



OJSC "Gomel Chemical Plant"

SAFETY DATA SHEET

prepared in accordance with Regulation (EU) 830/2015

Version: 3.1/EN

Revision date: 24.05.2017

SULPHURIC ACID

1 IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

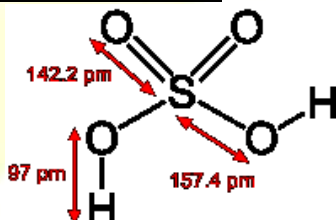
1.1 Product identifier

Trade name: sulphuric acid, technical grade

Chemical name: sulphuric acid

Chemical formula: H₂SO₄

Structural formula:



Molecular weight: 98.08

EC No: 231-639-5

CAS No: 7664-93-9

Registration No (REACH): 01-2119458838-20-0038

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

Sulphuric acid is used in production of mineral fertilizers, mineral salts and acids, different organic products, dyes, smoke-producing agents and explosives as well as in oil industry, metallurgy, textile industry, ledindustrio, metal industry, in processes of neutralization, pickling of metals, water demineralization and in some other branches of industry.

Substance use:

1. As an intermediate in manufacture of inorganic and organic chemicals including fertilizers
2. As a processing aid, catalyst, dehydrating agent, pH regulator.
3. In the process of surface treatments, purification and etching
4. In electrolytic processes
5. In gas purification, scrubbing and flue gas scrubbing
6. In production of sulphuric acid contained batteries
7. Mixing, preparation and repackaging

1.3 Details of the supplier of the safety data sheet

Company name: OJSC «Gomel Chemical Plant»

Legal address: 5 Khimzavodskaya str., Gomel, 246026, Republic of Belarus

Telephone: +375 (232) 49-24-26

Fax: +375 (232) 23-12-42

e-mail: market@himzavod.byweb site: www.belfert.by

Exclusive representative in the territory of EC:

AB „Lifosa”,

Juodkiskio 50 LT-57502, Kedainiai

tel.: + 370 (347) 66-483

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e-mail: info@lifosa.com

1.4 Emergency telephone number


+375 (232) 23-12-35 (around the clock)

2 HAZARDS IDENTIFICATION


2.1 Classification of the substance or mixture

2.1.1 Classification according to

Skin corrosion/irritation: category 1A

Regulation (EC) 1272/2008	Hazard pictogram:  GHS05 Signal word: Danger H314 – Causes severe skin burns and eye damage.
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2.2 Label elements

2.2.1 Labeling in accordance with Regulation (EC) No. 1272/2008	EC No: 231-639-5 CAS No: 7664-93-9 Registration No (REACH): 01-2119458838-20-0038 Skin corrosion/irritation: category 1A Hazard pictogram:  GHS05 Signal word: Danger H314 – causes severe skin burns and eye damage. Precautionary statements: P280 – Wear protective gloves/protective clothing/eye protection/face protection P310 – Immediately call a POISON CENTER or doctor/physician 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
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2.3 Other hazards

Corrosive (substance) causing corrosion of metals. Sulphuric acid chars various organic substances in particular those relating to carbohydrates.

3 COMPOSITION/INFORMATION ON INGREDIENTS

Component name	CAS No	EC No	Percentage, %	Classification
Sulfuric acid H ₂ SO ₄	7664-93-9	231-639-5	93-98	Skin corrosion/irritation: category 1A,H314
Water H ₂ O	7732-18-5	231-791-2	2-7	–

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

General recommendations	Causes severe corrosive burns. DO NOT attempt to neutralize the acid with bases since the reaction will produce heat that may add to injury.
Inhalation	Remove victim to fresh air and keep at rest in a position comfortable for breathing. (P304 + P340) If necessary, obtain medical attention.
Skin contact	(P303 + P361 + P353). IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
Eye contact	P305+351+338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing
Swallowing	(P301 + P330 + P331) If swallowed: Rinse mouth. Do NOT induce vomiting.

4.2 Most (important) typical symptoms and effects, both acute and delayed

Causes severe corrosive burns.

4.3 Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

5 FIRE FIGHTING MEASURES**5.1 Extinguishing media**

5.1.1 Suitable extinguishing media The product is fire-flame-proof substance.

5.1.2 Unsuitable extinguishing media Minimize use of water to avoid contamination of environment.

5.2 Special hazards arising from the substance or mixture

Releases toxic sulfur oxides at high temperatures.

5.3 Advice for fire fighters

The product is incombustible, but due to high temperatures, sulfur dioxide (SO₂) can be released. In fire conditions, one should wear protective clothing and self-contained breathing apparatus as prescribed by NIOSH.

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

6.1.1 For non-emergency personnel Use individual protective equipment as per Section 8 of the given safety data sheet. Do not touch nor tread upon spilled material.

6.1.2 For emergency responders Use individual protective equipment as per Section 8 of the given safety data sheet. Evacuate from spillage zone all the personnel not involved in accidental release measures. Provide ventilation of spillage zone. While collecting spillage, minimize dust generation.

6.2 Environmental precautions

Handle waste in accordance with section 13.

Prevent entry into sewers or waterways.

6.3 Methods and material for containment and cleaning up

Use individual protective equipment as per Section 8. Evacuate from spillage zone all the personnel not involved in accidental release measures.

Contain spillage through diking, Pump down spilled acid. Neutralize the residue with bases (caustic ash, lime). Collect neutralized mixture and handle it in accordance with section 13.

6.4 Reference to other sections

Information about individual precautions is set out in Section 8 of the given safety data sheet.

Information on disposal consideration and that on impure product disposal are set out in Section 13 of the given safety data sheet.

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

7.1.1 Precautions **When diluting, always add acid to water never the reverse.**
When opening reservoirs with sulfuric acid, use coppered tools to avoid sparking and ignition/explosion due to hydrogen release.

7.1.2 Advice on general hygiene While handling the product, observe precautions and measures of personal hygiene in accordance with section 8.
Use local suction-and-exhaust ventilation. When handling the product, do not eat, drink or smoke. After handling the product, wash contaminated clothing.
Before entering eating areas, remove protective clothing.

7.2 Conditions of safe storage, including any incompatibilities

Store locked up (P405) in clean tightly closed tanks made of stainless steel lined with acid proof tile or bricks. Store away from bases, food and fodder. Do not store with incompatible materials-see Section 10 of the given safety data sheet.

7.3 Specific end use(s)

Not available

8 EXPOSURE CONTROLS / PERSONAL PROTECTION**8.1 Control parameters**

Ingredient name	EC No	Exposure form	Occupational exposure limits
Sulfuric acid H ₂ SO ₄	231-639-5	mist	TLV (8 h) = 0,05 mg/m ³

DNELs (Derived No-Effect Level) for workers:

Acute effects, inhalation: 0.1 mg/m³;

Long-term –systematic effects, inhalation: 0.05 mg/m³.

