

# Sicherheitsdatenblatt

gemäß Verordnung (EG) Nr.1907/2006

Produktbezeichnung:  
erstellt am: 01.04.1994



**Schwefelsäure 76%**  
überarbeitet am: 06.06.2013

Materialnummer: 504  
Ausgabedatum: 06.06.2013 Seite 1 von 8

## ABSCHNITT 1: Bezeichnung des Stoffes und Firmenbezeichnung

<b>1.1</b>	<b>Produktidentifikator</b>	
1.1.1	Bezeichnung auf dem Kennzeichnungsschild/ Handelsname:	Schwefelsäure 76%
1.1.2	Zusätzliche Bezeichnungen:	
1.1.3	REACH Registrierungsnummer:	01-2119458838-20-0058
<b>1.2</b>	<b>Relevante identifizierte Verwendungen des Stoffs und Verwendungen, von denen abgeraten wird</b>	
1.2.1	Relevante identifizierte Verwendungen:	Herstellung von organischen und anorganischen Chemikalien, Katalysator, pH-Regulator, Entwässerungsmittel, Extraktionsmittel für Mineralien, Oberflächenbehandlung, Industrielles Reinigungsmittel, Beizen, elektrolytische Prozesse, Gaswäsche, Batterien.
1.2.2	Verwendungen, von denen abgeraten wird:	Keine bekannt
<b>1.3</b>	<b>Einzelheiten zum Lieferanten, der das Sicherheitsdatenblatt bereitstellt</b>	
1.3.1	EG-Inverkehrbringer (Hersteller):	Salzgitter Flachstahl GmbH
1.3.2	Hausadresse:	Eisenhüttenstraße 99, 38239 Salzgitter
1.3.3	Postadresse:	38223 Salzgitter
1.3.4	Land:	Deutschland
1.3.5	Telefon:	05341 / 21-01
1.3.6	Telefax:	05341 / 21-39 21
1.3.7	Auskunft gebender Bereich:	Hauptabteilung Arbeitssicherheit Tel. 05341 / 21-22 01 Fax. 05341 / 21-39 21
1.3.8	E-Mail (sachkundige Person):	szfg.reach@salzgitter-ag.de
1.4	Notrufnummer: (24 h/d besetzt)	05341 / 21-112 (Werkfeuerwehr)

## ABSCHNITT 2: Mögliche Gefahren

<b>2.1</b>	<b>Einstufung des Stoffes oder Gemisches</b>	
2.1.1	Gemäß RL 67/548/EWG Gef. Stoffe:	C, R35
		
		Ätzend
2.1.2	Gemäß Verordnung (EG) Nr. 1272/2008:	Korrosiv gegenüber Metallen, Kategorie 1 H290 Ätzwirkung auf die Haut, Kategorie 1A H314
<b>2.2</b>	<b>Kennzeichnungselemente nach Verordnung (EG) Nr.1272/2008</b>	
2.2.1	Piktogramme:	GHS05: Ätzend
		
2.2.2	Signalwort:	<b>Gefahr</b>
2.2.3	Gefahrenhinweise:	<b>H290</b> Kann gegenüber Metallen korrosiv sein. <b>H314</b> Verursacht schwere Verätzungen der Haut und schwere Augenschäden.
2.2.4	Sicherheitshinweise:	<b>P260</b> Gas/Nebel/Dampf/Aerosol nicht einatmen. <b>P280</b> Schutzhandschuhe/ Schutzkleidung/ Augenschutz/ Gesichtschutz tragen.

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**P301+P330+P331** Bei Verschlucken: Mund ausspülen. Kein Erbrechen herbeiführen.  
**P303+P361+P353** Bei Kontakt mit der Haut (oder dem Haar): Alle verschmutzten, getränkten Kleidungsstücke sofort ausziehen. Haut mit Wasser abwaschen/duschen.  
**P305+P351+P338** Bei Kontakt mit den Augen: Einige Minuten lang behutsam mit Wasser spülen. Vorhandene Kontaktlinsen nach Möglichkeit entfernen. Weiter spülen.  
**P309+310** Bei Exposition oder Unwohlsein: Sofort Giftinformationszentrum oder Arzt anrufen.

## 2.3 Zusätzliche Gefahrenhinweise für Mensch und Umwelt:

Beim Einatmen von Dämpfen in höherer Konzentration kann es zu schweren Schleimhautschäden der Atemwege (u.U. lebensbedrohlich) kommen. Wärmeentwicklung bei Verdünnen mit Wasser, z.T. mit sehr heftigen Reaktionen.

## ABSCHNITT 3: Zusammensetzung / Angaben zu Bestandteilen

3.1 Chemische Charakterisierung (Mischung): Schwefelsäurelösung

### 3.2 Gefährliche Inhaltsstoffe:

Reach Registriernummer: 01-2119458838-20-0058		Bezeichnung: Schwefelsäure			
EG-Nr.	CAS-Nr.	Bezeichnung	Anteil [%]	Einstufung Richtl. 67/548/EWG	Einstufung VO (EG) Nr.1272/2008
231-639-5	7664-93-9	Schwefelsäure	71 -78%	C: R35	Ätzwirkung auf Haut.1A; H314

## ABSCHNITT 4: Erste Hilfe Maßnahmen

### 4.1 Beschreibung der Erste-Hilfe Maßnahmen

- 4.1.1 **Allgemeine Hinweise:** **Sofort Arzt aufsuchen!** Bei Verschlucken oder Benetzung größerer Hautflächen mit Schwefelsäure besteht Lebensgefahr. Kontakt unbedingt vermeiden.
- 4.1.2 **Nach Einatmen:** Die betroffene Person an die frische Luft bringen. Person warm halten. Bei Bewusstlosigkeit Transport und Lagerung in stabiler Seitenlage.
- 4.1.3 **Nach Hautkontakt:** Kontaminierte Kleidung sofort entfernen. Sofort und lange mit viel Wasser abwaschen.
- 4.1.4 **Nach Augenkontakt:** Nach Einwirkung von Flüssigkeitsspritzern oder Aerosolen: Auge unter Schutz des unverletzten Auges mindestens 15 Minuten unter fließendem Wasser bei weitgespreizten Lidern spülen. Milden Wasserstrahl direkt in das Auge richten, um Säurereste schnellstmöglich und vollständig zu entfernen. Sofort Augenarzt hinzuziehen.
- 4.1.5 **Nach Verschlucken:** Mund ausspülen und reichlich Wasser trinken lassen. Kein Erbrechen herbeiführen.
- 4.2 **Wichtigste akute und verzögert auftretende Symptome und Wirkungen:** Reiz- und Ätzwirkung, Erblindungsgefahr!

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## 4.3 Hinweise für den Arzt:

Konzentrierte Schwefelsäure wirkt stark ätzend und gewebezerstörend. Da sich kein Ätzschorf bildet, dringt die Säure fortschreitend tiefer ein. Es entstehen sehr schwer heilende Wunden. Die Nebel wirken, je nach Konzentration, reizend bzw. ätzend auf die Schleimhäute, besonders der Augen und

Atemwege. Bei Gewöhnung kann es zur Schädigung der Lunge kommen (chronische Bronchitis) und zur Schädigung der Schneidezähne. Hohe Konzentrationen können zu Atem- und Herzstillstand führen. Nach Verschlucken sehr starke, schmerzhaft Verätzungen in Mund, Speiseröhre und Magen. Erbrechen, Schockzustand. *Quelle: CSR und GESTIS-Stoffdatenbank*

## ABSCHNITT 5: Maßnahmen zur Brandbekämpfung

- 5.1 **Geeignete Löschmittel:** Löschmaßnahmen auf die Umgebung abstimmen. Stoff selbst brennt nicht.
- 5.2 **Aus Sicherheitsgründen ungeeignete Löschmittel:** Wasservollstrahl.
- 5.3 **Besondere vom Stoff ausgehende Gefahren:** Entstehung giftiger und ätzender Gase (Schwefeloxide) und Dämpfe. Freiwerdende Nebel mit Sprühwasser niederschlagen. Nur säurefeste Hilfsgeräte verwenden.
- 5.4 **Besondere Schutzausrüstung bei der Brandbekämpfung:** Umgebungsluftunabhängiges Atemschutzgerät und Chemikalienschutzanzug tragen.
- 5.5 **Zusätzliche Hinweise:** Kontaminiertes Löschwasser getrennt sammeln. Nicht in die Kanalisation, Oberflächenwasser oder Grundwasser gelangen lassen. Bei Kontakt mit Laugen, Wasser und Metallen Wasserstoffbildung möglich.

## ABSCHNITT 6: Maßnahmen bei unbeabsichtigter Freisetzung

- 6.1 **Personenbezogene Vorsichtsmaßnahmen:** Schutzausrüstung tragen. Ungeschützte Personen fernhalten. Für ausreichende Lüftung sorgen.
- 6.2 **Umweltschutzmaßnahmen:** Nicht in den Boden, die Kanalisation oder in Gewässer gelangen lassen.
- 6.3 **Methoden und Material für Rückhaltung und Reinigung:** Mit flüssigkeitsbindendem Material (Sand, Kieselgur, Säurebinder, Universalbinder) aufnehmen. In geeigneten, geschlossenen Behältern sammeln und zur Entsorgung bringen. Den betroffenen Bereich belüften. Produktreste mit Kalk oder Soda vorsichtig neutralisieren, mit viel Wasser nachspülen.

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## **ABSCHNITT 7: Handhabung und Lagerung**

- 7.1 Schutzmaßnahmen zur sicheren Handhabung:**
- 7.1.1 Hinweise zum sicheren Umgang:** Aerosolbildung vermeiden
- 7.1.2 Technische Maßnahmen:** Abzug verwenden (Labor). Notdusche und Augenspülvorrichtung / Spülflasche in Arbeitsplatznähe bereit halten.
- 7.1.3 Spezifische Anforderungen oder Handhabungsregelungen:** Beim Verdünnen stets Wasser vorlegen und Produkt hineinrühren, nie umgekehrt.
- 7.1.4 Hinweise zum Brand- und Explosionsschutz:** Wasserstoffbildung als Reaktionsprodukt möglich. Stoff selbst brennt nicht (vgl. Pkt.5)
- 7.1.5 Allgemeine Hygienemaßnahmen:** Im Arbeitsbereich nicht Essen, Trinken oder Rauchen. Keine Lebensmittel im Arbeitsbereich aufbewahren. Nach Arbeitsende und vor den Pausen Hände waschen.
- 7.2 Bedingungen zur sicheren Lagerung:** Nicht zusammen mit Alkalien (Laugen) lagern. Getrennt von Metallen aufbewahren. Von organischen Verbindungen fernhalten. Lagerklasse (VCI) 8b
- 7.3 Spezifische Endanwendungen:** Synthese von organischen und anorganischen Chemikalien

## **ABSCHNITT 8: Begrenzung und Überwachung der Exposition/Persönliche Schutzausrüstung**

- 8.1 Expositionsgrenzwerte**
- 8.1.1 Arbeitsplatzgrenzwerte (TRGS 900):** Der AGW-Wert für Schwefelsäure ist zurzeit in Bearbeitung.
- 8.1.2 DNEL und PNEC-Werte:**
- DNEL (Arbeiter) Inhalativ (akut/ Kurzzeit): 0,1 mg/m<sup>3</sup>  
DNEL (Arbeiter) Inhalativ (Langzeit): 0,05 mg/m<sup>3</sup>  
DNEL (Bevölkerung): Es gibt keine signifikanten Hinweise auf eine zusätzliche inhalative Exposition über der natürlichen Hintergrund - Konzentration. DMELs und DNELs sind daher für die allgemeine Bevölkerung nicht ermittelt.
- PNEC Marin: 0,00025mg/l (Sicherheitsfaktor:100)  
PNEC aquatisch: 0,0025 mg/l (Sicherheitsfaktor: 10)  
PNEC Abwasserbehandlungsanlage: 8,8mg/l (Sicherheitsfaktor 10)  
PNEC Sediment aquatisch + marin 0,002mg/kg (Modelwert)
- 8.2 Begrenzung und Überwachung der Exposition**
- 8.2.1 Begrenzung und Überwachung der Exposition am Arbeitsplatz:** Vgl. ABSCHNITT 7.
- 8.2.2 Atemschutz:** Erforderlich bei Auftreten von Dämpfen /Aerosolen. Empfohlener Filtertyp P2 (Kennfarbe weiß).
- 8.2.3 Handschutz:** Hautschutzplan erstellen und beachten! Die Chemikalienbeständigkeit der Schutzhandschuhe ist mit dem Lieferanten abzuklären und muss den Spezifikationen der EG-Richtlinie 89/686/EWG und der daraus ergebenden Norm EN374 genügen.

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	Geeignet sind Handschuhe aus folgenden Materialien:
	Bei Vollkontakt: Handschuhmaterial: Fluorkautschuk Schichtstärke: 0,7 mm Durchbruchzeit: > 480 Min.
	Bei Kurzzeitkontakt / Spritzkontakt: Handschuhmaterial: Butylkautschuk Schichtstärke: 0,7 mm Durchbruchzeit: > 120 Min.
<b>8.2.4 Augenschutz:</b>	Dichtsitzende Schutzbrille bzw. Vollvisier-Gesichtsschutz tragen.
<b>8.2.5 Körperschutz:</b>	Säurebeständige Schutzkleidung (ggf. mit Kopf und Nackenschutz)
<b>8.3 Begrenzung und Überwachung der Umweltexposition:</b>	Siehe ABSCHNITT 7. Es sind keine darüber hinausgehenden Maßnahmen erforderlich.

## ABSCHNITT 9: Physikalische und chemische Eigenschaften

<b>9.1 Allgemeine Angaben</b>	
<b>9.1.1 Aggregatzustand:</b>	flüssig
<b>9.1.2 Farbe:</b>	farblos
<b>9.1.3 Geruch:</b>	geruchlos
<b>9.1.4 pH-Wert:</b>	< 1
<b>9.1.5 Schmelzpunkt/ -bereich:</b>	10,4°C – 10,9°C (für Schwefelsäure 100%, CSR)
<b>9.1.6 Siedepunkt/-bereich:</b>	ca. 200°C (1013 hPa)
<b>9.1.7 Dichte:</b>	1,71g/ml (20°C)
<b>9.1.8 Wasserlöslichkeit:</b>	mischbar (20°C)
<b>9.1.9 Flammpunkt:</b>	n.z. (1013 hPa)
<b>9.1.10 Zündtemperatur:</b>	n.z. (1013 hPa)
<b>9.1.11 Untere Explosionsgrenze:</b>	n.z. (nicht explosiv)
<b>9.1.12 Obere Explosionsgrenze:</b>	n.z. (nicht explosiv)
<b>9.1.13 Dampfdruck:</b>	< 0,001 hPa (20°C, Literaturangaben)

**9.2 Sonstige Angaben:** Kann gegenüber Metallen korrosiv sein.

## ABSCHNITT 10: Stabilität und Reaktivität

<b>10.1 Reaktivität:</b>	Wirkt korrodierend, starkes Oxidationsmittel.
<b>10.2 Chemische Stabilität:</b>	Stabil unter normalen Bedingungen.
<b>10.3 Möglichkeit gefährlicher Reaktionen:</b>	Bildung von Wasserstoff bei Kontakt mit Metallen, Oxidationsmitteln (z.B. Perchlorate). Beim Verdünnen Säure in Wasser geben, nie umgekehrt, da sonst starke exotherme Reaktion möglich.
<b>10.4 Zu vermeidende Bedingungen:</b>	Starkes Erhitzen, thermische Zersetzung (ca. 336°C)
<b>10.5 Unverträgliche Materialien:</b>	Oxidationsmittel. Kontakt mit Metallen setzt Wasserstoffgas frei.
<b>10.6 Gefährliche Zersetzungsprodukte:</b>	Schwefeloxide (SO <sub>x</sub> )

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## ABSCHNITT 11: Toxikologische Angaben

- 11.1 Akute Wirkungen** Die akute Wirkung beruht auf der ätzenden Wirkung der Schwefelsäure.
- 11.1.1 Akute Toxizität: oral:** Ratte (wistar)  
LD 50: 2140 mg/kg  
Der Haupteffekt entsteht durch die lokale, gewebezerstörende Wirkung der Schwefelsäure.
- Inhalativ:**  
LD 50: 375 mg/m<sup>3</sup> Ratte (OECD 403)  
LD 50 (4h): 0,85 mg/l Maus (OECD 403)  
LD 50 (8h): 0,6 mg/l Maus (OECD 403)
- 11.1.2 Reiz- / Ätzwirkung:** Schwefelsäure ist legal eingestuft in der RL 67/548/EWG als ätzend (R35) >15% und als Reizend > 5% -15%. Weitere Studien wurden daher nicht durchgeführt.
- 11.2 Sensibilisierung:** **Haut:** keine sensibilisierende Wirkung bekannt.
- 11.3 Toxizität bei wiederholter Aufnahme:** Kein Hinweis auf systemisch, toxische Effekte bei wiederholter Aufnahme.  
NOAEC: 0,3 mg/m<sup>3</sup> (OECD 412, Ratte wistar)
- 11.4 CMR-Wirkungen (krebserzeugende, erbgutverändernde und fortpflanzungsgef. Wirkung)**
- 11.4.1 Mutagen:** Tierstudien geben keinen Hinweis auf mutagene Wirkung
- 11.4.2 Karzinogen:** Tierstudien geben keinen Hinweis auf karzinogene Wirkung
- 11.4.3 Reproduktionstoxisch:** Kein Hinweis auf Reproduktionstoxizität.  
NOAEC 19,3 mg/m<sup>3</sup> (OECD 414, Kaninchen, Maus).  
*Quelle: Chemischer Sicherheitsbericht für Schwefelsäure (CSR)*

## ABSCHNITT 12: Umweltbezogene Angaben

- 12.1 Ökotoxizität:** Schwefelsäure ist im Anhang I der RL 67/548/EWG nicht als umweltgefährdend eingestuft. Die Testergebnisse (gemäß REACH-VO) geben keinen Hinweis auf eine Einstufung als Umweltgefährdend.
- 12.1.1 Aquatisch:** Kurzzeit:  
**LC50:** 16 mg/l (*Fisch: Lepomis macrochirus*)  
**EC50/LC50 (48h):** > 100mg/l (Wirbellose: *D.magna*)  
Langzeit:  
**NOEC:** 0,025 mg/l (*Fisch: Jordanella floridae*)  
**NOEC:** 0,15 mg/l (Wirbellose: *Tanytarsus dissimilis*)  
Wachst.rate:  
**EC50 (72h):** >100mg/l (*Alge: Desmodesmus sup.*)
- 12.1.2 Sediment: NOEC (37d):** 26000mg/l (Bakterientest, Atmungsrate)
- 12.1.3 Terrestrisch:** Eine terrestrische Exposition wird nicht angenommen.

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<b>12.2</b>	<b>Persistenz und Abbaubarkeit:</b>	Schwefelsäure ist eine starke mineralische Säure, die vollständig in Wasser dissoziiert (Anion $\text{SO}_4^-$ und Kation $\text{H}_3\text{O}^+$ ).
<b>12.3</b>	<b>Bioakkumulationspotenzial:</b>	nicht bioakkumulierend
<b>12.4</b>	<b>Mobilität im Boden:</b>	k.D.v.
<b>12.5</b>	<b>Ergebnis der Ermittlung der PBT-Eigenschaften:</b>	
<b>12.5.1</b>	<b>Persistente Eigenschaften:</b>	Schwefelsäure hat kein Potential für „(sehr) persistente (P; vP) Eigenschaften“.
<b>12.5.2</b>	<b>Bioakkumulierende Eigenschaften:</b>	Schwefelsäure erfüllt nicht die Kriterien für „Bioakkumulation“
<b>12.5.3</b>	<b>Toxische Eigenschaften:</b>	Schwefelsäure erfüllt nicht die Kriterien für „Toxisch“.
<b>12.6</b>	<b>Weitere ökologische Hinweise:</b>	keine <i>Quelle: Chemischer Sicherheitsbericht für Schwefelsäure (CSR)</i>

## **ABSCHNITT 13: Hinweise zur Entsorgung**

<b>13.1</b>	<b>Verfahren zur Abfallbehandlung:</b>	Produktreste sind unter der Beachtung der Abfallrichtlinie 2008/98/EG zu entsorgen.
<b>13.2</b>	<b>Vorschlagsliste für Abfallschlüssel/ Abfallbezeichnungen gemäß EAKV:</b>	06 01 01 (Schwefelsäure und schweflige Säure).
<b>13.3</b>	<b>Verpackung:</b>	Entleerte Verpackungen dem Recycling zukommen lassen.

## **ABSCHNITT 14: Angaben zum Transport**

<b>14.1</b>	<b>Landtransport ADR/RID und GGVS/GGVE (grenzüberschreitend/Inland):</b>	
<b>14.1.1</b>	<b>ADR/RID-GGVS/E Klasse:</b>	8 Ätzende Stoffe
<b>14.1.2</b>	<b>Verpackungsgruppe:</b>	II
<b>14.1.3</b>	<b>Klassifizierungscode:</b>	C1
<b>14.1.4</b>	<b>Kemmlerzahl:</b>	80
<b>14.1.5</b>	<b>UN-Nummer:</b>	1830
<b>14.1.6</b>	<b>Gefahrzettel:</b>	8
<b>14.1.7</b>	<b>Bezeichnung des Gutes:</b>	1830 Schwefelsäure
<b>14.1.8</b>	<b>Tunnelbeschränkungscode:</b>	E Beförderungskategorie 2
<b>14.1.9</b>	<b>Begrenzte Mengen:</b>	LQ 22
<b>14.2</b>	<b>Binnenschifftransport (ADNR):</b>	
<b>14.2.1</b>	<b>ADR/RID-GGVS/E Klasse:</b>	8 Ätzende Stoffe
<b>14.2.2</b>	<b>Verpackungsgruppe:</b>	II
<b>14.2.3</b>	<b>Klassifizierungscode:</b>	C1
<b>14.2.4</b>	<b>Kemmlerzahl:</b>	80
<b>14.2.5</b>	<b>UN-Nummer:</b>	1830
<b>14.2.6</b>	<b>Gefahrzettel:</b>	8
<b>14.2.7</b>	<b>Bezeichnung des Gutes:</b>	1830 Schwefelsäure
<b>14.3</b>	<b>Seeschifftransport (GGVSee):</b>	kein Seeschifftransport
<b>14.4</b>	<b>Lufttransport (ICAO-IATA):</b>	kein Lufttransport

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## ABSCHNITT 15: Rechtsvorschriften

- 15.1 Vorschriften zu Sicherheit, Gesundheits- und Umweltschutz/spezifische Rechtsvorschriften für den Stoff oder das Gemisch**
- 15.1.1 Beschäftigungsbeschränkung:** Beschäftigungsbeschränkungen für Jugendliche nach § 22 JArbSch.
- 15.1.2 Wassergefährdungsklasse:** WGK 1: schwach wassergefährdend (VwVwS)
- 15.1.3 Zusätzliche Hinweise zu nationalen Vorschriften:** Die nationalen Vorschriften sind zu beachten.
- 15.2 Stoffsicherheitsbeurteilung:** Im Rahmen der REACH-Verordnung (EG) Nr.1907/2006 wurde eine Stoffsicherheitsbeurteilung durchgeführt, welche im Stoffsicherheitsbericht (CSR) dokumentiert ist.

