APPENDIX: EXPOSURE SCENARIOS

The current document includes all relevant occupational and environmental exposure scenarios (ES) for the production and use of oxalic acid as required under the REACH Regulation (Regulation (EC) No 1907/2006). For the development of the ES the Regulation and the relevant REACH Guidance have been considered. For the description of the covered uses and processes, the "R.12 – Use descriptor system" guidance (Version: 2, March 2010, ECHA-2010-G-05-EN), for the description and implementation of risk management measures (RMM) the "R.13 – Risk management measures" guidance (Version: 1.1, May 2008), for the occupational exposure estimation the "R.14 – Occupational exposure estimation" guidance (Version: 2, May 2010, ECHA-2010-G-09-EN) and for the actual environmental exposure assessment the "R.16 – Environmental Exposure Assessment" (Version: 2, May 2010, ECHA-10-G-06-EN) was used.

The exposure assessment of oxalic acid professional and industrial and consumer use is performed and organized based on several scenarios. An overview of the scenarios and the coverage of substance life cycle is presented in Table 1.

Table 1: Overview on exposure scenarios and coverage of substance life cycle

ES number	ES name	Manufacture	Identified uses			Resulting life cycle stage		Sector of use (SU)	Chemical product Category (PC)	Process Category (PROC)	Article category (AC)	ERC
			Formulation	End use	Consumer use	Service life for articles	Waste stage					
1	Industrial uses of aqueous solutions of oxalic acid	X	X	X				SU3, SU5, SU6a, SU6b, SU8, SU9, SU10, SU13, SU14, SU16, SU17, SU18, SU19, SU20, SU23, SU0	PC0, PC7, PC9, PC10, PC14, PC 15, PC19, PC20, PC21, PC23, PC32, PC34 PC35, PC36, PC37	PROC1, PROC2, PROC3, PROC4, PROC5, PROC7, PROC8a, PROC8b, PROC9, PROC10, PROC13, PROC15		ERC1, ERC2, ERC3, ERC4, ERC5, ERC6a, ERC6b
2	Industrial uses of solid oxalic acid	X	X	X				SU3, SU5, SU6a, SU6b, SU8, SU9, SU10, SU13, SU14, SU16, SU17, SU18, SU19, SU20, SU23, SU0	PC0, PC7, PC9, PC10, PC14, PC 15, PC19, PC20, PC21, PC23, PC32, PC34 PC35, PC36, PC37	PROC1, PROC2, PROC3, PROC4, PROC5, PROC7, PROC8a, PROC8b, PROC9, PROC10, PROC13, PROC14, PROC15, PROC21, PROC22		ERC1, ERC2, ERC3, ERC4, ERC5, ERC6a, ERC6b
3	Professional uses of aqueous solutions of oxalic acid		X	X				SU22, SU6a, SU18	PC9a, PC14, PC15, PC25. PC35, PC31	PROC10, PROC11, PROC15, PROC21		ERC8a, ERC8b, ERC8c, ERC8d, ERC8e, ERC8f

			Identified uses			Resulting life cycle stage					
4	Professional uses of solid oxalic acid		X	X				SU22, SU6a, SU18	PC9a, PC14, PC15, PC25. PC35, PC31	PROC10, PROC11, PROC15, PROC21		ERC8a, ERC8b, ERC8c, ERC8d, ERC8e, ERC8f
5	Consumer use of formulation containing Ox. Acc.			X	X			SU21	PC35, PC9a, PC31	PROC 21		ERC8a, ERC8b, ERC8c, ERC8d, ERC8e, ERC8f

9.1. Industrial uses of aqueous solutions of oxalic acid

9.1.1. Exposure scenario

1. Title	
Free short title	Use of aqueous solutions of oxalic acid
ES number	1
Systematic title based on use descriptor	SU3, SU5 SU6a, SU6b SU8, SU9, SU10, SU13, SU14, SU16, SU17, SU18, SU19, SU20, SU23, SU0 PC0, PC7, PC9, PC10, PC14, PC 15, PC19, PC20, PC21, PC23, PC32, PC35, PC36, PC37, PC34 ERC1, ERC2, ERC3, ERC4, ERC5, ERC6a, ERC6b
Processes, tasks and/or activities covered	Processes, tasks and/or activities covered are described in Section 2 below.
Assessment Method	The assessment of inhalation, dermal and environmental exposure and is based on ECETOC TRA.

