil	
-	
Organizational measures to prevent/limit release from site	
-	
Conditions and measures related to municipal sewage treatment plant	
-	
Conditions and measures related to external treatment of waste for disposal	
Amount of substances in waste water resulting from identified uses covered in the exposure scenario	1370 kg/d
Type of waste, suitable waste codes	Suitable EWC code(s)
Type of external treatment aiming at final disposal of the waste	Incineration or landfill.

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**Conditions and measures related to external recovery of waste**

-

2.2 Control of workers exposure**Product characteristic**

Assessment approach: The assessment of worker exposure to sulphuric acid used as a laboratory chemical was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART).

Type of product the information relates to	Substance as such
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Physical state of product	Liquid
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Concentration of substance in product	98 %
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Molecular weight	98.08 g/mol
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Vapour Pressure	6 Pa
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Frequency and duration of use/exposure and other operational conditions affecting workers exposure

Contributing scenario	PROC	Exposure duration	Process temperature
Use as laboratory reagent	PROC 15	240 mins exposure / day; 240 mins non-exposure/day	Room temperature (15-25°C)

Technical conditions and measures at process level (source) to prevent release**Organisational measures to prevent /limit releases, dispersion and exposure**

Uses would generally be on a smaller scale and would be expected to be highly contained. Laboratory workers involved in handling and use of sulphuric acid are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimise exposure and risks.

Technical conditions and measures to control dispersion from source towards the worker

Uses would generally be on a smaller scale and would be expected to be highly contained. Laboratory workers involved in handling and use of sulphuric acid are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimise exposure and risks.

Contributing scenario	PROC	Localised controls	Dispersion
Use as laboratory reagent	PROC 15	LEV	Indoors, any sized room, only good natural ventilation

Conditions and measures related to personal protection, hygiene and health evaluation

Uses would generally be on a smaller scale and would be expected to be highly contained. Laboratory workers involved in handling and use of sulphuric acid are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimise exposure and risks.

Additional good practise advice beyond the REACH CSA

Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.

3. Exposure estimation and reference to its source

Environment: First tier conservative environmental exposure estimations were carried out in EUSES using the specified defaults. ERC 8A and 8B were used to determine the environmental emissions for ES1 in the first tier. Second tier worst case environmental exposure estimations were carried out using EUSES 2.1 to take into account more realistic factors that affect the environmental concentrations and partitioning including degradation and sorption parameters.

Worker: In the characterisation of the human health risks posed by acute/short term and long-term inhalation exposures to sulphuric acid the 90th percentile (e.g. worst case) inhalation exposure concentrations derived using the ART model for relevant PROC codes were compared with the DNEL value for acute local respiratory effects and the DNEL value for long-term local respiratory effects respectively.

Environment**Local exposure estimation and risk characterisation**

The predicted exposure concentrations (PEC) and risk characterisation ratios (RCR) are reported in the following table. PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.

Exposure estimation	ERC 8a, PEC value	ERC 8b, PEC value
Freshwater (mg/L)	1.38 x 10 ⁻⁴	2.12 x 10 ⁻⁶

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Marine water (mg/L)	7.39×10^{-6}	6.66×10^{-8}
Freshwater sediments (mg/kg)	1.16×10^{-5}	1.83×10^{-7}
Marine sediments (mg/kg)	6.39×10^{-7}	5.76×10^{-9}
Agricultural soil (mg/kg)	1.34×10^{-4}	1.34×10^{-7}
Grassland (mg/kg)	4.93×10^{-4}	4.94×10^{-7}
Air (mg/m ³)	4.8×10^{-7}	4.8×10^{-10}

Risk characterisation	PEC (mg/L)	PNEC (mg/L)	PEC/PNEC
ERC 8A Tier 1 Freshwater	1.34×10^{-4}	0.0025	0.0536
ERC 8A Tier 1 Sediment	2.67×10^{-5}	0.002 (EPM)	0.013
ERC 8A Tier 1 Marine sediment	6.04×10^{-6}	0.002 (EPM)	0.003
ERC 8A Tier 1 Marine	1.08×10^{-4}	0.00025	0.43
ERC 8A Tier 1 STP	7.79	8.8	0.885
ERC 8B Tier 1 Freshwater	2.21×10^{-6}	0.0025	8.8×10^{-4}
ERC 8B Tier 1 Sediment	1.7×10^{-6}	0.002 (EPM)	8.5×10^{-4}
ERC 8B Tier 1 Marine sediment	5.54×10^{-8}	0.002 (EPM)	2.7×10^{-5}
ERC 8B Tier 1 Marine	5.54×10^{-8}	0.00025	2.1×10^{-4}
ERC 8B Tier 1 STP	0.156	8.8	0.0177

