

# Copper Sulphate Pentahydrate

## Safety Data Sheet

according to Regulation (EC) No. 1907/2006 (REACH) with its amendment Regulation (EU) 2015/830  
Issue date: 6/28/2022 Revision date: 6/28/2022 Supersedes version of: 6/28/2022 Version: 4.1

### SECTION 1: Identification of the substance/mixture and of the company/undertaking

#### 1.1. Product identifier

Product form : Substance  
Trade name : Copper Sulphate Pentahydrate  
EC-No. : 231-847-6  
CAS-No. : 7758-847-8  
REACH registration No : 01-2119520566-40-XXXX  
Synonyms : Copper (II) Sulphate Pentahydrate

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

##### 1.2.1. Relevant identified uses

Industrial/Professional use spec : Industrial  
Use of the substance/mixture : Agricultural applications, animal feed additive, chemical manufacturing, metal treatment

##### 1.2.2. Uses advised against

No additional information available

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

Monarch Chemicals Limited  
Head Office  
New Road  
ME12 1LZ Sheerness - United Kingdom  
T +44 (0)1795 583333 (9.00am - 5.00pm Mon-Fri)  
[sales@monarchchemicals.co.uk](mailto:sales@monarchchemicals.co.uk) - [www.monarchchemicals.co.uk](http://www.monarchchemicals.co.uk)

#### 1.4. Emergency telephone number

Emergency number : +44 (0)7711 009064 (Out of Hours)

Country	Organisation/Company	Address	Emergency number	Comment
United Kingdom	National Poisons Information Service (Cardiff Centre) Gwenwyn Ward, Llandough Hospital	Penarth CF64 2XX Cardiff	0344 892 0111	
United Kingdom	Guy's & St Thomas' Poisons Unit Medical Toxicology Unit, Guy's & St Thomas' Hospital Trust	Avonley Road SE14 5ER London	+44 20 7188 7188	

### SECTION 2: Hazards identification

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

##### Classification according to Regulation (EC) No. 1272/2008 [CLP]

Acute toxicity (oral), Category 4 H302  
Serious eye damage/eye irritation, Category 1 H318  
Hazardous to the aquatic environment — Acute Hazard, Category 1 H400  
Hazardous to the aquatic environment — Chronic Hazard, Category 1 H410  
Full text of H-statements: see section 16

##### Adverse physicochemical, human health and environmental effects

Harmful if swallowed. Causes serious eye damage. Very toxic to aquatic life with long lasting effects.

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### 2.2. Label elements

#### Labelling according to Regulation (EC) No. 1272/2008 [CLP]

Hazard pictograms (CLP) :



GHS05

GHS07

GHS09

Signal word (CLP) :

Danger

Hazard statements (CLP) :

H302 - Harmful if swallowed.

H318 - Causes serious eye damage.

H410 - Very toxic to aquatic life with long lasting effects.

Precautionary statements (CLP) :

P273 - Avoid release to the environment.

P280 - Wear protective gloves, protective clothing, eye protection, face protection.

P301+P312 - IF SWALLOWED: Call a POISON CENTER, doctor if you feel unwell.

P305+P351+P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P310 - Immediately call a POISON CENTER, a doctor.

Dispose of contents/container to: An approved recycle or waste disposal facility.

### 2.3. Other hazards

No additional information available

## SECTION 3: Composition/information on ingredients

### 3.1. Substances

Name : Copper Sulphate Pentahydrate  
CAS-No. : 7758-847-8  
EC-No. : 231-847-6

Name	Product identifier	%	Classification according to Regulation (EC) No. 1272/2008 [CLP]
copper sulphate pentahydrate	CAS-No.: 7758-99-8 EC-No.: 231-847-6 EC Index-No.: 029-023-00-4	> 95	Acute Tox. 4 (Oral), H302 Eye Dam. 1, H318 Aquatic Acute 1, H400 (M=10) Aquatic Chronic 1, H410 (M=10)

Full text of H-statements: see section 16

### 3.2. Mixtures

Not applicable

## SECTION 4: First aid measures

### 4.1. Description of first aid measures

First-aid measures general : Call a poison center or a doctor if you feel unwell. Show safety data sheet to the doctor in attendance.

First-aid measures after inhalation : Remove person to fresh air and keep comfortable for breathing.

First-aid measures after skin contact : Remove all contaminated clothing and footwear. Wash skin with plenty of water.

First-aid measures after eye contact : Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a physician immediately.

First-aid measures after ingestion : Rinse mouth. Call a poison center or a doctor if you feel unwell.

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

Symptoms/effects after inhalation : Dust of the product, if present, may cause respiratory irritation after an excessive inhalation exposure.

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Symptoms/effects after skin contact	: May cause moderate irritation. Prolonged or repeated contact may cause skin to become dry.
Symptoms/effects after eye contact	: Serious damage to eyes.
Symptoms/effects after ingestion	: Harmful if swallowed. Ingestion may cause nausea and vomiting. May cause irritation to the digestive tract.

### 4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically. Eye bathing equipment or running water should be available on the premises. Show safety data sheet to the doctor in attendance.

## SECTION 5: Firefighting measures

### 5.1. Extinguishing media

Suitable extinguishing media : Water spray. Dry powder. Foam. Use water spray to cool containers.

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

Fire hazard	: May form combustible dust concentrations in air.
Explosion hazard	: No direct explosion hazard.
Hazardous decomposition products in case of fire	: Toxic fumes may be released. In combustion emits toxic fumes of sulphur oxides.

### 5.3. Advice for firefighters

Protection during firefighting : Do not attempt to take action without suitable protective equipment. Self-contained breathing apparatus. Complete protective clothing.

## SECTION 6: Accidental release measures

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

#### 6.1.1. For non-emergency personnel

Protective equipment	: Wear recommended personal protective equipment. Refer to section 8 for suitable protective equipment.
Emergency procedures	: Ventilate spillage area. Avoid contact with skin and eyes.

#### 6.1.2. For emergency responders

Protective equipment : Do not attempt to take action without suitable protective equipment. For further information refer to section 8: "Exposure controls/personal protection".

### 6.2. Environmental precautions

Avoid release to the environment.

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

For containment	: Collect spillage.
Methods for cleaning up	: Mechanically recover the product.
Other information	: Dispose of materials or solid residues at an authorized site.

### 6.4. Reference to other sections

For further information refer to section 13. Refer to section 8 for suitable protective equipment.

## SECTION 7: Handling and storage

### 7.1. Precautions for safe handling

Precautions for safe handling	: Ensure good ventilation of the work station. Avoid contact with skin and eyes. Wear personal protective equipment.
Hygiene measures	: Do not eat, drink or smoke when using this product. Always wash hands after handling the product.

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

Storage conditions	: Store in a well-ventilated place. Keep cool.
Incompatible products	: Avoid incompatible materials and conditions - see Section 10 for further information.
Information on mixed storage	: Keep away from food & feed stuffs.
Storage area	: Store away from heat.
Packaging materials	: Plastic or plastic lined packaging.

### 7.3. Specific end use(s)

No additional information available

## SECTION 8: Exposure controls/personal protection

### 8.1. Control parameters

#### 8.1.1. National occupational exposure and biological limit values

Copper Sulphate Pentahydrate (7758-847-8)	
EU - Indicative Occupational Exposure Limit (IOEL)	
Local name	Copper and inorganic compounds
Notes	(Year of adoption 2014)
Regulatory reference	SCOEL Recommendations
United Kingdom - Occupational Exposure Limits	
WEL TWA (OEL TWA) [1]	1 mg/m <sup>3</sup> (As Cu)
WEL STEL (OEL STEL)	2 mg/m <sup>3</sup> (As Cu)

#### 8.1.2. Recommended monitoring procedures

No additional information available

#### 8.1.3. Air contaminants formed

No additional information available

#### 8.1.4. DNEL and PNEC

Copper Sulphate Pentahydrate (7758-847-8)	
DNEL/DMEL (Workers)	
Long-term - systemic effects, dermal	137 mg/m <sup>3</sup>
PNEC (Water)	
PNEC aqua (freshwater)	0.0078 µg/L
PNEC aqua (marine water)	0.0052 µg/L
PNEC (Sediment)	
PNEC sediment (freshwater)	87 mg/kg dwt
PNEC sediment (marine water)	676 mg/kg dwt

#### 8.1.5. Control banding

No additional information available

### 8.2. Exposure controls

#### 8.2.1. Appropriate engineering controls

##### Appropriate engineering controls:

Ensure good ventilation of the work station.

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### 8.2.2. Personal protection equipment

#### Personal protective equipment:

Gloves. Protective clothing. Dust formation: dust mask.

#### Personal protective equipment symbol(s):



#### 8.2.2.1. Eye and face protection

##### Eye protection:

Safety glasses. Eye bathing equipment or running water should be available on the premises.

#### 8.2.2.2. Skin protection

##### Skin and body protection:

Wear suitable protective clothing

##### Hand protection:

Protective gloves

##### Other skin protection

##### Materials for protective clothing:

A decontamination shower or running water should be available on the premises.

#### 8.2.2.3. Respiratory protection

##### Respiratory protection:

In case of insufficient ventilation, wear suitable respiratory equipment

Respiratory protection			
Device	Filter type	Condition	Standard
	Type P3		

#### 8.2.2.4. Thermal hazards

No additional information available

### 8.2.3. Environmental exposure controls

#### Environmental exposure controls:

Avoid release to the environment.

## SECTION 9: Physical and chemical properties

### 9.1. Information on basic physical and chemical properties

Physical state	: Solid
Appearance	: Crystals or crystalline powder.
Colour	: Blue.
Odour	: odourless.
Odour threshold	: No data available
pH	: ≈ 4 10 % Solution
Relative evaporation rate (butylacetate=1)	: No data available
Melting point	: No data available
Freezing point	: Not applicable
Boiling point	: No data available
Flash point	: Not flammable
Auto-ignition temperature	: Not applicable
Decomposition temperature	: ≈ 110 °C
Flammability (solid, gas)	: Non flammable.
Vapour pressure	: No data available

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Relative vapour density at 20 °C	: No data available
Relative density	: 2.2
Solubility	: Soluble in water.
Partition coefficient n-octanol/water (Log Pow)	: No data available
Viscosity, kinematic	: Not applicable
Viscosity, dynamic	: No data available
Explosive properties	: Product is not explosive.
Oxidising properties	: Non-oxidising according to EC Criteria.
Explosive limits	: Not applicable

### 9.2. Other information

No additional information available

## SECTION 10: Stability and reactivity

### 10.1. Reactivity

The product is non-reactive under normal conditions of use, storage and transport.