2. Operational conditions and risk management measures		
PROC	**REACH definition**	**Involved tasks**
PROC1	Use in closed process, no likelihood of exposure	Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN, 26/03/2010).
PROC2	Use in closed, continuous process with occasional controlled exposure	
PROC3	Use in closed batch process (synthesis or formulation)	
PROC4	Use in batch and other process (synthesis) where opportunity for exposure arises	
PROC5	Mixing or blending in batch processes for formulation of preparations* and articles (multistage and/or significant con-tact)	
PROC7	Industrial spraying	
PROC8a	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	
PROC10	Roller application or brushing	
PROC13	Treatment of articles by dipping and pouring	
PROC15	Use as laboratory reagent	
ERC 1-6b	Manufacture, formulation and all types of industrial uses	

2.1 Control of workers exposure

Product characteristics

PROC	Used in preparation?	Content in preparation	Emission potential
PROC 7	Not excluded	> 25 % w/w (not restricted)	Medium
All other applicable PROCs	Not excluded	> 25 % w/w (not restricted)	Low

Amounts used

The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation, (industrial vs. professional) and level of containment/automation (as reflected in the PROC) is the main determinant of

the process intrinsic emission potential.				
Frequency and duration of use/exposure				
All applicable PROCs	> 4 hours (not restricted)			
Technical conditions and measures at process level (source) to prevent release				
Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.				
Technical conditions and measures to control dispersion from source towards the worker				
PROC	**Level of separation**	**Localised controls (LC)**	**Efficiency of LC (according to ECTOC TRA)**	**Further information**
All applicable PROCs	Separation of workers is generally not required in the processes, unless a specific process step is conducted less than full-shift. If that is the case, it has to be guaranteed that the worker is separated from the emission source for the remaining shift.	local exhaust ventilation (LEV) (*The use of LEV is not mandatory for PROC1, PROC2 and PROC3, , but it is recommended)	N/A	
Organisational measures to prevent /limit releases, dispersion and exposure				
Avoid inhalation or ingestion. General occupational hygiene measures are required to ensure a safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking at the workplace, the wearing of standard working clothes and shoes unless otherwise stated below. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.				
Conditions and measures related to personal protection, hygiene and health evaluation				
PROC	**Specification of RPE and efficiency**	**Specification of gloves**	**Specification of eye protection**	**Further PPE**
PROC 7	Use of respiratory protection with minimum efficiency 90%	Use suitable gloves (Nitrile, Neoprene, Natural rubber, Polyvinyl chloride, natural rubber: Permeation Breakthrought > 360). Protective clothing.	As oxalic acid is irritating to eyes, the use of face shield or eye protection is a prerequisite for all process steps.	standard working clothes
All other applicable PROCS	Not required			
2.2 Control of environmental exposure				
Amounts used				
The daily and annual amount per site (for point sources) is not considered to be the main determinant for environmental exposure.				
Frequency and duration of use				
Intermittent (< 12 time per year) or continuous use/release				
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil				
Risk management measures related to the environment aim to avoid discharging oxalic acid solutions into municipal wastewater or to surface water, in case such discharges are expected to cause significant pH changes. Regular control of the pH value during introduction into open waters is required. In general discharges should be carried out such that pH changes in receiving surface waters are minimised (e.g. through neutralisation).				
Conditions and measures related to waste				
Solid industrial waste of oxalic acid should be reused or discharged to the industrial wastewater and further neutralized if needed.				
3. Exposure estimation and reference to its source				
Occupational exposure				
ECTOC TRA was used for the inhalation and dermal exposure assessment. The risk characterisation ratio (RCR) for inhalation exposure is				

based on the DNELinhalation for oxalic acid of 2.29 mg.kg^{-1} day^{-1}. The risk characterisation ratio (RCR) for dermal exposure is based on the DNELdermal for oxalic acid of 4.03 mg.kg^{-1} day^{-1}