Risk characterisation for man via the environment

Indirect exposure of humans via the environment is expected to be negligible. Sulphuric acid is fully miscible in water and, as such, will not persist in any environmental compartment where indirect exposure of humans could occur. Furthermore none of the uses associated with sulphuric acid involve any targeted environmental emissions or application and the primary receiving compartment is the STP. Removal in the STP is expected to be efficient and so secondary exposure of the other receiving compartments is expected to be minimal. Similarly contamination of food crops or animals used as human food sources is not envisaged.

Worker exposure**Quantitative assessment (long-term, systemic effects, inhalation and dermal route)**

Estimated exposure via inhalation, DNEL values and the corresponding risk characterisation ratios (RCR) are reported in the below table.

Contributing scenario	PROC	Inhalation Acute – local effects			Dermal Long-term – local effects		
		Exposure concentrations (mg/m ³)	DNEL (mg/m ³)	RCR	Exposure concentrations (mg/m ³)	DNEL (mg/m ³)	RCR
Use as laboratory reagent	PROC 15	2.7×10^{-4}	0.1	2.7×10^{-3}	2.3×10^{-4}	0.05	4.6×10^{-3}

Qualitative assessment

The risk to human health due to the corrosive nature of sulphuric acid and the possibility of causing chemical burns when in dermal contact may arise for all the exposure scenarios and is assessed in a qualitative manner. In the industrial setting an acute risk of dermal burns from exposure to sulphuric acid in its concentrated form (or its dilute form) exists due to possible splashing of the liquid acid. This risk would be highest at times of transfer to tankers, filling of barrels and filling of small vessels etc. Though these events are considered unlikely due to the high degree of system closure and control the risk is still protected against in order to eliminate any possible routes of exposure.

To ensure safe use at least three safety aspects should be considered and relevant measures should be applied. These are, firstly, reduction of potential emissions with specialised systems. Secondly reduction of the potential for exposure of workers by means such as segregation and training and thirdly physical protection of the worker with the use of correct PPE. With the combination of these measures it is considered that the risk of chemical burns to workers (be they in large scale industrial production plants, transfer depots or formulation sites) is adequately managed.

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES**Environment**

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First tier conservative environmental exposure estimations were carried out in EUSES using the specified defaults. ERC 8A and 8B were used to determine the environmental emissions for ES1 in the first tier. Second tier worst case environmental exposure estimations were carried out using EUSES 2.1 to take into account more realistic factors that affect the environmental concentrations and partitioning including degradation and sorption parameters.

Exhaust gasses can be filtered and scrubbed; typically this removes >99% of sulphur oxides. Waste stream treatment may also be employed to reduce environmental exposure however for this wide dispersive use particular risk management measures are not needed to demonstrate environmental safe use for laboratories.

Human health exposure

The assessment of worker exposure to sulphuric acid used as a laboratory chemical was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART).

The predicted acute/short-term and long-term inhalation exposure concentrations derived using the ART model were not found to exceed the DNEL value for acute local respiratory effects or the DNEL value for long-term local respiratory effects respectively for any of the processes. On the basis of the assumptions made in the exposure assessment and this risk characterisation, it can be concluded that inhalation exposures to sulphuric acid that may potentially arise during processes do not pose an unacceptable health risk to workers.

This exposure scenario does not address consumers or industrial workers.