## ABSCHNITT 16: Sonstige Angaben

- 16.1 Änderungen:**
- 16.2 Wortlaut der R-Sätze unter Abschnitt 3:** **R35** Verursacht schwere Verätzungen.
- 16.3 Wortlaut der H- und EUH-Sätze gemäß CLP Verordnung (EG 1272/2008):** **H290** Kann gegenüber Metallen korrosiv sein.  
**H314** Verursacht schwere Verätzungen der Haut und schwere Augenschäden.
- 16.4 Literatur, Quellen:** **Stoffsicherheitsbericht (CSR Chemical Safety Report)**  
"Schwefelsäure" erstellt gemäß Verordnung (EG) Nr.1907/2006. **Institut für Arbeitsschutz der gesetzlichen Unfallversicherungen:** GESTIS Stoffdatenbank <http://www.dguv.de/ifa/de/gestis/stoffdb/index.jsp>
- 16.5 Weitere Informationen:** Abkürzungen:  
k.D.v. = keine Daten vorhanden  
n.z. = nicht zutreffend  
n.d. = nicht durchführbar  
u.a. = unter anderem

### *Erklärung:*

*Dieses Sicherheitsdatenblatt ist überarbeitet worden gemäß Anhang II der REACH Verordnung (2010). Die in diesem Sicherheitsdatenblatt verwendeten Daten beruhen auf dem Registrierungsdossier und dem Chemischen Sicherheitsbericht für Schwefelsäure. Die Angaben in diesem Sicherheitsdatenblatt stützen sich auf den heutigen Stand unserer Kenntnisse und Erfahrungen. Das Sicherheitsdatenblatt beschreibt die Produkte im Hinblick auf Sicherheitserfordernisse. Die Angaben haben nicht die Bedeutung von Eigenschaftszusicherungen*

## ANHANG



## **Anhang zum EG - Sicherheitsdatenblatt**

gemäß Verordnung (EG) Nr.1907/2006

Sicherheitsdatenblatt-Nummer: 504

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**Schwefelsäure 76 %**  
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## Exposure Scenario 1: Manufacturing of Sulphuric Acid

Description of activities and processes covered in the exposure scenario		
<b>Production of sulphuric acid in steel plants</b>		
During the carbonization of coal in coke oven plants metallurgical coke is attained as main product, whereas the arising coke oven gas is a by-product. This gas needs to be treated for further application. Sulphur dioxide leaving the H <sub>2</sub> S scrubber is converted into sulphuric acid by combustion with atmospheric oxygen.		
In the first step the H <sub>2</sub> S is burnt with oxygen to form sulphur dioxide: $H_2S + 1.5 O_2 \rightarrow SO_2 + H_2O$		
The sulphur dioxide is burnt with oxygen in the presence of a V <sub>2</sub> O <sub>5</sub> catalyst to form sulphur trioxide: $SO_2 + 0.5 O_2 \rightarrow SO_3$		
In a last step the sulphur trioxide is fed to a solution of sulphuric acid and water to form even more sulphuric acid: $SO_3 + H_2O \rightarrow H_2SO_4$		
The resulting sulphuric acid is stored in tanks and sold to the customers.		
Short title of the exposure scenario:		
Sector of use	Not applicable	
Product category	Not applicable	
Process category	PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9	
Article Category	Not Applicable	
Environmental release category	ERC1	
Operational conditions related to frequency, duration and amount of use		
Duration, frequency and amount		
Information type	Data field	Explanation
Duration of exposure per day at workplace [for one worker]	Up to 8 hours	Worst case assumption
Frequency of exposure at workplace [for one worker]	220 d/year	
Annual amount used per site	1,200,000 T/yr manufactured	Worst case assumption
Emission days per site	Up to 365 d/year	
Operational conditions and risk management measures related to product characteristics		
Information type	Data field	Explanation
Physical state	Liquid (aqueous solution)	The product is in liquid form in a sealed tank container.
Concentration of the substance in the product	25 – 100 %	
Operational conditions related to available dilution capacity and characteristics of exposed human		
Information type	Data field	Explanation
Respiration volume under conditions of use	10 m <sup>3</sup> /d	Default respiration volume for light work.
Area of skin contact with the substance under conditions of use	480 cm <sup>2</sup>	ECETOC default; due to the corrosive nature dermal exposure is not considered relevant as it must be prevented in all cases.
Body weight	70 kg	Default bodyweight for workers.
Discharge volume of sewage treatment plant	2,000 m <sup>3</sup> /day	EUSES default
Available river water volume	20,000 m <sup>3</sup> /day	Default
Risk management measures		
Risk management measures for industrial site		
Information type	Data field	Explanation
Containment and local exhaust ventilation		
Containment plus good work practice required	Effectiveness: Unknown	Production and handling have little or no potential for exposure. Facilities involved in the production are usually housed outdoors.
Local exhaust ventilation if required	Effectiveness: Unknown	
Personal protective equipment (PPE)		
Type of PPE (gloves, respirator, faceshield etc)	Effectiveness: Unknown	Production and handling have little or no potential for exposure. Facilities involved in the production are usually housed outdoors. Workers involved in sampling and transfer of materials to road tankers have to be trained in the procedures and protective equipment has to be worn which can cope with the worst case scenario.
Other risk management measures related to workers		
No further risk management measures required		
Risk management measures related to environmental emissions from industrial sites		
Onsite pre-treatment of waste water	Chemical pre-treatment or onsite STP	Waste waters are generally treated by onsite WWTP which will be neutralised before it reaches the biological treatment.
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.
Air emission abatement	Effectiveness: adequate measures in place	Exhaust gases may be treated by scrubbers.
Resulting fraction of applied amount in waste gas released to environment	33 kg/d	Worst case measured values. This value has been inputted into the environmental risk assessment and is

		determined to be safe for the environment.		
Onsite waste treatment	Effectiveness: complete	The neutralisation process is extremely efficient.		
Effluent (of the waste water treatment plant) discharge rate	2000 m <sup>3</sup> /d	Default value.		
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	0.01%	The neutralisation process is extremely efficient.		
<b>Waste related measures</b>				
The neutralisation process is extremely efficient. In some cases sludge can be formed. This sludge can be disposed by incineration or landfill.				
<b>Exposure estimation</b>				
<b>Workers exposure</b>				
<b>Acute/Short-term and long-term exposure</b>				
<b>Dermal exposure</b>				
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.				
<b>Inhalation exposures</b>				
Since the ECETOC TRA model is unsuitable due to closed and well-controlled processes the ART model was used to conduct a tier 2 assessment.				
<b>Parameters and assumptions used in the ART model</b>				
<b>Information type</b>	<b>PROC</b>	<b>Parameters</b>		
Duration of exposure	All	480 min		
Product type	All	Liquid (medium viscosity – like oil)		
Process temperature	PROC1, 2, 3, 4	Hot processes (50 – 150 °C)		
	PROC 8a, 8b, 9	Room temperature (15 – 25 °C)		
Vapour pressure	All	6 Pa – Substance is considered to be low volatile, exposure to mists is estimated		
Liquid weight fraction	All	0.98		
Primary source proximity	PROC 1, 2	Primary emission source is not located in the breathing zone of the worker – the assessment for this activity involves a primary far-field emission source only (workers are in a control room).		
	PROC 3, 4, 8a, 8b, 9	Primary emission source located in the breathing zone of the workers		
Activity class	All	Transfer of liquid products		
Containment	PROC 1, 2, 3, 9	Handling reduces contact between product and adjacent air		
	PROC 4	Open process, submerged loading		
	PROC 8a, 8b	n/a		
Localised controls	PROC 1,3,8b	Vapour recovery systems, LEV		
	PROC 2, 4, 9	Vapour recovery		
	PROC 8a	None		
Segregation	PROC 1, 2	Complete segregation of workers in separate control room		
Fugitive emission source	PROC 1, 3, 8b, 9	Process fully enclosed – not breached for sampling		
	PROC 2, 4, 8a	Not fully enclosed – effective housekeeping practices in place		
Dispersion	PROC 1, 2, 8a, 8b	Outdoors not close to buildings		
	PROC 3, 4	Outdoors near to buildings		
	PROC 9	Indoors, any sized room, only good natural ventilation		
<b>Summary of acute/short-term and long-term inhalation exposure concentration to workers</b>				
<b>Description of activity</b>	<b>PROC</b>	<b>ESEC<sup>1)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>	<b>ELEC<sup>2)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>	
Production (high integrity closed system, sampling via closed loop)	1	9.3 x 10 <sup>-9</sup>	9.4 x 10 <sup>-9</sup>	
Production and sampling (occasional exposure pattern)	2	9.2 x 10 <sup>-8</sup>	9.2 x 10 <sup>-8</sup>	
Production, transfer and sampling	3	4.2 x 10 <sup>-4</sup>	4.2 x 10 <sup>-4</sup>	
Production, transfer and sampling (exposure likely)	4	1.4 x 10 <sup>-2</sup>	1.4 x 10 <sup>-2</sup>	
Loading / transfer	8a	2.3 x 10 <sup>-2</sup>	2.3 x 10 <sup>-2</sup>	
Loading / transfer	8b	1.2 x 10 <sup>-4</sup>	4.8 x 10 <sup>-6</sup>	
Loading / transfer (small containers)	9	3.2 x 10 <sup>-3</sup>	2.8 x 10 <sup>-3</sup>	
1) Estimated short-term exposure concentrations		2) Estimated long-term exposure concentrations		
<b>Risk Characterisation</b>				
The risk characterisation ratios are derived for the respiratory irritation and corrosivity.				
<b>Acute / local effects</b>	<b>PROC</b>	<b>ESEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>	<b>RCR</b>
	1	9.3 x 10 <sup>-9</sup>	0.1	9.3 x 10 <sup>-8</sup>
	2	9.2 x 10 <sup>-8</sup>	0.1	9.2 x 10 <sup>-7</sup>
	3	4.2 x 10 <sup>-4</sup>	0.1	4.2 x 10 <sup>-3</sup>
	4	1.4 x 10 <sup>-2</sup>	0.1	0.14
	8a	2.3 x 10 <sup>-2</sup>	0.1	0.23
	8b	1.2 x 10 <sup>-4</sup>	0.1	1.2 x 10 <sup>-3</sup>

	9	$3.2 \times 10^{-3}$	0.1	$3.2 \times 10^{-2}$
<b>Long-term / local effects</b>	<b>PROC</b>	<b>ELEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>	<b>RCR</b>
	1	$9.4 \times 10^{-9}$	0.05	$1.9 \times 10^{-7}$
	2	$9.2 \times 10^{-8}$	0.05	$1.8 \times 10^{-6}$
	3	$4.2 \times 10^{-4}$	0.05	$8.4 \times 10^{-3}$
	4	$1.4 \times 10^{-2}$	0.05	0.28
	8a	$2.3 \times 10^{-2}$	0.05	0.46
	8b	$4.8 \times 10^{-6}$	0.05	$9.6 \times 10^{-5}$
	9	$2.8 \times 10^{-3}$	0.05	0.056
<b>Consumer exposure</b>				
Consumer exposure is not relevant for the production of sulphuric acid.				
<b>Indirect exposure of humans via the environment</b>				
Indirect exposure of humans via the environment is expected to be negligible.				
<b>Environmental exposure</b>				
<b>Environmental releases</b>				
<b>The Steel industry scenario is thought to be much less than what is reported below because of tonnage amounts and systems used and therefore will produce lower release levels, the scenario below should be used as a worst case.</b>				
For calculating the releases EUSES was used with the following parameters:				
- Molecular weight: 98.08 g/mol				
- Water solubility: miscible				
- log Kow = -1 (estimated)				
- Koc = 1 (estimated)				
- Biodegradability: not biodegradable (inorganic substance)				
Some parameters are modified to meet the specific properties of the substance and the process:				
- Due to the total neutralization to around pH 7 there is no loss to waste water (0 mg/L).				
- Since the production is a continuous process the emission days are set to 365.				
- The sludge is removed to landfill or incinerated. Therefore the concentration in soil due to sludge spreading is set to 0.				
- As a worst case the stack gas emission is set to 33.3 kg/day.				
<b>Predicted releases to the environment</b>				
<b>Compartments</b>	<b>Predicted releases</b>	<b>Explanation</b>		
Aquatic (before WWTP)	120,000 mg/L			
Aquatic (after WWTP)	0 mg/L	Set to 0 due to on-site treatment and removal		
Freshwater	0 mg/L			
<b>Waste water treatment plant</b>				
<b>Fraction description</b>	<b>Fraction amount</b>			
Fraction of emission directed to air by WWTP	$1.4 \times 10^{-5}$ %			
Fraction of emission directed to water by WWTP	0.209 %			
Fraction of emission directed to sludge by WWTP	$9 \times 10^{-3}$ %			
Fraction of emission degraded by WWTP	99.8 %			
<b>Predicted Exposure Concentrations (PEC)</b>				
<b>Compartments</b>	<b>Local concentration</b>	<b>PEC (local)</b>	<b>Justification / Explanation</b>	
Surface water (in mg/L)	0	$7 \times 10^{-7}$	Calculated using EUSES 2.1.	
Marine water (in mg/L)	0	$1 \times 10^{-7}$	Calculated using EUSES 2.1.	
Freshwater sediment (in mg/kg)	0	$6.7 \times 10^{-7}$	Calculated using EUSES 2.1.	
Marine sediment (in mg/kg)	0	$8.2 \times 10^{-8}$	Calculated using EUSES 2.1.	
Agricultural soil (in mg/kg)	$3.5 \times 10^{-5}$	$4.7 \times 10^{-5}$	Calculated using EUSES 2.1., averaged over 30 days	
Groundwater (in mg/L)	$3.5 \times 10^{-4}$	$3.5 \times 10^{-4}$	Calculated using EUSES 2.1.	
Air (in mg/m <sup>3</sup> )	0.0091	0.0091	Calculated using EUSES 2.1., annual average, PEC local and regional	
<b>Risk Characterisation</b>				
PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.				
<b>Terrestrial compartment:</b> Sulphuric acid is produced on a large scale, generally on major chemical sites, which may have dedicated effluent treatment facilities, involving both chemical and biological treatment. There is therefore no direct exposure of soils and no risk of contamination of groundwater. Given this lack of expected exposure no PNEC has been derived for the soil compartment and no risk characterisation is required.				
<b>Atmospheric compartment:</b> Atmospheric contamination is minimal, with either the use of sealed systems or the use of scrubbers. No atmospheric PNECs are derived and no atmospheric risk characterisation is required.				
<b>Compartments</b>	<b>PEC</b>	<b>PNEC</b>	<b>RCR</b>	<b>Explanation</b>
Surface water (in mg/L)	$7 \times 10^{-7}$	0.0025	$2.8 \times 10^{-4}$	
Marine water (in mg/L)	$1 \times 10^{-7}$	0.00025	$4 \times 10^{-4}$	
Freshwater sediment (in mg/kg)	$6.7 \times 10^{-7}$	0.002	$3.3 \times 10^{-4}$	EPM
Marine sediment (in mg/kg)	$8.2 \times 10^{-8}$	0.002	$4.1 \times 10^{-5}$	EPM
WWTP (in mg/L)	0	8.8	0	Due to neutralisation

## Exposure Scenario 2: Use of Sulphuric Acid as an Intermediate in Manufacture of Inorganic and Organic Chemicals including Fertilizers

Description of activities and processes covered in the exposure scenario		
Facilities that produce sulphuric acid for use as a chemical intermediate in organic and inorganic chemical synthesis may produce between 100 and 500 tonnes per day, during a working year of some 330-365 days. The large size of the facilities is such that vessels and reactors may generally be out-doors, managed by a small number of operators working in a separate enclosed control room.		
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 speciality 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.		
Short title of the exposure scenario:		
Sector of use	SU 3, SU 4, SU 6b, SU 8, SU 9, SU 14	
Product category	PC 19	
Process category	PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9	
Article Category	Not Applicable	
Environmental release category	ERC6a	
Operational conditions related to frequency, duration and amount of use		
Duration, frequency and amount		
Information type	Data field	Explanation
Duration of exposure per day at workplace [for one worker]	Up to 8 hours	Standard number of hours in one work day
Frequency of exposure at workplace [for one worker]	220 d/year	
Annual amount used per site	300,000 t/y	Worst case for single site
Emission days per site	365 d/year	
Operational conditions and risk management measures related to product characteristics		
Information type	Data field	Explanation
Physical state	Liquid	The product is in liquid form in a sealed tank container.
Concentration of the substance in the product	n.a.	
Operational conditions related to available dilution capacity and characteristics of exposed human		
Information type	Data field	Explanation
Respiration volume under conditions of use	10 m <sup>3</sup> /d	Default respiration volume for light work.
Area of skin contact with the substance under conditions of use	480 cm <sup>2</sup>	ECETOC default; due to the corrosive nature dermal exposure is not considered relevant as it must be prevented in all cases.
Body weight	70 kg	Default bodyweight for workers.
Discharge volume of sewage treatment plant	2,000 m <sup>3</sup> /day	EUSES default
Available river water volume	20,000 m <sup>3</sup> /day	Default
Risk management measures		
Risk management measures for industrial site		
Information type	Data field	Explanation
Containment and local exhaust ventilation		
Containment plus good work practice required	Effectiveness: Unknown	Handling of sulphuric acid has no or little potential for exposure. Facilities involved in the production are usually housed outdoors.
Local exhaust ventilation if required	Effectiveness: Unknown	
Personal protective equipment (PPE)		
Type of PPE (gloves, respirator, faceshield etc)	Effectiveness: Unknown	Handling of sulphuric acid has no or little potential for exposure. Facilities involved in the production are usually housed outdoors. Workers involved in sampling and transfer of materials to road tankers have to be trained in the procedures and protective equipment has to be worn which can cope with the worst case scenario.
Other risk management measures related to workers		
No further risk management measures required		
Risk management measures related to environmental emissions from industrial sites		
Onsite pre-treatment of waste water	Chemical pre-treatment or onsite STP	Waste waters are generally treated by onsite WWTP or a chemical neutralisation step. Thus these waste waters will be neutralised before it reaches the biological treatment.
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.
Air emission abatement	Effectiveness: adequate measures in place	Exhaust gases treated by scrubbers.
Onsite waste treatment	Effectiveness: complete	The neutralisation process is extremely efficient.
Effluent (of the waste water treatment plant) discharge rate	2000 m <sup>3</sup> /d	Default value.
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%	The neutralisation process is extremely efficient.		
<b>Waste related measures</b>				
The neutralisation process is extremely efficient. In some cases sludge can be formed. This sludge can be disposed by incineration or landfill.				
<b>Exposure estimation</b>				
<b>Workers exposure</b>				
<b>Acute/Short-term and long-term exposure</b>				
<b>Dermal exposure</b>				
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.				
<b>Inhalation exposures</b>				
Since the ECETOC TRA model is unsuitable due to closed and well-controlled processes the ART model was used to conduct a tier 2 assessment.				
<b>Parameters and assumptions used in the ART model</b>				
<b>Information type</b>	<b>PROC</b>	<b>Parameters</b>		
Duration of exposure	All	480 min		
Product type	All	Liquid (medium viscosity – like oil)		
Process temperature	PROC1, 2, 3, 4	Hot processes (50 – 150 °C)		
	PROC 8a, 8b, 9	Room temperature (15 – 25 °C)		
Vapour pressure	All	6 Pa – Substance is considered to be low volatile, exposure to mists is estimated		
Liquid weight fraction	All	0.98		
Primary source proximity	PROC 1, 2	Primary emission source is not located in the breathing zone of the worker – the assessment for this activity involves a primary far-field emission source only (workers are in a control room).		
	PROC 3, 4, 8a, 8b, 9	Primary emission source located in the breathing zone of the workers		
Activity class	All	Transfer of liquid products		
Containment	PROC 1, 2, 3, 9	Handling reduces contact between product and adjacent air		
	PROC 4	Open process, submerged loading		
	PROC 8a, 8b	n/a		
Localised controls	PROC 1,3,8b	Vapour recovery systems, LEV		
	PROC 2, 4, 9	Vapour recovery		
	PROC 8a	None		
Segregation	PROC 1, 2	Complete segregation of workers in separate control room		
Fugitive emission source	PROC 1, 3, 8b, 9	Process fully enclosed – not breached for sampling		
	PROC 2, 4, 8a	Not fully enclosed – effective housekeeping practices in place		
Dispersion	PROC 1, 2, 8a, 8b	Outdoors not close to buildings		
	PROC 3, 4	Outdoors near to buildings		
	PROC 9	Indoors, any sized room, only good natural ventilation		
<b>Summary of acute/short-term and long-term inhalation exposure concentration to workers</b>				
<b>Description of activity</b>	<b>PROC</b>	<b>ESEC<sup>1)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>	<b>ELEC<sup>2)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>	
Production (high integrity closed system, sampling via closed loop)	1	9.3 x 10 <sup>-9</sup>	9.4 x 10 <sup>-9</sup>	
Production and sampling (occasional exposure pattern)	2	9.2 x 10 <sup>-8</sup>	9.2 x 10 <sup>-8</sup>	
Production, transfer and sampling	3	4.2 x 10 <sup>-4</sup>	4.2 x 10 <sup>-4</sup>	
Production, transfer and sampling (exposure likely)	4	1.4 x 10 <sup>-2</sup>	1.4 x 10 <sup>-2</sup>	
Loading / transfer	8a	2.3 x 10 <sup>-2</sup>	2.3 x 10 <sup>-2</sup>	
Loading / transfer	8b	1.2 x 10 <sup>-4</sup>	4.8 x 10 <sup>-6</sup>	
Loading / transfer (small containers)	9	3.2 x 10 <sup>-3</sup>	2.8 x 10 <sup>-3</sup>	
1) Estimated short-term exposure concentrations    2) Estimated long-term exposure concentrations				
<b>Risk Characterisation</b>				
The risk characterisation ratios are derived for the respiratory irritation and corrosivity.				
<b>Acute / local effects</b>	<b>PROC</b>	<b>ESEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>	<b>RCR</b>
	1	9.3 x 10 <sup>-9</sup>	0.1	9.3 x 10 <sup>-8</sup>
	2	9.2 x 10 <sup>-8</sup>	0.1	9.2 x 10 <sup>-7</sup>
	3	4.2 x 10 <sup>-4</sup>	0.1	4.2 x 10 <sup>-3</sup>
	4	1.4 x 10 <sup>-2</sup>	0.1	0.14
	8a	2.3 x 10 <sup>-2</sup>	0.1	0.23
	8b	1.2 x 10 <sup>-4</sup>	0.1	1.2 x 10 <sup>-3</sup>
	9	3.2 x 10 <sup>-3</sup>	0.1	3.2 x 10 <sup>-2</sup>
<b>Long-term / local effects</b>	<b>PROC</b>	<b>ELEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>	<b>RCR</b>
	1	9.4 x 10 <sup>-9</sup>	0.05	1.9 x 10 <sup>-7</sup>
	2	9.2 x 10 <sup>-8</sup>	0.05	1.8 x 10 <sup>-6</sup>
	3	4.2 x 10 <sup>-4</sup>	0.05	8.4 x 10 <sup>-3</sup>
	4	1.4 x 10 <sup>-2</sup>	0.05	0.28
	8a	2.3 x 10 <sup>-2</sup>	0.05	0.46