PROC	Method used for inhalation exposure assessment	Inhalation exposure estimate mg/m3 (RCR)	Method used for dermal exposure assessment	Dermal exposure estimate mg/kg/day (RCR)
PROC1	ECTOC TRA	**0.038 (0.002)**	ECTOC TRA	**0.034 (0.009)**
PROC2	ECTOC TRA	**0.375 (0.023)**	ECTOC TRA	**0.137 (0.034)**
PROC3	ECTOC TRA	**1.125 (0.070)**	ECTOC TRA	**0.034 (0.009)**
PROC4	ECTOC TRA	**1.876 (0.117)**	ECTOC TRA	**0.686 (0.170)**
PROC5	ECTOC TRA	**1.876 (0.117)**	ECTOC TRA	**0.069 (0.017)**
PROC7	ECTOC TRA	**1.876 (0.117)**	ECTOC TRA	**2.143 (0.532)**
PROC8a	ECTOC TRA	**3.751 (0.234)**	ECTOC TRA	**0.137 (0.034)**
PROC8b	ECTOC TRA	**0.563 (0.035)**	ECTOC TRA	**0.686 (0.170)**
PROC9	ECTOC TRA	**1.876 (0.117)**	ECTOC TRA	**0.686 (0.170)**
PROC10	ECTOC TRA	**3.751 (0.234)**	ECTOC TRA	**1.371 (0.340)**
PROC13	ECTOC TRA	**3.751 (0.234)**	ECTOC TRA	**0.686 (0.170)**
PROC15	ECTOC TRA	**1.876 (0.117)**	ECTOC TRA	**0.034 (0.085)**

Environmental exposure

The environmental exposure assessment is only relevant for the aquatic environment, when applicable including STPs/WWTPs, as emissions of oxalic acid in the different life-cycle stages (production and use) mainly apply to (waste) water. The aquatic effect and risk assessment only deal with the effect on organisms/ecosystems due to possible pH changes related to H+ discharges, being the toxicity of oxalic acid expected to be negligible compared to the (potential) pH effect. Only the local scale is being addressed, including municipal sewage treatment plants (STPs) or industrial waste water treatment plants (WWTPs) when applicable, both for production and industrial use as any effects that might occur would be expected to take place on a local scale.
The high water solubility and very low vapour pressure indicate that oxalic acid will be found predominantly in water. Significant emissions or exposure to air are not expected due to the low vapour pressure. Significant emissions or exposure to the terrestrial environment are not expected either for this exposure scenario.

Environmental emissions	The production of oxalic acid can potentially result in an aquatic emission and locally increase the oxalic acid concentration and affect the pH in the aquatic environment. When the pH is not neutralised, the discharge of effluent from oxalic acid production sites may impact the pH in the receiving water. The pH of effluents is normally measured very frequently and can be neutralised easily as often required by national laws.						
Exposure concentration in waste water treatment plant (WWTP) (RCR in STP)	**ERC1 (RCR)**	**ERC2 (RCR)**	**ERC3 (RCR)**	**ERC4 (RCR)**	**ERC5 (RCR)**	**ERC6a (RCR)**	**ERC6b (RCR)**
	0.024	0.001	0.08	0.10	0.10	0.016	0.01
Exposure concentration in aquatic pelagic compartment	When oxalic acid is emitted to surface water, sorption to particulate matter and sediment will be negligible. When oxalic acid is rejected to surface water, the pH may decrease, depending on the buffer capacity of the water. The higher the buffer capacity of the water, the lower the effect on pH will be.						
Exposure concentration in sediments	The sediment compartment is not included in this ES, because it is not considered relevant for oxalic acid: when oxalic acid is emitted to the aquatic compartment, sorption of to sediment particles is negligible.						
Exposure concentrations in soil and groundwater	The terrestrial compartment is not included in this exposure scenario, because it is not considered to be relevant.						
Exposure concentration in atmospheric	The air compartment is not included in this CSA because it is considered not relevant for oxalic acid.						

compartment	
Exposure concentration relevant for the food chain (secondary poisoning)	Bioaccumulation in organisms is not relevant for oxalic acid: a risk assessment for secondary poisoning is therefore not required.

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

Occupational
The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as ECTOC TRA (www.ecetoc.org/tra) to estimate the associated exposure.

DNELinhalation for oxalic acid of 2.29 mg/(kg.day).
DNELdermal for oxalic acid of 4.03 mg/(kg.day)

Environmental
If a site does not comply with the conditions stipulated in the safe use ES, it is recommended to apply a tiered approach to perform a more site-specific assessment.

9.2. Industrial uses of solid oxalic acid

9.2.1. Exposure scenario

1. Title	
Free short title	Use of solid oxalic acid
ES numer	2
Systematic title based on use descriptor	SU3, SU5, SU6a, SU6b SU8, SU9, SU10, SU13, SU14, SU16, SU17, SU18, SU19, SU20, SU23, SU0 PC0, PC7, PC9, PC10, PC14, PC 15, PC19, PC20, PC21, PC23, PC32, PC35, PC36, PC37, PC34 ERC1, ERC2, ERC3, ERC4, ERC5, ERC6a, ERC6b
Processes, tasks and/or activities covered	Processes, tasks and/or activities covered are described in Section 2 below.
Assessment Method	The assessment of inhalation, dermal and environmental exposure and is based on ECETOC TRA.