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8: Use of sulphuric acid in industrial cleaning

1. Title of Exposure scenario	
Free text title: Use of sulphuric acid in industrial cleaning	CSR-ES 13
Market sector: -	PC: 35
Description of process(es) covered in the Exposure Scenario:	
Environment	
Wide dispersive indoor use of processing aids in open systems	ERC 8a
Wide dispersive indoor use of reactive substances in open systems	ERC 8b
Worker contributing scenarios	SU: 3
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2
Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)	PROC 5
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9
Roller application or brushing	PROC 10
Treatment of articles by dipping and pouring	PROC 13
Description of activities covered in the Exposure Scenario:	
This exposure scenario covers the industrial use of sulphuric acid in industrial cleaning including the use in closed processes, mixing and blending in batch processes, transfer of substance or preparation, use in roller application or brushing and in treatment of articles by pouring and dipping.	
2. Conditions of use affecting exposure	
2.1 Control of environmental exposure	
Product characteristics	
Properties of sulphuric acid:	
Molecular Weight	98.08 g/mol
Vapour Pressure (at 20 °C)	0.1 hPa
Water Solubility	Miscible
log Kow	-1 (estimated)
Koc	1 (estimated)
Amounts used	
Annual use at a site:	5 000 t/y
Frequency and duration of use	
Emission days per site: 365 d/y. Frequency at workplace (for one worker): 220 d/year. Duration per day at workplace (for one worker): 8hr/d. Intermittent contact is expected.	
Environment factors not influenced by risk management	
-	
Other given operational conditions affecting environmental exposure	
Discharge volume of sewage treatment plant	2000 m³/d
Available river water volume to receive the emissions from a site	20 000 m³/d
Technical conditions and measures at process level (source) to prevent release	
Technical conditions and measures to reduce or limit discharges, air emissions and releases to soil	
-	
Organizational measures to prevent/limit release from site	

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-			
Conditions and measures related to municipal sewage treatment plant			
-			
Conditions and measures related to external treatment of waste for disposal			
Amount of substances in waste water resulting from identified uses covered in the exposure scenario	1370 kg/d		
Type of waste, suitable waste codes	Suitable EWC code(s)		
Type of external treatment aiming at final disposal of the waste	Incineration or landfill.		
Conditions and measures related to external recovery of waste			
-			
2.2 Control of workers exposure			
Product characteristic			
Assessment approach: The assessment of worker exposure to sulphuric acid used as a heavy duty industrial cleaner was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART). When present in cleaning solutions it is expected that sulphuric acid would be present in very small concentrations (certainly less than 10%) and as such a lower concentration has been considered for this exposure scenario. There is no expected exposure to the concentrated acid in this exposure scenario.			
Type of product the information relates to	Substance as such		
Physical state of product	Liquid		
Concentration of substance in product	10 %		
Molecular weight	98.08 g/mol		
Vapour Pressure	214 Pa		
Frequency and duration of use/exposure and other operational conditions affecting workers exposure			
Contributing scenario	PROC	Exposure duration	Process temperature temperature
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	480 mins	Room temperature (15-25°C)
Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)	PROC 5		
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a		
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b		
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9		
Roller application or brushing	PROC 10		
Treatment of articles by dipping and pouring	PROC 13		
Technical conditions and measures at process level (source) to prevent release			
Organisational measures to prevent /limit releases, dispersion and exposure			
Loading and unloading of vessels of sulphuric acid for use in maintenance of batteries is usually performed in the open air. Workers wear protective clothing (face/eye protection, helmet, anti-acid gloves boots and protective overall). A safety shower is required nearby in case of accidental spillage.			
Contributing scenario	PROC	Containment	

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Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	Handling reduces contact between product and adjacent air
Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)	PROC 5	-
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a	Handling reduces contact between product and adjacent air
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	-
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	Handling reduces contact between product and adjacent air
Roller application or brushing	PROC 10	-
Treatment of articles by dipping and pouring	PROC 13	-

Technical conditions and measures to control dispersion from source towards the worker

Loading and unloading of vessels of sulphuric acid for use in maintenance of batteries is usually performed in the open air. Workers wear protective clothing (face/eye protection, helmet, anti-acid gloves boots and protective overall). A safety shower is required nearby in case of accidental spillage.

