The Chemical Safety Report (CSR) for copper sulphate pentahydrate lists downstream uses that have been identified by ourselves Each of these identified uses have been examined and sub-divided into a series of pre-defined processes resulting in workplace exposure (PROC codes) and environmental exposure (ERC codes). For each of these processes, standard assessment tools have been used to identify practices (including operating conditions and risk management measures) under which copper sulphate pentahydrate may "safely" be used at sites with standardized characteristics.

No attempt has been made in the CSR to further define the potential for overall exposure that may be associated with an identified use at a "real" site. Instead downstream users are invited to adapt the available exposure data to their own site-specific circumstances (with appropriate "scaling" of available data, if necessary) and develop their own safe emission scenarios.

In view of the highly complex nature of the CSR, generic information applicable to development of the eSDS has been extracted and presented in this document for clarity. This information comprises:

- Tabulated lists of identified uses, broken down to show processes that may lead to exposure of industrial workers, professional workers and the environment (as point sources and/or wide dispersive uses, as applicable).

- "Safe" use scenarios that have been determined for each PROC and ERC code under a variety of standardized circumstances, including relevant operating conditions and risk management measures.

In utilizing this information downstream users should review the detailed scenarios that have been developed for the PROC and ERC codes applicable to their uses of interest. Information on operating conditions and risk management measures that is applicable to the specific circumstances of their downstream uses can then be extracted and used to build up tailored safe-use scenarios.

1. PROC and ERC Codes Associated with Identified Uses

PROC and ERC codes associated with different Identified Uses are summarized in the following tables for Industrial workers and Professional workers. Information relating to Consumer use of products and articles is also presented (this is also applicable to workers who use these items).

Identified Industrial Uses and Associated PROC Codes

RELEVANT PROC	IDENTIFIED USE																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Absorbents	Adhesives	Catalysts	Ceramics	Coatings, inks	Cosmetics	Electroplating & galvanic	Fertiliser	Glass	Laboratory chemicals	Leather dyes	Lubricants & greases	Mineral flotation	Non-metal surface treatment	Photochemicals	Pigments	Polishes and waxes	Processing aids	Putties, fillers, construction chemicals	Raw material for non-ferrous smelting	Raw materials for copper compounds and fine chemicals	Rubber and plastics	Textile dyes	Washing and cleaning	Water treatment
PROC 1	✓		✓		✓	✓	✓					✓			✓			✓			✓			✓	
PROC 2			✓		✓	✓		✓				✓	✓	✓	✓	✓		✓			✓			✓	✓
PROC 3	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓		✓	✓	✓	✓	✓			
PROC 4		✓	✓		✓		✓	✓		✓		✓						✓			✓			✓	✓
PROC 5	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓		✓		✓		
PROC 7		✓			✓		✓		✓			✓							✓					✓	
PROC 8a		✓		✓	✓	✓					✓	✓		✓			✓	✓	✓		✓	✓	✓	✓	
PROC 8b	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
PROC 9		✓	✓		✓	✓	✓	✓	✓			✓		✓					✓			✓	✓		
PROC 10		✓			✓		✓					✓							✓					✓	
PROC 13		✓			✓		✓	✓	✓		✓	✓		✓					✓				✓	✓	
PROC 14		✓	✓	✓		✓			✓		✓								✓			✓			
PROC 15						✓	✓			✓		✓												✓	
PROC 17												✓												✓	
PROC 22									✓											✓					
PROC 23																				✓					
PROC 24																								✓	
PROC 25							✓																		

Identified Professional Uses and Associated PROC Codes

RELEVANT PROC	IDENTIFIED USE																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Absorbents	Adhesives	Catalysts	Ceramics	Coatings, inks	Cosmetics	Electroplating & galvanic	Fertiliser	Glass	Laboratory chemicals	Leather dyes	Lubricants & greases	Mineral flotation	Non-metal surface treatment	Photochemicals	Pigments	Polishes and waxes	Processing aids	Putties, fillers, construction chemicals	Raw material for non-ferrous smelting	Raw materials for copper compounds and fine chemicals	Rubber and plastics	Textile dyes	Washing and cleaning	Water treatment
PROC 1							✓					✓			✓										
PROC 2					✓			✓							✓										
PROC 3					✓		✓								✓										
PROC 4					✓		✓			✓															
PROC 5					✓		✓										✓								
PROC 8a		✓			✓							✓					✓								
PROC 8b		✓										✓					✓								
PROC 9		✓						✓																	
PROC 10		✓			✓							✓							✓						
PROC 11		✓			✓			✓				✓							✓						
PROC 13		✓					✓	✓				✓							✓						
PROC 15										✓															
PROC 17												✓													
PROC 19					✓														✓						
PROC 20												✓													
PROC 21				✓					✓																
PROC 25							✓																		
PROC 26								✓																	
PROC 0*																						✓			

* No significant exposure

Identified Consumer Uses – Service Life of Substances in Products and Articles

	IDENTIFIED USE																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Articles likely to be widely available	Absorbents	Adhesives	Catalysts	Ceramics	Coatings, inks	Cosmetics	Electroplating & galvanic	Fertiliser	Glass	Laboratory chemicals	Leather dyes	Lubricants & greases	Mineral flotation	Non-metal surface treatment	Photochemicals	Pigments	Polishes and waxes	Processing aids	Putties, fillers, construction chemicals	Raw material for non-ferrous smelting	Raw materials for copper compounds and fine chemicals	Rubber and plastics	Textile dyes	Washing and cleaning	Water treatment
		✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓

Identified Industrial Uses and Associated ERC Codes

RELEVANERC	IDENTIFIED USE																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Absorbents	Adhesives	Catalysts	Ceramics	Coatings, inks	Cosmetics	Electroplating & galvanic	Fertiliser	Glass	Laboratory chemicals	Leather dyes	Lubricants & greases	Mineral flotation	Non-metal surface treatment	Photochemicals	Pigments	Polishes and waxes	Processing aids	Putties, fillers, construction chemicals	Raw material for non-ferrous smelting	Raw materials for copper compounds and fine chemicals	Rubber and plastics	Textile dyes	Washing and cleaning	Water treatment
ERC 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓		
ERC 3	✓			✓			✓		✓				✓							✓			✓		
ERC 4			✓				✓					✓			✓			✓					✓	✓	✓
ERC 5		✓			✓			✓	✓		✓						✓		✓	✓			✓	✓	
ERC 6a			✓				✓	✓		✓								✓			✓				
ERC 6b	✓		✓				✓																✓	✓	
ERC 6d																						✓			
ERC 7												✓													
ERC 8a*																								✓	
ERC 8c*											✓			✓											
ERC 8d*											✓														
ERC 8e*											✓														
ERC10a*				✓																		✓			
ERC11a*				✓										✓					✓			✓			