### 10.2. Chemical stability

Stable under normal conditions.

### 10.3. Possibility of hazardous reactions

No dangerous reactions known under normal conditions of use.

### 10.4. Conditions to avoid

None under recommended storage and handling conditions (see section 7).

### 10.5. Incompatible materials

Strong oxidising agents. Acids.

### 10.6. Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced.

## SECTION 11: Toxicological information

### 11.1. Information on toxicological effects

Acute toxicity (oral)	: Harmful if swallowed.
Acute toxicity (dermal)	: Not classified
Acute toxicity (inhalation)	: Not classified

Copper Sulphate Pentahydrate (7758-847-8)	
LD50 oral rat	≈ 480 mg/kg
LD50 dermal rat	> 2000 mg/kg

Skin corrosion/irritation	: Not classified pH: ≈ 4 10 % Solution
Serious eye damage/irritation	: Causes serious eye damage. pH: ≈ 4 10 % Solution
Respiratory or skin sensitisation	: Not classified
Germ cell mutagenicity	: Not classified
Carcinogenicity	: Not classified
Reproductive toxicity	: Not classified
STOT-single exposure	: Not classified
STOT-repeated exposure	: Not classified
Aspiration hazard	: Not classified

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### Copper Sulphate Pentahydrate (7758-847-8)

Viscosity, kinematic	Not applicable
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## SECTION 12: Ecological information

### 12.1. Toxicity

Ecology - general : Very toxic to aquatic life with long lasting effects.  
Hazardous to the aquatic environment, short-term (acute) : Very toxic to aquatic life.  
Hazardous to the aquatic environment, long-term (chronic) : Very toxic to aquatic life with long lasting effects.  
Not rapidly degradable

### Copper Sulphate Pentahydrate (7758-847-8)

LC50 - Fish [1]	< 1 mg/l
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### 12.2. Persistence and degradability

### Copper Sulphate Pentahydrate (7758-847-8)

Persistence and degradability	The product is inorganic so can not be biodegradable, however it is expected to degrade or disassociate. May cause long-term adverse effects in the environment.
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### 12.3. Bioaccumulative potential

### Copper Sulphate Pentahydrate (7758-847-8)

Bioaccumulative potential	The product may have bioaccumulative potential.
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### 12.4. Mobility in soil

### Copper Sulphate Pentahydrate (7758-847-8)

Additional information	Not volatile. soluble in water
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### 12.5. Results of PBT and vPvB assessment

No additional information available

### 12.6. Other adverse effects

Additional information : Avoid release to the environment.

## SECTION 13: Disposal considerations

### 13.1. Waste treatment methods

Waste treatment methods : Dispose of contents/container in accordance with licensed collector's sorting instructions.  
Additional information : Consult an expert on waste disposal or treatment.

## SECTION 14: Transport information

In accordance with ADR / IMDG / IATA / ADN / RID

ADR	IMDG	IATA	ADN	RID
<b>14.1. UN number</b>				
UN 3077	UN 3077	UN 3077	UN 3077	UN 3077

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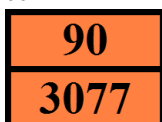
according to Regulation (EC) No. 1907/2006 (REACH) with its amendment Regulation (EU) 2015/830

ADR	IMDG	IATA	ADN	RID
<b>14.2. UN proper shipping name</b>				
ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (copper sulphate pentahydrate)	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (copper sulphate pentahydrate)	Environmentally hazardous substance, solid, n.o.s. (copper sulphate pentahydrate)	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (copper sulphate pentahydrate)	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (copper sulphate pentahydrate)
<b>Transport document description</b>				
UN 3077 ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (copper sulphate pentahydrate), 9, III, (-)	UN 3077 ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (copper sulphate pentahydrate), 9, III, MARINE POLLUTANT	UN 3077 Environmentally hazardous substance, solid, n.o.s. (copper sulphate pentahydrate), 9, III	UN 3077 ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (copper sulphate pentahydrate), 9, III	UN 3077 ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (copper sulphate pentahydrate), 9, III
<b>14.3. Transport hazard class(es)</b>				
9	9	9	9	9
<b>14.4. Packing group</b>				
III	III	III	III	III
<b>14.5. Environmental hazards</b>				
Dangerous for the environment: Yes	Dangerous for the environment: Yes Marine pollutant: Yes	Dangerous for the environment: Yes	Dangerous for the environment: Yes	Dangerous for the environment: Yes
No supplementary information available				

### 14.6. Special precautions for user

#### Overland transport

Classification code (ADR)	: M7
Special provisions (ADR)	: 274, 335, 375, 601
Limited quantities (ADR)	: 5kg
Excepted quantities (ADR)	: E1
Packing instructions (ADR)	: P002, IBC08, LP02, R001
Special packing provisions (ADR)	: PP12, B3
Mixed packing provisions (ADR)	: MP10
Portable tank and bulk container instructions (ADR)	: T1, BK1, BK2, BK3
Portable tank and bulk container special provisions (ADR)	: TP33
Tank code (ADR)	: SGAV, LGBV
Vehicle for tank carriage	: AT
Transport category (ADR)	: 3
Special provisions for carriage - Packages (ADR)	: V13
Special provisions for carriage - Bulk (ADR)	: VC1, VC2
Special provisions for carriage - Loading, unloading and handling (ADR)	: CV13
Hazard identification number (Kemler No.)	: 90
Orange plates	:



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Tunnel restriction code (ADR) : -  
EAC code : 2Z

### Transport by sea

Special provisions (IMDG) : 274, 335, 966, 967, 969  
Limited quantities (IMDG) : 5 kg  
Excepted quantities (IMDG) : E1  
Packing instructions (IMDG) : LP02, P002  
Special packing provisions (IMDG) : PP12  
IBC packing instructions (IMDG) : IBC08  
IBC special provisions (IMDG) : B3  
Tank instructions (IMDG) : BK1, BK2, BK3, T1  
Tank special provisions (IMDG) : TP33  
EmS-No. (Fire) : F-A  
EmS-No. (Spillage) : S-F  
Stowage category (IMDG) : A  
Stowage and handling (IMDG) : SW23

### Air transport

PCA Excepted quantities (IATA) : E1  
PCA Limited quantities (IATA) : Y956  
PCA limited quantity max net quantity (IATA) : 30kgG  
PCA packing instructions (IATA) : 956  
PCA max net quantity (IATA) : 400kg  
CAO packing instructions (IATA) : 956  
CAO max net quantity (IATA) : 400kg  
Special provisions (IATA) : A97, A158, A179, A197, A215  
ERG code (IATA) : 9L

### Inland waterway transport

Classification code (ADN) : M7  
Special provisions (ADN) : 274, 335, 375, 601  
Limited quantities (ADN) : 5 kg  
Excepted quantities (ADN) : E1  
Equipment required (ADN) : PP, A  
Number of blue cones/lights (ADN) : 0  
Additional requirements/Remarks (ADN) : \* Only in the molten state. \*\* For carriage in bulk see also 7.1.4.1. \*\*\* Only in the case of transport in bulk.

### Rail transport

Classification code (RID) : M7  
Special provisions (RID) : 274, 335, 375, 601  
Limited quantities (RID) : 5kg  
Excepted quantities (RID) : E1  
Packing instructions (RID) : P002, IBC08, LP02, R001  
Special packing provisions (RID) : PP12, B3  
Mixed packing provisions (RID) : MP10  
Portable tank and bulk container instructions (RID) : T1, BK1, BK2, BK3  
Portable tank and bulk container special provisions (RID) : TP33  
Tank codes for RID tanks (RID) : SGAV, LGBV  
Transport category (RID) : 3  
Special provisions for carriage – Packages (RID) : W13  
Special provisions for carriage – Bulk (RID) : VC1, VC2  
Special provisions for carriage - Loading, unloading and handling (RID) : CW13, CW31  
Colis express (express parcels) (RID) : CE11  
Hazard identification number (RID) : 90

### 14.7. Transport in bulk according to Annex II of Marpol and the IBC Code

Not applicable

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### SECTION 15: Regulatory information

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

##### 15.1.1. EU-Regulations

No REACH Annex XVII restrictions

Copper Sulphate Pentahydrate is not on the REACH Candidate List

Copper Sulphate Pentahydrate is not on the REACH Annex XIV List

Copper Sulphate Pentahydrate is not subject to Regulation (EU) No 649/2012 of the European Parliament and of the Council of 4 July 2012 concerning the export and import of hazardous chemicals.

Copper Sulphate Pentahydrate is not subject to Regulation (EU) No 2019/1021 of the European Parliament and of the Council of 20 June 2019 on persistent organic pollutants

##### Directive 2012/18/EU (SEVESO III)

Seveso Additional information : Product should be taking into account when considering Seveso/COMAH inventory from Environmentally hazardous substances.

##### 15.1.2. National regulations

###### Germany

Employment restrictions : Observe restrictions according Act on the Protection of Working Mothers (MuSchG)  
Observe restrictions according Act on the Protection of Young People in Employment (JArbSchG)

Water hazard class (WGK) : WGK 3, Highly hazardous to water (Classification according to AwSV; ID No. 141)

Hazardous Incident Ordinance (12. BImSchV) : Is not subject of the Hazardous Incident Ordinance (12. BImSchV)

###### Netherlands

SZW-lijst van kankerverwekkende stoffen : The substance is not listed

SZW-lijst van mutagene stoffen : The substance is not listed

SZW-lijst van reprotoxische stoffen – Borstvoeding : The substance is not listed

SZW-lijst van reprotoxische stoffen – Vruchtbaarheid : The substance is not listed

SZW-lijst van reprotoxische stoffen – Ontwikkeling : The substance is not listed

###### Denmark

Danish National Regulations : Young people below the age of 18 years are not allowed to use the product

###### Switzerland

Storage class (LK) : LK 8 - Corrosive materials

###### United Kingdom

British National Regulations : Seveso directive 96/82/EC.

#### 15.2. Chemical safety assessment

No chemical safety assessment has been carried out

### SECTION 16: Other information

#### Indication of changes:

Hazards identification. General update.