Contributing scenario	PROC	Localised controls	Dispersion
Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	LEV	Indoors, any sized room, only good natural ventilation
Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)	PROC 5	LEV	Indoors, any sized room, only good natural ventilation
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a	None	Indoors, any sized room, only good natural ventilation
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	None	Indoors, any sized room, only good natural ventilation
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	None	Indoors, any sized room, only good natural ventilation
Roller application or brushing	PROC 10	None	Indoors, any sized room, only good natural ventilation
Treatment of articles by dipping and pouring	PROC 13	None	Indoors, any sized room, only good natural ventilation

Conditions and measures related to personal protection, hygiene and health evaluation

Loading and unloading of vessels of sulphuric acid for use in maintenance of batteries is usually performed in the open air. Workers wear protective clothing (face/eye protection, helmet, anti-acid gloves boots and protective overall). A safety shower is required nearby in case of accidental spillage.

Additional good practise advice beyond the REACH CSA

Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH, Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.

3. Exposure estimation and reference to its source

Environment: Use of sulphuric acid in industrial cleaning is generally continuous with frequent use on a small scale with the region. First tier conservative environmental exposure estimations were carried out using EUSES with the specified defaults. ERC's 8A and 8B (both wide dispersive) were used to determine the environmental emissions in the first tier. Second tier worst case environmental exposure estimations

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were carried out using EUSES 2.1 to take into account more realistic factors that affect the environmental concentrations and partitioning including degradation and sorption parameters.

Worker: In the characterisation of the human health risks posed by acute/short term and long-term inhalation exposures to sulphuric acid, the 90th percentile (e.g. worst case) inhalation exposure concentrations derived using the ART model for relevant PROC codes were compared with the DNEL value for acute local respiratory effects and the DNEL value for long-term local respiratory effects respectively.

Environment**Local exposure estimation and risk characterisation**

The predicted exposure concentrations (PEC) and risk characterisation ratios (RCR) are reported in the following table. PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.

Exposure estimation	ERC 8a, PEC value	ERC 8b, PEC value
Freshwater (mg/L)	1.38×10^{-4}	2.12×10^{-6}
Marine water (mg/L)	7.39×10^{-6}	6.66×10^{-8}
Freshwater sediments (mg/kg)	1.16×10^{-5}	1.83×10^{-7}
Marine sediments (mg/kg)	6.39×10^{-7}	5.76×10^{-9}
Agricultural soil (mg/kg)	1.34×10^{-4}	1.34×10^{-7}
Grassland (mg/kg)	4.93×10^{-4}	4.94×10^{-7}
Air (mg/m ³)	4.8×10^{-7}	4.8×10^{-10}

Risk characterisation	PEC (mg/L)	PNEC (mg/L)	PEC/PNEC
ERC 8A Tier 1 Freshwater	1.34×10^{-4}	0.0025	0.0536
ERC 8A Tier 1 Sediment	2.67×10^{-5}	0.002 (EPM)	0.013
ERC 8A Tier 1 Marine sediment	6.04×10^{-6}	0.002 (EPM)	0.003
ERC 8A Tier 1 Marine	1.08×10^{-4}	0.00025	0.43
ERC 8A Tier 1 STP	7.79	8.8	0.885
ERC 8B Tier 1 Freshwater	2.21×10^{-6}	0.0025	8.8×10^{-4}
ERC 8B Tier 1 Sediment	1.7×10^{-6}	0.002 (EPM)	8.5×10^{-4}
ERC 8B Tier 1 Marine sediment	5.54×10^{-8}	0.002 (EPM)	2.7×10^{-5}
ERC 8B Tier 1 Marine	5.54×10^{-8}	0.00025	2.1×10^{-4}
ERC 8B Tier 1 STP	0.156	8.8	0.0177

Risk characterisation for man via the environment

Indirect exposure of humans via the environment is expected to be negligible. Sulphuric acid is fully miscible in water and, as such, will not persist in any environmental compartment where indirect exposure of humans could occur. Furthermore none of the uses associated with sulphuric acid involve any targeted environmental emissions or application and the primary receiving compartment is the STP. Removal in the STP is expected to be efficient and so secondary exposure of the other receiving compartments is expected to be minimal. Similarly contamination of food crops or animals used as human food sources is not envisaged.

Worker exposure**Quantitative assessment (long-term, systemic effects, inhalation and dermal route)**

Estimated exposure via inhalation, DNEL values and the corresponding risk characterisation ratios (RCR) are reported in the below table.