	8b	$4.8 \times 10^{-5}$	0.05	$9.6 \times 10^{-5}$
	9	$2.8 \times 10^{-3}$	0.05	0.056
<b>Consumer exposure</b>				
Consumer exposure is not relevant for the production of sulphuric acid.				
<b>Indirect exposure of humans via the environment</b>				
Indirect exposure of humans via the environment is expected to be negligible.				
<b>Environmental exposure</b>				
<b>Environmental releases</b>				
For calculating the releases EUSES was used with the following parameters:				
<ul style="list-style-type: none"> <li>- Molecular weight: 98.08 g/mol</li> <li>- Water solubility: miscible</li> <li>- log Kow = -1 (estimated)</li> <li>- Koc = 1 (estimated)</li> <li>- Biodegradability: not biodegradable (inorganic substance)</li> </ul>				
Some parameters are modified to meet the specific properties of the substance and the process:				
<ul style="list-style-type: none"> <li>- Due to the total neutralization to around pH 7 there is no loss to waste water (0 mg/L).</li> <li>- Since the production is a continuous process the emission days are set to 365.</li> <li>- The sludge is removed to landfill or incinerated. Therefore the concentration in soil due to sludge spreading is set to 0.</li> <li>- As a worst case the emission to air is set to 94.9 kg/day.</li> </ul>				
<b>Predicted releases to the environment</b>				
<b>Waste water treatment plant</b>				
<b>Compartments</b>	<b>Predicted releases</b>	<b>Explanation</b>		
Aquatic (before WWTP)	10,000 mg/L			
Aquatic (after WWTP)	0 mg/L	Set to 0 due to on-site treatment and removal		
Freshwater	0 mg/L			
<b>Fraction description</b>	<b>Fraction amount</b>			
Fraction of emission directed to air by WWTP	$1.4 \times 10^{-5}$ %			
Fraction of emission directed to water by WWTP	0.209 %			
Fraction of emission directed to sludge by WWTP	$9 \times 10^{-3}$ %			
Fraction of emission degraded by WWTP	99.8 %			
<b>Aquatic Compartment</b>				
<b>Predicted Exposure Concentrations (PEC)</b>				
<b>Compartments</b>	<b>Local concentration</b>	<b>PEC (local)</b>	<b>Justification / Explanation</b>	
Surface water (in mg/L)	0	$8.8 \times 10^{-4}$	Calculated using EUSES 2.1.	
Marine water (in mg/L)	0	$1.2 \times 10^{-4}$	Calculated using EUSES 2.1.	
Freshwater sediment (in mg/kg)	$7.13 \times 10^{-4}$	$7.13 \times 10^{-4}$	Calculated using EUSES 2.1.	
Marine sediment (in mg/kg)	$1.03 \times 10^{-4}$	$1.03 \times 10^{-4}$	Calculated using EUSES 2.1.	
Agricultural soil (in mg/kg)	$1 \times 10^{-4}$	0.0149	Calculated using EUSES 2.1., averaged over 30 days	
Groundwater (in mg/L)	0.11	0.11	Calculated using EUSES 2.1.	
Air (in mg/m <sup>3</sup> )	0.0261	0.0261	Calculated using EUSES 2.1., annual average, PEC local and regional	
<b>Risk Characterisation</b>				
PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.				
<b>Terrestrial compartment:</b> Sulphuric acid is produced on a large scale, generally on major chemical sites, which may have dedicated effluent treatment facilities, involving both chemical and biological treatment. There is therefore no direct exposure of soils and no risk of contamination of groundwater. Given this lack of expected exposure no PNEC has been derived for the soil compartment and no risk characterisation is required.				
<b>Atmospheric compartment:</b> Atmospheric contamination is minimal, with either the use of sealed systems or the use of scrubbers. No atmospheric PNECs are derived and no atmospheric risk characterisation is required.				
<b>Compartments</b>	<b>PEC</b>	<b>PNEC</b>	<b>RCR</b>	<b>Explanation</b>
Surface water (in mg/L)	$8.8 \times 10^{-4}$	0.0025	0.352	
Marine water (in mg/L)	$1.2 \times 10^{-4}$	0.00025	0.48	
Freshwater sediment (in mg/kg)	$7.3 \times 10^{-4}$	0.002	0.365	EPM
Marine sediment (in mg/kg)	$1.03 \times 10^{-4}$	0.002	0.051	EPM
WWTP (in mg/L)	0	8.8	0	Due to neutralisation

### Exposure Scenario 3: Use of Sulphuric Acid as a Processing Aid, Catalyst, Dehydrating agent, pH Regulator

Description of activities and processes covered in the exposure scenario		
ES3 deals with the use of sulphuric acid as a processing aid, catalyst, dehydrating agent, pH regulator. 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.		
Short title of the exposure scenario:		
Sector of use	SU3, SU4, SU5, SU6b, SU8, SU9, SU11, SU23	
Product category	PC20	
Process category	PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9, PROC 13	
Article Category	Not Applicable	
Environmental release category	ERC6b	
Operational conditions related to frequency, duration and amount of use		
Duration, frequency and amount		
Information type	Data field	Explanation
Duration of exposure per day at workplace [for one worker]	Up to 8 hours	Standard number of hours in one work day
Frequency of exposure at workplace [for one worker]	220 d/year	
Annual amount used per site	100,000 t/y	Worst case for single site
Emission days per site	365 d/year	
Operational conditions and risk management measures related to product characteristics		
Information type	Data field	Explanation
Physical state	Liquid (aqueous solution)	The product is in liquid form in a sealed tank container.
Concentration of the substance in the product	98 %	
Operational conditions related to available dilution capacity and characteristics of exposed human		
Information type	Data field	Explanation
Respiration volume under conditions of use	10 m <sup>3</sup> /d	Default respiration volume for light work.
Area of skin contact with the substance under conditions of use	480 cm <sup>2</sup>	ECETOC default; due to the corrosive nature dermal exposure is not considered relevant as it must be prevented in all cases.
Body weight	70 kg	Default bodyweight for workers.
Discharge volume of sewage treatment plant	2,000 m <sup>3</sup> /day	EUSES default
Available river water volume	20,000 m <sup>3</sup> /day	Default
Risk management measures		
Risk management measures for industrial site		
Information type	Data field	Explanation
Containment and local exhaust ventilation		
Containment plus good work practice required	Effectiveness: Unknown	Working with sulphuric acid has no or little potential for exposure. Facilities involved in the production are usually housed outdoors.
Local exhaust ventilation if required	Effectiveness: Unknown	
Personal protective equipment (PPE)		
Type of PPE (gloves, respirator, faceshield etc)	Effectiveness: Unknown	Working with sulphuric acid has no or little potential for exposure. Facilities involved in the production are usually housed outdoors. Workers involved in sampling and transfer of materials to road tankers have to be trained in the procedures and protective equipment has to be worn which can cope with the worst case scenario.
Other risk management measures related to workers		
No further risk management measures required		
Risk management measures related to environmental emissions from industrial sites		
Onsite pre-treatment of waste water	Chemical pre-treatment or onsite STP	Waste waters are generally treated by onsite WWTP or a chemical neutralisation step. Thus these waste waters will be neutralised before it reaches the biological treatment.
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.
Air emission abatement	Effectiveness: adequate measures in place	Exhaust gases treated by scrubbers.
Resulting fraction of applied amount in waste gas released to environment	274 kg/d	Refinement not required for this scenario.
Onsite waste treatment	Effectiveness: complete	The neutralisation process is extremely efficient.
Effluent (of the waste water treatment plant) discharge rate	2000 m <sup>3</sup> /d	Default value.
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%	The neutralisation process is extremely efficient.



<b>Waste related measures</b>				
The neutralisation process is extremely efficient. In some cases sludge can be formed. This sludge can be disposed by incineration or landfill.				
<b>Exposure estimation</b>				
<b>Workers exposure</b>				
<b>Acute/Short-term and long-term exposure</b>				
<b>Dermal exposure</b>				
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.				
<b>Inhalation exposures</b>				
Since the ECETOC TRA model is unsuitable due to closed and well-controlled processes the ART model was used to conduct a tier 2 assessment.				
<b>Parameters and assumptions used in the ART model</b>				
Information type	PROC	Parameters		
Duration of exposure	All	480 min		
Product type	All	Liquid (medium viscosity – like oil)		
Process temperature	PROC 1, 2, 3, 4	Hot processes (50 – 150 °C)		
	PROC 8a, 8b, 9, 13	Room temperature (15 – 25 °C)		
Vapour pressure	All	6 Pa – Substance is considered to be low volatile, exposure to mists is estimated		
Liquid weight fraction	All	0.98		
Primary source proximity	PROC 1, 2	Primary emission source is not located in the breathing zone of the worker – the assessment for this activity involves a primary far-field emission source only (workers are in a control room).		
	PROC 3, 4, 8a, 8b, 9, 13	Primary emission source located in the breathing zone of the workers		
Activity class	PROC 1, 2, 3, 4, 8a, 8b, 9	Transfer of liquid products		
	PROC 13	Activities with open liquid surface or reservoirs		
Containment	PROC 1, 2, 3, 9	Handling reduces contact between product and adjacent air		
	PROC 4	Open process, submerged loading		
	PROC 8a, 8b, 13	n/a		
Localised controls	PROC 1,3,8b	Vapour recovery systems, LEV		
	PROC 2, 4, 9	Vapour recovery		
	PROC 8a, 13	None		
Segregation	PROC 1, 2	Complete segregation of workers in separate control room		
Fugitive emission source	PROC 1, 3, 8b, 9	Process fully enclosed – not breached for sampling		
	PROC 2, 4, 8a, 13	Not fully enclosed – effective housekeeping practices in place		
Dispersion	PROC 1, 2, 8a, 8b	Outdoors not close to buildings		
	PROC 3, 4	Outdoors near to buildings		
	PROC 9, 13	Indoors, any sized room, only good natural ventilation		
<b>Summary of acute/short-term and long-term inhalation exposure concentration to workers</b>				
Description of activity	PROC	ESEC <sup>1)</sup> (mg/m <sup>3</sup> ), 90 <sup>th</sup> percentile	ELEC <sup>2)</sup> (mg/m <sup>3</sup> ), 90 <sup>th</sup> percentile	
Production (high integrity closed system, sampling via closed loop)	1	9.3 x 10 <sup>-9</sup>	9.4 x 10 <sup>-9</sup>	
Production and sampling (occasional exposure pattern)	2	9.2 x 10 <sup>-8</sup>	9.2 x 10 <sup>-8</sup>	
Production, transfer and sampling	3	4.2 x 10 <sup>-4</sup>	4.2 x 10 <sup>-4</sup>	
Production, transfer and sampling (exposure likely)	4	1.4 x 10 <sup>-2</sup>	1.4 x 10 <sup>-2</sup>	
Loading / transfer	8a	2.3 x 10 <sup>-2</sup>	2.3 x 10 <sup>-2</sup>	
Loading / transfer	8b	1.2 x 10 <sup>-4</sup>	4.8 x 10 <sup>-6</sup>	
Loading / transfer (small containers)	9	3.2 x 10 <sup>-3</sup>	2.8 x 10 <sup>-3</sup>	
Treatment of articles (dipping / pouring)	13	0.018	0.016	
1) Estimated short-term exposure concentrations    2) Estimated long-term exposure concentrations				
<b>Risk Characterisation</b>				
The risk characterisation ratios are derived for the respiratory irritation and corrosivity.				
Acute / local effects	PROC	ESEC (mg/m <sup>3</sup> )	DNEL (mg/m <sup>3</sup> )	RCR
	1	9.3 x 10 <sup>-9</sup>	0.1	9.3 x 10 <sup>-8</sup>
	2	9.2 x 10 <sup>-8</sup>	0.1	9.2 x 10 <sup>-7</sup>
	3	4.2 x 10 <sup>-4</sup>	0.1	4.2 x 10 <sup>-3</sup>
	4	1.4 x 10 <sup>-2</sup>	0.1	0.14
	8a	2.3 x 10 <sup>-2</sup>	0.1	0.23
	8b	1.2 x 10 <sup>-4</sup>	0.1	1.2 x 10 <sup>-3</sup>
	9	3.2 x 10 <sup>-3</sup>	0.1	3.2 x 10 <sup>-2</sup>
	13	1.8 x 10 <sup>-2</sup>	0.1	0.18
Long-term / local effects	PROC	ELEC (mg/m <sup>3</sup> )	DNEL (mg/m <sup>3</sup> )	RCR
	1	9.4 x 10 <sup>-9</sup>	0.05	1.9 x 10 <sup>-7</sup>
	2	9.2 x 10 <sup>-8</sup>	0.05	1.8 x 10 <sup>-6</sup>
	3	4.2 x 10 <sup>-4</sup>	0.05	8.4 x 10 <sup>-3</sup>

4	$1.4 \times 10^{-2}$	0.05	0.28
8a	$2.3 \times 10^{-2}$	0.05	0.46
8b	$4.8 \times 10^{-5}$	0.05	$9.6 \times 10^{-5}$
9	$2.8 \times 10^{-3}$	0.05	0.056
13	$6.2 \times 10^{-3}$	0.05	0.32

#### Consumer exposure

Consumer exposure is not relevant for the production of sulphuric acid.

#### Indirect exposure of humans via the environment

Indirect exposure of humans via the environment is expected to be negligible.

#### Environmental exposure

##### Environmental releases

For calculating the releases EUSES was used with the following parameters:

- Molecular weight: 98.08 g/mol
- Water solubility: miscible
- log Kow = -1 (estimated)
- Koc = 1 (estimated)
- Biodegradability: not biodegradable (inorganic substance)

Some parameters are modified to meet the specific properties of the substance and the process:

- Due to the total neutralization to around pH 7 there is no loss to waste water (0 mg/L).
- Since the production is a continuous process the emission days are set to 365.
- The sludge is removed to landfill or incinerated. Therefore the concentration in soil due to sludge spreading is set to 0.
- As a worst case the emission to air is set to 333 kg/day.

#### Predicted releases to the environment

##### Waste water treatment plant

Compartments	Predicted releases	Explanation
Aquatic (before WWTP)	8,330 mg/L	
Aquatic (after WWTP)	0 mg/L	Set to 0 due to on-site treatment and removal
Freshwater	0 mg/L	

Fraction description	Fraction amount
Fraction of emission directed to air by WWTP	$1.4 \times 10^{-5}$ %
Fraction of emission directed to water by WWTP	0.209 %
Fraction of emission directed to sludge by WWTP	$9 \times 10^{-3}$ %
Fraction of emission degraded by WWTP	99.8 %

#### Aquatic Compartment

##### Predicted Exposure Concentrations (PEC)

Compartments	Local concentration	PEC (local)	Justification / Explanation
Surface water (in mg/L)	0	$5.91 \times 10^{-6}$	Calculated using EUSES 2.1.
Marine water (in mg/L)	0	$8.56 \times 10^{-7}$	Calculated using EUSES 2.1.
Freshwater sediment (in mg/kg)	0	$4.8 \times 10^{-6}$	Calculated using EUSES 2.1.
Marine sediment (in mg/kg)	0	$6.9 \times 10^{-7}$	Calculated using EUSES 2.1.
Agricultural soil (in mg/kg)	$3 \times 10^{-4}$	$3.9 \times 10^{-4}$	Calculated using EUSES 2.1., averaged over 30 days
Groundwater (in mg/L)	$2.9 \times 10^{-3}$	$2.9 \times 10^{-3}$	Calculated using EUSES 2.1.
Air (in mg/m <sup>3</sup> )	0.0091	0.0091	Calculated using EUSES 2.1., annual average, PEC local and regional

#### Risk Characterisation

PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.

**Terrestrial compartment:** Sulphuric acid is produced on a large scale, generally on major chemical sites, which may have dedicated effluent treatment facilities, involving both chemical and biological treatment. There is therefore no direct exposure of soils and no risk of contamination of groundwater. Given this lack of expected exposure no PNEC has been derived for the soil compartment and no risk characterisation is required.

**Atmospheric compartment:** Atmospheric contamination is minimal, with either the use of sealed systems or the use of scrubbers. No atmospheric PNECs are derived and no atmospheric risk characterisation is required.

Compartments	PEC	PNEC	RCR	Explanation
Surface water (in mg/L)	$5.91 \times 10^{-6}$	0.0025	$2.3 \times 10^{-3}$	
Marine water (in mg/L)	$8.56 \times 10^{-7}$	0.00025	$3.4 \times 10^{-3}$	
Freshwater sediment (in mg/kg)	$4.8 \times 10^{-6}$	0.002	$2.35 \times 10^{-3}$	EPM
Marine sediment (in mg/kg)	$6.9 \times 10^{-7}$	0.002	$3.4 \times 10^{-4}$	EPM
WWTP (in mg/L)	0	8.8	0	Due to neutralisation

## Exposure Scenario 4: Use of Sulphuric Acid for Extractions and Processing of Minerals, ores

<b>Description of activities and processes covered in the exposure scenario</b>		
<p>ES4 covers the use of sulphuric acid in the industrial extraction of and processing of minerals and ores. This use includes leaching, dissolution and enrichment of ores including zinc, copper, nickel and uranium. Metal removal from sand and clay and titanium limonite leaching are also encompassed under this use. The processes are highly specialised and during the solution preparation are fully sealed to limit emissions and environmental exposure. Furthermore waste capture strategies including the use of scrubbers and dedicated effluent treatment facilities are generally employed.</p> <p>Sulphuric acid is utilised in this exposure scenario as a method of mineral and ore leaching and extraction. Ores and minerals are usually leached with sulphuric acid using specialised leaching systems which employs sulphuric acid to dissolve the ores or minerals from their substrate. This process may be performed in ore/mineral piles in the open. The sulphuric acid can then be stripped of its ore or minerals and can then be re-circulated and re-used.</p>		
<b>Short title of the exposure scenario:</b>		
Sector of use	SU2a, SU3, SU14	
Product category	PC20, PC40	
Process category	PROC2, PROC3, PROC4	
Article Category	Not Applicable	
Environmental release category	ERC4, ERC6b	
<b>Operational conditions related to frequency, duration and amount of use</b>		
<b>Duration, frequency and amount</b>		
Information type	Data field	Explanation
Duration of exposure per day at workplace [for one worker]	Up to 8 hours	Standard number of hours in one work day
Frequency of exposure at workplace [for one worker]	220 d/year	
Annual amount used per site	438 t/y	Worst case for single side
Emission days per site	365 d/year	
<b>Operational conditions and risk management measures related to product characteristics</b>		
Information type	Data field	Explanation
Physical state	Liquid	The product is in liquid form in a sealed tank container.
Concentration of the substance in the product	98 %	
<b>Operational conditions related to available dilution capacity and characteristics of exposed human</b>		
Information type	Data field	Explanation
Respiration volume under conditions of use	10 m <sup>3</sup> /d	Default respiration volume for light work.
Area of skin contact with the substance under conditions of use	480 cm <sup>2</sup>	ECETOC default; due to the corrosive nature dermal exposure is not considered relevant as it must be prevented in all cases.
Body weight	70 kg	Default bodyweight for workers.
Discharge volume of sewage treatment plant	2,000 m <sup>3</sup> /day	EUSES default
Available river water volume	20,000 m <sup>3</sup> /day	Default
<b>Risk management measures</b>		
<b>Risk management measures for industrial site</b>		
Information type	Data field	Explanation
<b>Containment and local exhaust ventilation</b>		
Containment plus good work practice required	Effectiveness: Unknown	Working with sulphuric acid has no or little potential for exposure. Facilities involved in the production are usually housed outdoors.
Local exhaust ventilation is not required	Effectiveness: Unknown	
<b>Personal protective equipment (PPE)</b>		
Type of PPE (gloves, respirator, faceshield etc)	Effectiveness: Unknown	Working with sulphuric acid has no or little potential for exposure. Facilities involved in the production are usually housed outdoors. Workers involved in sampling and transfer of materials to road tankers have to be trained in the procedures and protective equipment has to be worn which can cope with the worst case scenario.
<b>Other risk management measures related to workers</b>		
No further risk management measures required		
<b>Risk management measures related to environmental emissions from industrial sites</b>		
Onsite pre-treatment of waste water	Chemical pre-treatment or onsite STP	Waste waters are generally treated by onsite WWTP or a chemical neutralisation step. Thus these waste waters will be neutralised before it reaches the biological treatment.
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%	The neutralisation process is extremely efficient.
<b>Waste related measures</b>		
The neutralisation process is extremely efficient. In some cases sludge can be formed. This sludge can be disposed by incineration or landfill.		
<b>Exposure estimation</b>		
<b>Workers exposure</b>		

<b>Acute/Short-term and long-term exposure</b>				
<b>Dermal exposure</b> 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.				
<b>Inhalation exposures</b> Since the ECETOC TRA model is unsuitable due to closed and well-controlled processes the ART model was used to conduct a tier 2 assessment.				
<b>Parameters and assumptions used in the ART model</b>				
Information type	PROC	Parameters		
Duration of exposure	All	480 min		
Product type	All	Liquid (medium viscosity – like oil)		
Process temperature	All	Hot processes (50 – 150 °C)		
Vapour pressure	All	6 Pa – Substance is considered to be low volatile, exposure to mists is estimated		
Liquid weight fraction	All	0.98		
Primary source proximity	PROC 2	Primary emission source is not located in the breathing zone of the worker – the assessment for this activity involves a primary far-field emission source only (workers are in a control room).		
	PROC 3, 4	Primary emission source located in the breathing zone of the workers		
Activity class	All	Transfer of liquid products		
Containment	PROC 2, 3	Handling reduces contact between product and adjacent air		
	PROC 4	Open process, submerged loading		
Localised controls	PROC 2	Vapour recovery systems, LEV		
	PROC 2, 4	Vapour recovery		
Segregation	PROC 2	Complete segregation of workers in separate control room		
Fugitive emission source	PROC 3	Process fully enclosed – not breached for sampling		
	PROC 2, 4	Not fully enclosed – effective housekeeping practices in place		
Dispersion	PROC 2	Outdoors not close to buildings		
	PROC 3, 4	Outdoors near to buildings		
<b>Summary of acute/short-term and long-term inhalation exposure concentration to workers</b>				
Description of activity	PROC	ESEC <sup>1)</sup> (mg/m <sup>3</sup> ), 90 <sup>th</sup> percentile	ELEC <sup>2)</sup> (mg/m <sup>3</sup> ), 90 <sup>th</sup> percentile	
Used in a closed, continuous process (occasional exposure pattern)	2	9.2 x 10 <sup>-8</sup>	9.2 x 10 <sup>-8</sup>	
Used in a closed batch process (synthesis or formulation)	3	4.2 x 10 <sup>-4</sup>	4.2 x 10 <sup>-4</sup>	
Used in batch or other process (opportunity for exposure)	4	1.4 x 10 <sup>-2</sup>	1.4 x 10 <sup>-2</sup>	
1) Estimated short-term exposure concentrations    2) Estimated long-term exposure concentrations				
<b>Risk Characterisation</b>				
The risk characterisation ratios are derived for the respiratory irritation and corrosivity.				
Acute / local effects	PROC	ESEC (mg/m <sup>3</sup> )	DNEL (mg/m <sup>3</sup> )	RCR
	2	9.2 x 10 <sup>-8</sup>	0.1	9.2 x 10 <sup>-7</sup>
	3	4.2 x 10 <sup>-4</sup>	0.1	4.2 x 10 <sup>-3</sup>
	4	1.4 x 10 <sup>-2</sup>	0.1	0.14
Long-term / local effects	PROC	ELEC (mg/m <sup>3</sup> )	DNEL (mg/m <sup>3</sup> )	RCR
	2	9.2 x 10 <sup>-8</sup>	0.05	1.8 x 10 <sup>-6</sup>
	3	4.2 x 10 <sup>-4</sup>	0.05	8.4 x 10 <sup>-3</sup>
	4	1.4 x 10 <sup>-2</sup>	0.05	0.28
<b>Consumer exposure</b>				
Consumer exposure is not relevant for the production of sulphuric acid.				
<b>Indirect exposure of humans via the environment</b>				
Indirect exposure of humans via the environment is expected to be negligible.				
<b>Environmental exposure</b>				
<b>Environmental releases</b>				
For calculating the releases EUSES was used with the following parameters: - Molecular weight: 98.08 g/mol - Water solubility: miscible - log Kow = -1 (estimated) - Koc = 1 (estimated) - Biodegradability: not biodegradable (inorganic substance)				
Some parameters are modified to meet the specific properties of the substance and the process: - Due to the total neutralization to around pH 7 there is no loss to waste water (0 mg/L). - Since the production is a continuous process the emission days are set to 365. -The sludge is removed to landfill or incinerated. Therefore the concentration in soil due to sludge spreading is set to 0. - As a worst case the emission to air is set to 1.2 kg/day (ERC6b) and 1,140 kg/day (ERC4).				