Indication of changes			
Section	Changed item	Change	Comments
2.1		Modified	
2.2		Modified	

#### Abbreviations and acronyms

ADN	European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways
ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE	Acute Toxicity Estimate

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Abbreviations and acronyms	
BCF	Bioconcentration factor
BLV	Biological limit value
BOD	Biochemical oxygen demand (BOD)
COD	Chemical oxygen demand (COD)
DMEL	Derived Minimal Effect level
DNEL	Derived-No Effect Level
EC-No.	European Community number
EC50	Median effective concentration
EN	European Standard
IARC	International Agency for Research on Cancer
IATA	International Air Transport Association
IMDG	International Maritime Dangerous Goods
LC50	Median lethal concentration
LD50	Median lethal dose
LOAEL	Lowest Observed Adverse Effect Level
NOAEC	No-Observed Adverse Effect Concentration
NOAEL	No-Observed Adverse Effect Level
NOEC	No-Observed Effect Concentration
OECD	Organisation for Economic Co-operation and Development
OEL	Occupational Exposure Limit
PBT	Persistent Bioaccumulative Toxic
PNEC	Predicted No-Effect Concentration
RID	Regulations concerning the International Carriage of Dangerous Goods by Rail
SDS	Safety Data Sheet
STP	Sewage treatment plant
ThOD	Theoretical oxygen demand (ThOD)
TLM	Median Tolerance Limit
VOC	Volatile Organic Compounds
CAS-No.	Chemical Abstract Service number
N.O.S.	Not Otherwise Specified
vPvB	Very Persistent and Very Bioaccumulative
ED	Endocrine disrupting properties

Full text of H- and EUH-statements	
Acute Tox. 4 (Oral)	Acute toxicity (oral), Category 4
Aquatic Acute 1	Hazardous to the aquatic environment — Acute Hazard, Category 1
Aquatic Chronic 1	Hazardous to the aquatic environment — Chronic Hazard, Category 1
Eye Dam. 1	Serious eye damage/eye irritation, Category 1
H302	Harmful if swallowed.

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### Full text of H- and EUH-statements

H318	Causes serious eye damage.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

Safety Data Sheet (SDS), EU

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

## ANNEX I GENERIC EXPOSURE COPPER SULPHATE

The downstream uses of copper sulphate are considered in terms of user (industrial, professional, consumer) and environmental exposure route (point source and wide dispersive emissions). The range of copper sulphate uses is very diverse and, in order to provide assessments that can be applied as flexibly as possible, all potential worker activities (expressed in terms of PROC codes) and routes of environmental exposure (expressed as ERCs and spERCs) have been evaluated. These are treated as individual generic exposure scenarios (GES). In all cases, human and environmental exposure is expressed in terms of copper. Worker exposure scenarios also distinguish between the use of copper compounds in either liquid (assumed to be a solid at room temperature dissolved in water to produce an aqueous solution or slurry) or solid form. Solid forms are further classified as having low, medium or high dustiness, as defined by the developers of MEASE using the Rotating Drum Method (RDM);

1. Solid, low dustiness: Granules, pellets, wetted powders, etc. with little potential for dust emissions (dustiness is less than 2.5% according to the RDM).
2. Solid, medium dustiness: powders and dust consisting of relatively coarse particles with moderate potential to become (and stay) airborne (dustiness is less than 10% RDM).
3. Solid, high dustiness: fine powders having high potential to become and stay airborne.

The RMD methodology is defined within the European Committee for Standardization (CEN/TC137/WG3) 2006 document providing standardisation in measurement of dustiness of bulk powders (EN15051<sup>1</sup>). This standard establishes two reference test methods (single drop or rotating drum method) that classify dustiness in terms of health-related fractions of bulk solid materials.

The resulting scenarios, including information on associated operating conditions and risk management measures, are summarized in the tables that follow. In order to clearly identify each GES for downstream use of copper sulphate, the following descriptor codes have been developed: Environmental GES all have the prefix **E-GES**; worker GES all have the prefix **W-GES** (industrial) or **PW-GES** (professional) and consumer GES have the prefix **C-GES**. All of these then have '**DU**' for downstream use or '**WDU**' for widespread downstream use, as applicable. In order to define the specific release category or activities investigated within individual GES, a number of additional sub-categories have been added:

Scenario	Description		
<b>E-GES-DU</b>	Tier	1	Tier 1 – defaults from ERC codes
		2	Tier 2 – spERC <sup>+</sup> /measured data
	Waste water treatment	0	No waste water emission
		1	Waste water treated once at STP*
		(2)	Formulation of mixtures
		(3)	Formulation in materials

<sup>1</sup> European Committee for Standardization. EN 15051. Workplace atmospheres - Measurement of the dustiness of bulk materials - Requirements and reference test methods, 2006.

Scenario			Description
	Environmental release category (ERC)	(4)	Industrial use of processing aids in processes and products, not becoming part of articles
		(5)	Industrial use resulting in inclusion into or onto a matrix
		(6a)	Industrial use resulting in manufacture of another substance (use of intermediates)
		(6b)	Industrial use of reactive processing aids
		(6d)	Industrial use of process regulators for polymerisation processes in production of resins, rubbers, polymers
		(7)	Industrial use of substances in closed systems
		(12a)	Industrial processing of articles with abrasive techniques (low releases)
		(spERC F)	Industrial formulation of metal compounds
		(spERC U)	Industrial use of metal compounds
<b>E-GES-WDU</b>	Environmental release category (ERC)	(ERC8a-c)	Wide dispersive indoor use of substance
		(ERC8d-f)	Wide dispersive outdoor use of substance
		(ERC9a)	Wide dispersive indoor use of substance in closed systems
		(ERC9b)	Wide dispersive outdoor use of substance in closed systems
		(ERC10a)	Wide dispersive outdoor use of long-life articles with low release
		(ERC10b)	Wide dispersive outdoor use of long-life articles with high or intended release
		(ERC11a)	Wide dispersive indoor use of long-life articles with low release
(ERC11b)	Wide dispersive indoor use of long-life articles with high or intended release		
<b>W/PW-GES-DU</b>	Substance form	(High)	Solid, high dustiness
		(Med)	Solid, medium dustiness
		(Low)	Solid, low dustiness
		(Liquid)	Liquid, aqueous solution or slurry
<b>C-GES-DU</b>	Various unspecified articles and products		

<sup>†</sup> In addition to the ERC codes, spERCs have been developed to assess exposure from downstream formulation and use. These are applicable to open and closed systems using wet and dry processes and are based on specific RMM information gathered for metal compounds in various industrial activities. spERCs may be applied in preference to the default ERCs for sites that are known to comply with the stipulated conditions.

\* On-site WWTP can be introduced where applicable; Use of a sewage treatment plant (STP) presents a worst-case approach, as this allows for an assessment of risk to STP microorganisms, and the impact of sludge disposal to land.

## Generic Exposure - Industrial Setting

Exposure Scenario – Exposure resulting from industrial uses	
1. Title GES – Industrial downstream use of Copper sulphate	
<b>Life cycle</b>	Use (industrial) stage of copper sulphate
<b>Free short title</b>	Generic downstream industrial use of copper sulphate
<b>Systematic title based on use descriptor</b>	SU: SU3 – Industrial use PROC: 1, 2, 3, 4, 5, 7, 8a, 8b, 9, 10, 13, 14, 15, 17, 22, 23, 24, 25 [identified] PC: Various/not applicable AC: Not applicable ERC: 2, 3, 4, 5, 6a, 6b, 6d, 7, 8a*, 8c-e*, 10a*, 11a* [identified; *Wide dispersive use] spERC: F, U [where applicable]
<b>Processes, tasks, activities covered (workers)</b>	Downstream use of Copper sulphate All possible processes, tasks and activities described by the selected PROCs
Copper sulphate is widely used within downstream industrial processes, which are covered within this generic exposure scenario.	
2. Exposure scenario	
2.1 Contributing scenario (1) Controlling environmental exposure for <u>all industrial DU</u> of Copper sulphate [E-GES-DU1.0/2.0/1.1[ERC/spERC]/2.1[ERC/spERC]]	
<b>Environmental related free short title</b>	Generic exposure of the environment from the industrial DU of Copper sulphate
<b>Assessment Method</b>	Predicted (modelled) local and regional (measured) concentrations of copper are used for calculation of the PEC – Tools available: EUSES 2.0 / Suitable scaling tools
Product characteristics	
GENERIC Exposure: All forms have been investigated where applicable.	
Frequency and duration of use	
Intermittent (used < 12 times per year for not more than 24 h) or continuous use/release. GENERIC Exposure: Continuous production is assumed as a worst case. It is possible that use is not continuous; this has to be considered when estimating exposure.	
Environment factors not influenced by risk management	
GENERIC Exposure: Default for generic scenario: 18,000 m <sup>3</sup> /d, unless specified otherwise.	
Other given operational conditions affecting environmental exposure	
GENERIC Exposure: no operational conditions specified all wastewater emissions are based on ERC/spERC data.	
Technical conditions and measures at process level (source) to prevent release	
GENERIC Exposure: no operational conditions specified all wastewater emissions are based on ERC/spERC data.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
<p><u>GENERIC Exposure assumptions:</u></p> <p><b>Air:</b> 0.4% emission assumed irrespective of ERC. This value is taken from the worst-case available metal spERCs (Use of metals and metal compounds in metallic coating v1.1 Arche consultancy). This approach has been adopted due to negligible volatility of copper. The default ERC values for air emissions are unreasonably high.</p> <p><b>Waste water :</b> Either; - No release to water, or - Release as dictated by appropriate ERC or spERC (see Section 2.1.1 for specific % releases).</p> <p><b>Soil:</b> No significant direct releases assumed. However, where a municipal STP is used emissions via sewage sludge need to be taken into account.</p> <p><b>Wide dispersive use:</b> In relation to releases to water, the scenario for both indoor and outdoor wide dispersive uses is based on the assumption that they occur in the urban infrastructure, are collected in a central public sewage system and are then treated by an STP. For outdoor uses, this scenario can be considered a reasonable worst case. To assume that all releases occur on a paved surface of an urban infrastructure and are collected in a sewage system may be considered overly conservative, but this is balanced by the assumption that all releases to water are treated in an STP. Direct releases to air and soil are not considered in the wide dispersive use scenario.</p>	
Organisational measures to prevent /limit release from site	
GENERIC Exposure: no operational conditions specified all wastewater emissions are based on ERC/spERC data.	