*Wide dispersive use

Identified Professional Uses and Associated ERC Codes

RELEVANT ERC	IDENTIFIED USE																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Absorbents	Adhesives	Catalysts	Ceramics	Coatings, inks	Cosmetics	Electroplating & galvanic	Fertiliser	Glass	Laboratory chemicals	Leather dyes	Lubricants & greases	Mineral flotation	Non-metal surface treatment	Photochemicals	Pigments	Polishes and waxes	Processing aids	Putties, fillers, construction chemicals	Raw material for non-ferrous smelting	Raw materials for copper compounds and fine chemicals	Rubber and plastics	Textile dyes	Washing and cleaning	Water treatment
ERC 2								✓		✓															
ERC 3							✓																		
ERC 4							✓																		
ERC 5								✓																	
ERC 6a							✓			✓															
ERC 6b							✓																		
ERC 8a*												✓			✓										
ERC 8b*								✓																	
ERC 8c*		✓			✓												✓		✓						
ERC 8d*												✓					✓								
ERC 8e*								✓									✓								
ERC 8f*		✓			✓														✓						
ERC 9a*												✓													
ERC 9b*								✓				✓													
ERC10a*				✓															✓						
ERC11a*				✓					✓										✓						

* Wide dispersive use

Identified Consumer Uses – Service Life of Substances in Products and Articles and Associated ERC Codes

RELEVANT ERC	IDENTIFIED USE																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Absorbents	Adhesives	Catalysts	Ceramics	Coatings, inks	Cosmetics	Electroplating & galvanic	Fertiliser	Glass	Laboratory chemicals	Leather dyes	Lubricants & greases	Mineral flotation	Non-metal surface treatment	Photochemicals	Pigments	Polishes and waxes	Processing aids	Putties, fillers, construction chemicals	Raw material for non-ferrous smelting	Raw materials for copper com-pounds and fine chemicals	Rubber and plastics	Textile dyes	Washing and cleaning	Water treatment
Articles likely to be widely available		✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓
ERC 8a*																									
ERC 8b*																									
ERC 8c*																									
ERC 8d*																									
ERC 8e*																									
ERC 8f*													✓												
ERC 9a*																									
ERC 9b*																									
ERC10a*																									
ERC11a*																									
ERC 0#																									

* Wide dispersive use

#No significant exposure

spERC codes for both industrial and professional uses of copper compounds

In addition to the ERC codes, separate spERCs are available (developed by ARCHE consultants) for 'Metal compound formulation' [spERC F] and 'Industrial use of Metal compounds [spERC U]. These can be applied to downstream use processes that comply with the relevant on-site conditions.

spERC F: This spERC is considered appropriate for both open and closed systems using both wet and dry processes and is based on information gathered for metal compounds used in formulation activities. The activities listed include mixing and blending of metal compounds into preparations in the following formulating industries: catalysts, glass, pigments, paints, coatings, plastics, rubber stabilisers and water treatment chemicals (note, however, that the spERC may also be applied to other formulating industries, provided they meet the criteria discussed below). The spERC has been developed by considering how the existing appropriate RMMs can be used to achieve the necessary reduction in emissions. For air emissions, the spERC value was based on the finding that RMMs for air present in >80% of the sites included:

- Electrostatic precipitation;
- Fabric or bag filters (most common);
- Ceramic filters;
- Wet scrubbers (most common);
- Dry or semi-dry scrubbers.

From the available data, the maximum 90th percentile reported site-specific release factor to air (after RMM) from the formulation processes investigated was 0.004%.

For the releases to waste water the spERC value was based on the RMMs for water present in >60% of the sites including:

- Chemical precipitation;
- Sedimentation;
- Filtration;
- Electrolysis (rare).

The 50th percentile of the reported site-specific removal efficiency for 18 sites was 94% (50.00% – 93.30%). The maximum emission of the 90th percentiles of reported site-specific release factors to waste water was given as 0.5%. This is a worst-case assumption as waste water RMMs were confirmed at >60% site, suggesting that the 90th percentile release factor did not include RMMs. Therefore, an additional on-site removal step via an on-site WWTP may be added to the exposure scenario.

Emissions to soil were not considered to be relevant to metal compound formulation as the activities are undertaken largely indoors.

spERC U: This spERC is considered appropriate for both open and closed systems using both wet and dry processes and is based on information gathered for the use of metal compounds in the following industrial sectors: crystal manufacture, leather tanning, pigments, paints, coatings, plastics, rubber and textiles (note, however, that the spERC may also be applied to other sectors, provided they meet the criteria discussed below). The spERC has been developed by considering how the existing appropriate RMMs can be used to achieve the necessary reduction in emissions. For air emissions, the spERC value was based on the findings that the RMMs for air present in >50% of the sites included:

- Electrostatic precipitation;
- Fabric or bag filters (most common);
- Ceramic filters;
- Wet scrubbers (most common);
- Dry or semi-dry scrubbers.

From the available data the maximum 90th percentile reported site-specific release factor to air (after RMM) from the activities investigated was 0.1%.

For the releases to waste water the spERC value was based on the RMMs for water present in >50% of the sites including:

- Chemical precipitation;
- Sedimentation;
- Filtration;
- Electrolysis.

The 50th percentile of the reported site-specific removal efficiency for 12 sites was 95% (50.00% – 99.95%). The maximum emission of the 90th percentiles of reported site-specific release factors to waste water was given as 0.6% (after on-site RMM).

While site specific scaling with additional RMMs will be possible for individual sites, insufficient information is currently available for any further amendment of the generic spERC scenario.

The exposure resulting from the generic scenarios is presented below.

2. Exposure Scenarios Determined for Each PROC and ERC Code

All downstream use exposure scenario predictions are based on the standard EUSES 2.0 model for the environment and MEASE for worker exposure, in line with the available guidance for REACH.