PNEC (predicted no-effect concentration):

PNEC aqua - freshwater: 0.0025 mg/l;

PNEC aqua - marine water: 0.00025 mg/l; PNEC STP: 8,8 mg/l; PNEC sediment (freshwater): 0.002 mg/kg per day; PNEC sediment (seawater): 0.002 mg/kg per day.	
8.2 EXPOSURE CONTROL	
8.2.1 Appropriate engineering controls	General suction-and-exhaust ventilation, sealing of processing equipment.
8.2.2 Individual protection measures, such as personal protective equipment	8.2.2.1 Eye/face protection Chemical safety goggles or full face shield (EN 166). 8.2.2.2 Skin/hands protection Protective clothing (EN ISO 13982) and footwear (EN 13892, EN ISO 20347), impervious chemical resistant safety gloves (EN 374). If necessary, use a protective apron (EN 340) and safety boots (EN ISO 20347). 8.2.2.3 Respiratory protection: In case of insufficient ventilation (aerosol), half-mask for dust/particles (EN 149) or half-mask (EN 140) with filter type P1 or FFP1 for dust (EN 143) and half-gas-mask (EN 140).
8.2.3 Environmental exposure controls	Prevent entry into soil, surface water and ground water.
9 PHYSICAL AND CHEMICAL PROPERTIES	
9.1 Information on basic physical and chemical properties	
<u>Molecular weight:</u> 98.08; <u>Physical state:</u> liquid (under ordinary conditions); <u>Appearance:</u> clear to light brown liquid; <u>Odour:</u> odorless; <u>Hydrogen index pH:</u> 1 – 1,3; <u>Boiling temperature:</u> depends on strength; - for mass fraction of monohydrate 93% – 277,5 °C; - for mass fraction of monohydrate 94% – 286,7 °C; - for mass fraction of monohydrate 98% – 330 °C. <u>Ignition temperature</u> – fire-flame-proof substance. <u>Freezing temperature:</u> (– 27 °C) - for mass fraction of monohydrate 93%; (– 31,9 °C) for mass fraction of monohydrate 94%; (– 0,7 °C) - for mass fraction of monohydrate 98%. <u>Oxidizing properties</u> – strong oxidizer. <u>Steam pressure:</u> 6 Pa at 293 K (mass fraction of monohydrate 90%); <u>Density:</u> 1,827 g/cm ³ at mass fraction of monohydrate 93%; 1,831 g/cm ³ at mass fraction of monohydrate 94%. 1,840 g/cm ³ at mass fraction of monohydrate 98%. <u>Water solubility</u> – miscible with water whatsoever proportion.	
9.2 Other information	
Not available	
10 STABILITY AND REACTIVITY	
10.1 Reactivity	
Sulfuric acid is the strong oxidizer.	
10.2 Chemical stability	
Stable under ordinary conditions (T = 273,15 K, P = 101,3 KPa).	
10.3 Possibility of hazardous reactions	
Reacts with bases to form salts and with some metals to liberate hydrogen.	
10.4 Conditions to avoid	
When heated, concentrated sulfuric acid releases sulfur dioxide SO ₂ .	
10.5 Incompatible materials	
Combustible substances, bromates, carbides, chlorates, potassium, perchlorates, reducing agents, metals, metal carbides, highly flammable solvents, concentrated ammonia, alkaline earth oxides, organic substances.	
10.6 Hazardous decomposition products	
Sulfur oxides	

11 TOXICOLOGICAL INFORMATION**11.1 Information on toxicological effects**

Accumulation	While in body, the product dissociates into ions: H^+ , HSO_4^- and SO_4^{2-} . It is ions rather than the product alone that affect an organism. Sulfate ions are involved in metabolism, their level being regulated through homeostatic mechanisms. Excess sulfates are excreted into and with urine.
Acute toxicity	LD50 (oral, rats) = 2140 mg/kg; LC50 (inhalation, rats) = 375 mg/m ³ ;
Corrosion/irritation	Causes corrosive burns on contact with eye, skin or if inhaled, swallowed.
Sensitization	None
Repeated dose toxicity - inhalation	NOAEC: 0.3 mg/m ³
Mutagenicity	Sulfuric acid doesn't have genotoxic effect.
Carcinogenicity	A number of studies have not demonstrated carcinogenic effects from exposure to sulfuric acid.
Toxicity for reproduction	Results of studies in reproductive toxicity of mice and rabbits have not demonstrated systemic action on organism.

12 ECOLOGICAL INFORMATION**12.1 Toxicity**

When in soil, sulfuric acid decreases pH of soil solution.

Effects on living organisms:**Toxicity to fish:**

LC50 for freshwater fish: 16 mg/l;

EC10/LC10 or NOEC for freshwater fish: 0.025 mg/l.

Toxicity to invertebrates:

EC50/LC50 for freshwater invertebrates: 100 mg/l;

EC10/LC10 or NOEC for freshwater invertebrates: 0.15 mg/l.

Toxicity to algae:

EC10/LC10 or NOEC for freshwater algae: 100 mg/l (*Desmodesmus subspicatus*)

12.2 Persistence and degradability

In water solutions sulfuric acid dissociates, virtually in full, into H^+ , HSO_4^- and SO_4^{2-} ions.

12.3 Bioaccumulative potential

No bioaccumulation of sulfuric acid is possible.

bioconcentration factor (BCF) not available.

12.4 Mobility in soil

In soil solutions it is presented by hydrogen ions H^+ and sulfate ions SO_4^{2-} . Hydrogen ions can decrease pH of soil elements. Sulfate ions are involved in chemical reactions with other soil elements to form variety of salts.

12.5 Results of PBT and vPvB assessment

The substance is not classified as dangerous one as on PBT and vPvB criteria due to rapid dissociation into ions that form environmentally ubiquitous chemical compounds (water and sulfates).

12.6 Other adverse effects

The substance is not classified as CMR (Carcinogens, Mutagens and Reproductive Toxicants). Doesn't contain components destroying ozone layer.

13 DISPOSAL CONSIDERATIONS**13.1 Waste treatment**

Do not spill in surface water and sewage.

Sulfuric acid is neutralized with sodium carbonate Na_2CO_3 or with calcium hydroxide $Ca(OH)_2$. Resulting neutralized mixture is directed to bury in compliance with effective national legislation on waste treatment.

14 TRANSPORT INFORMATION**14.1 UN number**

1830 (concentration > 51%)

2796 (concentration ≤ 51%)

14.2 UN proper shipping name

SULPHURIC ACID with more than 51 % acid

SULPHURIC ACID with not more than 51 % acid or BATTERY FLUID, ACID

14.3 Transport hazard class

ADR/RID/AND/IMDG/ICAO: 8

14.4 Packing group

ADR/RID/AND/IMDG/ICAO: 2	
14.5 Environmental hazards	
ADR/RID/AND/IMDG – It is not environmentally hazardous; AND – hazardous to the aquatic environment (N3); IMDG – It is not a marine pollutant.	
14.6 Special precautions	
<u>ADR</u> Transport category: 2 Tunnel restriction code: (E) Label: 8 Classification code: C1 Hazard identification No.: 80	<u>ADN</u> Label: 8 Special equipment: PP, EP Classification code: C1 Dangers: 8+N3 Additional requirements: 2, 22, 30, 34
<u>RID</u> Transport category: 2 Label: 8 Classification code: C1 Hazard identification No.: 80	<u>ICAO, IATA</u> Label: 8 Cargo IMP Code: RCM Passenger and Cargo Aircraft: - EQ: E2; Ltd Qty: 0,5 l/Pkg; Pkg Inst: Y840 - max Net Qty/Pkg 1 l; Pkg Inst: 851 Cargo Aircraft only: - Pkg Inst: 855; Max Net Qty/Pkg 30 l ERG Cade: 8L.
<u>IMDG</u>	
Concentration ≤ 51%: Ship stowage and segregation: Category B EmS: F-A, S-B Segregation group 1: Acids	Concentration > 51%: Ship stowage and segregation: Category C. For steel drums, category B. EmS: F-A, S-B Segregation group 1: Acids
14.7 Transport according to II MARPOL73/78 and the IBC code	
Product name: Sulphuric acid Pollution Category (according to MARPOL Annex II): Y Ship type (according to IBC Code): 3 Specific and operational requirements (according to IBC Code): 15.11, 15.16.2, 15.19.6	
14.8 Other information	
The substance is carried by road, rail road and by water in accordance with regulations on carriage of dangerous goods effective for an appropriate transportation vehicle.	
15 REGULATORY INFORMATION	
15.1 Safety, health and environmental regulations/legislation specific for the substance	
- Regulation (EU) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH); - Regulation (EU) No 1272/2008 Of The European Parliament And Of The Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures; - Regulation (EU) No 830/2015 of 28 May 2015 amending Regulation (EC) No 1907/2006 on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).	
15.2 Chemical safety assessment	
Chemical safety assessment has been carried out for sulfuric acid.	
16 OTHER INFORMATION	
16.1 General information	
This version of Safety Data Sheet supersedes version 2.0.	
16.2 Acronyms	
DNEL – Derived No-Effect Level PNEC – Predicted No Effect Concentrations LD50 – Lethal Dose resulting in 50% mortality of test species LC50 – Lethal concentration resulting in 50% mortality of test species EC50 – 50% effect concentration NOAEL – no observed adverse effect level NOAEC – no observed adverse effect concentration	