<b>Conditions and measures related to municipal sewage treatment plant</b>	
GENERIC Exposure assumptions: In cases where applicable: the default size has been used.	
<b>Conditions and measures related to external treatment of waste for disposal</b>	
GENERIC Exposure assumptions: no additional emissions to the environment via solid waste have been included in the assessment as disposal via appropriate waste streams have been assumed.	
<b>Conditions and measures related to external recovery of waste</b>	
GENERIC Exposure assumptions: no additional emissions to the environment via solid waste have been included in the assessment as disposal via appropriate waste streams have been assumed.	
<b>Amounts used</b>	
Amounts released in waste water <u>should not</u> result in environmental concentrations for each compartment that exceeds the established effect threshold value given in section 2.1.1. Information on associated default emissions to air and water is provided, based on specified default assumptions for RMM and the assumed characteristics of the receiving environment.	
<b>2.1.1 Generic guidance – ERC/spERC related: Technical conditions and measures to control emissions to the environment resulting from <u>all industrial DU</u> of Copper sulphate [E-GES-DU1.0/2.0; E-GES-DU1.1[ERC]; E-GES-WDU[ERC]; E-GES-DU2.1[spERC]]</b>	
<b>Effects and background data</b>	
<b>Effect threshold data [predicted no effect concentration (PNEC) data in the relevant environmental compartments cannot exceed these levels]</b>	
Micro-organisms in STP (mg Cu L <sup>-1</sup> )	0.23
Freshwater aquatic (mg Cu L <sup>-1</sup> )	0.0078
Freshwater sediment (mg Cu kg dwt <sup>-1</sup> )	87.1
Marine water (mg Cu L <sup>-1</sup> )	0.0056
Marine sediment (mg Cu kg dwt <sup>-1</sup> )	676
Terrestrial compartment (mg Cu kg dwt <sup>-1</sup> )	64.6
<b>Background level concentrations [existing copper concentrations to be add to the predicted environmental concentrations from processes to ensure the effect threshold concentration is not reached]</b>	
Freshwater aquatic (mg Cu L <sup>-1</sup> )	0.0029
Freshwater sediment (mg Cu kg dwt <sup>-1</sup> )	0
Marine water (mg Cu L <sup>-1</sup> )	0.0011
Marine sediment (mg Cu kg dwt <sup>-1</sup> )	16.1
Terrestrial compartment (mg Cu kg dwt <sup>-1</sup> )	24.4
For individual assessments the default release data are available below in 2.1.1.1.	
<b>2.1.1.1 Local site specific point source assessment</b>	
<b>E-GES-DU1.0/2.0</b>	
<b>Emissions covered: Tier 1 (ERC codes) Tier 2 (spERC) - No waste water releases</b>	
<b>Environmental Release Code</b>	<b>ANY</b>
<b>Life cycle stage (LCS)</b>	Formulation/Use
<b>Type of use in LCS</b>	Any
<b>Default release to air from process [%]</b>	0.004
<b>Default release to water from process [%]</b>	0
<b>Default release to soil from process [%]</b>	0
<b>Maximum off-site emission (via air) = 0.004% of total copper use as copper sulphate</b>	
<b>E-GES-DU1.1</b>	
<b>Emissions covered: Tier 1 (ERC codes) – waste water emission via STP [On-site WWTP can be introduced where applicable (used to reduce emission % further) but use of a sewage treatment plant (STP) presents a worst-case approach, as this allows for an assessment of risk to STP microorganisms, and the impact of sludge disposal to land.]</b>	
<b>Environmental Release Code</b>	<b>ERC 2</b>
<b>Life cycle stage (LCS)</b>	Formulation
<b>Type of use in LCS</b>	Not included into matrix
<b>Default release to water from process [%]</b>	2
<b>Environmental Release Code</b>	<b>ERC 3</b>
<b>Life cycle stage (LCS)</b>	Formulation
<b>Type of use in LCS</b>	Formulation in materials

Default release to water from process [%]	0.2
<b>Environmental Release Code</b>	<b>ERC 4</b>
Life cycle stage (LCS)	Use
Type of use in LCS	Processing aid
Default release to water from process [%]	100**
<b>Environmental Release Code</b>	<b>ERC 5</b>
Life cycle stage (LCS)	Use
Type of use in LCS	Industrial use resulting in inclusion into or onto a matrix
Default release to water from process [%]	50
<b>Environmental Release Code</b>	<b>ERC 6a</b>
Life cycle stage (LCS)	Use
Type of use in LCS	Intermediate
Default release to water from process [%]	2
<b>Environmental Release Code</b>	<b>ERC 6b</b>
Life cycle stage (LCS)	Use
Type of use in LCS	Reactive processing aid
Default release to water from process [%]	5
<b>Environmental Release Code</b>	<b>ERC 6d</b>
Life cycle stage (LCS)	Use
Type of use in LCS	Industrial use of process regulators for polymerisation processes in production of resins, rubbers, polymers
Default release to water from process [%]	0.005
<b>Environmental Release Code</b>	<b>ERC 7</b>
Life cycle stage (LCS)	Use
Type of use in LCS	Industrial use of substances in closed systems
Default release to water from process [%]	5

<b>Environmental Release Code</b>	<b>ERC 12a</b>
<b>Life cycle stage (LCS)</b>	Use
<b>Type of use in LCS</b>	Industrial processing of articles with abrasive techniques (low releases)
<b>Default release to water from process [%]</b>	2.5
<b>Maximum off-site copper emission via water</b>	
Using the above information regarding emission factors and controls, the maximum off-site copper emission has been calculated to be either:	
<ol style="list-style-type: none"> <li>0.8575 kg Cu/d assuming connection to a municipal STP and receiving water with a default flow rate of 18000 m<sup>3</sup>/d (dilution factor of 10), or</li> <li>0.6174 kg Cu/d assuming direct release to receiving water [following on-site treatment] with a default flow rate of 18000 m<sup>3</sup>/d (dilution factor of 10).</li> </ol>	
<u>These values are intended to be illustrative. DU should confirm that they can support the environmental releases from their processes with the necessary monitoring and scaling calculations.</u>	
<b>2.1.1.2 Wide dispersive use assessment</b>	
<b>E-GES-WDU1.1</b>	
<b>Emissions covered: Tier 1 (ERC codes) – wide dispersive uses</b>	
It has not been possible to derive maximum allowable emissions for individual wide dispersive uses of copper sulphate. However, measured region-specific PEC data available for STP effluents from 3 EU countries (Belgium, the Netherlands and UK) range between 0.011 and 0.054 mg total Cu/l. The highest PEC of 0.054 mg total Cu/l, reported in the UK, was shown to be equivalent to 0.008 mg dissolved Cu/l.	
These data suggest that emissions to receiving water courses with dilutions $\geq 10 \leq 15$ would be sufficient to remove any concern for the aquatic environment as a result of wide dispersive uses of products containing Copper sulphate. This approach and these data have been presented and accepted within the VRA (2008) for the consideration of all copper inputs across the EU.	
For individual assessments the default release data are available below.	
<b>Environmental Release Code</b>	<b>ERC 8a</b>
<b>Life cycle stage (LCS)</b>	Wide dispersive use
<b>Type of use in LCS</b>	Wide dispersive indoor use of processing aids in open systems
<b>Default release to water from process [%]</b>	100
<b>Environmental Release Code</b>	<b>ERC 8b</b>
<b>Life cycle stage (LCS)</b>	Wide dispersive use
<b>Type of use in LCS</b>	Wide dispersive indoor use reaction on use in open systems
<b>Default release to water from process [%]</b>	2
<b>Environmental Release Code</b>	<b>ERC 8c</b>
<b>Life cycle stage (LCS)</b>	Wide dispersive use
<b>Type of use in LCS</b>	Wide dispersive indoor use resulting in inclusion into or onto a matrix in open systems
<b>Default release to water from process [%]</b>	1
<b>Environmental Release Code</b>	<b>ERC 8d</b>
<b>Life cycle stage (LCS)</b>	Wide dispersive use
<b>Type of use in LCS</b>	Wide dispersive indoor use of processing aids in open systems
<b>Default release to water from process [%]</b>	100
<b>Environmental Release Code</b>	<b>ERC 8e</b>
<b>Life cycle stage (LCS)</b>	Wide dispersive use
<b>Type of use in LCS</b>	Wide dispersive indoor use reaction on use in open systems
<b>Default release to water from process [%]</b>	2
<b>Environmental Release Code</b>	<b>ERC 8f</b>
<b>Life cycle stage (LCS)</b>	Wide dispersive use
<b>Type of use in LCS</b>	Wide dispersive indoor use resulting in inclusion into or onto a matrix in open systems

Default release to water from process [%]	1
Environmental Release Code	ERC 9a
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive indoor use of processing aids in closed systems
Default release to water from process [%]	N/A
Environmental Release Code	ERC 9b
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive outdoor use of processing aids in closed systems
Default release to water from process [%]	5
Environmental Release Code	ERC 10a
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive outdoor use resulting in inclusion into or onto a matrix in open systems
Default release to water from process [%]	0.16
Environmental Release Code	ERC 10b
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive indoor use resulting in inclusion into or onto a matrix in open systems
Default release to water from process [%]	100
Environmental Release Code	ERC 11a
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive indoor use resulting in inclusion into or onto a matrix in open systems
Default release to water from process [%]	0.05
Environmental Release Code	ERC 11b
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive indoor use resulting in inclusion into or onto a matrix in open systems
Default release to water from process [%]	100
<b>E-GES-DU2.1</b>	
Emissions covered: Tier 2 (spERC codes) – waste water emission via STP [On-site WWTP can be introduced where applicable (used to reduce emission % further) but use of a sewage treatment plant (STP) presents a worst-case approach, as this allows for an assessment of risk to STP microorganisms, and the impact of sludge disposal to land.]	
Environmental Release Code	spERC Metal Compound Formulation
Life cycle stage (LCS)	Formulation
Type of use in LCS	Formulating industries: <i>catalyst</i> , glass, pigments, paints, coatings, plastics, rubber and stabilisers, water treatment chemicals
Default release to air from process [%]	0.004
Default release to water from process [%]	0.5
Default release to soil from process [%]	0
Environmental Release Code	spERC Metal Compound Use
Life cycle stage (LCS)	Use
Type of use in LCS	Industrial use of metal compounds
Default release to air from process [%]	0.004
Default release to water from process [%]	0.1
Default release to soil from process [%]	0.6
<b>Maximum off-site copper emission via water</b>	
Using the above information regarding emission factors and controls, the maximum off-site copper emission has been calculated to be either:	
1. 0.8575 kg Cu/d assuming connection to a municipal STP and receiving water with a default flow rate of 18000 m <sup>3</sup> /d (dilution factor of 10), or	

2. 0.6174 kg Cu/d assuming direct release to receiving water [following on-site treatment] with a default flow rate of 18000 m<sup>3</sup>/d (dilution factor of 10).