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[1]). 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
E-GES-DU	Tier	1	Tier 1 – defaults from ERC codes
		2	Tier 2 – spERC[†]/measured data
	Waste water treatment Environmental	0	No waste water emission
		1	Waste water treated once at STP*
	re- lease category (ERC)	(2)	Formulation of mixtures
		(3)	Formulation in materials
		(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
E-GES-WDU	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
W/PW-GES-DU	Substance form	(High)	Solid, high dustiness
		(Med)	Solid, medium dustiness
		(Low)	Solid, low dustiness

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

Scenario		Description
	(Liquid)	Liquid, aqueous solution or slurry
C-GES-DU	Various unspecified articles and products	

[†] 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 indus- trial 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.

3. eSDS Examples

The following eSDS examples present the environmental and worker exposure for industrial, professional and consumer uses of copper sulphate as defined by the generic approach adopted within the CSR submitted in 2010. These are ONLY intended to serve as an example and require further amendment by suppliers/downstream users in the development of specific eSDS documentation.

All text in italics is guidance provided by the ECHA [Guidance on information requirements and chemical safety assessment: Exposure scenario format – in part D: Exposure scenario building; in part F: CSR format. Source: *http://guidance.echa.europa.eu/docs/guidance_document/information_requirements_ESformat_en.pdf*] *or refer to text that the 'Supplier/DU' may need to note/amend/remove in order to adopt the same format for their own substance/product specific eSDS.*

Generic Exposure - Industrial Setting

Exposure Scenario – Exposure resulting from industrial uses	
1. Title GES – Industrial downstream use of Copper sulphate	
Life cycle	Use (industrial) stage of copper sulphate
Free short title	Generic downstream industrial use of copper sulphate
Systematic title based on use descriptor	*List of all use descriptors related to the life cycle stage and all the uses under it; include market sector (by PC), if relevant;* 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]
Processes, tasks, activities covered (workers)	Downstream use of Copper sulphate All possible processes, tasks and activities described by the selected PROCs
Further explanations (if needed) Copper sulphate is widely used within downstream industrial processes, which are covered within this generic exposure scenario. *Specific details of each industrial process must be added here by the individual DU.*	
2. Exposure scenario	
2.1 Contributing scenario (1) Controlling environmental exposure for all industrial DU of Copper sulphate [E-GES-DU1.0/2.0/1.1[ERC/spERC]/2.1[ERC/spERC]]	
Environmental related free short title	Generic exposure of the environment from the industrial DU of Copper sulphate

Assessment Method	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	
Purity: *To be added by Supplier/DU* Form: *Solid (High, medium and low dustiness) or liquid (aqueous solution)*	

See Section 2.1.1: GENERIC Exposure: All forms have been investigated where applicable.

Frequency and duration of use

To be added by Supplier/DU:
Intermittent (used < 12 times per year for not more than 24 h) or continuous use/release

See Section 2.1.1: 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

To be added by Supplier/DU: *[only where releases to waste water occurs as a result of use]*
Flow rate of receiving waters
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).*

See Section 2.1.1: GENERIC Exposure: Default for generic scenario: 18,000 m3/d, unless specified otherwise.

Other given operational conditions affecting environmental exposure

To be added by Supplier/DU:
Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process (via air and waste water); dry or water based processes; conditions related to temperature and pressure; indoor or outdoor use of products; work in confined area or open air, e.g.;

- *In the wet process, most of the operations are in wet phase.*
- *In the direct and indirect dry process, all operational conditions are dry throughout the process; there are no process waters; high temperature steps;*
- *Even when no process waters (e.g. when dry process throughout), some non-process water can be generated containing zinc (e.g. from cleaning)*
- *All processes are performed indoor in a confined area. All residues containing zinc are recycled.*

See Section 2.1.1: 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

To be added by Supplier/DU: *Process design aiming to prevent releases and hence exposure to the environment; this includes in particular conditions ensuring rigorous containment; performance of the containment to be specified (e.g. by quantification of a release factors in section 2.1.1 below), e.g.;*

- *Process enclosures and closed circuits where relevant and possible.*
- *Dust capturing and removal techniques are applied on local exhaust ventilation on furnaces and other work areas with potential dust generation.*
- *Containment of liquid volumes in sumps to collect/prevent accidental spillage*

See Section 2.1.1: 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

To be added by Supplier/DU: *Technical measures, e.g. on-site waste water and waste treatment techniques, scrubbers, filters and other technical measures aiming at reducing releases to air, sewage system, surface water or soil; this includes strictly controlled conditions (procedural and control technology) to minimise emissions; specify effectiveness of measures; specify the size of industrial sewage treatment plant (m3/d), degradation effectiveness and sludge treatment (if applicable);*

- *On-site waste water treatment techniques can be applied to prevent releases to water (if applicable) e.g. chemical precipitation, sedimentation and filtration (efficiency **90-99.98**%).*
- *Air emissions are controlled by use of bag-house filters and/or other air emission abatement devices e.g. fabric (or bag) filters (up to 99% efficiency), wet scrubbers (**50-99**% efficiency). This may create a general negative pressure in the building.*

See Section 2.1.1: GENERIC Exposure assumptions:

Air: 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.

Waste water : Either;

- No release to water, or
- Release as dictated by appropriate ERC or spERC (see Section 2.1.1 for specific % releases).

Soil: No significant direct releases assumed. However, where a municipal STP is used emissions via sewage sludge need to be taken into account.

Wide dispersive use: 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.

Organisational measures to prevent /limit release from site

To be added by Supplier/DU: *Specific organisational measures or measures needed to support the functioning of particular technical measures. Those measures need to be reported in particular for demonstrating strictly controlled conditions. i.e.*

- *In general emissions are controlled and prevented by implementing an integrated management system e.g. ISO 9000, ISO 1400X series, or alike, and, when applicable, by being IPPC-compliant.*
  - *Such management system should include general industrial hygiene practice e.g.:*
    - *information and training of workers,*
    - *regular cleaning of equipment and floors,*
    - *procedures for process control and maintenance,*
- *Treatment and monitoring of releases to outside air, and exhaust gas streams (process & hygiene), according to national regulation.*
- *SEVESO 2 compliance, if applicable*

See Section 2.1.1: GENERIC Exposure: no operational conditions specified all wastewater emissions are based on ERC/spERC data.

Conditions and measures related to municipal sewage treatment plant

To be added by Supplier/DU: *Size of municipal sewage system/treatment plant (m3/d); specify degradation effectiveness; sludge treatment technique (disposal or recovery); measures to limit air emissions from sewage treatment (if applicable);* please note*: the default size of the municipal STP (2000 m3/d) will be rarely changeable for downstream uses.*

See Section 2.1.1: GENERIC Exposure assumptions: In cases where applicable: the default size has been used.