PBT/vPvB – Persistent Bioaccumulative And Toxic / very persistent very bioaccumulative
 TLV – threshold limit value
 Eye Irrit. 2 – eye irritation, category 2
 H319 – causes serious eye irritation
 ADN: European agreement concerning the carriage of dangerous goods by water routes in the country
 ADR: European agreement concerning the international carriage of dangerous goods by road
 IBC Code: International code on transport of chemicals in bulk
 IMDG: International maritime code for dangerous goods
 IMSBC Code: International maritime solid bulk cargoes code
 IATA: International air transport association
 ICAO: International civil aviation organization
 MARPOL: International convention for the prevention of pollution from ships
 NFPA: National fire protection organisation
 OEL: Occupational exposure limit
 RID: Regulations concerning the international transport of dangerous goods by rail

16.3 3 Most important sources of information used for compiling the safety data sheet

- Registration dossier and chemical safety report;
- European chemical Substances Information System (ESIS);
- Federation of European Risk Management Associations data (FERMA);
- Databases on hazardous substance GESTIS;
- Sulphuric acid Safety Data Sheet issued by OJSC «Gomel Chemical Plant», version 3.0 of 25.05.2015.

Prior to use of product please carefully study the information provided in this Safety Data Sheet.

The data provided in this Safety Data Sheet are based on information and experience available at OJSC «Gomel Chemical Plant» as of the day of Safety Data Sheet compilation.

The information provided in this Safety Data Sheet relates only to the given specific product and may not be valid for such product used in combination with any other substances and materials that affect the product properties. In no event will the manufacturer be responsible for injuries and health problems of any nature whatsoever resulting from the improper use of the product or from non-observance of safety handling, storage and transportation.

Attachments:

- ES01 Use of sulphuric acid as an intermediate in manufacture of inorganic and organic chemicals including fertilizers
- ES02 Use of sulphuric acid as a processing aid, catalyst, dehydrating agent, pH regulator.
- ES03 Use of sulphuric acid in the process of surface treatments, purification and etching
- ES04 Use of sulphuric acid in electrolytic processes
- ES05 Use of sulphuric acid in gas purification, scrubbing and flue gas scrubbing.
- ES06 Use of sulphuric acid in production of sulphuric acid contained batteries
- ES07 Use of sulphuric acid contained batteries

ES 01 – USE OF SULPHURIC ACID AS AN INTERMEDIATE IN MANUFACTURE OF INORGANIC AND ORGANIC CHEMICALS INCLUDING FERTILIZERS

1. Short title of the exposure scenario: Use of sulphuric acid as an intermediate in manufacture of inorganic and organic chemicals including fertilizers.

Sector of end use (SU):

SU3	Industrial uses: Uses of substances as such or in preparations at industrial sites
SU4	Manufacture of food products
SU6b	Manufacture of pulp, paper and paper products
SU8	Manufacture of bulk, large scale chemicals (including petroleum products)
SU9	Manufacture of fine chemicals
SU14	Manufacture of basic metals, including alloys

Market sector by type of chemical product (PC):

PC19	Intermediate
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List of names of contributing worker scenarios and corresponding PROCs:

PROC1	Use in closed process, no likelihood of exposure
PROC2	Use in closed, continuous process with occasional controlled exposure
PROC3	Use in closed batch process (synthesis or formulation)
PROC4	Use in batch and other process (synthesis) where opportunity for exposure arises
PROC8a	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non dedicated facilities
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

Name of contributing environmental scenario and corresponding ERC:

ERC6a	Industrial use resulting in manufacture of another substance (use of intermediates)
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Article category related to subsequent service life (AC):

–	Not applicable
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2. Environmental exposure controls:

ERC 6a	
Product Characteristics	Physical state: liquid.
Concentration of substance in mixture or articles	93 - 98%
Amounts used	Annual amount used per site 300 000 t/y (worst case).
Frequency and duration of use	Emission days per site: 365 d/y
Environmental factors not influenced by risk management	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.
Other given operation-	Use and processing of sulphuric acid involves high temperatures, and high contained

al conditions affecting environmental exposure	systems with little or no potential for exposure. The intermediate use of sulphuric acid is generally a continuous/batch production. Process is usually performed outdoors. The use of sulphuric acid as an intermediate in the production of inorganic and organic chemicals including but not limited to the production of fertilizers includes the production of oils used for lipolysis, sulphates, nitrogen fertilizers, granulation of complex fertilizers, phosphoric acid (wet process), titanium dioxide (sulphate route), hydrofluoric acid, fine chemicals and specialty chemicals. In addition to these uses the exposure scenario for intermediate use also includes reactive use in water treatment, use as a granulating agent and use as a tanning agent whereas sulphuric acid is consumed in a chemical synthesis to form sulphate.
Technical conditions and measures to reduce or limit discharges, air emissions and release to soil	Handling of sulphuric acid involves special equipment and controlled systems with little or no potential for exposure. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and release to soil	Exhaust gases may be treated by scrubbers or emissions may be measured and controlled according to local legislation; typically this removes >99% of sulphur oxides. 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. All sludge is collected and incinerated or sent to landfill. Dilution factor of 10 (STP 2000 m ³ /d).
Risk management measures - air	Release to air 94.9 kg/d (Worst case measured emissions associated with intermediate use).
Risk management measures - water	Aquatic freshwater (after STP) 0 kg/d (Based on efficiency of neutralization process).
Risk management measures - soil	Soil (direct only) Agricultural soil 0 kg/d (No directly loss to soil is expected for this ERC and no sludge spreading).
Risk management measures - other	On contact with water, sulphuric acid, as a strong mineral acid (pKa = 1.92), dissociates readily to hydrogen ions and sulphate ions (at all environmentally relevant pH's) and is totally miscible with the water layer. At all environmentally relevant concentrations, the substance will therefore exist as the environmentally ubiquitous non-hazardous sulphate (SO ₄ ²⁻) anion and hydronium (H ₃ O ⁺) cation. Estimated exposure concentrations Waste water before treatment 10000mg/L Sewage (STP effluent) 0 mg/L - Complete removal due to the neutralization process. Local freshwater 0 mg/L. 10-fold dilution by receiving waters. Local concentration with atmospheric deposition not yet taken into account.
Organizational measures to prevent/limit release from site	No data
Conditions and measures related to on-site or municipal sewage treatment plant	Chemical pre-treatment or onsite STP. Waste waters are generally treated by on site WWTP which will be neutralized before it reaches the biological tower of the WWTP or will be treated on site by chemical neutralization methods before release to the municipal STP or to the environment. Discharge volume of sewage treatment plant 2000 m ³ /d.
Conditions and measures related to external treatment of waste for disposal	Sediment from STP is stored in a landfill.
Conditions and measures related to external recovery of waste	Not applicable

3. Control of worker exposure:

PROC 1, 2, 3, 4, 8a, 8b, 9.