<b>Predicted releases to the environment</b>				
<b>Waste water treatment plant</b>				
<b>Compartments</b>	<b>Predicted releases</b>	<b>Explanation</b>		
Aquatic (before WWTP)	730 mg/L	ERC4		
Aquatic (before WWTP)	36.5 mg/L	ERC6b		
Aquatic (after WWTP)	0 mg/L	Set to 0 due to on-site treatment and removal, ERC4 and ERC6b		
Freshwater	0 mg/L	ERC4 and ERC6b		
<b>Fraction description</b>		<b>Fraction amount</b>		
Fraction of emission directed to air by WWTP		1.4 x 10 <sup>-5</sup> %		
Fraction of emission directed to water by WWTP		0.209 %		
Fraction of emission directed to sludge by WWTP		9 x 10 <sup>-3</sup> %		
Fraction of emission degraded by WWTP		99.8 %		
<b>Aquatic Compartment</b>				
<b>Predicted Exposure Concentrations (PEC) ERC4</b>				
<b>Compartments</b>	<b>Local concentration</b>	<b>PEC (local)</b>	<b>Justification / Explanation</b>	
Surface water (in mg/L)	0	2.5 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.	
Marine water (in mg/L)	0	3.6 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.	
Freshwater sediment (in mg/kg)	2 x 10 <sup>-5</sup>	2 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.	
Marine sediment (in mg/kg)	2.9 x 10 <sup>-6</sup>	2.9 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.	
Agricultural soil (in mg/kg)	1.2 x 10 <sup>-3</sup>	1.6 x 10 <sup>-3</sup>	Calculated using EUSES 2.1., averaged over 30 days	
Groundwater (in mg/L)	0.0121	0.0121	Calculated using EUSES 2.1.	
Air (in mg/m <sup>3</sup> )	0.317	0.317	Calculated using EUSES 2.1., annual average, PEC local and regional	
<b>Predicted Exposure Concentrations (PEC) ERC6</b>				
<b>Compartments</b>	<b>Local concentration</b>	<b>PEC (local)</b>	<b>Justification / Explanation</b>	
Surface water (in mg/L)	0	2.6 x 10 <sup>-8</sup>	Calculated using EUSES 2.1.	
Marine water (in mg/L)	0	3.8 x 10 <sup>-9</sup>	Calculated using EUSES 2.1.	
Freshwater sediment (in mg/kg)	2 x 10 <sup>-8</sup>	2 x 10 <sup>-8</sup>	Calculated using EUSES 2.1.	
Marine sediment (in mg/kg)	3 x 10 <sup>-9</sup>	3 x 10 <sup>-9</sup>	Calculated using EUSES 2.1.	
Agricultural soil (in mg/kg)	3 x 10 <sup>-4</sup>	3.9 x 10 <sup>-4</sup>	Calculated using EUSES 2.1., averaged over 30 days	
Groundwater (in mg/L)	2.9 x 10 <sup>-3</sup>	2.9 x 10 <sup>-3</sup>	Calculated using EUSES 2.1.	
Air (in mg/m <sup>3</sup> )	3.3 x 10 <sup>-4</sup>	3.3 x 10 <sup>-4</sup>	Calculated using EUSES 2.1., annual average, PEC local and regional	
<b>Risk Characterisation</b>				
PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.				
<b>Terrestrial compartment:</b> Sulphuric acid is produced on a large scale, generally on major chemical sites, which may have dedicated effluent treatment facilities, involving both chemical and biological treatment. There is therefore no direct exposure of soils and no risk of contamination of groundwater. Given this lack of expected exposure no PNEC has been derived for the soil compartment and no risk characterisation is required.				
<b>Atmospheric compartment:</b> Atmospheric contamination is minimal, with either the use of sealed systems or the use of scrubbers. No atmospheric PNECs are derived and no atmospheric risk characterisation is required.				
<b>ERC4</b>				
<b>Compartments</b>	<b>PEC</b>	<b>PNEC</b>	<b>RCR</b>	<b>Explanation</b>
Surface water (in mg/L)	2.5 x 10 <sup>-5</sup>	0.0025	0.01	
Marine water (in mg/L)	3.6 x 10 <sup>-6</sup>	0.00025	0.0144	
Freshwater sediment (in mg/kg)	2 x 10 <sup>-5</sup>	0.002	0.01	EPM
Marine sediment (in mg/kg)	2.9 x 10 <sup>-6</sup>	0.002	0.0145	EPM
WWTP (in mg/L)	0	8.8	0	Due to neutralisation
<b>ERC6b</b>				
<b>Compartments</b>	<b>PEC</b>	<b>PNEC</b>	<b>RCR</b>	<b>Explanation</b>
Surface water (in mg/L)	2.6 x 10 <sup>-8</sup>	0.0025	1.1 x 10 <sup>-4</sup>	
Marine water (in mg/L)	3.8 x 10 <sup>-9</sup>	0.00025	1.5 x 10 <sup>-5</sup>	
Freshwater sediment (in mg/kg)	2 x 10 <sup>-8</sup>	0.002	1 x 10 <sup>-5</sup>	EPM
Marine sediment (in mg/kg)	3 x 10 <sup>-9</sup>	0.002	1 x 10 <sup>-6</sup>	EPM
WWTP (in mg/L)	0	8.8	0	Due to neutralisation

## Exposure Scenario 5: Use of Sulphuric Acid in the Process of Surface Treatments, Purification and Etching

Description of activities and processes covered in the exposure scenario		
ES5 for sulphuric acid deals with its use as a metal surface treatment and etching agent. 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 neutralised and does not have any consumer application. The processes which use sulphuric acid as metallurgical surface treatments are highly specialised 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.		
Short title of the exposure scenario:		
Sector of use	SU2a, SU3, SU14, SU15, SU16	
Product category	PC14, PC15	
Process category	PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9, PROC 13	
Article Category	Not Applicable	
Environmental release category	ERC6b	
Operational conditions related to frequency, duration and amount of use		
Duration, frequency and amount		
Information type	Data field	Explanation
Duration of exposure per day at workplace [for one worker]	Up to 8 hours	Standard number of hours in one work day
Frequency of exposure at workplace [for one worker]	220 d/year	
Annual amount used per site	10,000 t/y	Worst case for single site
Emission days per site	365 d/year	
Operational conditions and risk management measures related to product characteristics		
Information type	Data field	Explanation
Physical state	Liquid	The product is in liquid form in a sealed tank container.
Concentration of the substance in the product	98 %	
Operational conditions related to available dilution capacity and characteristics of exposed human		
Information type	Data field	Explanation
Respiration volume under conditions of use	10 m <sup>3</sup> /d	Default respiration volume for light work.
Area of skin contact with the substance under conditions of use	480 cm <sup>2</sup>	ECETOC default; due to the corrosive nature dermal exposure is not considered relevant as it must be prevented in all cases.
Body weight	70 kg	Default bodyweight for workers.
Discharge volume of sewage treatment plant	2,000 m <sup>3</sup> /day	EUSES default
Available river water volume	20,000 m <sup>3</sup> /day	Default
Risk management measures		
Risk management measures for industrial site		
Information type	Data field	Explanation
Containment and local exhaust ventilation		
Containment plus good work practice required	Effectiveness: Unknown	Working with sulphuric acid has no or little potential for exposure. Facilities involved in the production are usually housed outdoors.
Local exhaust ventilation is not required	Effectiveness: Unknown	
Personal protective equipment (PPE)		
Type of PPE (gloves, respirator, faceshield etc)	Effectiveness: Unknown	Working with sulphuric acid has no or little potential for exposure. Facilities involved in the production are usually housed outdoors. Workers involved in sampling and transfer of materials to road tankers have to be trained in the procedures and protective equipment has to be worn which can cope with the worst case scenario.
Other risk management measures related to workers		
No further risk management measures required		
Risk management measures related to environmental emissions from industrial sites		
Onsite pre-treatment of waste water	Chemical pre-treatment or onsite STP	Waste waters are generally treated by onsite WWTP or a chemical neutralisation step. Thus these waste waters will be neutralised before it reaches the biological treatment.
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%	The neutralisation process is extremely efficient.
Waste related measures		
The neutralisation process is extremely efficient. In some cases sludge can be formed. This sludge can be disposed by incineration or landfill.		
Exposure estimation		
Workers exposure		

<b>Acute/Short-term and long-term exposure</b>				
<b>Dermal exposure</b> 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.				
<b>Inhalation exposures</b> Since the ECETOC TRA model is unsuitable due to closed and well-controlled processes the ART model was used to conduct a tier 2 assessment.				
<b>Parameters and assumptions used in the ART model</b>				
<b>Information type</b>	<b>PROC</b>	<b>Parameters</b>		
Duration of exposure	All	480 min		
Product type	All	Liquid (medium viscosity – like oil)		
Process temperature	PROC 1, 2, 3, 4	Hot processes (50 – 150 °C)		
	PROC 8a, 8b, 9, 13	Room temperature (15 – 25 °C)		
Vapour pressure	All	6 Pa – Substance is considered to be low volatile, exposure to mists is estimated		
Liquid weight fraction	All	0.98		
Primary source proximity	PROC 1, 2	Primary emission source is not located in the breathing zone of the worker – the assessment for this activity involves a primary far-field emission source only (workers are in a control room).		
	PROC 3, 4, 8a, 8b, 9, 13	Primary emission source located in the breathing zone of the workers		
Activity class	PROC 1, 2, 3, 4, 8a, 8b, 9	Transfer of liquid products		
	PROC 13	Activities with open liquid surface or reservoirs		
Containment	PROC 1, 2, 3, 9	Handling reduces contact between product and adjacent air		
	PROC 4	Open process, submerged loading		
	PROC 8a, 8b, 13	n/a		
Localised controls	PROC 1, 3, 8b	Vapour recovery systems, LEV		
	PROC 2, 4, 9	Vapour recovery		
	PROC 8a, 13	None		
Segregation	PROC 1, 2	Complete segregation of workers in separate control room		
Fugitive emission source	PROC 1, 3, 8b, 9	Process fully enclosed – not breached for sampling		
	PROC 2, 4, 8a, 13	Not fully enclosed – effective housekeeping practices in place		
Dispersion	PROC 1, 2, 8a, 8b	Outdoors not close to buildings		
	PROC 3, 4	Outdoors near to buildings		
	PROC 9, 13	Indoors, any sized room, only good natural ventilation		
<b>Summary of acute/short-term and long-term inhalation exposure concentration to workers</b>				
<b>Description of activity</b>	<b>PROC</b>	<b>ESEC<sup>1)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>	<b>ELEC<sup>2)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>	
Used in a closed process (no likelihood of exposure)	1	9.3 x 10 <sup>-9</sup>	9.4 x 10 <sup>-9</sup>	
Used in a closed, continuous process (occasional exposure pattern)	2	9.2 x 10 <sup>-8</sup>	9.2 x 10 <sup>-8</sup>	
Used in a closed batch process (synthesis or formulation)	3	4.2 x 10 <sup>-4</sup>	4.2 x 10 <sup>-4</sup>	
Used in batch or other process (opportunity for exposure)	4	1.4 x 10 <sup>-2</sup>	1.4 x 10 <sup>-2</sup>	
Loading / transfer	8a	2.3 x 10 <sup>-2</sup>	2.3 x 10 <sup>-2</sup>	
Loading / transfer	8b	1.2 x 10 <sup>-4</sup>	4.8 x 10 <sup>-6</sup>	
Loading / transfer (small containers)	9	3.2 x 10 <sup>-3</sup>	2.8 x 10 <sup>-3</sup>	
Treatment of articles (dipping / pouring)	13	1.8 x 10 <sup>-1</sup>	1.6 x 10 <sup>-1</sup>	
1) Estimated short-term exposure concentrations    2) Estimated long-term exposure concentrations				
<b>Risk Characterisation</b>				
The risk characterisation ratios are derived for the respiratory irritation and corrosivity.				
<b>Acute / local effects</b>	<b>PROC</b>	<b>ESEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>	<b>RCR</b>
	1	9.3 x 10 <sup>-9</sup>	0.1	9.3 x 10 <sup>-8</sup>
	2	9.2 x 10 <sup>-8</sup>	0.1	9.2 x 10 <sup>-7</sup>
	3	4.2 x 10 <sup>-4</sup>	0.1	4.2 x 10 <sup>-3</sup>
	4	1.4 x 10 <sup>-2</sup>	0.1	0.14
	8a	2.3 x 10 <sup>-2</sup>	0.1	0.23
	8b	1.2 x 10 <sup>-4</sup>	0.1	1.2 x 10 <sup>-3</sup>
	9	3.2 x 10 <sup>-3</sup>	0.1	3.2 x 10 <sup>-2</sup>
	13	1.8 x 10 <sup>-2</sup>	0.1	0.18
<b>Long-term / local effects</b>	<b>PROC</b>	<b>ELEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>	<b>RCR</b>
	1	9.4 x 10 <sup>-9</sup>	0.05	1.9 x 10 <sup>-7</sup>
	2	9.2 x 10 <sup>-8</sup>	0.05	1.8 x 10 <sup>-6</sup>
	3	4.2 x 10 <sup>-4</sup>	0.05	8.4 x 10 <sup>-3</sup>
	4	1.4 x 10 <sup>-2</sup>	0.05	0.28
	8a	2.3 x 10 <sup>-2</sup>	0.05	0.46
	8b	4.8 x 10 <sup>-6</sup>	0.05	9.6 x 10 <sup>-5</sup>

	9	$2.8 \times 10^{-3}$	0.05	0.056
	13	$1.6 \times 10^{-2}$	0.05	0.32
<b>Consumer exposure</b>				
Consumer exposure is not relevant for the production of sulphuric acid.				
<b>Indirect exposure of humans via the environment</b>				
Indirect exposure of humans via the environment is expected to be negligible.				
<b>Environmental exposure</b>				
<b>Environmental releases</b>				
For calculating the releases EUSES was used with the following parameters:				
- Molecular weight: 98.08 g/mol				
- Water solubility: miscible				
- log Kow = -1 (estimated)				
- Koc = 1 (estimated)				
- Biodegradability: not biodegradable (inorganic substance)				
Some parameters are modified to meet the specific properties of the substance and the process:				
- Due to the total neutralization to around pH 7 there is no loss to waste water (0 mg/L).				
- Since the production is a continuous process the emission days are set to 365.				
- The sludge is removed to landfill or incinerated. Therefore the concentration in soil due to sludge spreading is set to 0.				
- As a worst case the emission to air is set to 27.4 kg/day.				
<b>Predicted releases to the environment</b>				
<b>Waste water treatment plant</b>				
<b>Compartments</b>	<b>Predicted releases</b>		<b>Explanation</b>	
Aquatic (before WWTP)	833 mg/L			
Aquatic (after WWTP)	0 mg/L		Set to 0 due to on-site treatment and removal	
Freshwater	0 mg/L			
<b>Fraction description</b>		<b>Fraction amount</b>		
Fraction of emission directed to air by WWTP		$1.4 \times 10^{-5}$ %		
Fraction of emission directed to water by WWTP		0.209 %		
Fraction of emission directed to sludge by WWTP		$9 \times 10^{-3}$ %		
Fraction of emission degraded by WWTP		99.8 %		
<b>Aquatic Compartment</b>				
<b>Predicted Exposure Concentrations (PEC)</b>				
<b>Compartments</b>	<b>Local concentration</b>	<b>PEC (local)</b>	<b>Justification / Explanation</b>	
Surface water (in mg/L)	0	$5.91 \times 10^{-7}$	Calculated using EUSES 2.1.	
Marine water (in mg/L)	0	$8.56 \times 10^{-8}$	Calculated using EUSES 2.1.	
Freshwater sediment (in mg/kg)	$2 \times 10^{-8}$	$2 \times 10^{-8}$	Calculated using EUSES 2.1.	
Marine sediment (in mg/kg)	$3 \times 10^{-9}$	$3 \times 10^{-9}$	Calculated using EUSES 2.1.	
Agricultural soil (in mg/kg)	$2.95 \times 10^{-5}$	$3.94 \times 10^{-5}$	Calculated using EUSES 2.1., averaged over 30 days	
Groundwater (in mg/L)	$2.91 \times 10^{-4}$	$2.91 \times 10^{-4}$	Calculated using EUSES 2.1.	
Air (in mg/m <sup>3</sup> )	$7.62 \times 10^{-3}$	$7.62 \times 10^{-3}$	Calculated using EUSES 2.1., annual average, PEC local and regional	
<b>Risk Characterisation</b>				
PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.				
<b>Terrestrial compartment:</b> Sulphuric acid is produced on a large scale, generally on major chemical sites, which may have dedicated effluent treatment facilities, involving both chemical and biological treatment. There is therefore no direct exposure of soils and no risk of contamination of groundwater. Given this lack of expected exposure no PNEC has been derived for the soil compartment and no risk characterisation is required.				
<b>Atmospheric compartment:</b> Atmospheric contamination is minimal, with either the use of sealed systems or the use of scrubbers. No atmospheric PNECs are derived and no atmospheric risk characterisation is required.				
<b>Compartments</b>	<b>PEC</b>	<b>PNEC</b>	<b>RCR</b>	<b>Explanation</b>
Surface water (in mg/L)	$5.91 \times 10^{-7}$	0.0025	$2.3 \times 10^{-4}$	
Marine water (in mg/L)	$8.56 \times 10^{-8}$	0.00025	$3.4 \times 10^{-5}$	
Freshwater sediment (in mg/kg)	$4.75 \times 10^{-7}$	0.002	$2.35 \times 10^{-4}$	EPM
Marine sediment (in mg/kg)	$3 \times 10^{-9}$	0.002	$1 \times 10^{-6}$	EPM
WWTP (in mg/L)	0	8.8	0	Due to neutralisation



## Exposure Scenario 6: Use of Sulphuric Acid in Electrolytic Processes

Description of activities and processes covered in the exposure scenario		
ES6 deals with the use of sulphuric acid in electrolytic processes. This includes metal refining, electroplating of zinc and electrogalvanizing of iron and steel. The processes which use sulphuric acid as electrolytic agents are highly specialised 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. As the sulphuric acid acts primarily as an electrolyte the acid may be re-used several times before it is considered spent and sent to the waste system.		
Short title of the exposure scenario:		
Sector of use	SU3, SU14, SU15, SU17	
Product category	PC14, PC20	
Process category	PROC1, PROC2, PROC8b, PROC9, PROC 13	
Article Category	Not Applicable	
Environmental release category	ERC5, ERC6b	
Operational conditions related to frequency, duration and amount of use		
Duration, frequency and amount		
Information type	Data field	Explanation
Duration of exposure per day at workplace [for one worker]	Up to 8 hours	Standard number of hours in one work day
Frequency of exposure at workplace [for one worker]	220 d/year	
Annual amount used per site	2,306 t/y	Worst case for single side
Emission days per site	365 d/year	
Operational conditions and risk management measures related to product characteristics		
Information type	Data field	Explanation
Physical state	Liquid	The product is in liquid form in a sealed tank container.
Concentration of the substance in the product	95 - 98 %	
Operational conditions related to available dilution capacity and characteristics of exposed human		
Information type	Data field	Explanation
Respiration volume under conditions of use	10 m <sup>3</sup> /d	Default respiration volume for light work.
Area of skin contact with the substance under conditions of use	480 cm <sup>2</sup>	ECETOC default; due to the corrosive nature dermal exposure is not considered relevant as it must be prevented in all cases.
Body weight	70 kg	Default bodyweight for workers.
Discharge volume of sewage treatment plant	2,000 m <sup>3</sup> /day	EUSES default
Available river water volume	20,000 m <sup>3</sup> /day	Default
Risk management measures		
Risk management measures for industrial site		
Information type	Data field	Explanation
Containment and local exhaust ventilation		
Containment plus good work practice required	Effectiveness: Unknown	Working with sulphuric acid has no or little potential for exposure. Facilities involved in the production are usually housed outdoors.
Local exhaust ventilation is not required	Effectiveness: Unknown	
Personal protective equipment (PPE)		
Type of PPE (gloves, respirator, faceshield etc)	Effectiveness: Unknown	Working with sulphuric acid has no or little potential for exposure. Facilities involved in the production are usually housed outdoors. Workers involved in sampling and transfer of materials to road tankers have to be trained in the procedures and protective equipment has to be worn which can cope with the worst case scenario.
Other risk management measures related to workers		
No further risk management measures required		
Risk management measures related to environmental emissions from industrial sites		
Onsite pre-treatment of waste water	Chemical pre-treatment or onsite STP	Waste waters are generally treated by onsite WWTP or a chemical neutralisation step. Thus these waste waters will be neutralised before it reaches the biological treatment.
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%	The neutralisation process is extremely efficient.
Waste related measures		
The neutralisation process is extremely efficient. In some cases sludge can be formed. This sludge can be disposed by incineration or landfill.		
Exposure estimation		
Workers exposure		

<b>Acute/Short-term and long-term exposure</b>				
<b>Dermal exposure</b> 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.				
<b>Inhalation exposures</b> Since the ECETOC TRA model is unsuitable due to closed and well-controlled processes the ART model was used to conduct a tier 2 assessment.				
<b>Parameters and assumptions used in the ART model</b>				
<b>Information type</b>	<b>PROC</b>	<b>Parameters</b>		
Duration of exposure	All	480 min		
Product type	All	Liquid (medium viscosity – like oil)		
Process temperature	PROC 1, 2	Hot processes (50 – 150 °C)		
	PROC 8b, 9, 13	Room temperature (15 – 25 °C)		
Vapour pressure	All	6 Pa – Substance is considered to be low volatile, exposure to mists is estimated		
Liquid weight fraction	All	0.98		
Primary source proximity	PROC 1, 2	Primary emission source is not located in the breathing zone of the worker – the assessment for this activity involves a primary far-field emission source only (workers are in a control room).		
	PROC 8b, 9, 13	Primary emission source located in the breathing zone of the workers		
Activity class	PROC 1, 2, 8b, 9	Transfer of liquid products		
	PROC 13	Activities with open liquid surface or reservoirs		
Containment	PROC 1, 2, 9	Handling reduces contact between product and adjacent air		
	PROC 8b, 13	n/a		
Localised controls	PROC 1, 8b	Vapour recovery systems, LEV		
	PROC 2, 9	Vapour recovery		
	PROC 13	LEV		
Segregation	PROC1, 2	Complete segregation of workers in separate control room		
Fugitive emission source	PROC 1, 8b, 9	Process fully enclosed – not breached for sampling		
	PROC 2, 13	Not fully enclosed – effective housekeeping practices in place		
Dispersion	PROC 1, 2, 8b	Outdoors not close to buildings		
	PROC 9, 13	Indoors, any sized room, only good natural ventilation		
<b>Summary of acute/short-term and long-term inhalation exposure concentration to workers</b>				
<b>Description of activity</b>	<b>PROC</b>	<b>ESEC<sup>1)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>	<b>ELEC<sup>2)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>	
Used in a closed process (no likelihood of exposure)	1	9.3 x 10 <sup>-9</sup>	9.4 x 10 <sup>-9</sup>	
Used in a closed, continuous process (occasional exposure pattern)	2	9.2 x 10 <sup>-8</sup>	9.2 x 10 <sup>-8</sup>	
Loading / transfer	8b	1.2 x 10 <sup>-4</sup>	4.8 x 10 <sup>-6</sup>	
Loading / transfer (small containers)	9	3.2 x 10 <sup>-3</sup>	2.8 x 10 <sup>-3</sup>	
Treatment of articles (dipping / pouring)	13	0.54	0.47	
1) Estimated short-term exposure concentrations    2) Estimated long-term exposure concentrations				
<b>Risk Characterisation</b>				
The risk characterisation ratios are derived for the respiratory irritation and corrosivity.				
<b>Acute / local effects</b>	<b>PROC</b>	<b>ESEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>	<b>RCR</b>
	1	9.3 x 10 <sup>-9</sup>	0.1	9.3 x 10 <sup>-8</sup>
	2	9.2 x 10 <sup>-8</sup>	0.1	9.2 x 10 <sup>-7</sup>
	8b	1.2 x 10 <sup>-4</sup>	0.1	1.2 x 10 <sup>-3</sup>
	9	3.2 x 10 <sup>-3</sup>	0.1	3.2 x 10 <sup>-2</sup>
	13	5.4 x 10 <sup>-1</sup>	0.1	5.4
	13	3 x 10 <sup>-2</sup>	0.1	0.3 (see footnote)
<b>Long-term / local effects</b>	<b>PROC</b>	<b>ELEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>	<b>RCR</b>
	1	9.4 x 10 <sup>-9</sup>	0.05	1.9 x 10 <sup>-7</sup>
	2	9.2 x 10 <sup>-8</sup>	0.05	1.8 x 10 <sup>-6</sup>
	8b	4.8 x 10 <sup>-6</sup>	0.05	9.6 x 10 <sup>-5</sup>
	9	2.8 x 10 <sup>-3</sup>	0.05	0.056
	13	4.7 x 10 <sup>-1</sup>	0.05	9.4
	13	2 x 10 <sup>-2</sup>	0.05	0.4 (see footnote)
Footnote: Assumes Respiratory Protective Equipment (95 % reduction) is worn.				
<b>Consumer exposure</b>				
Consumer exposure is not relevant for the production of sulphuric acid.				
<b>Indirect exposure of humans via the environment</b>				
Indirect exposure of humans via the environment is expected to be negligible.				
<b>Environmental exposure</b>				
<b>Environmental releases</b>				
For calculating the releases EUSES was used with the following parameters:				
- Molecular weight: 98.08 g/mol				

- Water solubility: miscible
- log Kow = -1 (estimated)
- Koc = 1 (estimated)
- Biodegradability: not biodegradable (inorganic substance)

Some parameters are modified to meet the specific properties of the substance and the process:

- Due to the total neutralization to around pH 7 there is no loss to waste water (0 mg/L).
- Since the production is a continuous process the emission days are set to 365.
- The sludge is removed to metal recovery landfill or incinerated. Therefore the concentration in soil due to sludge spreading is set to 0.
- As a worst case the emission to air is set to 3,160 kg/day (ERC5) and 6.32 kg/day (ERC6b).