Conditions and measures related to external treatment of waste for disposal

To be added by Supplier/DU: *Fraction of used amount transferred to external waste treatment for disposal; type of suitable treatment for waste generated by workers uses, e.g. hazardous waste incineration, chemical-physical treatment for emulsions, chemical oxidation of aqueous waste; specify effectiveness of treatment;*

- *If any, all hazardous wastes are treated by certified contractors according to EU and national legislation.*
- *Users of Cu-compounds have to favour the recycling channels of the end-of-life products*
- *Users of Cu-compounds have to minimize Cu-containing waste, promote recycling routes and, for the remaining, dispose the waste streams according the Waste regulation.*

See Section 2.1.1: 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.

Conditions and measures related to external recovery of waste

To be added by Supplier/DU: *Fraction of used amount transferred to external waste treatment for recovery: specify type of suitable recovery specify type of suitable recovery operations for waste generated by workers uses, e.g. re-distillation of solvents, refinery process for lubricant waste, recovery of slags, heat recovery out-side waste incinerators; specify effectiveness of measure;*

- *All residues are recycled or handled and conveyed according to waste legislation.*

See Section 2.1.1: 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.

Amounts used

To be added by Supplier/DU: *Daily and annual amount per site (for uses in industrial setting) or daily and annual amount for wide disperse uses*

See Section 2.1.1 for generic guidance on allowable use of 'copper' within copper sulphate: Amounts released in waste water should not 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.

2.1.1Generic guidance – ERC/spERC related: Technical conditions and measures to control emissions to the environment resulting from all industrial DU of Copper sulphate [E-GES-DU1.0/2.0; E-GES-DU1.1[ERC]; E-GES-WDU[ERC]; E-GES-DU2.1[spERC]]

Effects and background data

Effect threshold data [predicted no effect concentration (PNEC) data in the relevant environmental compartments cannot exceed these levels]

Micro-organisms in STP (mg Cu L^{-1})	0.23
Freshwater aquatic (mg Cu L^{-1})	0.0078
Freshwater sediment (mg Cu kg dwt^{-1})	87.1
Marine water (mg Cu L^{-1})	0.0056
Marine sediment (mg Cu kg dwt^{-1})	676
Terrestrial compartment (mg Cu kg dwt^{-1})	64.6

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]

Freshwater aquatic (mg Cu L^{-1})	0.0029
Freshwater sediment (mg Cu kg dwt^{-1})	0
Marine water (mg Cu L^{-1})	0.0011
Marine sediment (mg Cu kg dwt^{-1})	16.1
Terrestrial compartment (mg Cu kg dwt^{-1})	24.4

For individual assessments the default release data are available below in 2.1.1.1.

2.1.1.1 Local site specific point source assessment

E-GES-DU1.0/2.0

Emissions covered: Tier 1 (ERC codes) Tier 2 (spERC) - No waste water releases

Environmental Release Code	**ANY**
Life cycle stage (LCS)	Formulation/Use
Type of use in LCS	Any
Default release to air from process [%]	0.004
Default release to water from process [%]	0

Default release to soil from process [%]	0
Maximum off-site emission (via air) = 0.004% of total copper use as copper sulphate	
E-GES-DU1.1	
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.**]**	
Environmental Release Code	**ERC 2**
Life cycle stage (LCS)	Formulation
Type of use in LCS	Not included into matrix
Default release to water from process [%]	2
Environmental Release Code	**ERC 3**
Life cycle stage (LCS)	Formulation
Type of use in LCS	Formulation in materials
Default release to water from process [%]	0.2
Environmental Release Code	**ERC 4**
Life cycle stage (LCS)	Use
Type of use in LCS **Default release to water from process [%]**	Processing aid 100**
Environmental Release Code	**ERC 5**
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

Environmental Release Code	**ERC 6a**
Life cycle stage (LCS)	Use
Type of use in LCS	Intermediate
Default release to water from process [%]	2
Environmental Release Code	**ERC 6b**
Life cycle stage (LCS)	Use
Type of use in LCS	Reactive processing aid
Default release to water from process [%]	5
Environmental Release Code	**ERC 6d**
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
Environmental Release Code	**ERC 7**
Life cycle stage (LCS)	Use
Type of use in LCS	Industrial use of substances in closed systems
Default release to water from process [%]	5
Environmental Release Code	**ERC 12a**
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^3/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^3/d (dilution factor of 10).

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.

2.1.1.2 Wide dispersive use assessment

E-GES-WDU1.1

Emissions covered: Tier 1 (ERC codes) – wide dispersive uses

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 ≥10 ≤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.

Environmental Release Code	**ERC 8a**
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive indoor use of processing aids in open systems
Default release to water from process [%]	100
Environmental Release Code	**ERC 8b**
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive indoor use reaction on use in open systems
Default release to water from process [%]	2
Environmental Release Code	**ERC 8c**
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 [%]	1
Environmental Release Code	**ERC 8d**
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive indoor use of processing aids in open systems
Default release to water from process [%]	100
Environmental Release Code	**ERC 8e**
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive indoor use reaction on use in open systems
Default release to water from process [%]	2
Environmental Release Code	**ERC 8f**
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 [%]	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
E-GES-DU2.1	

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: *catalyst*, 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
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^3/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^3/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]]	
Workers related free short title	Generic exposure for workers exposed to Copper sulphate
Assessment Method	Estimation of exposure based on predicted data using MEASE
Product characteristic	
Solid (High, medium and low dustiness) and liquid (aqueous solution)	
Amounts used	
Varying (risk limited by exposure not quantities)	
Frequency and duration of use/exposure	
Daily > 4 hours [Typically 8 hour shift]	
Human factors not influenced by risk management	
Respiration volume under conditions of use	10 m^3/8 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^2
Body weight	70 kg
DNEL inhalation	1 mg/m^3
DNEL dermal solids	9566.9 mg/day
DNEL dermal sol/slurry	956.9 mg/day
Other given operational conditions affecting workers exposure	
Worst case assumptions from MEASE: Wide dispersive use, direct handling and extensive contact	
Technical conditions and measures at process level (source) to prevent release	
Activity controlled in accordance with PROC descriptor	
Technical conditions and measures to control dispersion from source towards the worker	
Specific details to be added by Supplier/DU (see Section 2.2.1 for generic advice)	