These examples are intended to be illustrative. DU should confirm that they can support the environmental releases from their processes with the necessary monitoring and scaling calculations.

**2.2 Contributing scenario (2) Controlling of workers exposure for all industrial DU of Copper sulphate [W-GES-DU(High, Med, Low, Liquid)][PROC]**

<b>Workers related free short title</b>	Generic exposure for workers exposed to Copper sulphate			
<b>Assessment Method</b>	Estimation of exposure based on predicted data using MEASE			
<b>Product characteristic</b>				
Solid (High, medium and low dustiness) and liquid (aqueous solution)				
<b>Amounts used</b>				
Varying (risk limited by exposure not quantities)				
<b>Frequency and duration of use/exposure</b>				
Daily > 4 hours [Typically 8 hour shift]				
<b>Human factors not influenced by risk management</b>				
Respiration volume under conditions of use	10 m <sup>3</sup> /8 h shift			
Room size and ventilation rate	Room size is not specified as it is the breathable portion of air which is used to define the exposure and ventilation is used as an exposure modifier where LEV is required. See Section 2.2.1.			
Area of skin contact with the substance under conditions of use	240 cm <sup>2</sup>			
Body weight	70 kg			
DNEL inhalation	1 mg/m <sup>3</sup>			
DNEL dermal solids	9566.9 mg/day			
DNEL dermal sol/slurry	956.9 mg/day			
<b>Other given operational conditions affecting workers exposure</b>				
Worst case assumptions from MEASE: Wide dispersive use, direct handling and extensive contact				
<b>Technical conditions and measures at process level (source) to prevent release</b>				
Activity controlled in accordance with PROC descriptor				
<b>Technical conditions and measures to control dispersion from source towards the worker</b>				
Specific details to be added by Supplier/DU (see Section 2.2.1 for generic advice)				
<b>Organisational measures to prevent /limit releases, dispersion and exposure</b>				
Specific details to be added by Supplier/DU (good hygiene training and supervision assumed)				
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>				
Specific details to be added by Supplier/DU (see Section 2.2.1 for generic advice)				
<b>2.2.1 PROC related: Technical conditions and measures to control dispersion from source towards the worker and measures related to personal protection, hygiene and health evaluation [W-GES-DU(High, Med, Low, Liquid)][PROC]</b>				
<b>PROC 1</b>				
<b>Activities covered:</b> Use of the substances in high integrity contained system where little potential exists for exposures, e.g. any sampling via closed loop systems				
GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(High)	Solid [Dustine ss]	High	No	No
W-GES-DU(Med)		Medium	No	No
W-GES-DU(Low)		Low	No	No
W-GES-DU(Liquid)	Liquid		No	No
<b>PROC 2</b>				
<b>Activities covered:</b> Continuous process but where the design philosophy is not specifically aimed at minimizing emissions. It is not high integrity and occasional expose will arise e.g. through maintenance, sampling and equipment breakages				
GES	Physical form		Worker protection required	
			LEV	PPE

W-GES-DU(High)	Solid [Dustine ss]	High	Yes	No
W-GES-DU(Med)		Medium	No	No
W-GES-DU(Low)		Low	No	No
W-GES-DU(Liquid)	Liquid		No	No
<b>PROC 3</b>				
<b>Activities covered:</b> Batch manufacture of a chemical or formulation where the predominant handling is in a contained manner, e.g. through enclosed transfers, but where some opportunity for contact with chemicals occurs, e.g. through sampling				
GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(High)	Solid [Dustine ss]	High	Yes	No
W-GES-DU(Med)		Medium	Yes	No
W-GES-DU(Low)		Low	No	No
W-GES-DU(Liquid)	Liquid		No	No
<b>PROC 4</b>				
<b>Activities covered:</b> Use in batch manufacture of a chemical where significant opportunity for exposure arises, e.g. during charging, sampling or discharge of material, and when the nature of the design is likely to result in exposure				
GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(High)	Solid [Dustine ss]	High	Yes	Yes AFP = 4
W-GES-DU(Med)		Medium	Yes	No
W-GES-DU(Low)		Low	No	No
W-GES-DU(Liquid)	Liquid		No	No
<b>PROC 5</b>				
<b>Activities covered:</b> Manufacture or formulation of chemical products or articles using technologies related to mixing and blending of solid or liquid materials, and where the process is in stages and provides the opportunity for significant contact at any stage				
GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(High)	Solid [Dustine ss]	High	Yes	Yes AFP = 4
W-GES-DU(Med)		Medium	Yes	No
W-GES-DU(Low)		Low	No	No
W-GES-DU(Liquid)	Liquid		No	No
<b>PROC 7</b>				
<b>Activities covered:</b> Air dispersive techniques Spraying for surface coating, adhesives, polishes/cleaners, air care products, sandblasting Substances can be inhaled as aerosols. The energy of the aerosol particles may require advanced exposure controls; in case of coating, overspray may lead to waste water and waste.				
GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(Liquid)	Liquid		Yes	Yes AFP = 4
<b>PROC 8a</b>				
<b>Activities covered:</b> Sampling, loading, filling, transfer, dumping, bagging in <u>non-dedicated</u> facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected.				
GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(High)	Solid [Dustine ss]	High	Yes	Yes AFP = 10
W-GES-DU(Med)		Medium	Yes	No
W-GES-DU(Low)		Low	No	No
W-GES-DU(Liquid)	Liquid		No	No
<b>PROC 8b</b>				

**Activities covered:** Sampling, loading, filling, transfer, dumping, bagging in dedicated facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected.

GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(High)	Solid [Dustine ss]	High	Yes	Yes AFP = 4
W-GES-DU(Med)		Medium	Yes	No
W-GES-DU(Low)		Low	No	No
W-GES-DU(Liquid)	Liquid		No	No

#### PROC 9

**Activities covered:** Filling lines specifically designed to both capture vapour and aerosol emissions and minimise spillage.

GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(High)	Solid [Dustine ss]	High	Yes	Yes AFP = 4
W-GES-DU(Med)		Medium	Yes	No
W-GES-DU(Low)		Low	No	No
W-GES-DU(Liquid)	Liquid		No	No

#### PROC 10

**Activities covered:** Low energy spreading of e.g. coatings Including cleaning of surfaces. Substance can be inhaled as vapours, skin contact can occur through droplets, splashes, working with wipes and handling of treated surfaces.

GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(Liquid)	Liquid		No	No

#### PROC 13

**Activities covered:** Immersion operations

Treatment of articles by dipping, pouring, immersing, soaking, washing out or washing in substances; including cold formation or resin type matrix. Includes handling of treated objects (e.g. after dyeing, plating,).

Substance is applied to a surface by low energy techniques such as dipping the article into a bath or pouring a preparation onto a surface.

GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(Liquid)	Liquid		No	No

#### PROC 14

**Activities covered:** Processing of preparations and/or substances (liquid and solid) into preparations or articles. Substances in the chemical matrix may be exposed to elevated mechanical and/or thermal energy conditions. Exposure is predominantly related to volatiles and/or generated fumes, dust may be formed as well.

GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(High)	Solid [Dustine ss]	High	Yes	Yes AFP = 4
W-GES-DU(Med)		Medium	Yes	No
W-GES-DU(Low)		Low	No	No
W-GES-DU(Liquid)	Liquid		No	No

#### PROC 15

**Activities covered:** Use of substances at small scale laboratory (< 1 l or 1 kg present at workplace). Larger laboratories and R+D installations should be treated as industrial processes.

GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(High)	Solid [Dustine ss]	High	Yes	No
W-GES-DU(Med)		Medium	No	No
W-GES-DU(Low)		Low	No	No
W-GES-DU(Liquid)	Liquid		No	No

#### PROC 17

**Activities covered:** Lubrication at high energy conditions (temperature, friction) between moving parts and substance; significant part of process is open to workers.

The metal working fluid may form aerosols or fumes due to rapidly moving metal parts.

GES	Physical form	Worker protection required	
		LEV	PPE
W-GES-DU(Liquid)	Liquid	No	No

#### PROC 19

**Activities covered:** Addresses occupations where intimate and intentional contact with substances occurs without any specific exposure controls other than PPE.

GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(High)	Solid [Dustine ss]	High	No	Yes AFP = 40
W-GES-DU(Med)		Medium	No	Yes AFP = 10
W-GES-DU(Low)		Low	No	No
W-GES-DU(Liquid)	Liquid		No	No

#### PROC 20

**Activities covered:** Motor and engine oils, brake fluids Also in these applications, the lubricant may be exposed to high energy conditions and chemical reactions may take place during use. Exhausted fluids need to be disposed of as waste. Repair and maintenance may lead to skin contact.

GES	Physical form	Worker protection required	
		LEV	PPE
W-GES-DU(Liquid)	Liquid	No	No

#### PROC 21

**Activities covered:** Manual cutting, cold rolling or assembly/disassembly of material/article (including metals in massive form), possibly resulting in the release of fibres, metal fumes or dust.

GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(High)	Solid [Dustine ss]	High	Yes	No
W-GES-DU(Med)		Medium	Yes	No
W-GES-DU(Low)		Low	Yes	No

#### PROC 22

**Activities covered:** Activities at smelters, furnaces, refineries, coke ovens.

Exposure related to dust and fumes to be expected. Emission from direct cooling may be relevant.

GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(High)	Solid [Dustine ss]	High	Yes	No
W-GES-DU(Med)		Medium	Yes	No
W-GES-DU(Low)		Low	Yes	No

#### PROC 23

**Activities covered:** Sand and die casting, tapping and casting melted solids, dressing of melted solids, hot dip galvanising, raking of melted solids in paving.

Exposure related to dust and fumes to be expected.

GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(High)	Solid [Dustine ss]	High	Yes	No
W-GES-DU(Med)		Medium	Yes	No
W-GES-DU(Low)		Low	Yes	No

#### PROC 24

**Activities covered:** Substantial thermal or kinetic energy applied to substance (including metals in massive form) by hot rolling/forming, grinding, mechanical cutting, drilling or sanding. Exposure is predominantly expected to be to dust.

Dust or aerosol emission as result of direct cooling may be expected.

GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(High)	Solid [Dustine ss]	High	Yes	Yes APF = 4
W-GES-DU(Med)		Medium	Yes	No
W-GES-DU(Low)		Low	Yes	No
<b>PROC 25</b>				
<b>Activities covered:</b> Transfer and handling of ores, concentrates, raw metal oxides and scrap; packaging, un-packaging, mixing/blending and weighing of metal powders or other minerals				
GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(High)	Solid [Dustine ss]	High	Yes	No
W-GES-DU(Med)		Medium	Yes	No
W-GES-DU(Low)		Low	Yes	No
<b>PROC 25</b>				
<b>Activities covered:</b> Welding, soldering, gouging, brazing, flame cutting. Exposure is predominantly expected to fumes and gases.				
GES	Physical form		Worker protection required	
			LEV	PPE
W-GES-DU(High)	Solid [Dustine ss]	High	Yes	Yes APF = 4
W-GES-DU(Med)		Medium	Yes	No
W-GES-DU(Low)		Low	Yes	No
<b>3. Guidance to DU to evaluate whether he works inside the boundaries set by the ES</b>				
<b>Environment:</b>				
<b>Scaling tool: Metals EUSES IT tool (free download: <a href="http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool">http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool</a>).</b>				
Scaling of the release to air and water environment includes: Refining of the release factor to air and waste water and/or the efficiency of the air filter and waste water treatment facility.				
It should be noted that the maximum allowable emissions to wastewater presented in this document have been modelled on the basis of standardised (default) assumptions regarding the efficiency of municipal sewage treatment plants (where present) and dilution/flow rate of receiving waters. These standardised assumptions may not accurately reflect the conditions that prevail at a particular site. As such, the information presented in this document should be regarded as a guidance tool only. It remains the responsibility of the user to ensure that a compound is used safely within the context of their site and in full consultation with the relevant local authorities.				
<b>Workers – Industrial:</b>				
<b>Scaling tool: MEASE - Occupational Exposure Assessment Tool for REACH (free download: <a href="http://www.ebrc.de/ebrc/ebrc-mease.php">http://www.ebrc.de/ebrc/ebrc-mease.php</a>).</b>				
Scaling considering duration and frequency of use: Collect process occupational exposure monitoring data.				
It should be noted that the evaluation of worker safety presented in this document is based on standardised (default) assumptions on levels of exposure associated with generic processes, the behaviour of a compound in a particular working environment and the presumed efficiency of Risk Management Measures (e.g. LEV; RPE). These standardised assumptions may not accurately reflect the conditions that prevail within a specific workplace. As such, the information presented in this document should be regarded as a guidance tool only. It remains the responsibility of the user to ensure that a compound is used safely within the context of their site and in full consultation with the relevant local authorities.				
Predictions for inhalation exposure in the workplace may be further refined using the modelling approach set out in the copper Risk Assessment Report (2008), Chapter 4.1.2, Human Health Effects.				

## Generic Exposure - Professional Setting

Exposure scenario – Exposure resulting from professional uses	
1. Title GES – Professional downstream use of Copper sulphate	
<b>Life cycle</b>	Use stage of Copper sulphate
<b>Free short title</b>	Generic professional use of Copper sulphate
<b>Systematic title based on use descriptor</b>	SU: SU22 – Professional use PC: Various PROC: 1, 2, 3, 4, 5, 8a, 8b, 9, 10, 11, 13, 15, 17, 19, 20, 21, 25, 26. [identified] ERC: 2, 3, 4, 5, 6a, 6b, 8a-f*, 9a*, 9b*, 10a*, 11a* [identified; *Wide dispersive use] spERC: F, U [where applicable]
<b>Processes, tasks, activities covered (workers)</b>	Downstream use of Copper sulphate All possible processes, tasks and activities described by the selected PROCs
2. Exposure scenario	
2.1 Contributing scenario (1) Controlling environmental exposure for <u>all professional DU</u> of Copper sulphate [[E-GES-DU1.0/2.0; E-GES-DU1.1[ERC]; E-GES-WDU[ERC]; E-GES-DU2.1[spERC]]]	
<b>Environmental related free short title</b>	Generic exposure of the environment from the professional DU of Copper sulphate
<b>Assessment Method</b>	Predicted (modelled) local and regional (measured) concentrations of copper are used for calculation of the PEC – Tools available: EUSES 2.0 / Suitable scaling tools
Product characteristics	
<u>Purity</u> : To be added by Supplier/DU <u>Form</u> : Solid (High, medium and low dustiness) or liquid (aqueous solution)	
GENERIC Exposure: All forms have been investigated where applicable.	
Frequency and duration of use	
Intermittent (used < 12 times per year for not more than 24 h) <u>or</u> continuous use/release GENERIC Exposure: Continuous production is assumed as a worst case. It is possible that use is not continuous; this has to be considered when estimating exposure.	
Environment factors not influenced by risk management	
Dilution factor of 10, based on flow rate of receiving surface water (m3/d, a default of 18,000 m3/d is assumed for a standard EU town. please note: the default flow rate will be rarely changeable for downstream uses).  GENERIC Exposure: Default for generic scenario: 18,000 m3/d, unless specified otherwise.	
Other given operational conditions affecting environmental exposure	
GENERIC Exposure: no operational conditions specified all wastewater emissions are based on ERC/spERC data.	
Technical conditions and measures at process level (source) to prevent release	
GENERIC Exposure: no operational conditions specified all wastewater emissions are based on ERC/spERC data.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
GENERIC Exposure assumptions: <b>Air</b> : 0.4% emission assumed irrespective of ERC. This value is taken from the worst-case available metal spERCs (Use of metals and metal compounds in metallic coating v1.1 Arche consultancy). This approach has been adopted due to negligible volatility of copper. The default ERC values for air emissions are unreasonably high. <b>Waste water</b> : Either; - No release to water, or - Release as dictated by appropriate ERC or spERC (see Section 2.1.1 for specific % releases). <b>Soil</b> : No significant direct releases assumed. However, where a municipal STP is used emissions via sewage sludge need to be taken into account.	
<b>Wide dispersive use</b> : In relation to releases to water, the scenario for both indoor and outdoor wide dispersive uses is based on the assumption that they occur in the urban infrastructure, are collected in a central public sewage system and are then treated by an STP. For outdoor uses, this scenario can be	

<p>considered a reasonable worst case. To assume that all releases occur on a paved surface of an urban infrastructure and are collected in a sewage system may be considered overly conservative, but this is balanced by the assumption that all releases to water are treated in an STP. Direct releases to air and soil are not considered in the wide dispersive use scenario.</p>	
<p><b>Organisational measures to prevent /limit release from site</b></p>	
<p>GENERIC Exposure: no operational conditions specified all wastewater emissions are based on ERC/spERC data.</p>	
<p><b>Conditions and measures related to municipal sewage treatment plant</b></p>	
<p>GENERIC Exposure assumptions: In cases where applicable: the default size has been used.</p>	
<p><b>Conditions and measures related to external treatment of waste for disposal</b></p>	
<p>GENERIC Exposure assumptions: no additional emissions to the environment via solid waste have been included in the assessment as disposal via appropriate waste streams have been assumed.</p>	
<p><b>Conditions and measures related to external recovery of waste</b></p>	
<p>GENERIC Exposure assumptions: no additional emissions to the environment via solid waste have been included in the assessment as disposal via appropriate waste streams have been assumed.</p>	
<p><b>Amounts used</b></p>	
<p>Amounts released in waste water <u>should not</u> result in environmental concentrations for each compartment that exceeds the established effect threshold value given in section 2.1.1. Information on associated default emissions to air and water is provided, based on specified default assumptions for RMM and the assumed characteristics of the receiving environment.</p>	
<p><b>2.1.1 Generic guidance – ERC/spERC related: Technical conditions and measures to control emissions to the environment resulting from all professional DU of Copper sulphate [E-GES-DU1.0/2.0; E-GES-DU1.1[ERC]; E-GES-WDU[ERC]; E-GES-DU2.1[spERC]]</b></p>	
<p><b>Effects and background data</b></p>	
<p><b>Effect threshold data [predicted no effect concentration (PNEC) data in the relevant environmental compartments cannot exceed these levels]</b></p>	
Micro-organisms in STP (mg Cu L <sup>-1</sup> )	0.23
Freshwater aquatic (mg Cu L <sup>-1</sup> )	0.0078
Freshwater sediment (mg Cu kg dwt <sup>-1</sup> )	87.1
Marine water (mg Cu L <sup>-1</sup> )	0.0056
Marine sediment (mg Cu kg dwt <sup>-1</sup> )	676
Terrestrial compartment (mg Cu kg dwt <sup>-1</sup> )	64.6
<p><b>Background level concentrations [existing copper concentrations to be add to the predicted environmental concentrations from processes to ensure the effect threshold concentration is not reached]</b></p>	
Freshwater aquatic (mg Cu L <sup>-1</sup> )	0.0029
Freshwater sediment (mg Cu kg dwt <sup>-1</sup> )	0
Marine water (mg Cu L <sup>-1</sup> )	0.0011
Marine sediment (mg Cu kg dwt <sup>-1</sup> )	16.1
Terrestrial compartment (mg Cu kg dwt <sup>-1</sup> )	24.4
<p>For individual assessments the default release data are available below in 2.1.1.1.</p>	
<p><b>2.1.1.1 Local site specific point source assessment</b></p>	
<p><b>E-GES-DU1.0/2.0</b></p>	
<p><b>Emissions covered: Tier 1 (ERC codes) Tier 2 (spERC) - No waste water releases</b></p>	
<b>Environmental Release Code</b>	<b>ANY</b>
<b>Life cycle stage (LCS)</b>	Formulation/Use
<b>Type of use in LCS</b>	Any
<b>Default release to air from process [%]</b>	0.004
<b>Default release to water from process [%]</b>	0
<b>Default release to soil from process [%]</b>	0
<p><b>Maximum off-site emission (via air) = 0.004% of total copper use as copper sulphate</b></p>	
<p><b>E-GES-DU1.1</b></p>	
<p><b>Emissions covered: Tier 1 (ERC codes) – waste water emission via STP [On-site WWTP can be introduced where applicable (used to reduce emission % further) but use of a sewage treatment plant (STP) presents a worst-case approach, as this allows for an assessment of risk to STP microorganisms, and the impact of sludge disposal to land.]</b></p>	