#### Predicted releases to the environment

##### Waste water treatment plant

Compartments	Predicted releases	Explanation
Aquatic (before WWTP)	5,770 mg/L	ERC5
Aquatic (before WWTP)	577 mg/L	ERC6b
Aquatic (after WWTP)	0 mg/L	Set to 0 due to on-site treatment and removal, ERC5 and ERC6b
Freshwater	0 mg/L	ERC5 and ERC6b
Fraction description	Fraction amount	
Fraction of emission directed to air by WWTP	1.4 x 10 <sup>-5</sup> %	
Fraction of emission directed to water by WWTP	0.209 %	
Fraction of emission directed to sludge by WWTP	9 x 10 <sup>-3</sup> %	
Fraction of emission degraded by WWTP	99.8 %	

##### Aquatic Compartment

##### Predicted Exposure Concentrations (PEC) ERC5

Compartments	Local concentration	PEC (local)	Justification / Explanation
Surface water (in mg/L)	0	6.81 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.
Marine water (in mg/L)	0	9.87 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.
Freshwater sediment (in mg/kg)	5.48 x 10 <sup>-5</sup>	5.48 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.
Marine sediment (in mg/kg)	7.94 x 10 <sup>-6</sup>	7.94 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.
Agricultural soil (in mg/kg)	3.4 x 10 <sup>-3</sup>	4.54 x 10 <sup>-3</sup>	Calculated using EUSES 2.1., averaged over 30 days
0.0336	0.0336	0.0336	Calculated using EUSES 2.1.
Air (in mg/m <sup>3</sup> )	0.878	0.878	Calculated using EUSES 2.1., annual average, PEC local and regional

##### Predicted Exposure Concentrations (PEC) ERC6b

Compartments	Local concentration	PEC (local)	Justification / Explanation
Surface water (in mg/L)	0	1.36 x 10 <sup>-7</sup>	Calculated using EUSES 2.1.
Marine water (in mg/L)	0	1.97 x 10 <sup>-8</sup>	Calculated using EUSES 2.1.
Freshwater sediment (in mg/kg)	1.17 x 10 <sup>-7</sup>	1.17 x 10 <sup>-7</sup>	Calculated using EUSES 2.1.
Marine sediment (in mg/kg)	1.59 x 10 <sup>-8</sup>	1.59 x 10 <sup>-8</sup>	Calculated using EUSES 2.1.
Agricultural soil (in mg/kg)	6.81 x 10 <sup>-6</sup>	9.08 x 10 <sup>-6</sup>	Calculated using EUSES 2.1., averaged over 30 days
Groundwater (in mg/L)	6.72 x 10 <sup>-3</sup>	6.72 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.
Air (in mg/m <sup>3</sup> )	1.76 x 10 <sup>-3</sup>	1.76 x 10 <sup>-3</sup>	Calculated using EUSES 2.1., annual average, PEC local and regional

##### Risk Characterisation

PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.

**Terrestrial compartment:** Sulphuric acid is produced on a large scale, generally on major chemical sites, which may have dedicated effluent treatment facilities, involving both chemical and biological treatment. There is therefore no direct exposure of soils and no risk of contamination of groundwater. Given this lack of expected exposure no PNEC has been derived for the soil compartment and no risk characterisation is required.

**Atmospheric compartment:** Atmospheric contamination is minimal, with either the use of sealed systems or the use of scrubbers. No atmospheric PNECs are derived and no atmospheric risk characterisation is required.

##### ERC5

Compartments	PEC	PNEC	RCR	Explanation
Surface water (in mg/L)	6.81 x 10 <sup>-5</sup>	0.0025	0.039	
Marine water (in mg/L)	9.87 x 10 <sup>-6</sup>	0.00025	0.039	
Freshwater sediment (in mg/kg)	4.48 x 10 <sup>-5</sup>	0.002	0.022	EPM
Marine sediment (in mg/kg)	7.94 x 10 <sup>-6</sup>	0.002	3.9 x 10 <sup>-3</sup>	EPM
WWTP (in mg/L)	0	8.8	0	Due to neutralisation

##### ERC6b

Compartments	PEC	PNEC	RCR	Explanation
Surface water (in mg/L)	1.36 x 10 <sup>-7</sup>	0.0025	5.2 x 10 <sup>-5</sup>	
Marine water (in mg/L)	1.97 x 10 <sup>-8</sup>	0.00025	3.8 x 10 <sup>-4</sup>	
Freshwater sediment (in mg/kg)	1.17 x 10 <sup>-7</sup>	0.002	5.5 x 10 <sup>-5</sup>	EPM
Marine sediment (in mg/kg)	1.59 x 10 <sup>-8</sup>	0.002	7.9 x 10 <sup>-6</sup>	EPM
WWTP (in mg/L)	0	8.8	0	Due to neutralisation

## Exposure Scenario 7: Use of Sulphuric Acid in Gas Purification, Scrubbing and Flue Gas Scrubbing

Description of activities and processes covered in the exposure scenario		
ES7 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.		
Short title of the exposure scenario:		
Sector of use	SU3, SU8	
Product category	PC20	
Process category	PROC1, PROC2, PROC8b	
Article Category	Not Applicable	
Environmental release category	ERC7	
Operational conditions related to frequency, duration and amount of use		
Duration, frequency and amount		
Information type	Data field	Explanation
Duration of exposure per day at workplace [for one worker]	Up to 8 hours	Standard number of hours in one work day
Frequency of exposure at workplace [for one worker]	220 d/year	
Annual amount used per site	30,000 t/y	Worst case for single site
Emission days per site	365 d/year	
Operational conditions and risk management measures related to product characteristics		
Information type	Data field	Explanation
Physical state	Liquid	The product is in liquid form in a sealed tank container.
Concentration of the substance in the product	98 %	
Operational conditions related to available dilution capacity and characteristics of exposed human		
Information type	Data field	Explanation
Respiration volume under conditions of use	10 m <sup>3</sup> /d	Default respiration volume for light work.
Area of skin contact with the substance under conditions of use	480 cm <sup>2</sup>	ECETOC default; due to the corrosive nature dermal exposure is not considered relevant as it must be prevented in all cases.
Body weight	70 kg	Default bodyweight for workers.
Discharge volume of sewage treatment plant	2,000 m <sup>3</sup> /day	EUSES default
Available river water volume	20,000 m <sup>3</sup> /day	Default
Risk management measures		
Risk management measures for industrial site		
Information type	Data field	Explanation
Containment and local exhaust ventilation		
Containment plus good work practice required	Effectiveness: Unknown	The process associated with sulphuric acid has no or little potential for exposure. Facilities involved in the production are usually housed outdoors.
Local exhaust ventilation is not required	Effectiveness: Unknown	
Personal protective equipment (PPE)		
Type of PPE (gloves, respirator, faceshield etc)	Effectiveness: Unknown	The process associated with sulphuric acid has no or little potential for exposure. Facilities involved in the production are usually housed outdoors. Workers involved in sampling and transfer of materials to road tankers have to be trained in the procedures and protective equipment has to be worn which can cope with the worst case scenario.
Other risk management measures related to workers		
No further risk management measures required		
Risk management measures related to environmental emissions from industrial sites		
Onsite pre-treatment of waste water	Chemical pre-treatment or onsite STP	Waste waters are generally treated by onsite WWTP or a chemical neutralisation step. Thus these waste waters will be neutralised before it reaches the biological treatment.
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%	The neutralisation process is extremely efficient.
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 before.
Waste related measures		
The neutralisation process is extremely efficient. In some cases sludge can be formed. This sludge can be disposed by incineration or landfill.		
Exposure estimation		
Workers exposure		

<b>Acute/Short-term and long-term exposure</b>				
<b>Dermal exposure</b> 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.				
<b>Inhalation exposures</b> Since the ECETOC TRA model is unsuitable due to closed and well-controlled processes the ART model was used to conduct a tier 2 assessment.				
<b>Parameters and assumptions used in the ART model</b>				
Information type	PROC	Parameters		
Duration of exposure	All	480 min		
Product type	All	Liquid (medium viscosity – like oil)		
Process temperature	All	Hot processes (50 – 150 °C)		
Vapour pressure	All	6 Pa – Substance is considered to be low volatile, exposure to mists is estimated		
Liquid weight fraction	All	0.98		
Primary source proximity	PROC 1, 2	Primary emission source is not located in the breathing zone of the worker – the assessment for this activity involves a primary far-field emission source only (workers are in a control room).		
	PROC 8b	Primary emission source located in the breathing zone of the workers		
Activity class	All	Transfer of liquid products		
Containment	PROC 1, 2	Handling reduces contact between product and adjacent air		
	PROC 8b	n/a		
Localised controls	PROC 1, 8b	Vapour recovery systems, LEV		
	PROC 2	Vapour recovery		
Segregation	PROC1, 2	Complete segregation of workers in separate control room		
Fugitive emission source	PROC 1, 8b	Process fully enclosed – not breached for sampling		
	PROC 2	Not fully enclosed – effective housekeeping practices in place		
Dispersion	PROC 1, 2, 8b	Outdoors not close to buildings		
<b>Summary of acute/short-term and long-term inhalation exposure concentration to workers</b>				
Description of activity	PROC	ESEC <sup>1)</sup> (mg/m <sup>3</sup> ), 90 <sup>th</sup> percentile	ELEC <sup>2)</sup> (mg/m <sup>3</sup> ), 90 <sup>th</sup> percentile	
Production (high integrity closed system, sampling via closed loop)	1	9.3 x 10 <sup>-9</sup>	9.4 x 10 <sup>-9</sup>	
Production and sampling (occasional exposure pattern)	2	9.2 x 10 <sup>-8</sup>	9.2 x 10 <sup>-8</sup>	
Loading / transfer	8b	1.2 x 10 <sup>-4</sup>	4.8 x 10 <sup>-6</sup>	
1) Estimated short-term exposure concentrations		2) Estimated long-term exposure concentrations		
<b>Risk Characterisation</b>				
The risk characterisation ratios are derived for the respiratory irritation and corrosivity.				
Acute / local effects	PROC	ESEC (mg/m <sup>3</sup> )	DNEL (mg/m <sup>3</sup> )	RCR
	1	9.3 x 10 <sup>-9</sup>	0.1	9.3 x 10 <sup>-8</sup>
	2	9.2 x 10 <sup>-8</sup>	0.1	9.2 x 10 <sup>-7</sup>
	8b	1.2 x 10 <sup>-4</sup>	0.1	1.2 x 10 <sup>-3</sup>
Long-term / local effects	PROC	ELEC (mg/m <sup>3</sup> )	DNEL (mg/m <sup>3</sup> )	RCR
	1	9.4 x 10 <sup>-9</sup>	0.05	1.9 x 10 <sup>-7</sup>
	2	9.2 x 10 <sup>-8</sup>	0.05	1.8 x 10 <sup>-6</sup>
	8b	4.8 x 10 <sup>-6</sup>	0.05	9.6 x 10 <sup>-5</sup>
<b>Consumer exposure</b>				
Consumer exposure is not relevant for the production of sulphuric acid.				
<b>Indirect exposure of humans via the environment</b>				
Indirect exposure of humans via the environment is expected to be negligible.				
<b>Environmental exposure</b>				
<b>Environmental releases</b>				
For calculating the releases EUSES was used with the following parameters: - Molecular weight: 98.08 g/mol - Water solubility: miscible - log Kow = -1 (estimated) - Koc = 1 (estimated) - Biodegradability: not biodegradable (inorganic substance)				
Some parameters are modified to meet the specific properties of the substance and the process: - Due to the total neutralization to around pH 7 there is no loss to waste water (0 mg/L). - Since the production is a continuous process the emission days are set to 365. -The sludge is removed to landfill or incinerated. Therefore the concentration in soil due to sludge spreading is set to 0. - As a worst case the emission to air is set to 5,000 kg/day.				
<b>Predicted releases to the environment</b>				
<b>Waste water treatment plant</b>				
Compartment	Predicted releases	Explanation		
Aquatic (before WWTP)	2,500 mg/L			

Aquatic (after WWTP)	0 mg/L	Set to 0 due to on-site treatment and removal		
Freshwater	0 mg/L			
<b>Fraction description</b>		<b>Fraction amount</b>		
Fraction of emission directed to air by WWTP		1.4 x 10 <sup>-5</sup> %		
Fraction of emission directed to water by WWTP		0.209 %		
Fraction of emission directed to sludge by WWTP		9 x 10 <sup>-3</sup> %		
Fraction of emission degraded by WWTP		99.8 %		
<b>Aquatic Compartment</b>				
<b>Predicted Exposure Concentrations (PEC)</b>				
<b>Compartments</b>	<b>Local concentration</b>	<b>PEC (local)</b>	<b>Justification / Explanation</b>	
Surface water (in mg/L)	0	8.86 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.	
Marine water (in mg/L)	0	1.28 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.	
Freshwater sediment (in mg/kg)	7.13 x 10 <sup>-5</sup>	7.13 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.	
Marine sediment (in mg/kg)	1.03 x 10 <sup>-5</sup>	1.03 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.	
Agricultural soil (in mg/kg)	4.43 x 10 <sup>-3</sup>	5.91 x 10 <sup>-3</sup>	Calculated using EUSES 2.1., averaged over 30 days	
Groundwater (in mg/L)	0.0437	0.0437	Calculated using EUSES 2.1.	
Air (in mg/m <sup>3</sup> )	1.14	1.14	Calculated using EUSES 2.1., annual average, PEC local and regional	
<b>Risk Characterisation</b>				
PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.				
<b>Terrestrial compartment:</b> Sulphuric acid is produced on a large scale, generally on major chemical sites, which may have dedicated effluent treatment facilities, involving both chemical and biological treatment. There is therefore no direct exposure of soils and no risk of contamination of groundwater. Given this lack of expected exposure no PNEC has been derived for the soil compartment and no risk characterisation is required.				
<b>Atmospheric compartment:</b> Atmospheric contamination is minimal, with either the use of sealed systems or the use of scrubbers. No atmospheric PNECs are derived and no atmospheric risk characterisation is required.				
<b>Compartments</b>	<b>PEC</b>	<b>PNEC</b>	<b>RCR</b>	<b>Explanation</b>
Surface water (in mg/L)	8.86 x 10 <sup>-5</sup>	0.0025	0.0352	
Marine water (in mg/L)	1.28 x 10 <sup>-5</sup>	0.00025	0.048	
Freshwater sediment (in mg/kg)	7.13 x 10 <sup>-5</sup>	0.002	0.0355	EPM
Marine sediment (in mg/kg)	1.03 x 10 <sup>-5</sup>	0.002	0.005	EPM
WWTP (in mg/L)	0	8.8	0	Due to neutralisation

## Exposure Scenario 8: Use of Sulphuric Acid in Production of Sulphuric acid contained batteries

Description of activities and processes covered in the exposure scenario		
ES 8 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 specialised 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. The electrolyte solution generally contains sulphuric acid at a concentration of 25% to 40%. The electrolyte solution is added to the batteries and then sealed within them.		
Short title of the exposure scenario:		
Sector of use	SU3	
Product category	PC0 [UCN code E10100 (Electrolytes)]	
Process category	PROC2, PROC3, PROC4, PROC9	
Article Category	Not Applicable	
Environmental release category	ERC2, ERC5	
Operational conditions related to frequency, duration and amount of use		
Duration, frequency and amount		
Information type	Data field	Explanation
Duration of exposure per day at workplace [for one worker]	Up to 8 hours	Standard number of hours in one work day
Frequency of exposure at workplace [for one worker]	220 d/year	
Annual amount used per site	2,500 t/y	Worst case for single site
Emission days per site	365 d/year	
Operational conditions and risk management measures related to product characteristics		
Information type	Data field	Explanation
Physical state	Liquid (aqueous solution)	The product is in liquid form in a sealed tank container.
Concentration of the substance in the product	98 % initially. Diluted to 25 – 40 % in electrolyte solution.	
Operational conditions related to available dilution capacity and characteristics of exposed human		
Information type	Data field	Explanation
Respiration volume under conditions of use	10 m <sup>3</sup> /d	Default respiration volume for light work.
Area of skin contact with the substance under conditions of use	480 cm <sup>2</sup>	ECETOC default; due to the corrosive nature dermal exposure is not considered relevant as it must be prevented in all cases.
Body weight	70 kg	Default bodyweight for workers.
Discharge volume of sewage treatment plant	2,000 m <sup>3</sup> /day	EUSES default
Available river water volume	20,000 m <sup>3</sup> /day	Default
Risk management measures		
Risk management measures for industrial site		
Information type	Data field	Explanation
Containment and local exhaust ventilation		
Containment plus good work practice required	Effectiveness: Unknown	Use of sulphuric acid has no or little potential for exposure. Facilities involved in the production are usually housed outdoors.
Local exhaust ventilation is not required	Effectiveness: Unknown	
Personal protective equipment (PPE)		
Type of PPE (gloves, respirator, faceshield etc)	Effectiveness: Unknown	Use of sulphuric acid has no or little potential for exposure. Facilities involved in the production are usually housed outdoors. Workers involved in sampling and transfer of materials to road tankers have to be trained in the procedures and protective equipment has to be worn which can cope with the worst case scenario.
Other risk management measures related to workers		
No further risk management measures required		
Risk management measures related to environmental emissions from industrial sites		
Onsite pre-treatment of waste water	Chemical pre-treatment or onsite STP	Waste waters are generally treated by onsite WWTP or a chemical neutralisation step. Thus these waste waters will be neutralised before it reaches the biological treatment.
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%	The neutralisation process is extremely efficient.
Waste related measures		
The neutralisation process is extremely efficient. In some cases sludge can be formed. This sludge can be disposed by incineration or landfill.		
Exposure estimation		
Workers exposure		

<b>Acute/Short-term and long-term exposure</b>				
<b>Dermal exposure</b> 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.				
<b>Inhalation exposures</b> Since the ECETOC TRA model is unsuitable due to closed and well-controlled processes the ART model was used to conduct a tier 2 assessment.				
<b>Parameters and assumptions used in the ART model</b>				
Information type	PROC	Parameters		
Duration of exposure	All	480 min		
Product type	PROC 2, 3	Liquid (medium viscosity – like oil)		
	PROC 4, 9	Liquid (low viscosity – like water)		
Process temperature	All	Room temperature (15 – 25 °C)		
Vapour pressure	All	Substance is considered to be low volatile, exposure to mists is estimated		
Liquid weight fraction	PROC 2, 3	0.98		
	PROC 4, 9	0.25		
Primary source proximity	All	Primary emission source located in the breathing zone of the workers		
Activity class	All	Transfer of liquid products		
Containment	All	Handling reduces contact between product and adjacent air		
Localised controls	All	LEV		
Fugitive emission source	PROC 2	Process fully enclosed – not breached for sampling		
	PROC 3, 4, 9	Not fully enclosed – effective housekeeping practices in place		
Dispersion	All	Indoors, any sized room, only good natural ventilation		
<b>Summary of acute/short-term and long-term inhalation exposure concentration to workers</b>				
Description of activity	PROC	ESEC <sup>1)</sup> (mg/m <sup>3</sup> ), 90 <sup>th</sup> percentile	ELEC <sup>2)</sup> (mg/m <sup>3</sup> ), 90 <sup>th</sup> percentile	
Use in closed, continuous process (occasional exposure pattern)	2	1.6 x 10 <sup>-3</sup>	1.4 x 10 <sup>-3</sup>	
Use in closed batch process (synthesis or formulation)	3	0.016	0.014	
Production, transfer and sampling (exposure likely)	4	0.0014	0.0012	
Loading / transfer (small containers)	9	0.0014	0.0012	
1) Estimated short-term exposure concentrations		2) Estimated long-term exposure concentrations		
<b>Risk Characterisation</b>				
The risk characterisation ratios are derived for the respiratory irritation and corrosivity.				
Acute / local effects	PROC	ESEC (mg/m <sup>3</sup> )	DNEL (mg/m <sup>3</sup> )	RCR
	2	1.6 x 10 <sup>-3</sup>	0.1	1.6 x 10 <sup>-2</sup>
	3	1.6 x 10 <sup>-2</sup>	0.1	0.16
	4	1.4 x 10 <sup>-3</sup>	0.1	1.4 x 10 <sup>-2</sup>
	9	1.4 x 10 <sup>-3</sup>	0.1	1.4 x 10 <sup>-2</sup>
Long-term / local effects	PROC	ELEC (mg/m <sup>3</sup> )	DNEL (mg/m <sup>3</sup> )	RCR
	2	1.4 x 10 <sup>-3</sup>	0.05	2.8 x 10 <sup>-2</sup>
	3	1.4 x 10 <sup>-2</sup>	0.05	0.28
	4	1.2 x 10 <sup>-3</sup>	0.05	2.4 x 10 <sup>-2</sup>
	9	1.2 x 10 <sup>-3</sup>	0.05	2.4 x 10 <sup>-2</sup>
<b>Consumer exposure</b>				
Consumer exposure is not relevant for the production of sulphuric acid.				
<b>Indirect exposure of humans via the environment</b>				
Indirect exposure of humans via the environment is expected to be negligible.				
<b>Environmental exposure</b>				
<b>Environmental releases</b>				
For calculating the releases EUSES was used with the following parameters: - Molecular weight: 98.08 g/mol - Water solubility: miscible - log Kow = -1 (estimated) - Koc = 1 (estimated) - Biodegradability: not biodegradable (inorganic substance)				
Some parameters are modified to meet the specific properties of the substance and the process: - Due to the total neutralization to around pH 7 there is no loss to waste water (0 mg/L). - Since the production is a continuous process the emission days are set to 365. - The sludge is removed to landfill or incinerated. Therefore the concentration in soil due to sludge spreading is set to 0. - As a worst case the emission to air is set to 625 kg/day (ERC2) and 12,500 kg/day (ERC5).				
<b>Predicted releases to the environment</b>				
<b>Waste water treatment plant</b>				
Compartments	Predicted releases	Explanation		
Aquatic (before WWTP)	250 mg/L	ERC2		
Aquatic (before WWTP)	6,250 mg/L	ERC5		
Aquatic (after WWTP)	0 mg/L	Set to 0 due to on-site treatment and removal, ERC2 and ERC5		