Organisational measures to prevent /limit releases, dispersion and exposure
Specific details to be added by Supplier/DU (good hygiene training and supervision assumed)
Conditions and measures related to personal protection, hygiene and health evaluation
Specific details to be added by Supplier/DU (see Section 2.2.1 for generic advice)
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]]
PROC 1
Activities covered: 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 [Dusti-ness]	High	No	No
W-GES-DU(Med)		Medium	No	No
W-GES-DU(Low)		Low	No	No
W-GES-DU(Liquid)	Liquid		No	No

PROC 2

Activities covered: 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 [Dusti-ness]	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 3

Activities covered: 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 [Dusti-ness]	High	Yes	No
W-GES-DU(Med)		Medium	Yes	No
W-GES-DU(Low)		Low	No	No
W-GES-DU(Liquid)	Liquid		No	No

PROC 4

Activities covered: 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 [Dusti-ness]	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 5

Activities covered: 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 [Dusti-ness]	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 7

Activities covered: 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

PROC 8a

Activities covered: Sampling, loading, filling, transfer, dumping, bagging in non- 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 [Dusti-ness]	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

PROC 8b				
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 [Dusti-ness]	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 [Dusti-ness]	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 dying, 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 [Dusti-ness]	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 [Dusti-ness]	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 [Dusti-ness]	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 [Dusti-ness]	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 [Dusti-ness]	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 [Dusti-ness]	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 [Dusti-ness]	High	Yes	Yes APF = 4
W-GES-DU(Med)		Medium	Yes	No
W-GES-DU(Low)		Low	Yes	No

PROC 25

Activities covered: 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 [Dusti-ness]	High	Yes	No
W-GES-DU(Med)		Medium	Yes	No
W-GES-DU(Low)		Low	Yes	No

PROC 25

Activities covered: 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 [Dusti-ness]	High	Yes	Yes APF = 4
W-GES-DU(Med)		Medium	Yes	No
W-GES-DU(Low)		Low	Yes	No

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

Environment:

Scaling tool: Metals EUSES IT tool (free download: http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool).

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 – Industrial:

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.

Generic Exposure - Professional Setting

Exposure scenario – Exposure resulting from professional uses	
1. Title GES – Professional downstream use of Copper sulphate	
Life cycle	Use stage of Copper sulphate
Free short title	Generic professional use of Copper sulphate
Systematic title based on use descriptor	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]
Processes, tasks, activities covered (workers)	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 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]]]	
Environmental related free short title	Generic exposure of the environment from the professional DU of Copper sulphate
Assessment Method	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	
Purity: *To be added by Supplier/DU* Form: Solid (High, medium and low dustiness) or liquid (aqueous solution) See Section 2.1.1: GENERIC Exposure: All forms have been investigated where applicable.	
Frequency and duration of use	
To be added by Supplier/DU: *Intermittent (used < 12 times per year for not more than 24 h) or continuous use/release* See Section 2.1.1: 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	
To be added by Supplier/DU: *[only where releases to waste water occurs as a result of use]* *Flow rate of receiving waters* *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).* See Section 2.1.1: GENERIC Exposure: Default for generic scenario: 18,000 m3/d, unless specified otherwise.	
Other given operational conditions affecting environmental exposure	
To be added by Supplier/DU: *Other given operational conditions: e.g. technology or process techniques determining the initial release of substance from process (via air and waste water); dry or water based processes; conditions related to temperature and pressure; indoor or outdoor use of products; work in confined area or open air, e.g.;* • *In the wet process, most of the operations are in wet phase.* • *In the direct and indirect dry process, all operational conditions are dry throughout the process; there are no process waters; high temperature steps;* • *Even when no process waters (e.g. when dry process throughout), some non-process water can be generated containing zinc (e.g. from cleaning)* • *All processes are performed indoor in a confined area. All residues containing zinc are recycled.* See Section 2.1.1: 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	

To be added by Supplier/DU: *Process design aiming to prevent releases and hence exposure to the environment; this includes in particular conditions ensuring rigorous containment; performance of the containment to be specified (e.g. by quantification of a release factors in section 2.1.1 below), e.g.;*

- *Process enclosures and closed circuits where relevant and possible.*
- *Dust capturing and removal techniques are applied on local exhaust ventilation on furnaces and other work areas with potential dust generation.*
- *Containment of liquid volumes in sumps to collect/prevent accidental spillage*

See Section 2.1.1: 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

To be added by Supplier/DU: *Technical measures, e.g. on-site waste water and waste treatment techniques, scrubbers, filters and other technical measures aiming at reducing releases to air, sewage system, surface water or soil; this includes strictly controlled conditions (procedural and control technology) to minimise emissions; specify effectiveness of measures; specify the size of industrial sewage treatment plant (m3/d), degradation effectiveness and sludge treatment (if applicable);*

- *On-site waste water treatment techniques can be applied to prevent releases to water (if applicable) e.g. chemical precipitation, sedimentation and filtration (efficiency **90-99.98**%).*
- *Air emissions are controlled by use of bag-house filters and/or other air emission abatement devices e.g. fabric (or bag) filters (up to 99% efficiency), wet scrubbers (**50-99**% efficiency). This may create a general negative pressure in the building.*

See Section 2.1.1: GENERIC Exposure assumptions:

Air: 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.

Waste water : Either;

- No release to water, or
- Release as dictated by appropriate ERC or spERC (see Section 2.1.1 for specific % releases).

Soil: No significant direct releases assumed. However, where a municipal STP is used emissions via sewage sludge need to be taken into account.

Wide dispersive use: 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.

Organisational measures to prevent /limit release from site

To be added by Supplier/DU: *Specific organisational measures or measures needed to support the functioning of particular technical measures. Those measures need to be reported in particular for demonstrating strictly controlled conditions. i.e.*

- *In general emissions are controlled and prevented by implementing an integrated management system e.g. ISO 9000, ISO 1400X series, or alike, and, when applicable, by being IPPC-compliant.*
  - *Such management system should include general industrial hygiene practice e.g.:*
    - *information and training of workers,*
    - *regular cleaning of equipment and floors,*
    - *procedures for process control and maintenance,*
- *Treatment and monitoring of releases to outside air, and exhaust gas streams (process & hygiene), according to national regulation.*
- *SEVESO 2 compliance, if applicable*

See Section 2.1.1: GENERIC Exposure: no operational conditions specified all wastewater emissions are based on ERC/spERC data.