2. Operational conditions and risk management measures

PROC	REACH definition	Involved tasks
PROC1	Use in closed process, no likelihood of exposure	Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN, 26/03/2010).
PROC2	Use in closed, continuous process with occasional controlled exposure	
PROC3	Use in closed batch process (synthesis or formulation)	
PROC4	Use in batch and other process (synthesis) where opportunity for exposure arises	
PROC5	Mixing or blending in batch processes for formulation of preparations* and articles (multistage and/or significant con-tact)	
PROC7	Industrial spraying	
PROC8a	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities	
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	
PROC10	Roller application or brushing	
PROC13	Treatment of articles by dipping and pouring	
PROC14	Production of preparations* or articles by tabletting, compression, extrusion, pelletisation	
PROC15	Use as laboratory reagent	
PROC21	Low energy manipulation of substances bound in materials and/or articles	
PROC22	Potentially closed processing operations with minerals/metals at elevated temperature	
ERC 1-6b	Manufacture, formulation and all types of industrial uses	

2.1 Control of workers exposure

Product characteristics

PROC	Used in preparation?	Content in preparation	Emission potential
All applicable PROCs	Not excluded	(not restricted)	medium

Amounts used

The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation, (industrial vs. professional) and level of containment/automation (as reflected in the PROC) is the main determinant of the process intrinsic emission potential.

Frequency and duration of use/exposure

All applicable PROCs	> 4 hours (not restricted)

Technical conditions and measures at process level (source) to prevent release

Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.

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

PROC	Level of separation	Localised controls (LC)	Efficiency of LC (according to ECTOC TRA)	Further information
All applicable PROCs	Separation of workers is generally not required in the processes, unless a specific process step is conducted less than full-shift. If that is the case, it has to be guaranteed that the worker is separated from the emission source for the remaining shift.	local exhaust ventilation (LEV) (*The use of LEV is not mandatory for PROC1, PROC2, PROC3, PROC14, PROC15 and PROC21, but it is recommended)	N/A	--

Organisational measures to prevent /limit releases, dispersion and exposure

Avoid inhalation or ingestion. General occupational hygiene measures are required to ensure a safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking at the workplace, the wearing of standard working clothes and shoes unless otherwise stated below. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.

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

PROC	Specification of RPE and efficiency	Specification of gloves	Specification of eye protection	Further PPE
All other applicable PROCS	Not required	Use suitable gloves (Nitrile, Neoprene, Natural rubber, Polyvinyl chloride, natural rubber: Permeation Breakthrought > 360). Protective clothing.	As oxalic acid is irritating to eyes, the use of face shield or eye protection is a prerequisite for all process steps.	standard working clothes

2.2 Control of environmental exposure

Amounts used

The daily and annual amount per site (for point sources) is not considered to be the main determinant for environmental exposure.

Frequency and duration of use

Intermittent (< 12 time per year) or continuous use/release

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Risk management measures related to the environment aim to avoid discharging oxalic acid solutions into municipal wastewater or to surface water, in case such discharges are expected to cause significant pH changes. Regular control of the pH value during introduction into open waters is required. In general discharges should be carried out such that pH changes in receiving surface waters are minimised (e.g. through neutralisation).

Conditions and measures related to waste

Solid industrial waste of oxalic acid should be reused or discharged to the industrial wastewater and further neutralized if needed.

3. Exposure estimation and reference to its source

Occupational exposure

ECTOC TRA was used for the inhalation and dermal exposure assessment. The risk characterisation ratio (RCR) for inhalation exposure is based on the DNELinhalation for oxalic acid of 2.29 mg.kg^{-1} day^{-1}. The risk characterisation ratio (RCR) for dermal exposure is based on the DNELdermal for oxalic acid of 4.03 mg.kg^{-1} day^{-1}