<b>Environmental Release Code</b>	<b>ERC 2</b>
Life cycle stage (LCS)	Formulation
Type of use in LCS	Not included into matrix
Default release to water from process [%]	2
<b>Environmental Release Code</b>	<b>ERC 3</b>
Life cycle stage (LCS)	Formulation
Type of use in LCS	Formulation in materials
Default release to water from process [%]	0.2
<b>Environmental Release Code</b>	<b>ERC 4</b>
Life cycle stage (LCS)	Use
Type of use in LCS	Processing aid
Default release to water from process [%]	100**
<b>Environmental Release Code</b>	<b>ERC 5</b>
Life cycle stage (LCS)	Use
Type of use in LCS	Industrial use resulting in inclusion into or onto a matrix
Default release to water from process [%]	50
<b>Environmental Release Code</b>	<b>ERC 6a</b>
Life cycle stage (LCS)	Use
Type of use in LCS	Intermediate
Default release to water from process [%]	2
<b>Environmental Release Code</b>	<b>ERC 6b</b>
Life cycle stage (LCS)	Use
Type of use in LCS	Reactive processing aid
Default release to water from process [%]	5
<b>Environmental Release Code</b>	<b>ERC 6d</b>
Life cycle stage (LCS)	Use
Type of use in LCS	Industrial use of process regulators for polymerisation processes in production of resins, rubbers, polymers
Default release to water from process [%]	0.005
<b>Environmental Release Code</b>	<b>ERC 7</b>
Life cycle stage (LCS)	Use
Type of use in LCS	Industrial use of substances in closed systems
Default release to water from process [%]	5
<b>Environmental Release Code</b>	<b>ERC 12a</b>
Life cycle stage (LCS)	Use
Type of use in LCS	Industrial processing of articles with abrasive techniques (low releases)
Default release to water from process [%]	2.5

#### Maximum off-site copper emission via water

Using the above information regarding emission factors and controls, the maximum off-site copper emission has been calculated to be either;

1. 0.8575 kg Cu/d assuming connection to a municipal STP and receiving water with a default flow rate of 18000 m<sup>3</sup>/d (dilution factor of 10).
2. 0.6174 kg Cu/d assuming direct release to receiving water [following on-site treatment] with a default flow rate of 18000 m<sup>3</sup>/d (dilution factor of 10).

These examples are intended to be illustrative. DU should confirm that they can support the environmental releases from their processes with the necessary monitoring and scaling calculations.

<b>2.1.1.2 Wide dispersive use assessment</b>	
<b>E-GES-WDU1.1</b>	
<b>Emissions covered: Tier 1 (ERC codes) – wide dispersive uses</b>	
It has not been possible to derive maximum allowable emissions for individual wide dispersive uses of copper sulphate. However, measured region-specific PEC data available for STP effluents from 3 EU countries (Belgium, the Netherlands and UK) range between 0.011 and 0.054 mg total Cu/l. The highest PEC for the STP of 0.054 mg total Cu/l, reported in the UK, was shown to be equivalent to 0.008 mg dissolved Cu/l.	
These data suggest that emissions to receiving water courses with dilutions $\geq 10 \leq 15$ would be sufficient to remove any concern for the aquatic environment as a result of wide dispersive uses of products containing Copper sulphate. This approach and these data have been presented and accepted within the VRA (2008) for the consideration of all copper inputs across the EU.	
For individual assessments the default release data are available below.	
<b>Environmental Release Code</b>	<b>ERC 8a</b>
<b>Life cycle stage (LCS)</b>	Wide dispersive use
<b>Type of use in LCS</b>	Wide dispersive indoor use of processing aids in open systems
<b>Default release to water from process [%]</b>	100
<b>Environmental Release Code</b>	<b>ERC 8b</b>
<b>Life cycle stage (LCS)</b>	Wide dispersive use
<b>Type of use in LCS</b>	Wide dispersive indoor use reaction on use in open systems
<b>Default release to water from process [%]</b>	2
<b>Environmental Release Code</b>	<b>ERC 8c</b>
<b>Life cycle stage (LCS)</b>	Wide dispersive use
<b>Type of use in LCS</b>	Wide dispersive indoor use resulting in inclusion into or onto a matrix in open systems
<b>Default release to water from process [%]</b>	1
<b>Environmental Release Code</b>	<b>ERC 8d</b>
<b>Life cycle stage (LCS)</b>	Wide dispersive use
<b>Type of use in LCS</b>	Wide dispersive indoor use of processing aids in open systems
<b>Default release to water from process [%]</b>	100
<b>Environmental Release Code</b>	<b>ERC 8e</b>
<b>Life cycle stage (LCS)</b>	Wide dispersive use
<b>Type of use in LCS</b>	Wide dispersive indoor use reaction on use in open systems
<b>Default release to water from process [%]</b>	2
<b>Environmental Release Code</b>	<b>ERC 8f</b>
<b>Life cycle stage (LCS)</b>	Wide dispersive use
<b>Type of use in LCS</b>	Wide dispersive indoor use resulting in inclusion into or onto a matrix in open systems
<b>Default release to water from process [%]</b>	1
<b>Environmental Release Code</b>	<b>ERC 9a</b>
<b>Life cycle stage (LCS)</b>	Wide dispersive use
<b>Type of use in LCS</b>	Wide dispersive indoor use of processing aids in closed systems
<b>Default release to water from process [%]</b>	N/A
<b>Environmental Release Code</b>	<b>ERC 9b</b>
<b>Life cycle stage (LCS)</b>	Wide dispersive use
<b>Type of use in LCS</b>	Wide dispersive outdoor use of processing aids in closed systems
<b>Default release to water from process [%]</b>	5
<b>Environmental Release Code</b>	<b>ERC 10a</b>
<b>Life cycle stage (LCS)</b>	Wide dispersive use
<b>Type of use in LCS</b>	Wide dispersive outdoor use resulting in inclusion into or onto a matrix in open systems
<b>Default release to water from process [%]</b>	0.16
<b>Environmental Release Code</b>	<b>ERC 10b</b>
<b>Life cycle stage (LCS)</b>	Wide dispersive use
<b>Type of use in LCS</b>	Wide dispersive indoor use resulting in inclusion into or onto a matrix in open systems
<b>Default release to water from process [%]</b>	100
<b>Environmental Release Code</b>	<b>ERC 11a</b>
<b>Life cycle stage (LCS)</b>	Wide dispersive use

Type of use in LCS	Wide dispersive indoor use resulting in inclusion into or onto a matrix in open systems
Default release to water from process [%]	0.05
Environmental Release Code	<b>ERC 11b</b>
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive indoor use resulting in inclusion into or onto a matrix in open systems
Default release to water from process [%]	100
<b>E-GES-DU2.1</b>	
<b>Emissions covered: Tier 2 (spERC codes) – waste water emission via STP</b> [On-site WWTP can be introduced where applicable (used to reduce emission % further) but use of a sewage treatment plant (STP) presents a worst-case approach, as this allows for an assessment of risk to STP microorganisms, and the impact of sludge disposal to land.]	
Environmental Release Code	<b>spERC Metal Compound Formulation</b>
Life cycle stage (LCS)	Formulation
Type of use in LCS	Formulating industries: <i>catalyst</i> , glass, pigments, paints, coatings, plastics, rubber and stabilisers, water treatment chemicals
Default release to air from process [%]	0.004
Default release to water from process [%]	0.5
Default release to soil from process [%]	0
Environmental Release Code	<b>spERC Metal Compound Use</b>
Life cycle stage (LCS)	Use
Type of use in LCS	Industrial use of metal compounds
Default release to air from process [%]	0.004
Default release to water from process [%]	0.1
Default release to soil from process [%]	0.6
<b>Maximum off-site copper emission via water</b>	
Using the above information regarding emission factors and controls, the maximum off-site copper emission has been calculated to be either;	
<ol style="list-style-type: none"> <li>0.8575 kg Cu/d assuming connection to a municipal STP and receiving water with a default flow rate of 18000 m<sup>3</sup>/d (dilution factor of 10), or</li> <li>0.6174 kg Cu/d assuming direct release to receiving water [following on-site treatment] with a default flow rate of 18000 m<sup>3</sup>/d (dilution factor of 10).</li> </ol>	
<u>This is only intended as an example and DU should ensure that they check that they can support the environmental releases from their processes with the necessary monitoring and scaling calculations.</u>	
<b>2.2 Contributing scenario (2) Controlling of workers exposure for all professional DU of Copper sulphate [W-GES-DU(High, Med, Low, Liquid)][PROC]</b>	
Workers related free short title	Generic exposure for professional workers exposed to Copper sulphate
Assessment Method	Estimation of exposure based on predicted data using MEASE
<b>Product characteristic</b>	
Solid (High, medium and low dustiness) and liquid (aqueous solution)	
<b>Amounts used</b>	
Varying (risk limited by exposure not quantities)	
<b>Frequency and duration of use/exposure</b>	
Daily > 4 hours [Typically 8 hour shift]	
<b>Human factors not influenced by risk management</b>	
Respiration volume under conditions of use	10 m <sup>3</sup> /8 h shift
Room size and ventilation rate	Room size is not specified as it is the breathable portion of air which is used to define the exposure and ventilation is used as an exposure modifier where LEV is required. See Section 2.2.1.
Area of skin contact with the substance under conditions of use	240 cm <sup>2</sup>
Body weight	70 kg
DNEL inhalation	1 mg/m <sup>3</sup>
DNEL dermal solids	9566.9 mg/day

DNEL dermal sol/slurry		956.9 mg/day		
<b>Other given operational conditions affecting workers exposure</b>				
Worst case assumptions from MEASE : Wide dispersive use, direct handling and extensive contact				
<b>Technical conditions and measures at process level (source) to prevent release</b>				
Activity controlled in accordance with PROC descriptor				
<b>Technical conditions and measures to control dispersion from source towards the worker</b>				
Specific details to be added by Supplier/ DU (see Section 2.2.1 for generic advice)				
<b>Organisational measures to prevent /limit releases, dispersion and exposure</b>				
Specific details to be added by Supplier/DU (good hygiene training and supervision assumed)				
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>				
Specific details to be added by Supplier/ DU (see Section 2.2.1 for generic advice)				
<b>2.2.1 Technical conditions and measures to control dispersion from source towards the worker and measures related to personal protection, hygiene and health evaluation [PW-GES-DU-High, Med, Low, Liquid]</b>				
<b>PROC 1</b>				
<b>Activities covered:</b> Use of the substances in high integrity contained system where little potential exists for exposures, e.g. any sampling via closed loop systems				
GES	Physical form		Worker protection required	
			LEV	PPE
PW-GES-DU(High)	Solid [Dustiness]	High	No	No
PW-GES-DU(Med)		Medium	No	No
PW-GES-DU(Low)		Low	No	No
PW-GES-DU(Liquid)	Liquid		No	No
<b>PROC 2</b>				
<b>Activities covered:</b> Continuous process but where the design philosophy is not specifically aimed at minimizing emissions It is not high integrity and occasional expose will arise e.g. through maintenance, sampling and equipment breakages				
GES	Physical form		Worker protection required	
			LEV	PPE
PW-GES-DU(High)	Solid [Dustiness]	High	Yes	No
PW-GES-DU(Med)		Medium	Yes	No
PW-GES-DU(Low)		Low	No	No
PW-GES-DU(Liquid)	Liquid		No	No
<b>PROC 3</b>				
<b>Activities covered:</b> Batch manufacture of a chemical or formulation where the predominant handling is in a contained manner, e.g. through enclosed transfers, but where some opportunity for contact with chemicals occurs, e.g. through sampling				
GES	Physical form		Worker protection required	
			LEV	PPE
PW-GES-DU(High)	Solid [Dustiness]	High	Yes	No
PW-GES-DU(Med)		Medium	Yes	No
PW-GES-DU(Low)		Low	No	No
PW-GES-DU(Liquid)	Liquid		No	No
<b>PROC 4</b>				
<b>Activities covered:</b> Use in batch manufacture of a chemical where significant opportunity for exposure arises, e.g. during charging, sampling or discharge of material, and when the nature of the design is likely to result in exposure				
GES	Physical form		Worker protection required	
			LEV	PPE
PW-GES-DU(High)	Solid [Dustiness]	High	Yes	Yes APF = 10
PW-GES-DU(Med)		Medium	Yes	No
PW-GES-DU(Low)		Low	Yes	No
PW-GES-DU(Liquid)	Liquid		No	No