Product Characteristics

Concentration of substance in mixture or articles	93-98%
Physical state	Physical state: liquid.
Amounts used	No data

Frequency and duration of use	8 h/d, 220 d/y
Human factors not influenced by risk management	The effects of sulphuric acid following dermal exposures are local irritation and corrosivity of the skin. There is no evidence of systemic effects following dermal exposures to sulphuric acid. 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 processes associated with sulphuric acid production involve any targeted environmental emissions or application and the primary receiving compartment is the on-site STP where rigorous neutralizations processes and employed. Body parts potentially exposed: skin (hands, face). Respiration volume under conditions of use 10m ³ /d. Default value for a worker breathing for a 8hrs work day <u>Skin contact area with the substance under conditions of use 480cm² (ECETOC default).</u> Please note that due to the corrosive nature of sulphuric acid dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases.
Other given operational conditions affecting workers exposure	Worker contact is generally very low as most operations are remotely controlled and sampling/analysis events are of short duration. Workers generally operate in a separate control room, with no direct contact to the installations housing the material. 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 minimize exposure and risks.
Technical conditions and measures at process level (source) to prevent release	Worker exposure considered to be negligible due to the specialized systems and closed nature of the process.
Technical conditions and measures to control dispersion from source towards the worker	Local exhaust ventilation if required. 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.
Organizational measures to prevent/limit releases, dispersion and exposure	Training. Monitoring/reporting and auditing systems: Equipment must be well maintained and cleaned daily. Containment plus good work practice required.
Conditions and measures related to personal protection, hygiene and health evaluation	There is no worker exposure under normal conditions (LEV- if required, closed and controlled processes, separated control room). However there is required the use of personal protective equipment in order to minimize the risk exposure. See section 8 of the SDS.

ES 02 – USE OF SULPHURIC ACID AS A PROCESSING AID, CATALYST, DEHYDRATING AGENT, PH REGULATOR

1. Short title of the exposure scenario: Use of sulphuric acid as a processing aid, catalyst, dehydrating agent, pH regulator.

Sector of end use (SU):

SU3	Industrial uses: Uses of substances as such or in preparations at industrial sites
SU4	Manufacture of food products
SU5	Manufacture of textiles, leather, fur
SU6b	Manufacture pulp, paper and paper products
SU8	Manufacture of bulk, large scale chemicals (including petroleum product)
SU9	Manufacture of fine chemicals
SU11	Manufacture of rubber products
SU23	Electricity, steam, gas water supply and sewage treatment

Market sector by type of chemical product (PC):

PC20	Products such as ph-regulators, flocculants, precipitants, neutralization agents
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List of names of contributing worker scenarios and corresponding PROCs:

PROC1	Use in closed process, no likelihood of exposure
PROC2	Use in closed, continuous process with occasional controlled exposure
PROC3	Use in closed batch process (synthesis or formulation)
PROC4	Use in batch and other process (synthesis) where opportunity for exposure arises
PROC8a	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non dedicated facilities
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)
PROC13	Treatment of articles by dipping and pouring

Name of contributing environmental scenario and corresponding ERC:

ERC6b	Industrial use of reactive processing aids
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Article category related to subsequent service life (AC):

–	Not applicable
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2. Environmental exposure controls:

ERC 6b	
Product Characteristics	Physical state: liquid
Concentration of substance in mixture or articles	93-98%
Amounts used	Annual amount used per site 100 000 t/y (worst case).
Frequency and duration of use	Emission days per site 365 d/y. Estimate number of emission days, based on continuous use.
Environmental factors not influenced by risk management	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.
Other given operational conditions affecting environmental exposure	Use and processing of sulphuric acid involves high temperatures, and high integrity contained systems with little or no potential for exposure. The use of sulphuric acid as processing aid, catalyst, dehydrating agent or pH regulator is generally a continuous/batch production. Process is usually performed outdoors. Sulphuric acid is used in the industrial manufacture of organic chemicals and fine chemicals. These processes include using sulphuric acid in large volumes as a processing aid, catalyst or dehydration agent in the chemicals process of manufacture of adhesives, explosives, acids, organic salts, dyes and pigments, biofuels, pharmaceuticals and the alkylation of aliphatics. Sulphuric acid is used in the industrial manufacture of organic chemicals and fine chemicals. These processes include using sulphuric acid in large volumes as a processing aid, catalyst or dehydration agent in the chemical process of manufacture of adhesives, explosives, acids, organic salts, dyes and pigments, biofuels, pharmaceuticals and the alkylation of aliphatics. Sulphuric acid may also be used to regulate pH in water streams and as a process aid in the leather and textiles industry.
Technical conditions and measures at process level (source) to prevent release	Handling of sulphuric acid involves special equipment and controlled systems with little or no potential for exposure. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered.
Technical conditions and measures to reduce or limit discharges, air emissions and release to soil	Exhaust gases may be treated by scrubbers or emissions may be measured and controlled according to local legislation; typically this removes >99% of sulphur oxides. The waste water neutralization process is extremely efficient with almost total neutralization achieved. pH alarms are in place to ensure that successful neutralization has taken place. All sludge is collected and incinerated or sent to landfill. Dilution factor of 10 (STD 2000 m ³ /d).
Risk management measures – air	Release to air 333 kg/d.

Risk management measures – water	Aquatic freshwater (after STP) 0 kg/d – (Based on effective neutralization and pre-treatment).
Risk management measures – soil	Soil (direct only) Agricultural soil 0 kg/d – (No directly loss to soil is expected for this ERC and no sludge spreading).
Risk management measures – other	On contact with water, sulphuric acid, as a strong mineral acid ($pK_a = 1.92$), dissociates readily to hydrogen ions and sulphate ions (at all environmentally relevant pH's) and is totally miscible with the water layer. At all environmentally relevant concentrations, the substance will therefore exist as the environmentally ubiquitous non-hazardous sulphate (SO_4^{2-}) anion and hydronium (H_3O^+) cation. Estimated exposure concentrations Waste water before treatment 8,330mg/L Sewage (STP effluent) 0mg/L - Set to 0 due to on-site treatment and removal. Local freshwater 0mg/L. 10-fold dilution by receiving waters. Local concentration with atmospheric deposition not yet taken into account.
Organizational measures to prevent/limit release from site	No data
Conditions and measures related to on-site or municipal sewage treatment plant	Chemical pretreatment or onsite STP. Waste waters are generally treated by on site WWTP which will be neutralized before it reaches the biological tower of the WWTP or will be treated on site by chemical neutralization methods before release to the municipal STP or to the environment. Discharge volume of sewage treatment plant 2000 m ³ /d.
Conditions and measures related to external treatment of waste for disposal	Sediment from STP is stored in a landfill.
Conditions and measures related to external recovery of waste	Not applicable

3. Control of worker exposure:

PROC 1, 2, 3, 4, 8a, 8b, 9, 13	
Product Characteristics	
Concentration of substance in mixture or articles	93-98%
Physical state	Physical state: liquid.
Amounts used	No data
Frequency and duration of use	8 h/d, 220 d/y
Human factors not influenced by risk management	The effects of sulphuric acid following dermal exposures are local irritation and corrosivity of the skin. There is no evidence of systemic effects following dermal exposures to sulphuric acid. 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 processes associated with sulphuric acid production involve any targeted environmental emissions or application and the primary receiving compartment is the on-site STP where rigorous neutralizations processes and employed. Body parts potentially exposed: skin (hands, face). <u>Respiration volume under conditions of use</u> 10m ³ /d. Default value for a worker breathing for a 8hrs work day. <u>Skin contact area with the substance under conditions of use</u> 480cm ² (ECETOC default). Please note that due to the corrosive nature of sulphuric acid dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases.
Other given operational conditions affecting workers exposure	Worker contact is generally very low as most operations are remotely controlled and sampling/analysis events are of short duration. Workers generally operate in a separate control room, with no direct contact to the installations housing the material. 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 sce-

	nario, in order to minimize exposure and risks.
Technical conditions and measures at process level (source) to prevent release	Worker exposure considered to be negligible due to the specialized systems and closed nature of the process.
Technical conditions and measures to control dispersion from source towards the worker	Local exhaust ventilation if required. 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.
Organizational measures to prevent /limit releases, dispersion and exposure	Training. Monitoring/reporting and auditing systems: Equipment must be well maintained and cleaned daily. Containment plus good work practice required.
Conditions and measures related to personal protection, hygiene and health evaluation	There is no worker exposure under normal conditions (LEV- if required, closed and controlled processes, separated control room). However there is required the use of personal protective equipment in order to minimize the risk exposure. See section 8 of the SDS.