*Assumes Respiratory Protective Equipment (95% reduction) is worn

Contributing scenario	PROC	Inhalation Acute – local effects			Inhalation Long-term – local effects		
		Exposure concentrations (mg/m ³)	DNEL (mg/m ³)	RCR	Exposure concentrations (mg/m ³)	DNEL (mg/m ³)	RCR

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Use in closed, continuous process with occasional controlled exposure (including sampling and maintenance)	PROC 2	5.5×10^{-4}	0.1	5.5×10^{-3}	4.8×10^{-4}	0.05	9.6×10^{-3}
Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)	PROC 5	6.1×10^{-2}	0.1	6.1×10^{-1}	5.3×10^{-2} (2.7×10^{-3})*	0.05	1.1×10^0 (5.3×10^{-2})*
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a	5.5×10^{-3}	0.1	5.5×10^{-2}	4.8×10^{-3}	0.05	9.6×10^{-2}
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	5.5×10^{-3}	0.1	5.5×10^{-2}	4.8×10^{-3}	0.05	9.6×10^{-2}
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	5.5×10^{-3}	0.1	5.5×10^{-2}	4.8×10^{-3}	0.05	9.6×10^{-2}
Roller application or brushing	PROC 10	6.1×10^{-1} (3×10^{-2})*	0.1	6.1×10^0 (3×10^{-1})*	5.3×10^{-1} (2.7×10^{-2})*	0.05	1.1×10^1 (0.54)*
Treatment of articles by dipping and pouring	PROC 13	6.1×10^{-3}	0.1	6.1×10^{-2}	5.3×10^{-3}	0.05	1.1×10^{-1}

Qualitative assessment

The risk to human health due to the corrosive nature of sulphuric acid and the possibility of causing chemical burns when in dermal contact may arise for all the exposure scenarios and is assessed in a qualitative manner. In the industrial setting an acute risk of dermal burns from exposure to sulphuric acid in its concentrated form (or its dilute form) exists due to possible splashing of the liquid acid. This risk would be highest at times of transfer to tankers, filling of barrels and filling of small vessels etc. Though these events are considered unlikely due to the high degree of system closure and control the risk is still protected against in order to eliminate any possible routes of exposure.

To ensure safe use at least three safety aspects should be considered and relevant measures should be applied. These are, firstly, reduction of potential emissions with specialised systems. Secondly reduction of the potential for exposure of workers by means such as segregation and training and thirdly physical protection of the worker with the use of correct PPE. With the combination of these measures it is considered that the risk of chemical burns to workers (be they in large scale industrial production plants, transfer depots or formulation sites) is adequately managed.

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES**Environment**

Use of sulphuric acid in industrial cleaning is generally continuous with frequent use on a small scale with the region. First tier conservative environmental exposure estimations were carried out using EUSES with the specified defaults. ERC's 8A and 8B (both wide dispersive) were used to determine the environmental emissions in the first tier. Second tier worst case environmental exposure estimations were carried out using EUSES 2.1 to take into account more realistic factors that affect the environmental concentrations and partitioning including degradation and sorption parameters.

Exhaust gasses may be removed by LEV. Workers involved in using sulphuric acid in industrial cleaning applications are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimise exposure and risks. Waste stream treatment may also be employed to reduce environmental exposure however for this wide dispersive use particular risk management measures are not needed to demonstrate environmental safe use.

Human health exposure

The assessment of worker exposure to sulphuric acid used as a heavy duty industrial cleaner was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART). When present in cleaning solutions it is expected that sulphuric acid would be present in very small concentrations (certainly less than 10%) and as such a lower concentration has been considered for this exposure scenario. There is no expected exposure to the concentrated acid in this exposure scenario.

The predicted acute/short-term and long-term inhalation exposure concentrations derived using the ART model were not found to exceed the DNEL value for acute local respiratory effects or the DNEL value for long-term local respiratory effects respectively for any of the processes. On the basis of the assumptions made in the exposure assessment and this risk characterisation, it can be concluded that inhalation exposures to sulphuric acid that may potentially arise during processes do not pose an unacceptable health risk to workers.