Freshwater	0 mg/L	ERC2 and ERC5		
<b>Fraction description</b>		<b>Fraction amount</b>		
Fraction of emission directed to air by WWTP		1.4 x 10 <sup>-4</sup> %		
Fraction of emission directed to water by WWTP		0.209 %		
Fraction of emission directed to sludge by WWTP		9 x 10 <sup>-3</sup> %		
Fraction of emission degraded by WWTP		99.8 %		
<b>Aquatic Compartment</b>				
<b>Predicted Exposure Concentrations (PEC) ERC2</b>				
<b>Compartments</b>	<b>Local concentration</b>	<b>PEC (local)</b>	<b>Justification / Explanation</b>	
Surface water (in mg/L)	0	3.69 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.	
Marine water (in mg/L)	0	5.35 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.	
Freshwater sediment (in mg/kg)	2.97 x 10 <sup>-5</sup>	2.97 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.	
Marine sediment (in mg/kg)	4.3 x 10 <sup>-6</sup>	4.3 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.	
Agricultural soil (in mg/kg)	2.46 x 10 <sup>-4</sup>	2.46 x 10 <sup>-4</sup>	Calculated using EUSES 2.1., averaged over 30 days	
Groundwater (in mg/L)	1.82 x 10 <sup>-3</sup>	1.82 x 10 <sup>-3</sup>	Calculated using EUSES 2.1.	
Air (in mg/m <sup>3</sup> )	0.0476	0.0476	Calculated using EUSES 2.1., annual average, PEC local and regional	
<b>Predicted Exposure Concentrations (PEC) ERC5</b>				
<b>Compartments</b>	<b>Local concentration</b>	<b>PEC (local)</b>	<b>Justification / Explanation</b>	
Surface water (in mg/L)	0	7.38 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.	
Marine water (in mg/L)	0	1.07 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.	
Freshwater sediment (in mg/kg)	5.94 x 10 <sup>-5</sup>	5.94 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.	
Marine sediment (in mg/kg)	8.8 x 10 <sup>-6</sup>	8.8 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.	
Agricultural soil (in mg/kg)	3.69 x 10 <sup>-4</sup>	4.92 x 10 <sup>-3</sup>	Calculated using EUSES 2.1., averaged over 30 days	
Groundwater (in mg/L)	3.64 x 10 <sup>-3</sup>	0.0364	Calculated using EUSES 2.1.	
Air (in mg/m <sup>3</sup> )	0.952	0.952	Calculated using EUSES 2.1., annual average, PEC local and regional	
<b>Risk Characterisation</b>				
PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.				
<b>Terrestrial compartment:</b> Sulphuric acid is produced on a large scale, generally on major chemical sites, which may have dedicated effluent treatment facilities, involving both chemical and biological treatment. There is therefore no direct exposure of soils and no risk of contamination of groundwater. Given this lack of expected exposure no PNEC has been derived for the soil compartment and no risk characterisation is required.				
<b>Atmospheric compartment:</b> Atmospheric contamination is minimal, with either the use of sealed systems or the use of scrubbers. No atmospheric PNECs are derived and no atmospheric risk characterisation is required.				
<b>ERC2</b>				
<b>Compartments</b>	<b>PEC</b>	<b>PNEC</b>	<b>RCR</b>	<b>Explanation</b>
Surface water (in mg/L)	3.69 x 10 <sup>-5</sup>	0.0025	0.0147	
Marine water (in mg/L)	5.35 x 10 <sup>-6</sup>	0.00025	0.0212	
Freshwater sediment (in mg/kg)	2.97 x 10 <sup>-5</sup>	0.002	0.0148	EPM
Marine sediment (in mg/kg)	4.3 x 10 <sup>-6</sup>	0.002	0.0021	EPM
WWTP (in mg/L)	0	8.8	0	Due to neutralisation
<b>ERC5</b>				
<b>Compartments</b>	<b>PEC</b>	<b>PNEC</b>	<b>RCR</b>	<b>Explanation</b>
Surface water (in mg/L)	7.38 x 10 <sup>-5</sup>	0.0025	0.0295	
Marine water (in mg/L)	1.07 x 10 <sup>-5</sup>	0.00025	0.042	
Freshwater sediment (in mg/kg)	5.94 x 10 <sup>-5</sup>	0.002	0.029	EPM
Marine sediment (in mg/kg)	8.8 x 10 <sup>-6</sup>	0.002	0.0044	EPM
WWTP (in mg/L)	0	8.8	0	Due to neutralisation

## Exposure Scenario 9: Use of Sulphuric Acid in Maintenance of Sulphuric acid contained batteries

Description of activities and processes covered in the exposure scenario		
<p>ES 9 encompasses the use sulphuric acid in battery maintenance. Given that batteries are sealed articles and that the sulphuric acid involved in their maintenance is not intended for direct release, exposure to and emission from sulphuric acid in these processes should be minimal. The only exposure from the maintenance of lead acid batteries will come when the electrolyte solution is topped off or replaced with fresh de-ionized water. During routine battery maintenance, it is expected that should such operations be carried out, sufficient emission and exposure control measures are put in place to protect those carrying out the maintenance and the environment. As the maintenance of lead acid batteries is carried out at a large number of facilities on a small scale this use is considered wide dispersive. For ES 9 is the use which involves sulphuric acid in the maintenance of batteries, maintenance is generally carried out by trained technicians. 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, respiratory protection and protective overall). A safety shower is required nearby in case of accidental spillage.</p>		
Short title of the exposure scenario:		
Sector of use	SU22	
Product category	PC0 [UN code E10100 (Electrolytes)]	
Process category	PROC19	
Article Category	Not Applicable	
Environmental release category	ERC8b, ERC9b	
Operational conditions related to frequency, duration and amount of use		
Duration, frequency and amount		
Information type	Data field	Explanation
Duration of exposure per day at workplace [for one worker]	Up to 8 hours	Standard number of hours in one work day
Frequency of exposure at workplace [for one worker]	220 d/year	
Annual amount used per site	2,500 t/y	Worst case for single side
Emission days per site	365 d/year	
Operational conditions and risk management measures related to product characteristics		
Information type	Data field	Explanation
Physical state	Liquid	The product is in liquid form in a sealed tank container.
Concentration of the substance in the product	25 - 40 %	
Operational conditions related to available dilution capacity and characteristics of exposed human		
Information type	Data field	Explanation
Respiration volume under conditions of use	10 m <sup>3</sup> /d	Default respiration volume for light work.
Area of skin contact with the substance under conditions of use	480 cm <sup>2</sup>	ECETOC default; due to the corrosive nature dermal exposure is not considered relevant as it must be prevented in all cases.
Body weight	70 kg	Default bodyweight for workers.
Discharge volume of sewage treatment plant	2,000 m <sup>3</sup> /day	EUSES default
Available river water volume	20,000 m <sup>3</sup> /day	Default
Risk management measures		
Risk management measures for industrial site		
Information type	Data field	Explanation
Containment and local exhaust ventilation		
Containment plus good work practice required	Effectiveness: Unknown	Loading and unloading of vessels 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.
Local exhaust ventilation is not required	Effectiveness: Unknown	
Personal protective equipment (PPE)		
Type of PPE (gloves, respirator, faceshield etc)	Effectiveness: Unknown	Loading and unloading of vessels 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.
Other risk management measures related to workers		
No further risk management measures required		
Risk management measures related to environmental emissions from industrial sites		
None required to demonstrate safe use.		
Waste related measures		
Worst case emission for the amount in waste water is set to 342 kg/day.		
Exposure estimation		
Workers exposure		
Acute/Short-term and long-term exposure		
Dermal exposure		
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.		
Inhalation exposures		
Since the ECETOC TRA model is unsuitable due to closed and well-controlled processes the ART model was used to conduct a tier 2 assessment. For dilute solutions a vapour pressure of 214 Pa is assumed.		
Parameters and assumptions used in the ART model		
Information type	PROC	Parameters

Duration of exposure	PROC 19	240 min exposure / day; 240 min non-exposure / day	
Product type	PROC 19	Liquid (low viscosity – like water)	
Process temperature	PROC 19	Room temperature (15 – 25 °C)	
Vapour pressure	PROC 19	Substance is considered to be low volatile, exposure to mists is estimated	
Liquid weight fraction	PROC 19	0.25	
Primary source proximity	PROC 19	Primary emission source located in the breathing zone of the workers	
Activity class	PROC 19	Handling of contaminated objects	
Localised controls	PROC 19	none	
Fugitive emission source	PROC 19	Not fully enclosed – effective housekeeping practices in place	
Dispersion	PROC 19	Indoors, any sized room, only good natural ventilation	
<b>Summary of acute/short-term and long-term inhalation exposure concentration to workers</b>			
<b>Description of activity</b>	<b>PROC</b>	<b>ESEC<sup>1)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>	<b>ELEC<sup>2)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>
Hand-mixing with intimate contact: only PPE available	19	2.3 x 10 <sup>-3</sup>	2 x 10 <sup>-3</sup>
1) Estimated short-term exposure concentrations    2) Estimated long-term exposure concentrations			
<b>Risk Characterisation</b>			
The risk characterisation ratios are derived for the respiratory irritation and corrosivity.			
<b>Acute / local effects</b>	<b>PROC</b>	<b>ESEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>
	19	2.3 x 10 <sup>-3</sup>	0.1
<b>Long-term / local effects</b>	<b>PROC</b>	<b>ELEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>
	19	2 x 10 <sup>-3</sup>	0.05
<b>RCR</b>			
			2.3 x 10 <sup>-2</sup>
			4 x 10 <sup>-2</sup>
<b>Consumer exposure</b>			
Consumer exposure is not relevant for the production of sulphuric acid.			
<b>Indirect exposure of humans via the environment</b>			
Indirect exposure of humans via the environment is expected to be negligible.			
<b>Environmental exposure</b>			
<b>Environmental releases</b>			
For calculating the releases EUSES was used with the following parameters:			
- Molecular weight: 98.08 g/mol			
- Water solubility: miscible			
- log Kow = -1 (estimated)			
- Koc = 1 (estimated)			
- Biodegradability: not biodegradable (inorganic substance)			
Some parameters are modified to meet the specific properties of the substance and the process:			
- Since the production is a continuous process the emission days are set to 365.			
- The sludge is removed to landfill or incinerated. Therefore the concentration in soil due to sludge spreading is set to 0.			
- For the emission to air predicted values from EUSES are used: 0.686 kg/day (ERC8b) and 34.2 kg/day (ERC9b).			
- For the aquatic freshwater (after WWTP) predicted values from EUSES are used: 13.7 kg/day (ERC8b) and 34.2 kg/day (ERC9b).			
<b>Predicted releases to the environment</b>			
<b>Waste water treatment plant</b>			
<b>Compartments</b>	<b>Predicted releases</b>	<b>Explanation</b>	
Aquatic (before WWTP)	6.86 mg/L	ERC8b	
Aquatic (after WWTP)	0.0779 mg/L		
Freshwater	0.0078 mg/L		
Aquatic (before WWTP)	17.1 mg/L	ERC9b	
Aquatic (after WWTP)	0.195 mg/L		
Freshwater	0.0195 mg/L		
<b>Fraction description</b>	<b>Fraction amount</b>		
Fraction of emission directed to air by WWTP	1.4 x 10 <sup>-5</sup> %		
Fraction of emission directed to water by WWTP	0.209 %		
Fraction of emission directed to sludge by WWTP	9 x 10 <sup>-3</sup> %		
Fraction of emission degraded by WWTP	99.8 %		
<b>Aquatic Compartment</b>			
<b>Predicted Exposure Concentrations (PEC) ERC8b</b>			
<b>Compartments</b>	<b>Local concentration</b>	<b>PEC (local)</b>	<b>Justification / Explanation</b>
Surface water (in mg/L)	2.26 x 10 <sup>-5</sup>	3.31 x 10 <sup>-5</sup>	Calculated using EUSES 2.1., wide dispersive dilution
Marine water (in mg/L)	2.26 x 10 <sup>-5</sup>	2.29 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.
Freshwater sediment (in mg/kg)	2.67 x 10 <sup>-5</sup>	2.67 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.
Marine sediment (in mg/kg)	1.84 x 10 <sup>-5</sup>	1.84 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.
Agricultural soil (in mg/kg)	5.52 x 10 <sup>-5</sup>	5.77 x 10 <sup>-5</sup>	Calculated using EUSES 2.1., averaged over 30 days
Groundwater (in mg/L)	9.08 x 10 <sup>-5</sup>	9.08 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.
Air (in mg/m <sup>3</sup> )	1.9 x 10 <sup>-4</sup>	1.9 x 10 <sup>-4</sup>	Calculated using EUSES 2.1., annual average, PEC local and regional
<b>Predicted Exposure Concentrations (PEC) ERC9b</b>			
<b>Compartments</b>	<b>Local concentration</b>	<b>PEC (local)</b>	<b>Justification / Explanation</b>
Surface water (in mg/L)	5.64 x 10 <sup>-5</sup>	8.99 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.;

			wide dispersive dilution
Marine water (in mg/L)	$5.64 \times 10^{-5}$	$5.83 \times 10^{-5}$	Calculated using EUSES 2.1.
Freshwater sediment (in mg/kg)	$7.23 \times 10^{-5}$	$7.23 \times 10^{-5}$	Calculated using EUSES 2.1.
Marine sediment (in mg/kg)	$4.69 \times 10^{-5}$	$4.69 \times 10^{-5}$	Calculated using EUSES 2.1.
Agricultural soil (in mg/kg)	$7.23 \times 10^{-5}$	$7.23 \times 10^{-5}$	Calculated using EUSES 2.1., averaged over 30 days
Groundwater (in mg/L)	$1.35 \times 10^{-3}$	$1.35 \times 10^{-3}$	Calculated using EUSES 2.1.
Air (in mg/m <sup>3</sup> )	$9.52 \times 10^{-3}$	$9.52 \times 10^{-3}$	Calculated using EUSES 2.1., annual average, PEC local and regional

#### Risk Characterisation

PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.

**Terrestrial compartment:** Sulphuric acid is produced on a large scale, generally on major chemical sites, which may have dedicated effluent treatment facilities, involving both chemical and biological treatment. There is therefore no direct exposure of soils and no risk of contamination of groundwater. Given this lack of expected exposure no PNEC has been derived for the soil compartment and no risk characterisation is required.

**Atmospheric compartment:** Atmospheric contamination is minimal, with either the use of sealed systems or the use of scrubbers. No atmospheric PNECs are derived and no atmospheric risk characterisation is required.

#### ERC8b

Compartments	PEC	PNEC	RCR	Explanation
Surface water (in mg/L)	$2.26 \times 10^{-5}$	0.0025	0.009	
Marine water (in mg/L)	$2.26 \times 10^{-5}$	0.00025	0.09	
Freshwater sediment (in mg/kg)	$2.67 \times 10^{-5}$	0.002	0.0133	EPM
Marine sediment (in mg/kg)	$1.84 \times 10^{-5}$	0.002	0.009	EPM
WWTP (in mg/L)	0.0779	8.8	0.0089	

#### ERC9b

Compartments	PEC	PNEC	RCR	Explanation
Surface water (in mg/L)	$5.64 \times 10^{-5}$	0.0025	0.02	
Marine water (in mg/L)	$5.54 \times 10^{-5}$	0.00025	$2.1 \times 10^{-4}$	
Freshwater sediment (in mg/kg)	$1.84 \times 10^{-5}$	0.002	0.0092	EPM
Marine sediment (in mg/kg)	$4.69 \times 10^{-5}$	0.002	0.0023	EPM
WWTP (in mg/L)	0.195	8.8	0.0221	

## Exposure Scenario 10: Use of Sulphuric Acid in Recycling of Sulphuric Acid contained Batteries

Description of activities and processes covered in the exposure scenario		
ES 10 encompasses the management of sulphuric acid electrolyte (25 – 40%) in battery recycling. Given that lead-acid batteries are sealed articles and that the sulphuric acid involved in their recycling is not intended for direct release, exposure to and emission from sulphuric acid in these processes should be minimal.		
The process of battery recycling is aimed at recovery of the lead from the battery plates and removal of the sulphuric acid electrolyte solution. The batteries are mechanically crushed using, for example, a hydraulic press, and the electrolyte is drained and collected. Recovered acid may be reused for some applications or can be neutralized and treated to remove contaminants and disposed.		
Short title of the exposure scenario:		
Sector of use	SU3	
Product category	PC0 [UCN code E10100 (Electrolytes)]	
Process category	PROC2, PROC4, PROC5, PROC8a	
Article Category	Not Applicable	
Environmental release category	ERC1	
Operational conditions related to frequency, duration and amount of use		
Duration, frequency and amount		
Information type	Data field	Explanation
Duration of exposure per day at workplace [for one worker]	Up to 8 hours	Standard number of hours in one work day
Frequency of exposure at workplace [for one worker]	220 d/year	
Annual amount used per site	2,500 t/y	Worst case for single side
Emission days per site	365 d/year	
Operational conditions and risk management measures related to product characteristics		
Information type	Data field	Explanation
Physical state	Liquid	The product is in liquid form in a sealed tank container.
Concentration of the substance in the product	25 – 40 %	
Operational conditions related to available dilution capacity and characteristics of exposed human		
Information type	Data field	Explanation
Respiration volume under conditions of use	10 m <sup>3</sup> /d	Default respiration volume for light work.
Area of skin contact with the substance under conditions of use	480 cm <sup>2</sup>	ECETOC default; due to the corrosive nature dermal exposure is not considered relevant as it must be prevented in all cases.
Body weight	70 kg	Default bodyweight for workers.
Discharge volume of sewage treatment plant	2,000 m <sup>3</sup> /day	EUSES default
Available river water volume	20,000 m <sup>3</sup> /day	Default
Risk management measures		
Risk management measures for industrial site		
Information type	Data field	Explanation
Containment and local exhaust ventilation		
Containment plus good work practice required	Effectiveness: Unknown	Loading and unloading of vessels of sulphuric acid 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.
Local exhaust ventilation is not required	Effectiveness: Unknown	
Personal protective equipment (PPE)		
Type of PPE (gloves, respirator, faceshield etc)	Effectiveness: Unknown	Loading and unloading of vessels of sulphuric acid 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.
Other risk management measures related to workers		
No further risk management measures required		
Risk management measures related to environmental emissions from industrial sites		
Onsite pre-treatment of waste water	Chemical pre-treatment or onsite STP	Waste waters are generally treated by onsite WWTP or a chemical neutralisation step. Thus these waste waters will be neutralised before it reaches the biological treatment.
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%	The neutralisation process is extremely efficient.
Waste related measures		
The neutralisation process is extremely efficient. In some cases sludge can be formed. This sludge can be disposed by incineration or landfill.		
Exposure estimation		
Workers exposure		

<b>Acute/Short-term and long-term exposure</b>				
<b>Dermal exposure</b> 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.				
<b>Inhalation exposures</b> Since the ECETOC TRA model is unsuitable due to closed and well-controlled processes the ART model was used to conduct a tier 2 assessment. For the dilute electrolyte solution as a worst case the vapour pressure is set to 214 Pa.				
<b>Parameters and assumptions used in the ART model</b>				
Information type	PROC	Parameters		
Duration of exposure	All	480 min		
Product type	All	Liquid (low viscosity – like water)		
Process temperature	All	Room temperature (15 – 25 °C)		
Vapour pressure	All	Substance is considered to be low volatile, exposure to mists is estimated		
Liquid weight fraction	All	0.25		
Primary source proximity	All	Primary emission source located in the breathing zone of the workers		
Activity class	PROC 2, 4	Transfer of liquid products		
	PROC 2, 4, 8a	Transfer of liquid products – falling liquids, 1 – 10 L/min		
	PROC 5	Activities with open surfaces		
Containment	PROC 2	Handling reduces contact between product and adjacent air		
	PROC 4	Open process, submerged loading		
	PROC 5	n/a		
	PROC 8a	Handling reduces contact between product and adjacent air - submerged loading		
Localised controls	All	LEV		
Fugitive emission source	All	Not fully enclosed – effective housekeeping practices in place		
Dispersion	All	Indoors, any sized room, only good natural ventilation		
<b>Summary of acute/short-term and long-term inhalation exposure concentration to workers</b>				
Description of activity	PROC	ESEC <sup>1)</sup> (mg/m <sup>3</sup> ), 90 <sup>th</sup> percentile	ELEC <sup>2)</sup> (mg/m <sup>3</sup> ), 90 <sup>th</sup> percentile	
Used in closed, continuous process (occasional exposure pattern)	2	0.0014	0.0012	
Use in batch or other process (exposure likely)	4	0.0046	0.004	
Mixing or blending in batch process (significant contact)	5	0.015	0.013	
Transfer of 10.5 sulphuric acid cleaning solution at non-dedicated facilities	8a	0.0069	0.006	
1) Estimated short-term exposure concentrations    2) Estimated long-term exposure concentrations				
<b>Risk Characterisation</b>				
The risk characterisation ratios are derived for the respiratory irritation and corrosivity.				
Acute / local effects	PROC	ESEC (mg/m <sup>3</sup> )	DNEL (mg/m <sup>3</sup> )	RCR
	2	1.4 x 10 <sup>-3</sup>	0.1	1.4 x 10 <sup>-2</sup>
	4	4.6 x 10 <sup>-3</sup>	0.1	4.6 x 10 <sup>-2</sup>
	5	1.5 x 10 <sup>-2</sup>	0.1	0.15
	8a	6.9 x 10 <sup>-3</sup>	0.1	6.9 x 10 <sup>-2</sup>
Long-term / local effects	PROC	ELEC (mg/m <sup>3</sup> )	DNEL (mg/m <sup>3</sup> )	RCR
	2	1.2 x 10 <sup>-3</sup>	0.05	2.4 x 10 <sup>-2</sup>
	4	4 x 10 <sup>-3</sup>	0.05	8 x 10 <sup>-2</sup>
	5	1.3 x 10 <sup>-2</sup>	0.05	0.26
	8a	6 x 10 <sup>-3</sup>	0.05	0.12
<b>Consumer exposure</b>				
Consumer exposure is not relevant for the production of sulphuric acid.				
<b>Indirect exposure of humans via the environment</b>				
Indirect exposure of humans via the environment is expected to be negligible.				
<b>Environmental exposure</b>				
<b>Environmental releases</b>				
For calculating the releases EUSES was used with the following parameters:				
- Molecular weight: 98.08 g/mol				
- Water solubility: miscible				
- log Kow = -1 (estimated)				
- Koc = 1 (estimated)				
- Biodegradability: not biodegradable (inorganic substance)				
Some parameters are modified to meet the specific properties of the substance and the process:				
- Due to the total neutralization to around pH 7 there is no loss to waste water (0 mg/L).				
- Since the production is a continuous process the emission days are set to 365.				
- The sludge is removed to landfill or incinerated. Therefore the concentration in soil due to sludge spreading is set to 0.				
- As a worst case the emission to air is set to 34.2 kg/day.				