PROC	Method used for inhalation exposure assessment	Inhalation exposure estimate mg/m3 (RCR)	Method used for dermal exposure assessment	Dermal exposure estimate mg/kg/day (RCR)
PROC1	ECTOC TRA	**0.010 (0.001)**	ECTOC TRA	**0.034 (0.009)**
PROC2	ECTOC TRA	**0.100 (0.006)**	ECTOC TRA	**0.137 (0.034)**
PROC3	ECTOC TRA	**0.100 (0.006)**	ECTOC TRA	**0.034 (0.009)**
PROC4	ECTOC TRA	**2.500 (0.156)**	ECTOC TRA	**0.686 (0.170)**
PROC5	ECTOC TRA	**2.500 (0.156)**	ECTOC TRA	**0.069 (0.017)**
PROC7	ECTOC TRA	**5.000 (0.312)**	ECTOC TRA	**2.143 (0.532)**
PROC8a	ECTOC TRA	**5.000 (0.312)**	ECTOC TRA	**0.137 (0.034)**
PROC8b	ECTOC TRA	**1.250 (0.078)**	ECTOC TRA	**0.686 (0.170)**
PROC9	ECTOC TRA	**2.000 (0.125)**	ECTOC TRA	**0.686 (0.170)**
PROC10	ECTOC TRA	**1.000 (0.062)**	ECTOC TRA	**1.371 (0.340)**
PROC13	ECTOC TRA	**0.500 (0.031)**	ECTOC TRA	**0.686 (0.170)**
PROC 14	ECTOC TRA	**1.000 (0.062)**	ECTOC TRA	**0.343 (0.085)**
PROC15	ECTOC TRA	**0.500 (0.031)**	ECTOC TRA	**0.034 (0.009)**
PROC21	ECTOC TRA	**1.000 (0.062)**	ECTOC TRA	**0.283 (0.070)**
PROC 22	ECTOC TRA	**0.100 (0.006)**	ECTOC TRA	**0.849 (0.211)**

Environmental exposure

The environmental exposure assessment is only relevant for the aquatic environment, when applicable including STPs/WWTPs, as emissions of oxalic acid in the different life-cycle stages (production and use) mainly apply to (waste) water. The aquatic effect and risk assessment only deal with the effect on organisms/ecosystems due to possible pH changes related to H+ discharges, being the toxicity of oxalic acid expected to be negligible compared to the (potential) pH effect. Only the local scale is being addressed, including municipal sewage treatment plants (STPs) or industrial waste water treatment plants (WWTPs) when applicable, both for production and industrial use as any effects that might occur would be expected to take place on a local scale.
The high water solubility and very low vapour pressure indicate that oxalic acid will be found predominantly in water. Significant emissions or exposure to air are not expected due to the low vapour pressure. Significant emissions or exposure to the terrestrial environment are not expected either for this exposure scenario.

Environmental emissions	The production of oxalic acid can potentially result in an aquatic emission and locally increase the oxalic acid concentration and affect the pH in the aquatic environment. When the pH is not neutralised, the discharge of effluent from oxalic acid production sites may impact the pH in the receiving water. The pH of effluents is normally measured very frequently and can be neutralised easily as often required by national laws.						
Exposure concentration in waste water treatment plant (WWTP) (RCR in STP)	**ERC1 (RCR)**	**ERC2 (RCR)**	**ERC3 (RCR)**	**ERC4 (RCR)**	**ERC5 (RCR)**	**ERC6a (RCR)**	**ERC6b (RCR)**
	0.024	0.001	0.0001	0.10	0.10	0.016	0.01
Exposure concentration in aquatic pelagic compartment	When oxalic acid is emitted to surface water, sorption to particulate matter and sediment will be negligible. When oxalic acid is rejected to surface water, the pH may decrease, depending on the buffer capacity of the water. The higher the buffer capacity of the water, the lower the effect on pH will be.						

Exposure concentration in sediments	The sediment compartment is not included in this ES, because it is not considered relevant for oxalic acid: when oxalic acid is emitted to the aquatic compartment, sorption of to sediment particles is negligible.
Exposure concentrations in soil and groundwater	The terrestrial compartment is not included in this exposure scenario, because it is not considered to be relevant.
Exposure concentration in atmospheric compartment	The air compartment is not included in this CSA because it is considered not relevant for oxalic acid.
Exposure concentration relevant for the food chain (secondary poisoning)	Bioaccumulation in organisms is not relevant for oxalic acid: a risk assessment for secondary poisoning is therefore not required.

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

Occupational
The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as ECTOC TRA (www.ecetoc.org/tra) to estimate the associated exposure.

DNELinhalation for oxalic acid of 2.29 mg/(kg.day).
DNELdermal for oxalic acid of 4.03 mg/(kg.day)

Environmental
If a site does not comply with the conditions stipulated in the safe use ES, it is recommended to apply a tiered approach to perform a more site-specific assessment.