Conforms to Annex II of Regulation (EC) No. 1907/2006 (REACH)

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This exposure scenario does not address consumers or professional workers.

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9: Mixing, preparation and repackaging of sulphuric acid

1. Title of Exposure scenario	
Free text title: Mixing, preparation and repackaging of sulphuric acid	CSR-ES 14
Market sector: -	PC: -
Description of process(es) covered in the Exposure Scenario:	
Environment: Formulation of preparations	ERC 2
Worker contributing scenarios	SU: 3, 10
Use in closed process, no likelihood of exposure	PROC 1
Use in closed batch process (synthesis or formulation)	PROC 3
Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)	PROC 5
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9
Description of activities covered in the Exposure Scenario:	
This exposure scenario covers the mixing, preparation and repackaging of sulphuric acid including the use in closed processes, mixing or blending and transfer of substance or preparation.	
2. Conditions of use affecting exposure	
2.1 Control of environmental exposure	
Product characteristics	
<u>Properties of sulphuric acid:</u>	
Molecular Weight	98.08 g/mol
Vapour Pressure (at 20 °C)	0.1 hPa
Water Solubility	Miscible
log Kow	-1 (estimated)
Koc	1 (estimated)
Amounts used	
Annual use at a site:	300 000 t/y
Frequency and duration of use	
Emission days per site: 365 d/y. Frequency at workplace (for one worker): 220 d/year. Duration per day at workplace (for one worker): 8hr/d. Intermittent contact is expected.	
Environment factors not influenced by risk management	
-	
Other given operational conditions affecting environmental exposure	
Discharge volume of sewage treatment plant	2000 m³/d
Available river water volume to receive the emissions from a site	20 000 m³/d
Technical conditions and measures at process level (source) to prevent release	
Technical conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Onsite pre-treatment of waste water	Chemical pre-treatment or onsite STP. Waste waters are generally treated on site by chemical neutralisation methods before release to the municipal STP or to the environment.
Resulting fraction of initially applied amount in waste water released from site to the external sewage system	Varies depending on system. The neutralisation process is extremely efficient and pH monitors are in place to ensure that complete neutralisation and removal have taken place.
Air emission abatement	Measured emissions of waste gas. Exhaust gases treated by scrubbers.

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Resulting fraction of applied amount in waste gas released to environment	1%. 99% of waste gas removed by scrubbing.		
Organizational measures to prevent/limit release from site			
-			
Conditions and measures related to municipal sewage treatment plant			
Onsite waste treatment	Effectiveness: complete. The waste water neutralisation process is extremely efficient with complete neutralisation achieved. pH alarms are in place to ensure that successful neutralisation has taken place		
Effluent (of the waste water treatment plant) discharge rate	2000 m³/d		
Recovery of sludge for agriculture or horticulture	No. All sludge is collected and incinerated and sent to landfill or recycled for reuse of recovered metals, if any.		
Resulting fraction of initially applied amount in waste water released from site	Less than 0.01%		
Conditions and measures related to external treatment of waste for disposal			
Amount of substances in waste water resulting from identified uses covered in the exposure scenario	0 kg/d		
Type of waste, suitable waste codes	Suitable EWC code(s)		
Type of external treatment aiming at final disposal of the waste	Incineration or landfill.		
Conditions and measures related to external recovery of waste			
-			
2.2 Control of workers exposure			
Product characteristic			
Assessment approach: The assessment of worker exposure to sulphuric acid following mixing, preparation and repackaging of sulphuric acid was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART).			
Type of product the information relates to	Substance as such		
Physical state of product	Liquid		
Concentration of substance in product	98 %		
Molecular weight	98.08 g/mol		
Vapour Pressure	6 Pa		
Frequency and duration of use/exposure and other operational conditions affecting workers exposure			
Contributing scenario	PROC	Exposure duration	Process temperature
Use in closed process, no likelihood of exposure	PROC 1	480 mins	Hot processes (50-150°C)
Use in closed batch process (synthesis or formulation)	PROC 3		
Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)	PROC 5		Room temperature (15-25°C)
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a		
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b		