<b>Predicted releases to the environment</b>				
<b>Waste water treatment plant</b>				
<b>Compartments</b>	<b>Predicted releases</b>	<b>Explanation</b>		
Aquatic (before WWTP)	17.1 mg/L			
Aquatic (after WWTP)	0 mg/L	Set to 0 due to on-site treatment and removal		
Freshwater	0 mg/L			
<b>Fraction description</b>		<b>Fraction amount</b>		
Fraction of emission directed to air by WWTP		1.4 x 10 <sup>-5</sup> %		
Fraction of emission directed to water by WWTP		0.209 %		
Fraction of emission directed to sludge by WWTP		9 x 10 <sup>-3</sup> %		
Fraction of emission degraded by WWTP		99.8 %		
<b>Aquatic Compartment</b>				
<b>Predicted Exposure Concentrations (PEC)</b>				
<b>Compartments</b>	<b>Local concentration</b>	<b>PEC (local)</b>	<b>Justification / Explanation</b>	
Surface water (in mg/L)	0	7.38 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.	
Marine water (in mg/L)	0	1.07 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.	
Freshwater sediment (in mg/kg)	5.94 x 10 <sup>-6</sup>	5.94 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.	
Marine sediment (in mg/kg)	8.6 x 10 <sup>-7</sup>	8.6 x 10 <sup>-7</sup>	Calculated using EUSES 2.1.	
Agricultural soil (in mg/kg)	3.96 x 10 <sup>-5</sup>	1.6 x 10 <sup>-4</sup>	Calculated using EUSES 2.1., averaged over 30 days	
Groundwater (in mg/L)	1.18 x 10 <sup>-3</sup>	1.18 x 10 <sup>-3</sup>	Calculated using EUSES 2.1.	
Air (in mg/m <sup>3</sup> )	9.52 x 10 <sup>-3</sup>	9.52 x 10 <sup>-3</sup>	Calculated using EUSES 2.1., annual average, PEC local and regional	
<b>Risk Characterisation</b>				
PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.				
<b>Terrestrial compartment:</b> Sulphuric acid is produced on a large scale, generally on major chemical sites, which may have dedicated effluent treatment facilities, involving both chemical and biological treatment. There is therefore no direct exposure of soils and no risk of contamination of groundwater. Given this lack of expected exposure no PNEC has been derived for the soil compartment and no risk characterisation is required.				
<b>Atmospheric compartment:</b> Atmospheric contamination is minimal, with either the use of sealed systems or the use of scrubbers. No atmospheric PNECs are derived and no atmospheric risk characterisation is required.				
<b>Compartments</b>	<b>PEC</b>	<b>PNEC</b>	<b>RCR</b>	<b>Explanation</b>
Surface water (in mg/L)	7.38 x 10 <sup>-6</sup>	0.0025	0.00292	
Marine water (in mg/L)	1.07 x 10 <sup>-6</sup>	0.00025	0.0042	
Freshwater sediment (in mg/kg)	5.94 x 10 <sup>-6</sup>	0.002	0.0029	EPM
Marine sediment (in mg/kg)	8.6 x 10 <sup>-7</sup>	0.002	4.3 x 10 <sup>-4</sup>	EPM
WWTP (in mg/L)	0	8.8	0	Due to neutralisation

## Exposure Scenario 11: Use of Sulphuric Acid contained Batteries

Description of activities and processes covered in the exposure scenario		
ES 11 encompasses the use of sulphuric acid in battery maintenance by the consumer in the form of DIY battery maintenance/top-up kits. This would be sporadic in nature. Given that batteries are sealed articles and that the sulphuric acid involved in their maintenance is not intended for direct release, exposure to and emission from sulphuric acid in these processes should be minimal. This scenario is essentially identical to the maintenance of lead acid batteries with (ES 9) except that it is carried out very sporadically by the consumer rather than routinely by trained workers.		
Short title of the exposure scenario:		
Sector of use	SU21	
Product category	Not applicable	
Process category	PROC19 (used for calculation)	
Article Category	AC3	
Environmental release category	ERC9b	
Operational conditions related to frequency, duration and amount of use		
Duration, frequency and amount		
Information type	Data field	Explanation
Duration of exposure per day at workplace [for one worker]	Up to 8 hours	Standard number of hours in one work day
Frequency of exposure at workplace [for one worker]	220 d/year	
Annual amount used per site	2,500 t/y	Worst case for single site
Emission days per site	365 d/year	
Operational conditions and risk management measures related to product characteristics		
Information type	Data field	Explanation
Physical state	Liquid	The product is in liquid form in a sealed tank container.
Concentration of the substance in the product	25 – 40 %	
Operational conditions related to available dilution capacity and characteristics of exposed human		
Information type	Data field	Explanation
Respiration volume under conditions of use	10 m <sup>3</sup> /d	Default respiration volume for light work.
Area of skin contact with the substance under conditions of use	480 cm <sup>2</sup>	ECETOC default; due to the corrosive nature dermal exposure is not considered relevant as it must be prevented in all cases.
Body weight	70 kg	Default bodyweight for workers.
Discharge volume of sewage treatment plant	2,000 m <sup>3</sup> /day	EUSES default
Available river water volume	20,000 m <sup>3</sup> /day	Default
Risk management measures		
Risk management measures for industrial site		
Information type	Data field	Explanation
Containment and local exhaust ventilation		
Containment plus good work practice required	Effectiveness: Unknown	Loading and unloading of vessels of sulphuric acid is usually performed in the open air. Consumers are advised to wear protective clothing, however, the worst case assumption is that no localised controls are used in the process.
Local exhaust ventilation is not required	Effectiveness: Unknown	
Personal protective equipment (PPE)		
Type of PPE (gloves, respirator, faceshield etc)	Effectiveness: Unknown	Loading and unloading of vessels of sulphuric acid is usually performed in the open air. Consumers are advised to wear protective clothing, however, the worst case assumption is that no localised controls are used in the process.
Other risk management measures related to workers		
No further risk management measures required		
Risk management measures related to environmental emissions from industrial sites		
None required to demonstrate safe use		
Waste related measures		
Worst case emission of the amount of substance in waste water: 34.2 kg/day		
Workers exposure		
Workers exposure is not relevant for the production of sulphuric acid.		
Exposure estimation		
Consumers exposure		
Acute/Short-term and long-term exposure		
Dermal exposure		
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.		
Inhalation exposures		
Since the ECETOC TRA model is unsuitable due to closed and well-controlled processes the ART model was used to conduct a tier 2 assessment. For the dilute electrolyte solution as a worst case the vapour pressure is set to 214 Pa.		
Parameters and assumptions used in the ART model		
Information type	PROC	Parameters
Duration of exposure	PROC 19	240 min exposure / day; 240 min non-exposure / day
Product type	PROC 19	Liquid (low viscosity – like water)
Process temperature	PROC 19	Room temperature (15 – 25 °C)



Vapour pressure	PROC 19	Substance is considered to be low volatile, exposure to mists is estimated		
Liquid weight fraction	PROC 19	0.25		
Primary source proximity	PROC 19	Primary emission source located in the breathing zone of the workers		
Activity class	PROC 19	Handling of contaminated objects		
Localised controls	PROC 19	None		
Fugitive emission source	PROC 19	Not fully enclosed – effective housekeeping practices in place		
Dispersion	PROC 19	Indoors, any sized room, only good natural ventilation		
<b>Summary of acute/short-term and long-term inhalation exposure concentration to workers</b>				
<b>Description of activity</b>	<b>PROC</b>	<b>ESEC<sup>1)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>	<b>ELEC<sup>2)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>	
Hand-mixing with intimate contact; only PPE available	19	0.0023	0.002	
1) Estimated short-term exposure concentrations		2) Estimated long-term exposure concentrations		
<b>Risk Characterisation</b>				
The risk characterisation ratios are derived for the respiratory irritation and corrosivity.				
<b>Acute / local effects</b>	<b>PROC</b>	<b>ESEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>	<b>RCR</b>
	19	2.3 x 10 <sup>-3</sup>	0.1	2.3 x 10 <sup>-2</sup>
<b>Long-term / local effects</b>	<b>PROC</b>	<b>ELEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>	<b>RCR</b>
	19	2 x 10 <sup>-3</sup>	0.05	4 x 10 <sup>-2</sup>
<b>Indirect exposure of humans via the environment</b>				
Indirect exposure of humans via the environment is expected to be negligible.				
<b>Environmental exposure</b>				
<b>Environmental releases</b>				
For calculating the releases EUSES was used with the following parameters:				
<ul style="list-style-type: none"> <li>- Molecular weight: 98.08 g/mol</li> <li>- Water solubility: miscible</li> <li>- log Kow = -1 (estimated)</li> <li>- Koc = 1 (estimated)</li> <li>- Biodegradability: not biodegradable (inorganic substance)</li> </ul>				
Some parameters are modified to meet the specific properties of the substance and the process:				
<ul style="list-style-type: none"> <li>- Since the production is a continuous process the emission days are set to 365.</li> <li>- The sludge is removed to landfill or incinerated. Therefore the concentration in soil due to sludge spreading is set to 0.</li> <li>- As a worst case the emission to air is set to 34.2 kg/day.</li> <li>- Predicted by EUSES the release to the aquatic freshwater is set to 34.2 kg/day.</li> </ul>				
<b>Predicted releases to the environment</b>				
<b>Waste water treatment plant</b>				
<b>Compartments</b>	<b>Predicted releases</b>		<b>Explanation</b>	
Aquatic (before WWTP)	17.1 mg/L			
Aquatic (after WWTP)	0.195 mg/L			
Freshwater	0.0195 mg/L			
<b>Fraction description</b>		<b>Fraction amount</b>		
Fraction of emission directed to air by WWTP		1.4 x 10 <sup>-5</sup> %		
Fraction of emission directed to water by WWTP		0.209 %		
Fraction of emission directed to sludge by WWTP		9 x 10 <sup>-3</sup> %		
Fraction of emission degraded by WWTP		99.8 %		
<b>Aquatic Compartment</b>				
<b>Predicted Exposure Concentrations (PEC)</b>				
<b>Compartments</b>	<b>Local concentration</b>	<b>PEC (local)</b>	<b>Justification / Explanation</b>	
Surface water (in mg/L)	5.64 x 10 <sup>-5</sup>	8.99 x 10 <sup>-5</sup>	Calculated using EUSES 2.1., wide dispersive dilution	
Marine water (in mg/L)	5.64 x 10 <sup>-5</sup>	5.83 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.	
Freshwater sediment (in mg/kg)	7.23 x 10 <sup>-5</sup>	7.23 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.	
Marine sediment (in mg/kg)	4.69 x 10 <sup>-5</sup>	4.69 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.	
Agricultural soil (in mg/kg)	1.73 x 10 <sup>-4</sup>	2.96 x 10 <sup>-4</sup>	Calculated using EUSES 2.1.	
Groundwater (in mg/L)	1.35 x 10 <sup>-3</sup>	1.35 x 10 <sup>-3</sup>	Calculated using EUSES 2.1.	
Air (in mg/m <sup>3</sup> )	9.52 x 10 <sup>-3</sup>	9.52 x 10 <sup>-3</sup>	Calculated using EUSES 2.1., annual average, PEC local and regional	
<b>Risk Characterisation</b>				
PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.				
<b>Terrestrial compartment:</b> Sulphuric acid is produced on a large scale, generally on major chemical sites, which may have dedicated effluent treatment facilities, involving both chemical and biological treatment. There is therefore no direct exposure of soils and no risk of contamination of groundwater. Given this lack of expected exposure no PNEC has been derived for the soil compartment and no risk characterisation is required.				
<b>Atmospheric compartment:</b> Atmospheric contamination is minimal, with either the use of sealed systems or the use of scrubbers. No atmospheric PNECs are derived and no atmospheric risk characterisation is required.				
<b>Compartments</b>	<b>PEC</b>	<b>PNEC</b>	<b>RCR</b>	<b>Explanation</b>
Surface water (in mg/L)	5.64 x 10 <sup>-5</sup>	0.0025	0.22	
Marine water (in mg/L)	5.64 x 10 <sup>-5</sup>	0.00025	0.022	
Freshwater sediment (in mg/kg)	1.84 x 10 <sup>-5</sup>	0.002	0.092	EPM
Marine sediment (in mg/kg)	4.69 x 10 <sup>-5</sup>	0.002	0.0023	EPM

WWTP (in mg/L)	0.195	8.8	0.0221	
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## Exposure Scenario 9: Use of Sulphuric Acid in Maintenance of Sulphuric acid contained batteries

Description of activities and processes covered in the exposure scenario		
<p>ES12 covers the use of sulphuric acid as a laboratory chemical. These uses would be on a small scale R and D basis and would include use in buffers, in protein reagents and as acidification reagents.</p> <p>Uses would generally be on a smaller scale and would not be intensive. Furthermore, waste capture strategies including the use of flow hoods with gaseous removal and dedicated effluent capture treatment facilities are generally employed. It is expected that should such operations be carried out, sufficient emission and exposure control measures must be put in place to protect those carrying out the laboratory work and the environment. As the use of sulphuric acid in the laboratory is carried out at a large number of facilities on a relatively small scale, this use is considered widespread. It may also be the case that many dilutions of sulphuric acid may be used in laboratories as the uses of acid in laboratory science are so diverse.</p>		
Short title of the exposure scenario:		
Sector of use	SU22	
Product category	PC21	
Process category	PROC15	
Article Category	Not Applicable	
Environmental release category	ERC8a, ERC8b	
Operational conditions related to frequency, duration and amount of use		
Duration, frequency and amount		
Information type	Data field	Explanation
Duration of exposure per day at workplace [for one worker]	Up to 8 hours	Standard number of hours in one work day
Frequency of exposure at workplace [for one worker]	220 d/year	
Annual amount used per site	5,000 t/y	Worst case for single site
Emission days per site	365 d/year	
Operational conditions and risk management measures related to product characteristics		
Information type	Data field	Explanation
Physical state	Liquid	The product is in liquid form in a sealed tank container.
Concentration of the substance in the product	98 %	
Operational conditions related to available dilution capacity and characteristics of exposed human		
Information type	Data field	Explanation
Respiration volume under conditions of use	10 m <sup>3</sup> /d	Default respiration volume for light work.
Area of skin contact with the substance under conditions of use	480 cm <sup>2</sup>	ECETOC default; due to the corrosive nature dermal exposure is not considered relevant as it must be prevented in all cases.
Body weight	70 kg	Default bodyweight for workers.
Discharge volume of sewage treatment plant	2,000 m <sup>3</sup> /day	EUSES default
Available river water volume	20,000 m <sup>3</sup> /day	Default
Risk management measures		
Risk management measures for industrial site		
Information type	Data field	Explanation
Containment and local exhaust ventilation		
Containment plus good work practice required	Effectiveness: Unknown	Uses would generally be on a smaller scale and would be expected to be highly contained. Laboratory workers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimise exposure and risks.
Local exhaust ventilation is not required	Effectiveness: Unknown	
Personal protective equipment (PPE)		
Type of PPE (gloves, respirator, faceshield etc)	Effectiveness: Unknown	Uses would generally be on a smaller scale and would be expected to be highly contained. Laboratory workers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimise exposure and risks.
Other risk management measures related to workers		
No further risk management measures required		
Risk management measures related to environmental emissions from industrial sites		
None required to demonstrate safe use.		
Waste related measures		
Worst case emission for the amount in waste water is set to 1,370 kg/day.		
Exposure estimation		
Workers exposure		
Acute/Short-term and long-term exposure		
Dermal exposure		
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.		
Inhalation exposures		
Since the ECETOC TRA model is unsuitable due to closed and well-controlled processes the ART model was used to conduct a tier 2 assessment.		
Parameters and assumptions used in the ART model		
Information type	PROC	Parameters
Duration of exposure	PROC 15	240 min exposure / day; 240 min non-exposure / day
Product type	PROC 15	Liquid (medium viscosity – like oil)

Process temperature	PROC 15	Room temperature (15 – 25 °C)		
Vapour pressure	PROC 15	Substance is considered to be low volatile, exposure to mists is estimated		
Liquid weight fraction	PROC 15	0.98		
Primary source proximity	PROC 15	Primary emission source located in the breathing zone of the workers		
Activity class	PROC 15	Transfer of liquids		
Localised controls	PROC 15	LEV		
Fugitive emission source	PROC 15	Not fully enclosed – effective housekeeping practices in place		
Dispersion	PROC 15	Indoors, any sized room, only good natural ventilation		
<b>Summary of acute/short-term and long-term inhalation exposure concentration to workers</b>				
<b>Description of activity</b>	<b>PROC</b>	<b>ESEC<sup>1)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>	<b>ELEC<sup>2)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>	
Hand-mixing with intimate contact: only PPE available	19	2.7 x 10 <sup>-4</sup>	2.3 x 10 <sup>-4</sup>	
1) Estimated short-term exposure concentrations		2) Estimated long-term exposure concentrations		
<b>Risk Characterisation</b>				
The risk characterisation ratios are derived for the respiratory irritation and corrosivity.				
<b>Acute / local effects</b>	<b>PROC</b>	<b>ESEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>	<b>RCR</b>
	15	2.7 x 10 <sup>-4</sup>	0.1	2.7 x 10 <sup>-3</sup>
<b>Long-term / local effects</b>	<b>PROC</b>	<b>ELEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>	<b>RCR</b>
	15	2.3 x 10 <sup>-4</sup>	0.05	4.6 x 10 <sup>-3</sup>
<b>Consumer exposure</b>				
Consumer exposure is not relevant for the production of sulphuric acid.				
<b>Indirect exposure of humans via the environment</b>				
Indirect exposure of humans via the environment is expected to be negligible.				
<b>Environmental exposure</b>				
<b>Environmental releases</b>				
For calculating the releases EUSES was used with the following parameters:				
- Molecular weight: 98.08 g/mol				
- Water solubility: miscible				
- log Kow = -1 (estimated)				
- Koc = 1 (estimated)				
- Biodegradability: not biodegradable (inorganic substance)				
Some parameters are modified to meet the specific properties of the substance and the process:				
- Since the production is a continuous process the emission days are set to 365.				
- The sludge is removed to landfill or incinerated. Therefore the concentration in soil due to sludge spreading is set to 0.				
- For the emission to air predicted values from EUSES are used: 1,370 kg/day (ERC8a) and 1.37 kg/day (ERC8b).				
- For the aquatic freshwater (after WWTP) predicted values from EUSES are used: 1,370 kg/day (ERC8a) and 27.4 kg/day (ERC8b).				
<b>Predicted releases to the environment</b>				
<b>Waste water treatment plant</b>				
<b>Compartments</b>	<b>Predicted releases</b>	<b>Explanation</b>		
Aquatic (before WWTP)	685 mg/L	ERC8a		
Aquatic (after WWTP)	7.79 mg/L			
Freshwater	0.779 mg/L			
Aquatic (before WWTP)	13.7 mg/L	ERC8b		
Aquatic (after WWTP)	0.156 mg/L			
Freshwater	0.0156 mg/L			
<b>Fraction description</b>	<b>Fraction amount</b>			
Fraction of emission directed to air by WWTP	1.4 x 10 <sup>-5</sup> %			
Fraction of emission directed to water by WWTP	0.209 %			
Fraction of emission directed to sludge by WWTP	9 x 10 <sup>-3</sup> %			
Fraction of emission degraded by WWTP	99.8 %			
<b>Aquatic Compartment</b>				
<b>Predicted Exposure Concentrations (PEC) ERC8a</b>				
<b>Compartments</b>	<b>Local concentration</b>	<b>PEC (local)</b>	<b>Justification / Explanation</b>	
Surface water (in mg/L)	1.15 x 10 <sup>-7</sup>	1.34 x 10 <sup>-4</sup>	Calculated using EUSES 2.1., wide dispersive dilution	
Marine water (in mg/L)	1.15 x 10 <sup>-7</sup>	6.04 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.	
Freshwater sediment (in mg/kg)	1.08 x 10 <sup>-4</sup>	1.08 x 10 <sup>-4</sup>	Calculated using EUSES 2.1.	
Marine sediment (in mg/kg)	6.04 x 10 <sup>-6</sup>	6.04 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.	
Agricultural soil (in mg/kg)	6.92 x 10 <sup>-3</sup>	6.42 x 10 <sup>-3</sup>	Calculated using EUSES 2.1., averaged over 30 days	
Groundwater (in mg/L)	0.0213	0.0213	Calculated using EUSES 2.1.	
Air (in mg/m <sup>3</sup> )	0.381	0.381	Calculated using EUSES 2.1., annual average, PEC local and regional	
<b>Predicted Exposure Concentrations (PEC) ERC8b</b>				
<b>Compartments</b>	<b>Local concentration</b>	<b>PEC (local)</b>	<b>Justification / Explanation</b>	
Surface water (in mg/L)	2.29 x 10 <sup>-9</sup>	2.12 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.; wide dispersive dilution	
Marine water (in mg/L)	2.29 x 10 <sup>-9</sup>	5.54 x 10 <sup>-8</sup>	Calculated using EUSES 2.1.	
Freshwater sediment (in mg/kg)	1.7 x 10 <sup>-6</sup>	1.7 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.	

Marine sediment (in mg/kg)	$5.54 \times 10^{-5}$	$5.54 \times 10^{-8}$	Calculated using EUSES 2.1.
Agricultural soil (in mg/kg)	$1.1 \times 10^{-4}$	$1.1 \times 10^{-4}$	Calculated using EUSES 2.1., averaged over 30 days
Groundwater (in mg/L)	$1.49 \times 10^{-4}$	$1.49 \times 10^{-4}$	Calculated using EUSES 2.1.
Air (in mg/m <sup>3</sup> )	$3.81 \times 10^{-4}$	$3.81 \times 10^{-4}$	Calculated using EUSES 2.1., annual average, PEC local and regional

#### Risk Characterisation

PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.

**Terrestrial compartment:** Sulphuric acid is produced on a large scale, generally on major chemical sites, which may have dedicated effluent treatment facilities, involving both chemical and biological treatment. There is therefore no direct exposure of soils and no risk of contamination of groundwater. Given this lack of expected exposure no PNEC has been derived for the soil compartment and no risk characterisation is required.

**Atmospheric compartment:** Atmospheric contamination is minimal, with either the use of sealed systems or the use of scrubbers. No atmospheric PNECs are derived and no atmospheric risk characterisation is required.