9.3. Professional uses of aqueous solutions of oxalic acid

9.3.1. Exposure scenario

1. Title	
Free short title	Professional use of aqueous solutions of oxalic acid
ES number	3
Systematic title based on use descriptor	SU22, SU6a, SU18 PC9a, PC14, PC15, PC25, PC35, PC31 PROC10, PROC11, PROC15, PROC21 ERC8a, ERC8b, ERC8c, ERC8d, ERC8e, ERC8f
Processes, tasks and/or activities covered	Processes, tasks and/or activities covered are described in Section 2 below.
Assessment Method	The assessment of inhalation, dermal and environmental exposure and is based on ECETOC TRA.

2. Operational conditions and risk management measures

PROC	REACH definition	Involved tasks
PROC10	Roller application or brushing	Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN, 26/03/2010).
PROC11	Non industrial spraying	
PROC15	Use as laboratory reagent	
PROC21	Low energy manipulation of substances bound in materials and/or articles	
ERC8a, ERC8b, ERC8c, ERC8d, ERC8e, ERC8f	Wide dispersive indoor and outdoor use of reactive substances or processing aids in open systems	

2.1 Control of workers exposure

Product characteristics

PROC	Used in preparation?	Content in preparation	Emission potential
PROC10, PROC11	Not excluded	>25% w/w (not restricted)	High
All other applicable PROCs	Not excluded	>25% w/w (not restricted)	Low

Amounts used

The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation, (industrial vs. professional) and level of containment/automation (as reflected in the PROC) is the main determinant of the process intrinsic emission potential.

Frequency and duration of use/exposure

All applicable PROCs	> 4 hours (not restricted)

Technical conditions and measures at process level (source) to prevent release

Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.

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

PROC	Level of separation	Localised controls (LC)	Efficiency of LC (according to ECTOC TRA)	Further information
All applicable PROCs	Separation of workers is generally not required in the	local exhaust ventilation	N/A	--

	processes, unless a specific process step is conducted less than full-shift. If that is the case, it has to be guaranteed that the worker is separated from the emission source for the remaining shift.			

Organisational measures to prevent /limit releases, dispersion and exposure

Avoid inhalation or ingestion. General occupational hygiene measures are required to ensure a safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking at the workplace, the wearing of standard working clothes and shoes unless otherwise stated below. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.

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

PROC	Specification of RPE and efficiency	Specification of gloves	Specification of eye protection	Further PPE
PROC10, PROC11	Use of respiratory protection with minimum efficiency of 90%	Use suitable gloves (Nitrile, Neoprene, Natural rubber, Polyvinyl chloride, natural rubber: Permeation Breakthrought > 360). Protective clothing.	As oxalic acid is irritating to eyes, the use of face shield or eye protection is a prerequisite for all process steps.	standard working clothes
All other applicable PROCS	Not required			

2.2 Control of environmental exposure

Amounts used

1.000 kg/day

Frequency and duration of use

Intermittent (< 12 time per year) or continuous use/release

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Risk management measures related to the environment aim to avoid discharging oxalic acid solutions into municipal wastewater or to surface water.

Conditions and measures related to waste

Oxalic acid wastes must not be disposed together with household garbage. Do not allow product to reach sewage system.

3. Exposure estimation and reference to its source

Occupational exposure

ECTOC TRA was used for the inhalation and dermal exposure assessment. The risk characterisation ratio (RCR) for inhalation exposure is based on the DNELinhalation for oxalic acid of 2.29 $mg.kg^{-1}$ day^{-1}. The risk characterisation ratio (RCR) for dermal exposure is based on the DNELdermal for oxalic acid of 4.03 $mg.kg^{-1}$ day^{-1}

PROC	Method used for inhalation exposure assessment	Inhalation exposure estimate mg/m3 (RCR)	Method used for dermal exposure assessment	Dermal exposure estimate mg/kg/day (RCR)

PROC10	ECTOC TRA	**1.876**	**(0.117)**	ECTOC TRA	**1.371** **(0.340)**
PROC11	ECTOC TRA	**7.503**	**(0.468)**	ECTOC TRA	**2.143** **(0.532)**
PROC15	ECTOC TRA	**3.751**	**(0.234)**	ECTOC TRA	**0.034** **(0.009)**
PROC21	ECTOC TRA	**Only for solids**		ECTOC TRA	**0.283** **(0.070)**

Environmental exposure

The high water solubility and very low vapour pressure indicate that oxalic acid will be found predominantly in water. Significant emissions or exposure to air are not expected due to the low vapour pressure. Significant emissions or exposure to the terrestrial environment are not expected either for this exposure scenario.