ES 03 – USE OF SULPHURIC ACID IN THE PROCESS OF SURFACE TREATMENT, PURIFICATION AND ETCHING

1. Short title of the exposure scenario: Use of sulphuric acid in the process of surface treatment, purification and etching.

Sector of end use (SU):

SU3	Industrial uses: Uses of substances as such or in preparations at industrial sites
SU2a	Mining, (without offshore industries)
SU14	Manufacture of basic metals, including alloys
SU15	Manufacture of fabricated metal , except machinery and equipment
SU16	Manufacture of computer, electronic and optical products, electrical equipment

Market sector by type of chemical product (PC):

PC14	Metal surface treatment products, including galvanic and electroplating products
PC15	Non-metal- surface treatment products

List of names of contributing worker scenarios and corresponding PROCs:

PROC1	Use in closed process, no likelihood of exposure
PROC2	Use in closed, continuous process with occasional controlled exposure
PROC3	Use in closed batch process (synthesis or formulation)
PROC4	Use in batch and other process (synthesis) where opportunity for exposure arises
PROC8a	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non dedicated facilities
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)
PROC13	Treatment of articles by dipping and pouring

Name of contributing environmental scenario and corresponding ERC:

ERC6b	Industrial use of reactive processing aids
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Article category related to subsequent service life (AC):

–	Not applicable
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2. Environmental exposure controls:

ERC 6b	
Product Characteristics	Physical state: liquid.

Concentration of substance in mixture or articles	93 - 98% Concentrated acid. Slightly diluted concentration may also be used.
Amounts used	Annual amount used per site 10 000 t/y (worst case).
Frequency and duration of use	Emission days per site: 365 d/y Estimate number of emission days, based on continuous use.
Environmental factors not influenced by risk management	Discharge volume of sewage treatment plant 2000 m ³ /d. Available river water volume to receive the emissions from a site 20000 m ³ /d.
Other given operational conditions affecting workers exposure	Use of sulphuric acid a metallurgical surface treatment and etching agent involves specialized processes used to etch the surface of produced metals and surface contamination. Sulphuric acid is used in this manner to pickle metallic surface prior to electrolysis in order to remove impurities, stains, rust or other inorganic contaminants. Used pickling fluid is generally neutralized and does not have any consumer application. The processes which use sulphuric acid as metallurgical surface treatment are highly specialized and are controlled to limit emission and environmental exposure. Generally the treatment process would be continuous.
Technical conditions and measures to reduce or limit discharges, air emissions and release to soil	Handling of sulphuric acid involves special equipment and controlled systems with little or no potential for exposure. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and release to soil	Exhaust gases may be treated by scrubbers or emissions may be measured and controlled according to local legislation; typically this removes >99% of sulphur oxides. The waste water neutralization process is extremely efficient with almost total neutralization achieved. pH alarms are in place to ensure that successful neutralization has taken place. All sludge is collected and incinerated or sent to landfill. Dilution factor of 10 (STP 2000 m ³ /d).
Risk management measures - air	Release to air 27,4 kg/d (No refinement needed from tier 1, only the number of emission days has been refine).
Risk management measures - water	Aquatic freshwater (after STP) 0 kg/d (Based on effective of neutralization and pre-treatment).
Risk management measures - soil	Soil (direct only) Agricultural soil 0 kg/d (No directly loss to soil is expected for this ERC and no sludge spreading).
Risk management measures - other	On contact with water, sulphuric acid, as a strong mineral acid (pKa = 1.92), dissociates readily to hydrogen ions and sulphate ions (at all environmentally relevant pH's) and is totally miscible with the water layer. At all environmentally relevant concentrations, the substance will therefore exist as the environmentally ubiquitous non-hazardous sulphate (SO ₄ ²⁻) anion and hydronium (H ₃ O ⁺) cation. Estimated exposure concentrations Waste water before treatment 833mg/L. Sewage (STP effluent) 0 mg/L – Set to 0 due to on-site treatment and removal. Local freshwater 0 mg/L. 10-fold dilution by receiving waters. Local concentration with atmospheric deposition not yet taken into account.
Organizational measures to prevent/limit release from site	No data
Conditions and measures related to on-site or municipal sewage treatment plant	Typical pretreatment or onsite STP. Waste waters are generally treated by on site WWTP which will be neutralized before it reaches the biological tower of the WWTP or will be treated on site by chemical neutralization methods before release to the municipal STP or to the environment. Discharge volume of sewage treatment
Conditions and measures related to external treatment of waste for disposal	Sediment from STP is stored in a landfill.
Conditions and measures related to external recovery of waste	Not applicable

3. Control of worker exposure:

PROC 1, 2, 3, 4, 8a, 8b, 9,13.

Product Characteristics

Concentration of substance in mixture or articles	93 - 98% Concentrated acid. Slightly diluted concentration may also be used.
Physical state	Physical state: liquid.
Amounts used	No data
Frequency and duration of use	8 h/d, 220 d/y
Human factors not influenced by risk management	<p>The effects of sulphuric acid following dermal exposures are local irritation and corrosivity of the skin. There is no evidence of systemic effects following dermal exposures to sulphuric acid. 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 processes associated with sulphuric acid production involve any targeted environmental emissions or application and the primary receiving compartment is the on-site STP where rigorous neutralizations processes and employed. Body parts potentially exposed: skin (hands, face).</p> <p>Respiration volume under conditions of use 10m³/d. Default value for a worker breathing for a 8hrs work day.</p> <p>Skin contact area with the substance under conditions of use 480cm² (ECETOC default). Please note that due to the corrosive nature of sulphuric acid dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases.</p>
Other given operational conditions affecting workers exposure	Worker contact is generally very low as most operations are remotely controlled and sampling/analysis events are of short duration. Workers generally operate in a separate control room, with no direct contact to the installations housing the material. 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 minimize exposure and risks.
Technical conditions and measures at process level (source) to prevent release	Worker exposure considered to be negligible due to the specialized systems and closed nature of the process.
Technical conditions and measures to control dispersion from source towards the worker	Local exhaust ventilation if required. 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.
Organizational measures to prevent/limit releases, dispersion and exposure	Workshop are trained in equipment procedures, General Recommendation and Good Work Practices, operations instructions.
Conditions and measures related to personal protection, hygiene and health evaluation	There is no worker exposure under normal conditions (LEV- if required, closed and controlled processes, separated control room). However there is required the use of personal protective equipment in order to minimize the risk exposure. See section 8 of the SDS.

ES 04 – USE OF SULPHURIC ACID IN ELECTROLYTIC PROCESSES**1. Short title of the exposure scenario:** Use of sulphuric acid in electrolytic processes.**Sector of end use (SU):**

SU3	Industrial uses: Uses of substances as such or in preparations at industrial sites
SU14	Manufacture of basic metals, including alloys
SU15	Manufacture of fabricated metal products, except machinery and equipment
SU17	General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment

Market sector by type of chemical product (PC):

PC14	Metal surface treatment products, including galvanic and electroplating products
PC20	Products such as ph-regulators, flocculants, precipitants, neutralization agents

List of names of contributing worker scenarios and corresponding PROCs:

PROC1	Use in closed process, no likelihood of exposure
PROC2	Use in closed, continuous process with occasional controlled exposure
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)
PROC13	Treatment of articles by dipping and pouring

Name of contributing environmental scenario and corresponding ERC:

ERC5	Industrial use resulting in inclusion into or onto a matrix
ERC6b	Industrial use of reactive processing aids

Article category related to subsequent service life (AC):

-	Not applicable
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2. Environmental exposure controls:

ERC 5, 6b.	
Product Characteristics	Physical state: liquid.
Concentration of substance in mixture or articles	93-98 % This concentration is used to prepare a diluted electrolyte solution.
Amounts used	Annual amount used per site: 2306 t/y (Worst case site).
Frequency and duration of use	Emission days per site 365 d/y. Estimate number of emission days, based on continuous use.
Environmental factors not influenced by risk management	Discharge volume of sewage treatment plant 2000 m ³ /d. Available river water volume to receive the emissions from a site 20000 m ³ /d.
Other given operational conditions affecting environmental exposure	For ES06 the processes utilizing sulphuric acid in electrolytic processes is highly specialized and utilizes specialized vessels, chambers and processes. The processes which use sulphuric acid as electrolytic agents are highly specialized and are controlled to limit emissions and environmental exposure. The electrolytic processes take place in a specially constructed vessel which contains a bath of sulphuric acid solution. Two electrical poles are located either side of the acid bath and these pass current through the electrolyte to achieve electrolysis
Technical conditions and measures at process level (source) to prevent release	Handling of sulphuric acid involves special equipment and controlled systems with little or no potential for exposure. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and release to soil	Exhaust gases may be treated by scrubbers or emissions may be measured and controlled according to local legislation; typically this removes >99% of sulphur oxides. The waste water neutralization process is extremely efficient with almost total neutralization achieved. pH alarms are in place to ensure that successful neutralization has taken place. All sludge is collected and incinerated or sent to landfill. Dilution factor of 10 (STP 2000 m ³ /d).
Risk management measures - air	ERC 6b: Release to air 6.32 kg/d (No refinement needed from tier 1, only the number of emission days has been refined). ERC 5: 3,160 kg/d (No refinement needed from tier 1, only the number of emission days has been refined).
Risk management measures - water	ERC 6b: Aquatic freshwater (after STP) 0 kg/d (Based on effective neutralization and pretreatment) ERC 5: Aquatic freshwater (after STP) 0 kg/d (Based on effective neutralization and pretreatment)
Risk management	ERC 6b: Soil (direct only) /Agricultural soil 0 kg/d (No directly loss to

measures - soil	soil is expected for this ERC and no sludge spreading). ERC 5: Soil (direct only) /Agricultural soil 0 kg/d (No directly loss to soil is expected for this ERC and no sludge spreading).
Risk management measures - other	On contact with water, sulphuric acid, as a strong mineral acid ($pK_a = 1.92$), dissociates readily to hydrogen ions and sulphate ions (at all environmentally relevant pH's) and is totally miscible with the water layer. At all environmentally relevant concentrations, the substance will therefore exist as the environmentally ubiquitous non-hazardous sulphate (SO_4^{2-}) anion and hydronium (H_3O^+) cation. Estimated exposure concentrations. Waste water before treatment ERC6b: 577 mg/L – ERC6b. Sewage (STP effluent) 0mg/L – Based on neutralization to around pH 7. ERC6b Local freshwater 0mg/L. 10-fold dilution by receiving waters. Waste water before treatment ERC5: 5.77mg/L. ERC5 Sewage (STP effluent) 0mg/L - Based on neutralization to around pH. ERC5 Local freshwater 0mg/L. 10-fold dilution by receiving waters
Organizational measures to prevent/limit release from site	No data
Conditions and measures related to on-site or municipal sewage treatment plant	Chemical pretreatment or onsite STP. Waste waters are generally treated by on site WWTP which will be neutralized before it reaches the biological tower of the WWTP or will be treated on site by chemical neutralization methods before release to the municipal STP or to the environment. Discharge volume of sewage treatment plant 2000 m ³ /d.
Conditions and measures related to external treatment of waste for disposal	As the sulphuric acid acts primarily as an electrolyte the acid may be reused several times before it is considered spent and sent to the waste system. Furthermore waste capture strategies including the use of scrubbers and dedicated effluent treatment facilities are generally employed to reduce environmental emissions. Sediment from STP is stored in a landfill.
Conditions and measures related to external recovery of waste	Not applicable

3. Control of worker exposure

PROC 1, 2, 8b, 9, 13.

Product Characteristics	
Concentration of substance in mixture or articles	93-98 % This concentration is used to prepare a diluted electrolyte solution.
Physical state	Physical state: liquid.
Amounts used	No data
Frequency and duration of use	8 h/d, 220 d/y
Human factors not influenced by risk management	The effects of sulphuric acid following dermal exposures are local irritation and corrosivity of the skin. There is no evidence of systemic effects following dermal exposures to sulphuric acid. 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 processes associated with sulphuric acid production involve any targeted environmental emissions or application and the primary receiving compartment is the on-site STP where rigorous neutralizations processes and employed. Body parts potentially exposed: skin (hands, face). <u>Respiration volume under conditions of use</u> 10m ³ /d. Default value for a worker breathing for a 8hrs work day. <u>Skin contact area with the substance under conditions of use</u> 480cm ² (ECETOC default). Please note that due to the corrosive nature of sulphuric acid dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases.
Other given operation-	Worker contact is generally very low as most operations are remotely controlled

al conditions affecting workers exposure	and sampling/analysis events are of short duration. Workers generally operate in a separate control room, with no direct contact to the installations housing the material. 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 minimize exposure and risks.
Technical conditions and measures at process level (source) to prevent release	Worker exposure considered to be negligible due to specialized systems.
Technical conditions and measures to control dispersion from source towards the worker	Local exhaust ventilation is not required. The nature of the process during electrolysis (including the corrosive nature of the acid and the electrical currents) all vessels, chambers, housings and pipelines are strictly controlled.
Organizational measures to prevent /limit releases, dispersion and exposure	Workers are trained in equipment procedures, General Recommendations and Good Work Practices, operations instructions.
Conditions and measures related to personal protection, hygiene and health evaluation	There is no worker exposure under normal conditions (closed and controlled processes). However there is required the use of personal protective equipment in order to minimize the risk exposure. See section 8 of the SDS.

ES 05 – USE OF SULPHURIC ACID IN GAS PURIFICATION, SCRUBBING AND FLUE GAS SCRUBBING

1. Short title of the exposure scenario: Use of sulphuric acid in gas purification, scrubbing and flue gas scrubbing

Sector of end use (SU):

SU3	Industrial uses: Uses of substances as such or in preparations at industrial sites
SU8	Manufacture of bulk, large scale chemicals (including petroleum products)

Market sector by type of chemical product (PC):

PC20	Products such as ph-regulators, flocculants, precipitants, neutralization agents
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List of names of contributing worker scenarios and corresponding PROCs:

PROC1	Use in closed process, no likelihood of exposure
PROC2	Use in closed, continuous process with occasional controlled exposure
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities

Name of contributing environmental scenario and corresponding ERC:

ERC7	Industrial use of substances in closed systems
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Article category related to subsequent service life (AC):

–	Not applicable
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2. Environmental exposure controls:

ERC 7	
Product Characteristics	Physical state: liquid
Concentration of substance in mixture or articles	93-98 %
Amounts used	Annual amount used per site: 30000 t/y (Worst case site).
Frequency and duration of use	Emission days per site 365 d/y. Estimate number of emission days, based on continuous use.