<b>PROC 5</b>				
<b>Activities covered:</b> Manufacture or formulation of chemical products or articles using technologies related to mixing and blending of solid or liquid materials, and where the process is in stages and provides the opportunity for significant contact at any stage				
GES	Physical form		Worker protection required	
			LEV	PPE
PW-GES-DU(High)	Solid [Dustiness]	High	Yes	Yes APF = 10
PW-GES-DU(Med)		Medium	Yes	No
PW-GES-DU(Low)		Low	Yes	No
PW-GES-DU(Liquid)	Liquid		No	No
<b>PROC 8a</b>				
<b>Activities covered:</b> Sampling, loading, filling, transfer, dumping, bagging in <u>non-dedicated</u> facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected.				
GES	Physical form		Worker protection required	
			LEV	PPE
PW-GES-DU(High)	Solid [Dustiness]	High	Yes	Yes APF = 10
PW-GES-DU(Med)		Medium	Yes	No
PW-GES-DU(Low)		Low	No	No
PW-GES-DU(Liquid)	Liquid		No	No
<b>PROC 8b</b>				
<b>Activities covered:</b> Sampling, loading, filling, transfer, dumping, bagging in <u>dedicated</u> facilities. Exposure related to dust, vapour, aerosols or spillage, and cleaning of equipment to be expected.				
GES	Physical form		Worker protection required	
			LEV	PPE
PW-GES-DU(High)	Solid [Dustiness]	High	Yes	Yes APF = 4
PW-GES-DU(Med)		Medium	Yes	No
PW-GES-DU(Low)		Low	No	No
PW-GES-DU(Liquid)	Liquid		No	No
<b>PROC 9</b>				
<b>Activities covered:</b> Filling lines specifically designed to both capture vapour and aerosol emissions and minimise spillage.				
GES	Physical form		Worker protection required	
			LEV	PPE
PW-GES-DU(High)	Solid [Dustiness]	High	Yes	Yes APF = 4
PW-GES-DU(Med)		Medium	Yes	No
PW-GES-DU(Low)		Low	No	No
PW-GES-DU(Liquid)	Liquid		No	No
<b>PROC 10</b>				
<b>Activities covered:</b> Low energy spreading of e.g. coatings Including cleaning of surfaces. Substance can be inhaled as vapours, skin contact can occur through droplets, splashes, working with wipes and handling of treated surfaces.				
GES	Physical form		Worker protection required	
			LEV	PPE
PW-GES-DU(Liquid)	Liquid		No	No
<b>PROC 11</b>				
<b>Activities covered:</b> Air dispersive techniques. Spraying for surface coating, adhesives, polishes/cleaners, air care products, sandblasting. Substances can be inhaled as aerosols. The energy of the aerosol particles may require advanced exposure controls.				
GES	Physical form		Worker protection required	
			LEV	PPE

PW-GES-DU(Liquid)	Liquid	Yes	Yes APF = 10
<b>PROC 13</b>			
<b>Activities covered:</b> Immersion operations Treatment of articles by dipping, pouring, immersing, soaking, washing out or washing in substances; including cold formation or resin type matrix. Includes handling of treated objects (e.g. after dyeing, plating,). Substance is applied to a surface by low energy techniques such as dipping the article into a bath or pouring a preparation onto a surface.			
GES	Physical form	Worker protection required	
		LEV	PPE
PW-GES-DU(Liquid)	Liquid	No	No
<b>PROC 14</b>			
<b>Activities covered:</b> Processing of preparations and/or substances (liquid and solid) into preparations or articles. Substances in the chemical matrix may be exposed to elevated mechanical and/or thermal energy conditions. Exposure is predominantly related to volatiles and/or generated fumes, dust may be formed as well.			
GES	Physical form	Worker protection required	
		LEV	PPE
PW-GES-DU(High)	Solid [Dustiness]	High	Yes APF = 10
PW-GES-DU(Med)		Medium	No
PW-GES-DU(Low)		Low	No
PW-GES-DU(Liquid)	Liquid	No	No
<b>PROC 15</b>			
<b>Activities covered:</b> Use of substances at small scale laboratory (< 1 l or 1 kg present at workplace). Larger laboratories and R+D installations should be treated as industrial processes.			
GES	Physical form	Worker protection required	
		LEV	PPE
PW-GES-DU(High)	Solid [Dustiness]	High	No
PW-GES-DU(Med)		Medium	No
PW-GES-DU(Low)		Low	No
PW-GES-DU(Liquid)	Liquid	No	No
<b>PROC 17</b>			
<b>Activities covered:</b> Lubrication at high energy conditions (temperature, friction) between moving parts and substance; significant part of process is open to workers. The metal working fluid may form aerosols or fumes due to rapidly moving metal parts.			
GES	Physical form	Worker protection required	
		LEV	PPE
PW-GES-DU(Liquid)	Liquid	Yes	No
<b>PROC 19</b>			
<b>Activities covered:</b> Addresses occupations where intimate and intentional contact with substances occurs without any specific exposure controls other than PPE.			
GES	Physical form	Worker protection required	
		LEV	PPE
PW-GES-DU(High)	Solid [Dustiness]	High	Yes APF = 40 [exposure time <4h/d]
PW-GES-DU(Med)		Medium	Yes APF = 10
PW-GES-DU(Low)		Low	No
PW-GES-DU(Liquid)	Liquid	No	No

<b>PROC 20</b>				
<b>Activities covered:</b> Motor and engine oils, brake fluids Also in these applications, the lubricant may be exposed to high energy conditions and chemical reactions may take place during use. Exhausted fluids need to be disposed of as waste. Repair and maintenance may lead to skin contact.				
GES	Physical form		Worker protection required	
			LEV	PPE
PW-GES-DU(Liquid)	Liquid		No	No
<b>PROC 21</b>				
<b>Activities covered:</b> Manual cutting, cold rolling or assembly/disassembly of material/article (including metals in massive form), possibly resulting in the release of fibres, metal fumes or dust.				
GES	Physical form		Worker protection required	
			LEV	PPE
PW-GES-DU(Low)	Solid [Dustiness]	Low	No	No
<b>PROC 22</b>				
<b>Activities covered:</b> Welding, soldering, gouging, brazing, flame cutting. Exposure is predominantly expected to fumes and gases.				
GES	Physical form		Worker protection required	
			LEV	PPE
PW-GES-DU(High)	Solid [Dustiness]	High	Yes	Yes APF = 4
PW-GES-DU(Med)		Medium	Yes	Yes APF = 4
PW-GES-DU(Low)		Low	Yes	Yes APF = 4
<b>PROC 25</b>				
<b>Activities covered:</b> Welding, soldering, gouging, brazing, flame cutting. Exposure is predominantly expected to fumes and gases.				
GES	Physical form		Worker protection required	
			LEV	PPE
PW-GES-DU(High)	Solid [Dustiness]	High	Yes	No
PW-GES-DU(Med)		Medium	Yes	No
PW-GES-DU(Low)		Low	Yes	No
<b>PROC 26</b>				
<b>Activities covered:</b> Transfer and handling of ores, concentrates, raw metal oxides and scrap; packaging, un-packaging, mixing/blending and weighing of metal powders or other minerals.				
GES	Physical form		Worker protection required	
			LEV	PPE
PW-GES-DU(High)	Solid [Dustiness]	High	Yes	Yes APF = 10
PW-GES-DU(Med)		Medium	Yes	Yes APF = 4
PW-GES-DU(Low)		Low	Yes	No
<b>3. Guidance to DU to evaluate whether he works inside the boundaries set by the ES</b>				
<b>Environment:</b>				
<b>Scaling tool: Metals EUSES IT tool (free download: <a href="http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool">http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool</a>).</b>				
Scaling of the release to air and water environment includes: Refining of the release factor to air and waste water and/or the efficiency of the air filter and waste water treatment facility.				
It should be noted that the maximum allowable emissions to wastewater presented in this document have been modelled on the basis of standardised (default) assumptions regarding the efficiency of municipal sewage treatment plants (where present) and dilution/flow rate of receiving waters. These standardised assumptions may not accurately reflect the conditions that prevail at a particular site. As such, the information presented in this document should be regarded as a guidance tool only. It remains the responsibility of the user to ensure that a compound is used safely within the context of their site and in full consultation with the relevant local authorities.				

**Workers - Professional:**

**Scaling tool: MEASE - Occupational Exposure Assessment Tool for REACH (free download: <http://www.ebrc.de/ebrc/ebrc-mease.php>).**

Scaling considering duration and frequency of use. Collect process occupational exposure monitoring data.

It should be noted that the evaluation of worker safety presented in this document is based on standardised (default) assumptions on levels of exposure associated with generic processes, the behaviour of a compound in a particular working environment and the presumed efficiency of Risk Management Measures (e.g. LEV; RPE). These standardised assumptions may not accurately reflect the conditions that prevail within a specific workplace. As such, the information presented in this document should be regarded as a guidance tool only. It remains the responsibility of the user to ensure that a compound is used safely within the context of their site and in full consultation with the relevant local authorities.

Predictions for inhalation exposure in the workplace may be further refined using the modelling approach set out in the copper Risk Assessment Report (2008), Chapter 4.1.2, Human Health Effects.