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Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9		
Technical conditions and measures at process level (source) to prevent release			
Organisational measures to prevent /limit releases, dispersion and exposure			
Production and handling of sulphuric acid involves special equipment and high integrity contained systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors.			
Contributing scenario	PROC	Containment	
Use in closed process, no likelihood of exposure	PROC 1	Handling reduces contact between product and adjacent air	
Use in closed batch process (synthesis or formulation)	PROC 3	Handling reduces contact between product and adjacent air	
Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)	PROC 5	-	
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a	-	
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	-	
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	Handling reduces contact between product and adjacent air	
Technical conditions and measures to control dispersion from source towards the worker			
Production and handling of sulphuric acid involves special equipment and high integrity contained systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors.			
Contributing scenario	PROC	Localised controls	Dispersion
Use in closed process, no likelihood of exposure	PROC 1	Vapour recovery systems; LEV)	Outdoors not close to buildings
Use in closed batch process (synthesis or formulation)	PROC 3	Vapour recovery systems; LEV	Outdoors near to buildings
Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)	PROC 5	LEV	Indoors, any sized room, only good natural ventilation
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a	-	Outdoors not close to buildings
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	Vapour recovery systems; LEV	Outdoors not close to buildings
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	Vapour recovery	Indoors, any sized room, only good natural ventilation
Conditions and measures related to personal protection, hygiene and health evaluation			
Production and handling of sulphuric acid involves special equipment and high integrity contained systems with little or no potential for exposure. Facilities involved in the production and uses of sulphuric acid are usually housed outdoors. Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimise exposure and risks.			
Additional good practise advice beyond the REACH CSA			
<i>Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH. Thus, the downstream user is not obliged to i) carry out an own CSA and ii) to notify the use to the Agency, if he does not implement these measures.</i>			

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**3. Exposure estimation and reference to its source**

Environment: First tier conservative environmental exposure estimations were carried out in EUSES tool using the specified defaults. ERC 2 was used to determine the environmental emissions in the first tier. Second tier worst case environmental exposure estimations were carried out using EUSES 2.1 to take into account more realistic factors that affect the environmental concentrations and partitioning including degradation and sorption parameters.

Worker: In the characterisation of the human health risks posed by acute/short term and long-term inhalation exposures to sulphuric acid, the 90th percentile (e.g. worst case) inhalation exposure concentrations derived using the ART model for relevant PROC codes were compared with the DNEL value for acute local respiratory effects and the DNEL value for long-term local respiratory effects respectively.

Environment**Local exposure estimation and risk characterisation**

The predicted exposure concentrations (PEC) and risk characterisation ratios (RCR) are reported in the following table. PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.

Exposure estimation	PEC value
Freshwater (mg/L)	4.43×10^{-5}
Marine water (mg/L)	6.42×10^{-6}
Freshwater sediments (mg/kg)	3.83×10^{-6}
Marine sediments (mg/kg)	5.55×10^{-7}
Agricultural soil (mg/kg)	2×10^{-4}
Grassland (mg/kg)	7.4×10^{-4}
Air (mg/m ³)	7.19×10^{-7}

Risk characterisation	PEC (mg/L)	PNEC (mg/L)	PEC/PNEC
Tier 2 Freshwater	4.43×10^{-5}	0.0025	0.01
Tier 2 Sediment	3.56×10^{-5}	0.002 (EPM)	0.0178
Tier 2 Marine sediment	5.16×10^{-6}	0.002 (EPM)	0.0025
Tier 2 Marine	6.42×10^{-6}	0.00025	0.0256
Tier 2 Freshwater	4.43×10^{-5}	0.0025	0.01
Tier 2 STP	0	3.8	0

Risk characterisation for man via the environment

Indirect exposure of humans via the environment is expected to be negligible. Sulphuric acid is fully miscible in water and, as such, will not persist in any environmental compartment where indirect exposure of humans could occur. Furthermore none of the uses associated with sulphuric acid involve any targeted environmental emissions or application and the primary receiving compartment is the STP. Removal in the STP is expected to be efficient and so secondary exposure of the other receiving compartments is expected to be minimal. Similarly contamination of food crops or animals used as human food sources is not envisaged.