Conditions and measures related to municipal sewage treatment plant
To be added by Supplier/DU: *Size of municipal sewage system/treatment plant (m3/d); specify degradation effectiveness; sludge treatment technique (disposal or recovery); measures to limit air emissions from sewage treatment (if applicable);* please note*: the default size of the municipal STP (2000 m3/d) will be rarely changeable for downstream uses.* See Section 2.1.1: GENERIC Exposure assumptions: In cases where applicable: the default size has been used.
Conditions and measures related to external treatment of waste for disposal
To be added by DU: *Fraction of used amount transferred to external waste treatment for disposal; type of suitable treatment for waste generated by workers uses, e.g. hazardous waste incineration, chemical-physical treatment for emulsions, chemical oxidation of aqueous waste; specify effectiveness of treatment;* • *If any, all hazardous wastes are treated by certified contractors according to EU and national legislation.* • *Users of Cu-compounds have to favour the recycling channels of the end-of-life products* • *Users of Cu-compounds have to minimize Cu-containing waste, promote recycling routes and, for the remaining, dispose the waste streams according the Waste regulation.* See Section 2.1.1: 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.
Conditions and measures related to external recovery of waste
To be added by Supplier/DU: *Fraction of used amount transferred to external waste treatment for recovery: specify type of suitable recovery specify type of suitable recovery operations for waste generated by workers uses, e.g. re-distillation of solvents, refinery process for lubricant waste, recovery of slags, heat recovery out-side waste incinerators; specify effectiveness of measure;* • *All residues are recycled or handled and conveyed according to waste legislation.* See Section 2.1.1: 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.
Amounts used
To be added by Supplier/DU: *Daily and annual amount per site (for uses in industrial setting) or daily and annual amount for wide disperse uses* See Section 2.1.1 for generic guidance on allowable use of 'copper' within copper sulphate: Amounts released in waste water should not 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.

2.1.1Generic 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]]

Effects and background data

Effect threshold data [predicted no effect concentration (PNEC) data in the relevant environmental compartments cannot exceed these levels]	
Micro-organisms in STP (mg Cu L^{-1})	0.23
Freshwater aquatic (mg Cu L^{-1})	0.0078
Freshwater sediment (mg Cu kg dwt^{-1})	87.1
Marine water (mg Cu L^{-1})	0.0056
Marine sediment (mg Cu kg dwt^{-1})	676
Terrestrial compartment (mg Cu kg dwt^{-1})	64.6
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]	
Freshwater aquatic (mg Cu L^{-1})	0.0029
Freshwater sediment (mg Cu kg dwt^{-1})	0
Marine water (mg Cu L^{-1})	0.0011
Marine sediment (mg Cu kg dwt^{-1})	16.1
Terrestrial compartment (mg Cu kg dwt^{-1})	24.4

For individual assessments the default release data are available below in 2.1.1.1.

2.1.1.1 Local site specific point source assessment	
E-GES-DU1.0/2.0	
Emissions covered: Tier 1 (ERC codes) Tier 2 (spERC) - No waste water releases	
Environmental Release Code	**ANY**
Life cycle stage (LCS)	Formulation/Use
Type of use in LCS	Any
Default release to air from process [%]	0.004
Default release to water from process [%]	0
Default release to soil from process [%]	0
Maximum off-site emission (via air) = 0.004% of total copper use as copper sulphate	
E-GES-DU1.1	
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.**]**	
Environmental Release Code	**ERC 2**
Life cycle stage (LCS)	Formulation
Type of use in LCS	Not included into matrix
Default release to water from process [%]	2
Environmental Release Code	**ERC 3**
Life cycle stage (LCS)	Formulation
Type of use in LCS	Formulation in materials
Default release to water from process [%]	0.2
Environmental Release Code	**ERC 4**
Life cycle stage (LCS)	Use
Type of use in LCS	Processing aid
Default release to water from process [%]	100**
Environmental Release Code	**ERC 5**
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
Environmental Release Code	**ERC 6a**
Life cycle stage (LCS)	Use
Type of use in LCS	Intermediate
Default release to water from process [%]	2

Environmental Release Code	**ERC 6b**
Life cycle stage (LCS)	Use
Type of use in LCS	Reactive processing aid
Default release to water from process [%]	5
Environmental Release Code	**ERC 6d**
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
Environmental Release Code	**ERC 7**
Life cycle stage (LCS)	Use
Type of use in LCS	Industrial use of substances in closed systems
Default release to water from process [%]	5
Environmental Release Code	**ERC 12a**
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^3/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^3/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.

2.1.1.2 Wide dispersive use assessment

E-GES-WDU1.1

Emissions covered: Tier 1 (ERC codes) – wide dispersive uses

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 ≥10 ≤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.

Environmental Release Code	**ERC 8a**
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive indoor use of processing aids in open systems
Default release to water from process [%]	100
Environmental Release Code	**ERC 8b**
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive indoor use reaction on use in open systems
Default release to water from process [%]	2
Environmental Release Code	**ERC 8c**
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 [%]	1
Environmental Release Code	**ERC 8d**
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive indoor use of processing aids in open systems
Default release to water from process [%]	100
Environmental Release Code	**ERC 8e**
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive indoor use reaction on use in open systems
Default release to water from process [%]	2
Environmental Release Code	**ERC 8f**
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 [%]	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

E-GES-DU2.1

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: *catalyst*, 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

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^3/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^3/d (dilution factor of 10).

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.

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

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

Product characteristic

Solid (High, medium and low dustiness) and liquid (aqueous solution)	
Amounts used	
Varying (risk limited by exposure not quantities)	
Frequency and duration of use/exposure	
Daily > 4 hours [Typically 8 hour shift]	
Human factors not influenced by risk management	
Respiration volume under conditions of use	10 m^3/8 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^2
Body weight	70 kg
DNEL inhalation	1 mg/m^3
DNEL dermal solids	9566.9 mg/day
DNEL dermal sol/slurry	956.9 mg/day
Other given operational conditions affecting workers exposure	
Worst case assumptions from MEASE : Wide dispersive use, direct handling and extensive contact	
Technical conditions and measures at process level (source) to prevent release	
Activity controlled in accordance with PROC descriptor	
Technical conditions and measures to control dispersion from source towards the worker	
Specific details to be added by Supplier/ DU (see Section 2.2.1 for generic advice)	
Organisational measures to prevent /limit releases, dispersion and exposure	
Specific details to be added by Supplier/DU (good hygiene training and supervision assumed)	
Conditions and measures related to personal protection, hygiene and health evaluation	
Specific details to be added by Supplier/ DU (see Section 2.2.1 for generic advice)	