Environmental factors not influenced by risk management	Discharge volume of sewage treatment plant 2000 m ³ /d. Available river water volume to receive the emissions from a site 20000 m ³ /d.
Other given operational conditions affecting environmental exposure	ES07 encompasses the use of concentrated sulphuric acid as agent for gas purification. This includes gas scrubbing and flue gas scrubbing. The main applications of this would be in purification of gas from coke ovens and in the purification and drying of industrial gases generated from the manufacture of other substances. These processes are highly specialized and are controlled to limit emissions and environmental exposure. Furthermore waste capture strategies including the containment of sulphuric acid in scrubbers and dedicated effluent treatment facilities are generally employed.
Technical conditions and measures at process level (source) to prevent release	Working with sulphuric acid involves, special equipment and high integrity contained systems with little or no potential for exposure. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and/or filtered.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and release to soil	Exhaust gases may be treated by scrubbers or emissions may be measured and controlled according to local legislation; typically this removes >99% of sulphur oxides. The waste water neutralization process is extremely efficient with almost total neutralization achieved. pH alarms are in place to ensure that successful neutralization has taken place. All sludge is collected and incinerated or sent to landfill. Dilution factor of 10 (STP 2000 m ³ /d).
Risk management measures - air	Release to air 5000 kg/d (No refinement needed from tier 1, only the number of emission days has been refine).
Risk management measures - water	Aquatic freshwater (after STP) 0 kg/d (Based on effective neutralization and pre-treatment).
Risk management measures - soil	Soil (direct only) /Agricultural soil 0 kg/d (No directly loss to soil is expected for this ERC and no sludge spreading).
Risk management measures - other	On contact with water, sulphuric acid, as a strong mineral acid (pKa = 1.92), dissociates readily to hydrogen ions and sulphate ions (at all environmentally relevant pH's) and is totally miscible with the water layer. At all environmentally relevant concentrations, the substance will therefore exist as the environmentally ubiquitous non-hazardous sulphate (SO ₄ ²⁻) anion and hydronium (H ₃ O ⁺) cation. Estimated exposure concentrations Waste water before treatment 2500mg/L Sewage (STP effluent) 0mg/L - Set to 0 due to on-site treatment and removal. Local freshwater 0mg/L. 10-fold dilution by receiving waters. Local concentration with atmospheric deposition not yet taken into account.
Organizational measures to prevent/limit release from site	No data
Conditions and measures related to on-site or municipal sewage treatment plant	Chemical pre-treatment or onsite STP. Waste waters are generally treated by on site WWTP which will be neutralized before it reaches the biological tower of the WWTP or will be treated on site by chemical neutralization methods before release to the municipal STP or to the environment. Discharge volume of sewage treatment plant 2000 m ³ /d.
Conditions and measures related to external treatment of waste for disposal	Liquid wastes are treated (neutralization 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.
Conditions and measures related to external recovery of waste	Not applicable

3. Control of worker exposure:

PROC 1, 2, 8b

Product Characteristics:

Concentration of substance in mixture or articles	93-98 %
Physical state	Physical state: liquid.
Amounts used	No data
Frequency and dura-	8 h/d, 220 d/y

tion of use	
Human factors not influenced by risk management	<p>The effects of sulphuric acid following dermal exposures are local irritation and corrosivity of the skin. There is no evidence of systemic effects following dermal exposures to sulphuric acid. 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 processes associated with sulphuric acid production involve any targeted environmental emissions or application and the primary receiving compartment is the on-site STP where rigorous neutralizations processes and employed. Body parts potentially exposed: skin (hands, face).</p> <p><u>Respiration volume under conditions of use</u> 10m³/d. Default value for a worker breathing for a 8hrs work day.</p> <p><u>Skin contact area with the substance under conditions of use</u> 480cm² (ECETOC default). Please note that due to the corrosive nature of sulphuric acid dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases.</p>
Other given operational conditions affecting workers exposure	Worker contact is generally very low as most operations are remotely controlled and sampling/analysis events are of short duration. Workers generally operate in a separate control room, with no direct contact to the installations housing the material. 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 minimize exposure and risks.
Technical conditions and measures at process level (source) to prevent release	Worker exposure considered to be negligible due to specialized systems.
Technical conditions and measures to control dispersion from source towards the worker	Local exhaust ventilation is not required. 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.
Organizational measures to prevent /limit releases, dispersion and exposure	Workers are trained in equipment procedures, General Recommendations and Good Work Practices, operations instructions.
Conditions and measures related to personal protection, hygiene and health evaluation	There is no worker exposure under normal conditions (closed and controlled processes). However there is required the use of personal protective equipment in order to minimize the risk exposure. See section 8 of the SDS.

ES 06 – USE OF SULPHURIC ACID IN PRODUCTION OF SULPHURIC ACID CONTAINED BATTERIES

1. Short title of the exposure scenario: Use of sulphuric acid in production of sulphuric acid contained batteries.

Sector of end use (SU):

SU3	Industrial uses: Uses of substances as such or in preparations at industrial sites
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Market sector by type of chemical product (PC):

PC0	Other: UCN code E10100 (Electrolytes)
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List of names of contributing worker scenarios and corresponding PROCs:

PROC2	Use in closed, continuous process with occasional controlled exposure
PROC3	Use in closed batch process (synthesis or formulation)
PROC4	Use in batch and other process (synthesis) where opportunity for exposure arises
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

Name of contributing environmental scenario and corresponding ERC:

ERC2	Formulation of preparations
ERC5	Industrial use resulting in inclusion into or onto a matrix

Article category related to subsequent service life (AC):

AC3	Electrical batteries and accumulators
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2. Environmental exposure controls:

ERC 2, 5.	
Product Characteristics	Physical state: liquid.
Concentration of substance in mixture or articles	Diluted to 25 – 40% in electrolyte solution.
Amounts used	Emission days per site: 365 d/y
Environmental factors not influenced by risk management	Discharge volume of sewage treatment plant 2000 m ³ /d. Available river water volume to receive the emissions from a site 20000 m ³ /d.
Other given operational conditions affecting environmental exposure	ES08 deals with the use of sulphuric acid in the production of lead-acid batteries. Specifically sulphuric acid is used in the production of the liquid electrolyte for batteries. The processes used in battery production are highly specialized and are controlled to limit emissions and environmental exposure. Furthermore waste capture strategies including the use of scrubbers and dedicated effluent treatment facilities are generally employed.
Technical conditions and measures at process level (source) to prevent release	Working with sulphuric acid involves, special equipment and high integrity contained systems with little or no potential for exposure. Any gas displaced from containers is conducted via pipeline to be processed i.e. removed and scrubbed and /or filtered.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and release to soil	Exhaust gases may be treated by scrubbers or emissions may be measured and controlled according to local legislation; typically this removes >99% of sulphur oxides. The waste water neutralization process is extremely efficient with almost total neutralization achieved. pH alarms are in place to ensure that successful neutralization has taken place. All sludge is collected and incinerated or sent to landfill. Dilution factor of 10 (STP 2000 m ³ /d).
Risk management measures - air	ERC 2: Release to air 625 kg/d No refinement needed from tier 1 to demonstrate safe use. As such the tier 1 value is presented here. ERC 5: Release to air 12500 kg/d No refinement needed from tier 1 to demonstrate safe use. As such the tier 1 value is presented here.
Risk management measures – water	ERC 2: Aquatic freshwater (after STP) 0 kg/d (Based on effective neutralization and pretreatment). ERC 5: Aquatic freshwater (after STP) 0 kg/d (Based on effective neutralization and pretreatment).
Risk management measures - soil	ERC 2: Soil (direct only) /Agricultural soil 0 kg/d (No directly loss to soil is expected for this ERC and no sludge spreading). ERC 5: Soil (direct only) /Agricultural soil 0 kg/d (No directly loss to soil is expected for this ERC and no sludge spreading)
Risk management measures - other	On contact with water, sulphuric acid, as a strong mineral acid (pKa = 1.92), dissociates readily to hydrogen ions and sulphate ions (at all environmentally relevant pH's) and is totally miscible with the water layer. At all environmentally relevant concentrations, the substance will therefore exist as the environmentally ubiquitous non-hazardous sulphate (SO ₄ ²⁻) anion and hydronium (H ₃ O ⁺) cation. Estimated exposure concentrations Waste water before treatment ERC2: 250 mg/L ERC2: Sewage (STP effluent) 0mg/L - Based on neutralization to around pH 7. ERC2: Local freshwater 0mg/L. 10-fold dilution by receiving waters. Waste water before treatment ERC5: 6.250 mg/L ERC5: Sewage (STP effluent) 0mg/L - Based on neutralization to around pH. ERC5: Local freshwater 0mg/L. 10-fold dilution by receiving waters.
Organizational measures to prevent/limit release from site	No data
Conditions and measures related to on-site or municipal sewage treatment plant	Chemical pretreatment or onsite STP. Waste waters are generally treated by on site WWTP which will be neutralized before it reaches the biological tower of the WWTP or will be treated on site by chemical neutralization methods before release to the municipal STP or to the envi-

	ronment. Discharge volume of sewage treatment plant 2000 m ³ /d.
Conditions and measures related to external treatment of waste for disposal	Liquid wastes are treated (neutralization to neutral pH) prior to emission to remove any sulphuric acid in the waste water and for disposal 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 neutralization followed by flocculation or decantation
Conditions and measures related to external recovery of waste	Not applicable

3. Control of worker exposure:

PROC 2, 3, 4, 9.