Worker exposure**Quantitative assessment (long-term, systemic effects, inhalation and dermal route)**

Estimated exposure via inhalation, DNEL values and the corresponding risk characterisation ratios (RCR) are reported in the below table.

Contributing scenario	PROC	Inhalation Acute – local effects			Inhalation Long-term – local effects		
		Exposure concentrations (mg/m ³)	DNEL (mg/m ³)	RCR	Exposure concentrations (mg/m ³)	DNEL (mg/m ³)	RCR
Use in closed process, no likelihood of exposure	PROC 1	9.3×10^{-9}	0.1	9.3×10^{-8}	9.4×10^{-9}	0.05	1.9×10^{-7}
Use in closed batch process (synthesis or formulation)	PROC 3	4.2×10^{-4}	0.1	4.2×10^{-3}	4.2×10^{-4}	0.05	8.4×10^{-3}

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Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)	PROC 5	1.8×10^{-2}	0.1	1.8×10^{-1}	1.6×10^{-2}	0.05	3.2×10^{-1}
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	PROC 8a	2.3×10^{-2}	0.1	2.3×10^{-1}	2.3×10^{-2}	0.05	4.6×10^{-1}
Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	PROC 8b	1.2×10^{-4}	0.1	1.2×10^{-3}	4.8×10^{-6}	0.05	9.6×10^{-5}
Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	PROC 9	3.2×10^{-3}	0.1	3.2×10^{-2}	2.8×10^{-3}	0.05	5.6×10^{-2}

Qualitative assessment

The risk to human health due to the corrosive nature of sulphuric acid and the possibility of causing chemical burns when in dermal contact may arise for all the exposure scenarios and is assessed in a qualitative manner. In the industrial setting an acute risk of dermal burns from exposure to sulphuric acid in its concentrated form (or its dilute form) exists due to possible splashing of the liquid acid. This risk would be highest at times of transfer to tankers, filling of barrels and filling of small vessels etc. Though these events are considered unlikely due to the high degree of system closure and control the risk is still protected against in order to eliminate any possible routes of exposure.

To ensure safe use at least three safety aspects should be considered and relevant measures should be applied. These are, firstly, reduction of potential emissions with specialised systems. Secondly reduction of the potential for exposure of workers by means such as segregation and training and thirdly physical protection of the worker with the use of correct PPE. With the combination of these measures it is considered that the risk of chemical burns to workers (be they in large scale industrial production plants, transfer depots or formulation sites) is adequately managed.

4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES**Environment**

First tier conservative environmental exposure estimations were carried out in EUSES tool using the specified defaults. ERC 2 was used to determine the environmental emissions in the first tier. Second tier worst case environmental exposure estimations were carried out using EUSES 2.1 to take into account more realistic factors that affect the environmental concentrations and partitioning including degradation and sorption parameters.

Environmental emissions are limited by designated waste treatment processes designed to limit environmental exposure to all relevant compartments. Waste gas emissions are scrubbed and may also then be diverted to the wastewater stream. This significantly lessens the possible emission by atmospheric deposition to soil or surface waters. Liquid wastes are treated (neutralisation to neutral pH) prior to emission to remove any sulphuric acid in the waste water and sludge from the waste water treatment plant is sent for incineration or landfill and is not used for agricultural spreading. This precludes any contamination of soil by sludge spreading. Waste water treatment is usually carried out by neutralisation followed by flocculation or decantation.

Human health exposure

The assessment of worker exposure to sulphuric acid following mixing, preparation and repackaging of sulphuric acid was carried for processes relevant to this use scenario as identified by PROC codes. Initially, a screening-level (Tier 1) assessment was carried out using the ECETOC Targeted Risk Assessment (TRA) model. A higher tier (Tier 2) refinement of the Tier 1 assessment was carried out using the Advanced REACH Tool (ART).

The predicted acute/short-term and long-term inhalation exposure concentrations derived using the ART model were not found to exceed the DNEL value for acute local respiratory effects or the DNEL value for long-term local respiratory effects respectively for any of the processes. On the basis of the assumptions made in the exposure assessment and this risk characterisation, it can be concluded that inhalation exposures to sulphuric acid that may potentially arise during processes do not pose an unacceptable health risk to workers.

This exposure scenario does not address consumers.