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]

PROC 1

Activities covered: 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

PROC 2

Activities covered: 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

PROC 3

Activities covered: 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	High	Yes	No
PW-GES-DU(Med)		Medium	Yes	No

PW-GES-DU(Low)	[Dustiness]	Low	No	No
PW-GES-DU(Liquid)	Liquid		No	No
PROC 4				
Activities covered: 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
PROC 5				
Activities covered: 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
PROC 8a				
Activities covered: Sampling, loading, filling, transfer, dumping, bagging in non- 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**
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
PROC 8b				
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**
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
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**
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
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**

PW-GES-DU(Liquid)	Liquid	No	No

PROC 11

Activities covered: 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

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 dying, 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

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
PW-GES-DU(High)	Solid [Dustiness]	High	Yes	Yes APF = 10
PW-GES-DU(Med)		Medium	No	No
PW-GES-DU(Low)		Low	No	No
PW-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
PW-GES-DU(High)	Solid [Dustiness]	High	Yes	No
PW-GES-DU(Med)		Medium	No	No
PW-GES-DU(Low)		Low	No	No
PW-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
PW-GES-DU(Liquid)	Liquid	Yes	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
PW-GES-DU(High)	Solid [Dustiness]	High	No	Yes APF = 40 [exposure time <4h/d]
PW-GES-DU(Med)		Medium	No	Yes APF = 10
PW-GES-DU(Low)		Low	No	No

PW-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**
PW-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**
PW-GES-DU(Low)	Solid [Dustiness]	Low	No	No
PROC 22				
Activities covered: 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
PROC 25				
Activities covered: 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
PROC 26				
Activities covered: Transfer and handling of ores, concentrates, raw metal oxides and scrap; packaging, un-packaging, mix-ing/blending and weighing of metal powders or other minerals.				
GES	**Physical form**		**Worker protection required**	
			LEV	**PPE**
PW-GES-DU(High)	Solid	High	Yes	Yes APF = 10
PW-GES-DU(Med)	[Dustiness]	Medium	Yes	Yes APF = 4
PW-GES-DU(Low)		Low	Yes	No
3. Guidance to DU to evaluate whether he works inside the boundaries set by the ES				

Environment:

Scaling tool: Metals EUSES IT tool (free download: http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool).

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.

Generic Exposure – Consumer

The format related to consumers' uses should include conditions controlling consumers' exposure and environmental exposure. Note: the content of this exposure scenario is to be communicated to downstream users producing consumer products (mixtures).

Where the format is related to service life (and subsequent waste life stage) following from downstream uses, this should include conditions controlling consumers' and environmental exposure. Note: the content of this exposure scenario is to be communicated to the downstream users producing articles to be handled by consumers.

The measures controlling risks to consumers are predominantly to be addressed under product characteristics (first subheadline). Other measures might be considered as well, if deemed appropriate. However, **please note**: Information on hazards, behavioural advice and personal protection measures are usually not expected to be effective for reducing consumer exposure, unless the registrant has particular evidence available. For the risk management measures information on the required/assumed effectiveness has to be reported (if applicable and relevant). This is because the use of consumer instructions as RMMs cannot be expected to be highly effective, unless consumer behavioural data provide evidence that a sufficient degree of compliance can be assumed. Consumer RMMs based on instructions should be introduced only when the use of such RMMs can be shown to be effective and be well adhered to by consumers.

There are limited circumstances for consideration of personal protective equipment (PPE) in consumer exposure, because people will not necessarily use PPE even though recommended by the manufacturer. Even when PPE is provided with the product (e.g., gloves with a hair dye), it cannot be ensured that consumers will use it. The exposure estimation needs to consider the reasonable worst-case situation which indicates no use of gloves or other PPE. As an element of good practice and personal hygiene, the advice to use household gloves or other skin protection should be part of consumer instructions (e.g. for products that are irritating/corrosive to the skin, such as strongly acidic, alkaline or oxidising household detergents). [See: Chapter R.15 – Guidance on Consumer Exposure Estimation, Version 2 (April 2010). Source: http://guidance.echa.europa.eu/docs/guidance_document/information_requirements_r15_en.pdf **Note:** For consumer uses, section 4 contains information addressed to the formulator producing the consumer product, not the consumer.]

The following format is for guidance only.

Exposure scenario – Addressing uses carried out by consumers	
1. Title GES – Consumer downstream use of Copper sulphate	
Life cycle	Use stage of Copper sulphate
Free short title	Generic consumer use of Copper sulphate
Systematic title based on use descriptor	SU: Main PC: 1, 9a, 9b, 9c, 12, 15, 24, 30, 31, 35 AC: 2 ERC: 8a-f*, 9a*, 9b*, 10a*, 10b*, 11a*
Processes, tasks, activities covered (workers)	This scenario covers consumer end use of the following product types containing Copper sulphate : • Adhesives • Coatings and inks • Ceramics • Cosmetics • Fertilisers • Glass (e.g. bottles, frit) • Lubricants and greases • Leather dyes • Putties and fillers, construction chemicals • Photo chemicals • Polishes and waxes • Rubber and plastics • Washing and cleaning • Textile dyes
2. Exposure scenario	
2.1 Contributing scenario (1) Controlling environmental exposure for all consumer DU of Copper sulphate [E-GES-WDU[ERC]]	
Environmental related free short title	Generic exposure of the environment from the consumer DU of Copper sulphate
Assessment Method	Copper VRA (2008)
Product characteristics	
To be added by Supplier: *Product related conditions, e.g. the concentration of the substance in a mixture; package design affecting exposure.*	
Amounts used	
To be added by Supplier: *Annual amount supplied into the consumer use(s) covered in this exposure scenario.*	
Frequency and duration of use	
To be added by Supplier: Usually continuous use/release (365 days) to be assumed, unless there are significant seasonal variations.	
Environment factors not influenced by risk management	
To be added by Supplier: *Flow rate of receiving surface water (m3/d) (usually 18,000 m3/d by default for the standard town);*	

please note: *the default flow rate will be rarely changeable for downstream uses.*
Other given user conditions affecting environmental exposure
To be added by Supplier: *Other operational conditions, e.g. indoor or outdoor use of products.*
Conditions and measures related to municipal sewage treatment plant
Size of municipal sewage system/treatment plant (m3/d) (usually 2000 m3/d by default for the standard town); specify degradation effectiveness; sludge treatment technique (disposal or recovery); measures to limit air emissions from sewage treatment (if applicable;) **please note**: *the default size of the municipal STP will be rarely changeable for downstream uses.*
Conditions and measures related to external treatment of waste for disposal
Fraction of used amount transferred to external waste treatment for disposal: type of suitable treatment for waste generated by consumer uses, e.g. municipal waste incineration, hazardous waste incineration: specify efficacy of treatment; provide corresponding instructions regarding separation of waste to be communicated to consumers;
Conditions and measures related to external recovery of waste
Fraction of used amount transferred to external waste treatment for recovery: Specify type of suitable recovery operations for waste generated by consumer uses, e.g. refinery process for lubricant waste; specify efficacy of measure; provide corresponding instructions regarding separation of waste to be communicated to consumers

Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario.