Environmental emissions						
Exposure concentration in local fresh water	**ERC8a (RCR)**	**ERC8b (RCR)**	**ERC8c (RCR)**	**ERC8d (RCR)**	**ERC8e (RCR)**	**ERC8f (RCR)**
	0.179	**0.013**	**0.011**	**0.179**	**0.013**	**0.011**
Exposure concentration in aquatic pelagic compartment	When oxalic acid is emitted to surface water, sorption to particulate matter and sediment will be negligible. When oxalic acid is rejected to surface water, the pH may decrease, depending on the buffer capacity of the water. The higher the buffer capacity of the water, the lower the effect on pH will be.					
Exposure concentration in sediments	The sediment compartment is not included in this ES, because it is not considered relevant for oxalic acid: when oxalic acid is emitted to the aquatic compartment, sorption of to sediment particles is negligible.					
Exposure concentrations in soil and groundwater	The terrestrial compartment is not included in this exposure scenario, because it is not considered to be relevant.					
Exposure concentration in atmospheric compartment	The air compartment is not included in this CSA because it is considered not relevant for oxalic acid.					
Exposure concentration relevant for the food chain (secondary poisoning)	Bioaccumulation in organisms is not relevant for oxalic acid: a risk assessment for secondary poisoning is therefore not required.					

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

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as ECTOC TRA (www.ecetoc.org/tra) to estimate the associated exposure.

DNELinhalation for oxalic acid of 2.29 mg/(kg.day).
DNELdermal for oxalic acid of 4.03 mg/(kg.day)

9.4. Professional uses of solid oxalic acid

9.4.1. Exposure scenario

1. Title	
Free short title	Professional use of solid oxalic acid
ES number	4
Systematic title based on use descriptor	SU22, SU6a, SU18 PC9a, PC14, PC15, PC25, PC35, PC31 PROC10, PROC11, PROC15, PROC21 ERC8a, ERC8b, ERC8c, ERC8d, ERC8e, ERC8f
Processes, tasks and/or activities covered	Processes, tasks and/or activities covered are described in Section 2 below.
Assessment Method	The assessment of inhalation, dermal and environmental exposure and is based on ECETOC TRA.

2. Operational conditions and risk management measures

PROC	REACH definition	Involved tasks
PROC10	Roller application or brushing	Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN, 26/03/2010).
PROC11	Non industrial spraying	
PROC15	Use as laboratory reagent	
PROC21	Low energy manipulation of substances bound in materials and/or articles	
ERC8a, ERC8b, ERC8c, ERC8d, ERC8e, ERC8f	Wide dispersive indoor and outdoor use of reactive substances or processing aids in open systems	

2.1 Control of workers exposure

Product characteristics

PROC	Used in preparation?	Content in preparation	Emission potential
All applicable PROCs	Not excluded	>25% w/w (not restricted)	Low

Amounts used

The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation, (industrial vs. professional) and level of containment/automation (as reflected in the PROC) is the main determinant of the process intrinsic emission potential.

Frequency and duration of use/exposure

All applicable PROCs	> 4 hours (not restricted)

Technical conditions and measures at process level (source) to prevent release

Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.

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

PROC	Level of separation	Localised controls (LC)	Efficiency of LC (according to ECTOC TRA)	Further information
All applicable PROCs	Separation of workers is generally not required in the processes, unless a specific process step is conducted	local exhaust ventilation	N/A	--

	less than full-shift. If that is the case, it has to be guaranteed that the worker is separated from the emission source for the remaining shift.			

Organisational measures to prevent /limit releases, dispersion and exposure

Avoid inhalation or ingestion. General occupational hygiene measures are required to ensure a safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking at the workplace, the wearing of standard working clothes and shoes unless otherwise stated below. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.

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

PROC	Specification of RPE and efficiency	Specification of gloves	Specification of eye protection	Further PPE
All other applicable PROCS	Not required	Use suitable gloves (Nitrile, Neoprene, Natural rubber, Polyvinyl chloride, natural rubber: Permeation Breakthrought > 360). Protective clothing.	As oxalic acid is irritating to eyes, the use of face shield or eye protection is a prerequisite for all process steps.	standard working clothes

2.2 Control of environmental exposure

Amounts used

1.000 kg/day

Frequency and duration of use

Intermittent (< 12 time per year) or continuous use/release

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Risk management measures related to the environment aim to avoid discharging oxalic acid solutions into municipal wastewater or to surface water.

Conditions and measures related to waste

Oxalic acid wastes must not be disposed together with household garbage. Do not allow product to reach sewage system.