Product Characteristics

Concentration of substance in mixture or articles	Diluted to 25 – 40% in electrolyte solution
Physical state	Physical state: liquid.
Amounts used	No data
Frequency and duration of use	8 h/d, 220 d/y
Human factors not influenced by risk management	<p>The effects of sulphuric acid following dermal exposures are local irritation and corrosivity of the skin. There is no evidence of systemic effects following dermal exposures to sulphuric acid. 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 processes associated with sulphuric acid production involve any targeted environmental emissions or application and the primary receiving compartment is the on-site STP where rigorous neutralizations processes and employed. Body parts potentially exposed: skin (hands, face).</p> <p><u>Respiration volume under conditions of use</u> 10m³/d. Default value for a worker breathing for a 8hrs work day.</p> <p><u>Skin contact area with the substance under conditions of use</u> 480cm² (ECETOC default). Please note that due to the corrosive nature of sulphuric acid dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases.</p>
Other given operational conditions affecting workers exposure	Worker contact is generally very low as most operations are remotely controlled and sampling/analysis events are of short duration. Workers generally operate in a separate control room, with no direct contact to the installations housing the material. 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 minimize exposure and risks.
Technical conditions and measures at process level (source) to prevent release	Worker exposure considered to be negligible due to specialized systems.
Technical conditions and measures to control dispersion from source towards the worker	Local exhaust ventilation is not required. 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.
Organizational measures to prevent /limit releases, dispersion and exposure	Workers are trained in equipment procedures, General Recommendations and Good Work Practices, operations instructions.
Conditions and measures related to personal protection, hygiene and health evaluation	There is no worker exposure under normal conditions (closed and controlled processes). However there is required the use of personal protective equipment in order to minimize the risk exposure. See section 8 of the SDS.

ES 07 – MIXING, PREPARATION AND REPACKAGING OF SULPHURIC ACID

1. Short title of the exposure scenario: Mixing, preparation and repackaging of sulphuric acid.

Sector of end use (SU):

SU3	Industrial uses: Uses of substances as such or in preparations at industrial sites
SU10	Formulation [mixing] of preparations and/or repackaging (excluding alloys)

Market sector by type of chemical product (PC):

–	Not applicable
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List of names of contributing worker scenarios and corresponding PROCs:

PROC1	Use in closed process, no likelihood of exposure
PROC3	Use in closed batch process (synthesis or formulation)
PROC5	Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)
PROC8a	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non dedicated facilities
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

Name of contributing environmental scenario and corresponding ERC:

ERC2	Formulation of preparations
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Article category related to subsequent service life (AC):

–	Not applicable
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2. Environmental exposure controls:

ERC 2	
Product Characteristics	Psychical state: liquid.
Concentration of substance in mixture or articles	93-98%
Amounts used	Annual amount used per site: 300000 t/y Worst case site.
Frequency and duration of use	365 d/y
Environment factors not influenced by risk management	Discharge volume of sewage treatment plant 2000 m ³ /d. Available river water volume to receive the emissions from a site 20000 m ³ /d.
Other given operational conditions affecting environmental exposure	ES13 encompasses the use sulphuric acid during mixing, repackaging, preparation and in the production of Oleum. Oleum is produced using sulphur trioxide which is dissolved in concentrated sulphuric acid. Sulphuric acid is used in this manner is generally recycled by dilution of the produced oleum. These processes are highly specialized and are controlled to limit emissions and environmental exposure.
Technical conditions and measures at process level (source) to prevent release	Because of the high temperatures involved in the manufacturing processes (and the nature of sulphuric acid and the produced gases) all reactors and pipelines are sealed and insulated, to prevent loss of the reaction materials and maintain the necessary temperatures, and to protect the workforce and the environment.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and release to soil	Exhaust gasses can be filtered and scrubbed; typically this removes >99% of sulphur oxides. Environmental emissions are limited by designated waste treatment processes designed to limit environmental exposure.

Risk management measures - air	Release to air 205 kg/d No refinement of the emission amounts is required only the number of emission days have been altered to derive this value.
Risk management measures - water	Aquatic freshwater (after STP) 0 kg/d Based on efficient neutralization.
Risk management measures - soil	Soil (direct only)/ Agricultural soil 0 kd/d No directly loss to soil is expected for this ERC and no sludge spreading.
Risk management measures - other	On contact with water, sulphuric acid, as a strong mineral acid (pKa = 1.92), dissociates readily to hydrogen ions and sulphate ions (at all environmentally relevant pH's) and is totally miscible with the water layer. At all environmentally relevant concentrations, the substance will therefore exist as the environmentally ubiquitous non-hazardous sulphate (SO ₄ ²⁻) anion and hydronium (H ₃ O ⁺) cation. Estimated exposure concentrations. Waste water before treatment 13200 mg/L. Sewage (STP effluent) 0mg/L - Based on efficient neutralization Local freshwater 0mg/L. 10-fold dilution by receiving waters. Local concentration with atmospheric deposition not yet taken into account.
Organizational measures to prevent/limit release from site	No data
Conditions and measures related to on-site or municipal sewage treatment plant	Chemical pre-treatment or onsite STP. Waste waters are generally treated on site by chemical neutralization methods before release to the municipal STP or to the environment. Discharge volume of sewage treatment plant 2000 m ³ /d.
Conditions and measures related to external treatment of waste for disposal	Liquid wastes are treated (neutralization 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.
Conditions and measures related to external recovery of waste	Not applicable

3. Control of consumer exposure

PROC 1, 3, 5, 8a, 8b, 9.

Product Characteristics	
Concentration of substance in mixture or articles	93-98%
Physical state	Psychical state: liquid
Amounts used	No data
Frequency and duration of use/exposure	480 min/d
Human factors not influenced by risk management	The effects of sulphuric acid following dermal exposures are local irritation and corrosivity of the skin. There is no evidence of systemic effects following dermal exposures to sulphuric acid. 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 processes associated with sulphuric acid production involve any targeted environmental emissions or application and the primary receiving compartment is the on-site STP where rigorous neutralizations processes and employed. Body parts potentially exposed: skin (hands, face). <u>Respiration volume under conditions of use</u> 10m ³ /d. Default value for a worker breathing for a 8hrs work day. <u>Skin contact area with the substance under conditions of use</u> 480cm ² (ECETOC default). Please note that due to the corrosive nature of sulphuric acid dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases.
Other given operational conditions affecting consumers	Worker contact is generally very low as most operations are remotely controlled and sampling/analysis events are of short duration. Workers generally operate in a separate control room, with no direct contact to the installations housing the material.

exposure	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 minimize exposure and risks.
Technical conditions and measures at process level (source) to prevent release	Worker exposure considered to be negligible due to specialized systems.
Technical conditions and measures to control dispersion from source towards the worker	Local exhaust ventilation is not required. 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.
Organizational measures to prevent /limit releases, dispersion and exposure	Training. Monitoring/reporting and auditing systems: Equipment must be well maintained and cleaned daily. Containment plus good work practice required.
Conditions and measures related to personal protection, hygiene and health evaluation	There is no worker exposure under normal conditions (LEV- if required, closed and controlled processes, separated control room). However there is required the use of personal protective equipment in order to minimize the risk exposure. See section 8 of the SDS.