2.1.1Generic guidance – ERC/spERC related: Technical conditions and measures to control emissions to the environment resulting from all consumer DU of Copper sulphate [E-GES-WDU[ERC] only applicable]

E-GES-WDU1.1

Emissions covered: Tier 1 (ERC codes) – wide dispersive uses

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) that 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 ≥10 ≤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.

Environmental Release Code	**ERC 8a**
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive indoor use of processing aids in open systems
Default release to water from process [%]	100
Environmental Release Code	**ERC 8b**
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive indoor use reaction on use in open systems
Default release to water from process [%]	2
Environmental Release Code	**ERC 8c**
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 [%]	1
Environmental Release Code	**ERC 8d**
Life cycle stage (LCS)	Wide dispersive use
Type of use in LCS	Wide dispersive indoor use of processing aids in open systems
Default release to water from process [%]	100
Environmental Release Code	**ERC 8e**
Life cycle stage (LCS)	Wide dispersive use

Type of use in LCS	Wide dispersive indoor use reaction on use in open systems
Default release to water from process [%]	2

Environmental Release Code	**ERC 8f**
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 [%]	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
2.2 Contributing scenario (2) Controlling of workers exposure for all_consumer_DU_ of Copper sulphate [C-GES-DU]	
Workers related free short title	Generic exposure for consumers exposed to Copper sulphate
Assessment Method	Cu VRA (2008)
Product characteristic	
To be added by Supplier: (solid, liquid; if solid: level of dustiness), package design affecting exposure; Consumer products containing Copper sulphate are typically in liquid/slurry form. Sintered products are solid, with low dustiness. Concentrations of Copper sulphate in consumer products are invariably low.	
Amounts used	
To be added by Supplier: Amounts used per event Varying (risk limited by exposure not quantities)	
Frequency and duration of use/exposure	

To be added by Supplier: Duration of exposure per event and frequency of events; please note: Tier 1 exposure assessment usually refers to external event exposure, without taking into account the duration and frequency of the event (see Guidance Chapter R.15);

Human factors not influenced by risk management

To be added by Supplier: Particular conditions of use, e.g. body parts potentially exposed; population potentially exposed (adults, children)	
Adult Body weight	70 kg
DNEL inhalation	1 mg/m3
DNEL dermal solids	9566.9 mg/day
DNEL dermal sol/slurry	956.9 mg/day

Other given operational conditions affecting consumers exposure

To be added by Supplier/DU: Other operational conditions e.g. room volume [ConsExpo 20 m^3*], air exchange rate, outdoor or indoor use*

Conditions and measures related to information and behavioural advice to consumers

To be added by Supplier/DU: Safety advice to be communicated to consumers in order to control exposure, e.g. technical instruction, behavioural advice; please note: usually such measures are not expected to be effective, unless the registrant has available particular evidence that consumers follow the advice. These measures may however be included under the "Good Practice Advice", and thus the effectiveness of the instructions/advice would not be taken into account when deriving exposure estimates and risk characterisation in the CSR.

Conditions and measures related to personal protection and hygiene

To be added by Supplier/DU: Usually personal protection measures are not expected for consumer products; however if e.g. gloves are recommend this can be specified here; specify the suitable material for the PPE (where relevant,) and advise how long the protective equipment can be used before replacement (if relevant);please note: usually such measures are not expected to be effective if applied by consumers. Thus, is recommended to include these measures under the "Good Practice Advice", rather than taking the use of PPE into account when deriving exposure estimates and risk characterisation in the CSR.

Information from CSR:

To be added by Supplier/DU:

Consumer exposure scenario for combined occupational and consumer assessment:

The consumer exposure assessments are not directly relevant to workers. It is also assumed that workers in the copper/Copper sulphate industries are unlikely to take copper in dietary supplements. Therefore, for the purpose of combining occupational and consumer exposures for this group, a separate consumer scenario is considered following the Cu VRA. As a typical consumer scenario for workers, it will be assumed that they are exposed via the dermal route to 0.14 mg Cu/day to coins and to $4.3E^{-6}$ mg Cu/day via hair-care products. As a RWC consumer scenario for workers, it will be assumed that workers are exposed via the dermal route to 0.28 mg Cu/day to coins, to $1.4E^{-5}$ mg Cu/day via hair-care products and via the inhalation route to 0.001 mg Cu/person/day by smoking cigarettes.

Consumer exposure scenario: The exposure estimation for consumer exposure only can be found below. The most relevant routes of exposure are summarised below. Selection of the worst-case exposure route is based on consumer estimations from the Cu VRA (2008).			

	Inhalation	Dermal	Oral
Massive or sintered copper/copper compound products.	Not relevant	Dermal contact to handling of coins, copper jewellery	Not relevant
Preparations containing copper powder/copper compounds.	Inhalation exposure through unintentional use cigarette smoking	Dermal contact to face cream, hair-care products, paint	Oral exposure through food supplements
Worst-case exposure considered in generic consumer exposure scenario.	Inhalation exposure through unintentional use cigarette smoking	Dermal exposure through paint	Oral exposure through food supplements
External exposure (mg/person/day)	Typical: none Reasonable worst case: 0.0005	Typical: none Reasonable worst case: 4.03	Typical: none Reasonable worst case: 2

Long Term Exposure			
	Unit	**Exposure concentration**	**Justification**
Internal dermal + inhalation systemic (occupational)	mg/kg bw/d	$1.9x10^{-2}$	Reasonable worst-case internal exposure estimate from Cu VRA
Risk characterisation ratio (combined dermal and inhalation)	-	0.46	Based on NOAEL for repeated dose effects of 4.075 mg/kg bw/day and an assessment factor of 100 (VRA, 2008).