#### ERC8a

Compartments	PEC	PNEC	RCR	Explanation
Surface water (in mg/L)	$1.34 \times 10^{-4}$	0.0025	0.0536	
Marine water (in mg/L)	$1.08 \times 10^{-4}$	0.00025	0.43	
Freshwater sediment (in mg/kg)	$2.67 \times 10^{-5}$	0.002	0.013	EPM
Marine sediment (in mg/kg)	$6.04 \times 10^{-6}$	0.002	0.003	EPM
WWTP (in mg/L)	7.79	8.8	0.885	

#### ERC8b

Compartments	PEC	PNEC	RCR	Explanation
Surface water (in mg/L)	$2.21 \times 10^{-6}$	0.0025	$8.8 \times 10^{-4}$	
Marine water (in mg/L)	$5.54 \times 10^{-8}$	0.00025	$2.1 \times 10^{-4}$	
Freshwater sediment (in mg/kg)	$1.7 \times 10^{-6}$	0.002	$8.5 \times 10^{-4}$	EPM
Marine sediment (in mg/kg)	$5.54 \times 10^{-8}$	0.002	$2.7 \times 10^{-5}$	EPM
WWTP (in mg/L)	0.156	8.8	0.0177	

## Exposure Scenario 13: Use of Sulphuric Acid in Industrial Cleaning

Description of activities and processes covered in the exposure scenario		
ES 13 covers the use of sulphuric acid as a component or feedstock in heavy duty industrial cleaners. This use would not be very regular and would generally be used in cases of heavy industrial contamination. Emissions would be directed to the STP. The sulphuric acid present in the cleaner is generally in quite small concentrations and certainly is much less concentrated than in most industrial exposure scenarios.		
Short title of the exposure scenario:		
Sector of use	SU3	
Product category	PC35	
Process category	PROC2, PROC5, PROC8a, PROC8b, PROC9, PROC10, PROC 13	
Article Category	Not Applicable	
Environmental release category	ERC8a, ERC8b	
Operational conditions related to frequency, duration and amount of use		
Duration, frequency and amount		
Information type	Data field	Explanation
Duration of exposure per day at workplace [for one worker]	Up to 8 hours	Standard number of hours in one work day
Frequency of exposure at workplace [for one worker]	220 d/year	
Annual amount used per site	5,000 t/y	Worst case for single site
Emission days per site	365 d/year	
Operational conditions and risk management measures related to product characteristics		
Information type	Data field	Explanation
Physical state	Liquid	The product is in liquid form in a sealed tank container.
Concentration of the substance in the product	10 %	
Operational conditions related to available dilution capacity and characteristics of exposed human		
Information type	Data field	Explanation
Respiration volume under conditions of use	10 m <sup>3</sup> /d	Default respiration volume for light work.
Area of skin contact with the substance under conditions of use	480 cm <sup>2</sup>	ECETOC default; due to the corrosive nature dermal exposure is not considered relevant as it must be prevented in all cases.
Body weight	70 kg	Default bodyweight for workers.
Discharge volume of sewage treatment plant	2,000 m <sup>3</sup> /day	EUSES default
Available river water volume	20,000 m <sup>3</sup> /day	Default
Risk management measures		
Risk management measures for industrial site		
Information type	Data field	Explanation
Containment and local exhaust ventilation		
Containment plus good work practice required	Effectiveness: Unknown	Loading and unloading of vessels of sulphuric acid 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.
Local exhaust ventilation is not required	Effectiveness: Unknown	
Personal protective equipment (PPE)		
Type of PPE (gloves, respirator, faceshield etc)	Effectiveness: Unknown	Loading and unloading of vessels of sulphuric acid 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.
Other risk management measures related to workers		
No further risk management measures required		
Risk management measures related to environmental emissions from industrial sites		
None required to demonstrate safe use		
Waste related measures		
The neutralisation process is extremely efficient. In some cases sludge can be formed. This sludge can be disposed by incineration or landfill.		
Exposure estimation		
Workers exposure		
Acute/Short-term and long-term exposure		
Dermal exposure		
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.		
Inhalation exposures		
Since the ECETOC TRA model is unsuitable due to closed and well-controlled processes the ART model was used to conduct a tier 2 assessment.		
The vapour pressure is set to 214 Pa for the dilute cleaning solution.		
Parameters and assumptions used in the ART model		
Information type	PROC	Parameters
Duration of exposure	All	480 min
Product type	All	Liquid (low viscosity – like water)
Process temperature	All	Room temperature (15 – 25 °C)
Vapour pressure	All	Substance is considered to be low volatile, exposure to mists is estimated
Liquid weight fraction	All	0.1
Primary source proximity	All	Primary emission source located in the breathing zone of the workers

Activity class	PROC 2, 8a, 8b, 9	Transfer of liquid products		
	PROC 5, 13	Activities with open liquid surface or reservoirs		
	PROC 10	Spreading of liquid products		
Containment	PROC 2, 8a, 9	Handling reduces contact between product and adjacent air		
	PROC 5, 8b, 10, 13	n/a		
Localised controls	PROC 2, 5	LEV		
	PROC 8a, 8b, 9, 10, 13	none		
Fugitive emission source	All	Not fully enclosed – effective housekeeping practices in place		
Dispersion	All	Indoors, any sized room, only good natural ventilation		
<b>Summary of acute/short-term and long-term inhalation exposure concentration to workers</b>				
<b>Description of activity</b>	<b>PROC</b>	<b>ESEC<sup>1)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>	<b>ELEC<sup>2)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>	
Production (high integrity closed system, sampling via closed loop)	2	0.00055	4.80 x 10 <sup>-4</sup>	
Mixing in batch process for formulation (significant contact)	5	0.061	0.053	
Transfer of 10 % sulphuric acid cleaning solution	8a	0.0055	0.0048	
Transfer of 10 % sulphuric acid cleaning solution	8b	0.0055	0.0048	
Filling small containers with 10 % sulphuric acid cleaning solution	9	0.0055	0.0048	
Applying 10 % sulphuric acid cleaning solution using brush or roller	10	0.61	0.53	
Cleaning of articles (dipping / pouring)	13	0.0061	0.0053	
1) Estimated short-term exposure concentrations      2) Estimated long-term exposure concentrations				
<b>Risk Characterisation</b>				
The risk characterisation ratios are derived for the respiratory irritation and corrosivity.				
<b>Acute / local effects</b>	<b>PROC</b>	<b>ESEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>	<b>RCR</b>
	2	5.5 x 10 <sup>-4</sup>	0.1	5.5 x 10 <sup>-3</sup>
	5	6.1 x 10 <sup>-2</sup>	0.1	0.61
	8a	5.5 x 10 <sup>-3</sup>	0.1	5.5 x 10 <sup>-2</sup>
	8b	5.5 x 10 <sup>-3</sup>	0.1	5.5 x 10 <sup>-2</sup>
	9	5.5 x 10 <sup>-3</sup>	0.1	5.5 x 10 <sup>-2</sup>
	10	6.1 x 10 <sup>-1</sup>	0.1	6.1
	10	3 x 10 <sup>-2</sup>	0.1	0.3 (see footnote)
	13	6.1 x 10 <sup>-3</sup>	0.1	6.1 x 10 <sup>-2</sup>
<b>Long-term / local effects</b>	<b>PROC</b>	<b>ELEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>	<b>RCR</b>
	2	4.8 x 10 <sup>-4</sup>	0.05	9.6 x 10 <sup>-3</sup>
	5	5.3 x 10 <sup>-2</sup>	0.05	1.1
	5	2.7 x 10 <sup>-3</sup>	0.05	5.3 x 10 <sup>-2</sup> (see footnote)
	8a	4.8 x 10 <sup>-3</sup>	0.05	9.6 x 10 <sup>-2</sup>
	8b	4.8 x 10 <sup>-3</sup>	0.05	9.6 x 10 <sup>-2</sup>
	9	4.8 x 10 <sup>-3</sup>	0.05	9.6 x 10 <sup>-2</sup>
	10	5.3 x 10 <sup>-1</sup>	0.05	11
	10	2.7 x 10 <sup>-2</sup>	0.05	0.54 (see footnote)
	13	5.3 x 10 <sup>-3</sup>	0.05	0.11
Footnote: Assumes Respiratory Protective Equipment (95 % reduction) is worn.				
<b>Consumer exposure</b>				
Consumer exposure is not relevant for the production of sulphuric acid.				
<b>Indirect exposure of humans via the environment</b>				
Indirect exposure of humans via the environment is expected to be negligible.				
<b>Environmental exposure</b>				
<b>Environmental releases</b>				
For calculating the releases EUSES was used with the following parameters:				
- Molecular weight: 98.08 g/mol				
- Water solubility: miscible				
- log Kow = -1 (estimated)				
- Koc = 1 (estimated)				
- Biodegradability: not biodegradable (inorganic substance)				
Some parameters are modified to meet the specific properties of the substance and the process:				
- The amount of substance in waste water is set to 1,370 kg/day (ERC8a) and 27.4 kg/day (ERC8b) as worst case emission.				
- Since the production is a continuous process the emission days are set to 365.				
- The sludge is removed to landfill or incinerated. Therefore the concentration in soil due to sludge spreading is set to 0.				
- As a worst case the emission to air is set to 1,370 kg/day (ERC8a) and 1.37 kg/day (ERC8b).				
<b>Predicted releases to the environment</b>				
<b>Waste water treatment plant</b>				
<b>Compartments</b>	<b>Predicted releases</b>	<b>Explanation</b>		
Aquatic (before WWTP)	685 mg/L	ERC8a		
Aquatic (before WWTP)	13.7 mg/L	ERC8b		
Aquatic (after WWTP)	7.79 mg/L	ERC8a		
Aquatic (after WWTP)	0.156 mg/L	ERC8b		

Freshwater	0.779 mg/L	ERC8a		
Freshwater	0.0156 mg/L	ERC8b		
<b>Fraction description</b>	<b>Fraction amount</b>			
Fraction of emission directed to air by WWTP	1.4 x 10 <sup>-5</sup> %			
Fraction of emission directed to water by WWTP	0.209 %			
Fraction of emission directed to sludge by WWTP	9 x 10 <sup>-3</sup> %			
Fraction of emission degraded by WWTP	99.8 %			
<b>Aquatic Compartment</b>				
<b>Predicted Exposure Concentrations (PEC) ERC8a</b>				
<b>Compartments</b>	<b>Local concentration</b>	<b>PEC (local)</b>	<b>Justification / Explanation</b>	
Surface water (in mg/L)	1.15 x 10 <sup>-7</sup>	1.34 x 10 <sup>-4</sup>	Calculated using EUSES 2.1., wide dispersive dilution	
Marine water (in mg/L)	1.15 x 10 <sup>-7</sup>	6.04 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.	
Freshwater sediment (in mg/kg)	1.08 x 10 <sup>-4</sup>	1.08 x 10 <sup>-4</sup>	Calculated using EUSES 2.1.	
Marine sediment (in mg/kg)	6.04 x 10 <sup>-6</sup>	6.04 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.	
Agricultural soil (in mg/kg)	6.92 x 10 <sup>-3</sup>	6.42 x 10 <sup>-3</sup>	Calculated using EUSES 2.1., averaged over 30 days	
Groundwater (in mg/L)	0.0213	0.0213	Calculated using EUSES 2.1.	
Air (in mg/m <sup>3</sup> )	0.381	0.381	Calculated using EUSES 2.1., annual average, PEC local and regional	
<b>Predicted Exposure Concentrations (PEC) ERC8b</b>				
<b>Compartments</b>	<b>Local concentration</b>	<b>PEC (local)</b>	<b>Justification / Explanation</b>	
Surface water (in mg/L)	2.29 x 10 <sup>-9</sup>	2.12 x 10 <sup>-6</sup>	Calculated using EUSES 2.1., wide dispersive dilution	
Marine water (in mg/L)	2.29 x 10 <sup>-9</sup>	5.54 x 10 <sup>-8</sup>	Calculated using EUSES 2.1.	
Freshwater sediment (in mg/kg)	1.7 x 10 <sup>-6</sup>	1.7 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.	
Marine sediment (in mg/kg)	5.54 x 10 <sup>-8</sup>	5.54 x 10 <sup>-8</sup>	Calculated using EUSES 2.1.	
Agricultural soil (in mg/kg)	1.1 x 10 <sup>-4</sup>	1.1 x 10 <sup>-4</sup>	Calculated using EUSES 2.1., averaged over 30 days	
Groundwater (in mg/L)	1.49 x 10 <sup>-4</sup>	1.49 x 10 <sup>-4</sup>	Calculated using EUSES 2.1.	
Air (in mg/m <sup>3</sup> )	3.81 x 10 <sup>-4</sup>	3.81 x 10 <sup>-4</sup>	Calculated using EUSES 2.1., annual average, PEC local and regional	
<b>Risk Characterisation</b>				
PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.				
<b>Terrestrial compartment:</b> Sulphuric acid is produced on a large scale, generally on major chemical sites, which may have dedicated effluent treatment facilities, involving both chemical and biological treatment. There is therefore no direct exposure of soils and no risk of contamination of groundwater. Given this lack of expected exposure no PNEC has been derived for the soil compartment and no risk characterisation is required.				
<b>Atmospheric compartment:</b> Atmospheric contamination is minimal, with either the use of sealed systems or the use of scrubbers. No atmospheric PNECs are derived and no atmospheric risk characterisation is required.				
<b>ERC8a</b>				
<b>Compartments</b>	<b>PEC</b>	<b>PNEC</b>	<b>RCR</b>	<b>Explanation</b>
Surface water (in mg/L)	1.34 x 10 <sup>-4</sup>	0.0025	0.0536	
Marine water (in mg/L)	1.08 x 10 <sup>-4</sup>	0.00025	0.43	
Freshwater sediment (in mg/kg)	2.67 x 10 <sup>-5</sup>	0.002	0.013	EPM
Marine sediment (in mg/kg)	6.04 x 10 <sup>-6</sup>	0.002	0.003	EPM
WWTP (in mg/L)	7.79	8.8	0.885	
<b>ERC8b</b>				
<b>Compartments</b>	<b>PEC</b>	<b>PNEC</b>	<b>RCR</b>	<b>Explanation</b>
Surface water (in mg/L)	2.21 x 10 <sup>-6</sup>	0.0025	8.8 x 10 <sup>-4</sup>	
Marine water (in mg/L)	5.54 x 10 <sup>-8</sup>	0.00025	2.1 x 10 <sup>-4</sup>	
Freshwater sediment (in mg/kg)	1.7 x 10 <sup>-6</sup>	0.002	8.5 x 10 <sup>-4</sup>	EPM
Marine sediment (in mg/kg)	5.54 x 10 <sup>-8</sup>	0.002	2.7 x 10 <sup>-5</sup>	EPM
WWTP (in mg/L)	0.156	8.8	0.0177	Due to neutralisation



## Exposure Scenario 14: Mixing, Preparation and Repackaging of Sulphuric Acid

Description of activities and processes covered in the exposure scenario		
ES14 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 specialised 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.		
Short title of the exposure scenario:		
Sector of use	SU3, SU10	
Product category	Not Applicable	
Process category	PROC1, PROC3, PROC5, PROC8a, PROC8b, PROC9	
Article Category	Not Applicable	
Environmental release category	ERC2	
Operational conditions related to frequency, duration and amount of use		
Duration, frequency and amount		
Information type	Data field	Explanation
Duration of exposure per day at workplace [for one worker]	Up to 8 hours	Standard number of hours in one work day
Frequency of exposure at workplace [for one worker]	220 d/year	
Annual amount used per site	300,000 t/y	Worst case for single side
Emission days per site	365 d/year	
Operational conditions and risk management measures related to product characteristics		
Information type	Data field	Explanation
Physical state	Liquid	The product is in liquid form in a sealed tank container.
Concentration of the substance in the product	98 %	
Operational conditions related to available dilution capacity and characteristics of exposed human		
Information type	Data field	Explanation
Respiration volume under conditions of use	10 m <sup>3</sup> /d	Default respiration volume for light work.
Area of skin contact with the substance under conditions of use	480 cm <sup>2</sup>	ECETOC default; due to the corrosive nature dermal exposure is not considered relevant as it must be prevented in all cases.
Body weight	70 kg	Default bodyweight for workers.
Discharge volume of sewage treatment plant	2,000 m <sup>3</sup> /day	EUSES default
Available river water volume	20,000 m <sup>3</sup> /day	Default
Risk management measures		
Risk management measures for industrial site		
Information type	Data field	Explanation
Containment and local exhaust ventilation		
Containment plus good work practice required	Effectiveness: Unknown	Handling of sulphuric acid has no or little potential for exposure. Facilities involved in the production are usually housed outdoors.
Local exhaust ventilation is not required	Effectiveness: Unknown	
Personal protective equipment (PPE)		
Type of PPE (gloves, respirator, faceshield etc)	Effectiveness: Unknown	Handling of sulphuric acid has no or little potential for exposure. Facilities involved in the production are usually housed outdoors. Workers involved in sampling and transfer of materials to road tankers have to be trained in the procedures and protective equipment has to be worn which can cope with the worst case scenario.
Other risk management measures related to workers		
No further risk management measures required		
Risk management measures related to environmental emissions from industrial sites		
Onsite pre-treatment of waste water	Chemical pre-treatment or onsite STP	Waste waters are generally treated by onsite WWTP or a chemical neutralisation step. Thus these waste waters will be neutralised before it reaches the biological treatment.
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.
Air emission abatement	Measured emissions of waste gas	Exhaust gases treated by scrubbers.
Resulting fraction of applied amount in waste gas released to environment	1 %	99 % of waste gas removed by scrubbing
Onsite waste treatment	Effectiveness: complete	The neutralisation process is extremely efficient.
Effluent (of the waste water treatment plant) discharge rate	2000 m <sup>3</sup> /d	Default value.
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%	The neutralisation process is extremely efficient.
Waste related measures		
The neutralisation process is extremely efficient. In some cases sludge can be formed. This sludge can be disposed by incineration or landfill.		

<b>Exposure estimation</b>				
<b>Workers exposure</b>				
<b>Acute/Short-term and long-term exposure</b>				
<b>Dermal exposure</b> 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.				
<b>Inhalation exposures</b> Since the ECETOC TRA model is unsuitable due to closed and well-controlled processes the ART model was used to conduct a tier 2 assessment.				
<b>Parameters and assumptions used in the ART model</b>				
<b>Information type</b>	<b>PROC</b>	<b>Parameters</b>		
Duration of exposure	All	480 min		
Product type	All	Liquid (medium viscosity – like oil)		
Process temperature	PROC 1, 3	Hot processes (50 – 150 °C)		
	PROC 5, 8a, 8b, 9	Room temperature (15 – 25 °C)		
Vapour pressure	All	Substance is considered to be low volatile, exposure to mists is estimated		
Liquid weight fraction	All	0.98		
Primary source proximity	PROC 1	Primary emission source is not located in the breathing zone of the worker – the assessment for this activity involves a primary far-field emission source only (workers are in a control room).		
	PROC 3, 5, 8a, 8b, 9	Primary emission source located in the breathing zone of the workers		
Activity class	PROC 1, 3, 8a, 8b, 9	Transfer of liquid products		
	PROC 5	Activities with open liquid surfaces		
Containment	PROC 1, 3, 9	Handling reduces contact between product and adjacent air		
	PROC 5, 8a, 8b	n/a		
Localised controls	PROC 1,3,8b	Vapour recovery systems, LEV		
	PROC 2, 9	Vapour recovery		
	PROC 5	LEV		
Segregation	PROC1	Complete segregation of workers in separate control room		
Fugitive emission source	PROC 1, 3, 8b, 9	Process fully enclosed – not breached for sampling		
	PROC 5, 8a	Not fully enclosed – effective housekeeping practices in place		
Dispersion	PROC 1, 8a, 8b	Outdoors not close to buildings		
	PROC 3	Outdoors near to buildings		
	PROC 5, 9	Indoors, any sized room, only good natural ventilation		
<b>Summary of acute/short-term and long-term inhalation exposure concentration to workers</b>				
<b>Description of activity</b>	<b>PROC</b>	<b>ESEC<sup>1)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>	<b>ELEC<sup>2)</sup> (mg/m<sup>3</sup>), 90<sup>th</sup> percentile</b>	
Production (high integrity closed system, sampling via closed loop)	1	9.3 x 10 <sup>-9</sup>	9.4 x 10 <sup>-9</sup>	
Used in closed batch process	3	4.2 x 10 <sup>-4</sup>	4.2 x 10 <sup>-4</sup>	
Mixing for formulation of preparations (significant contact)	5	1.8 x 10 <sup>-2</sup>	1.6 x 10 <sup>-2</sup>	
Loading / transfer	8a	2.3 x 10 <sup>-2</sup>	2.3 x 10 <sup>-2</sup>	
Loading / transfer	8b	1.2 x 10 <sup>-4</sup>	4.8 x 10 <sup>-6</sup>	
Loading / transfer (small containers)	9	3.2 x 10 <sup>-3</sup>	2.8 x 10 <sup>-3</sup>	
1) Estimated short-term exposure concentrations		2) Estimated long-term exposure concentrations		
<b>Risk Characterisation</b>				
The risk characterisation ratios are derived for the respiratory irritation and corrosivity.				
<b>Acute / local effects</b>	<b>PROC</b>	<b>ESEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>	<b>RCR</b>
	1	9.3 x 10 <sup>-9</sup>	0.1	9.3 x 10 <sup>-8</sup>
	3	4.2 x 10 <sup>-4</sup>	0.1	4.2 x 10 <sup>-3</sup>
	5	1.8 x 10 <sup>-2</sup>	0.1	0.18
	8a	2.3 x 10 <sup>-2</sup>	0.1	0.23
	8b	1.2 x 10 <sup>-4</sup>	0.1	1.2 x 10 <sup>-3</sup>
	9	3.2 x 10 <sup>-3</sup>	0.1	3.2 x 10 <sup>-2</sup>
<b>Long-term / local effects</b>	<b>PROC</b>	<b>ELEC (mg/m<sup>3</sup>)</b>	<b>DNEL (mg/m<sup>3</sup>)</b>	<b>RCR</b>
	1	9.4 x 10 <sup>-9</sup>	0.05	1.9 x 10 <sup>-7</sup>
	3	4.2 x 10 <sup>-4</sup>	0.05	8.4 x 10 <sup>-3</sup>
	5	1.6 x 10 <sup>-2</sup>	0.05	0.32
	8a	2.3 x 10 <sup>-2</sup>	0.05	0.46
	8b	4.8 x 10 <sup>-6</sup>	0.05	9.6 x 10 <sup>-5</sup>
	9	2.8 x 10 <sup>-3</sup>	0.05	5.6 x 10 <sup>-2</sup>
<b>Consumer exposure</b>				
Consumer exposure is not relevant for the production of sulphuric acid.				
<b>Indirect exposure of humans via the environment</b>				
Indirect exposure of humans via the environment is expected to be negligible.				

Environmental exposure				
Environmental releases				
For calculating the releases EUSES was used with the following parameters:				
- Molecular weight: 98.08 g/mol				
- Water solubility: miscible				
- log Kow = -1 (estimated)				
- Koc = 1 (estimated)				
- Biodegradability: not biodegradable (inorganic substance)				
Some parameters are modified to meet the specific properties of the substance and the process:				
- Due to the total neutralization to around pH 7 there is no loss to waste water (0 mg/L).				
- Since the production is a continuous process the emission days are set to 365.				
- The sludge is removed to landfill or incinerated. Therefore the concentration in soil due to sludge spreading is set to 0.				
- As a worst case the emission to air is set to 205 kg/day.				
Predicted releases to the environment				
Waste water treatment plant				
Compartments	Predicted releases	Explanation		
Aquatic (before WWTP)	13,200 mg/L			
Aquatic (after WWTP)	0 mg/L	Set to 0 due to on-site treatment and removal		
Freshwater	0 mg/L			
Fraction description		Fraction amount		
Fraction of emission directed to air by WWTP		1.4 x 10 <sup>-5</sup> %		
Fraction of emission directed to water by WWTP		0.209 %		
Fraction of emission directed to sludge by WWTP		9 x 10 <sup>-3</sup> %		
Fraction of emission degraded by WWTP		99.8 %		
Aquatic Compartment				
Predicted Exposure Concentrations (PEC)				
Compartments	Local concentration	PEC (local)	Justification / Explanation	
Surface water (in mg/L)	0	4.43 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.	
Marine water (in mg/L)	0	6.42 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.	
Freshwater sediment (in mg/kg)	3.56 x 10 <sup>-5</sup>	3.56 x 10 <sup>-5</sup>	Calculated using EUSES 2.1.	
Marine sediment (in mg/kg)	5.16 x 10 <sup>-6</sup>	5.16 x 10 <sup>-6</sup>	Calculated using EUSES 2.1.	
Agricultural soil (in mg/kg)	9.42 x 10 <sup>-4</sup>	9.42 x 10 <sup>-4</sup>	Calculated using EUSES 2.1., averaged over 30 days	
Groundwater (in mg/L)	0.007	0.007	Calculated using EUSES 2.1.	
Air (in mg/m <sup>3</sup> )	0.0571	0.0571	Calculated using EUSES 2.1., annual average, PEC local and regional	
Risk Characterisation				
PNEC sediment values are those as calculated by the equilibrium partitioning method (EPM) in EUSES.				
<b>Terrestrial compartment:</b> Sulphuric acid is produced on a large scale, generally on major chemical sites, which may have dedicated effluent treatment facilities, involving both chemical and biological treatment. There is therefore no direct exposure of soils and no risk of contamination of groundwater. Given this lack of expected exposure no PNEC has been derived for the soil compartment and no risk characterisation is required.				
<b>Atmospheric compartment:</b> Atmospheric contamination is minimal, with either the use of sealed systems or the use of scrubbers. No atmospheric PNECs are derived and no atmospheric risk characterisation is required.				
Compartments	PEC	PNEC	RCR	Explanation
Surface water (in mg/L)	4.43 x 10 <sup>-5</sup>	0.0025	0.01	
Marine water (in mg/L)	6.42 x 10 <sup>-6</sup>	0.00025	0.0256	
Freshwater sediment (in mg/kg)	3.56 x 10 <sup>-5</sup>	0.002	0.0178	EPM
Marine sediment (in mg/kg)	5.16 x 10 <sup>-6</sup>	0.002	0.0025	EPM
WWTP (in mg/L)	0	8.8	0	Due to neutralisation