3. Exposure estimation and reference to its source

Occupational exposure

ECTOC TRA was used for the inhalation and dermal exposure assessment. The risk characterisation ratio (RCR) for inhalation exposure is based on the DNELinhalation for oxalic acid of 2.29 $mg.kg^{-1}$ day^{-1}. The risk characterisation ratio (RCR) for dermal exposure is based on the DNELdermal for oxalic acid of 4.03 $mg.kg^{-1}$ day^{-1}

PROC	Method used for inhalation exposure assessment	Inhalation exposure estimate mg/m3 (RCR)	Method used for dermal exposure assessment	Dermal exposure estimate mg/kg/day (RCR)
PROC10	ECTOC TRA	**0.100 (0.006)**	ECTOC TRA	**1.371 (0.340)**
PROC11	ECTOC TRA	**0.200 (0.012)**	ECTOC TRA	**2.143 (0.532)**
PROC15	ECTOC TRA	**0.020 (0.001)**	ECTOC TRA	**0.034 (0.009)**
PROC21	ECTOC TRA	**0.600 (0.037)**	ECTOC TRA	**0.283 (0.070)**

Environmental exposure

The high water solubility and very low vapour pressure indicate that oxalic acid will be found predominantly in water. Significant emissions

or exposure to air are not expected due to the low vapour pressure. Significant emissions or exposure to the terrestrial environment are not expected either for this exposure scenario.

Environmental emissions						
Exposure concentration in local fresh water	**ERC8a (RCR)**	**ERC8b (RCR)**	**ERC8c (RCR)**	**ERC8d (RCR)**	**ERC8e (RCR)**	**ERC8f (RCR)**
	0.179	**0.013**	**0.011**	**0.179**	**0.013**	**0.011**
Exposure concentration in aquatic pelagic compartment	When oxalic acid is emitted to surface water, sorption to particulate matter and sediment will be negligible. When oxalic acid is rejected to surface water, the pH may decrease, depending on the buffer capacity of the water. The higher the buffer capacity of the water, the lower the effect on pH will be.					
Exposure concentration in sediments	The sediment compartment is not included in this ES, because it is not considered relevant for oxalic acid: when oxalic acid is emitted to the aquatic compartment, sorption of to sediment particles is negligible.					
Exposure concentrations in soil and groundwater	The terrestrial compartment is not included in this exposure scenario, because it is not considered to be relevant.					
Exposure concentration in atmospheric compartment	The air compartment is not included in this CSA because it is considered not relevant for oxalic acid.					
Exposure concentration relevant for the food chain (secondary poisoning)	Bioaccumulation in organisms is not relevant for oxalic acid: a risk assessment for secondary poisoning is therefore not required.					

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

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as ECTOC TRA (www.ecetoc.org/tra) to estimate the associated exposure.

DNELinhalation for oxalic acid of 2.29 mg/(kg.day).
DNELdermal for oxalic acid of 4.03 mg/(kg.day)

9.5. Consumer uses of oxalic acid

9.5.1. Exposure scenario

1. Title	
Free short title	Consumer uses of preparation containing oxalic acid
ES number	5
Systematic title based on use descriptor	SU21 PC9a, PC35, PC31 PROC21 ERC8a, ERC8b, ERC8c, ERC8d, ERC8e, ERC8f
Processes, tasks and/or activities covered	Processes, tasks and/or activities covered are described in Section 2 below.
Assessment Method	The assessment of inhalation, dermal and environmental exposure and is based on ECETOC TRA.

2. Operational conditions and risk management measures

PROC	REACH definition	Involved tasks
PROC21	Low energy manipulation of substances bound in materials and/or articles	Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN, 26/03/2010).
ERC8a, ERC8b, ERC8c, ERC8d, ERC8e, ERC8f	Wide dispersive indoor and outdoor use of reactive substances or processing aids in open systems	

2.1 Control of exposure

Product characteristics

PROC	Used in preparation?	Content in preparation	Emission potential
All applicable PROCs	Not excluded	>25% w/w (not restricted)	Low

Amounts used

The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation, (and level of containment/automation (as reflected in the PC) is the main determinant of the use intrinsic emission potential.

Frequency and duration of use/exposure

All applicable PROCs	(not restricted)

Technical conditions and measures at process level (source) to prevent release

Risk management measures for this consumer use are generally not required in the processes.

Conditions of use for the consumers

PC	PC sub-category	Product spray?	Amount of product used per application (g)	Product ingredient fraction by weight
PC35	Cleaners, liquids (all purpose cleaners, sanitary products, floor cleaners, glass cleaners, carpet cleaners, metal cleaners)	No	10	<5%
PC9a	Removers (paint-, glue-, wall paper-, sealant-remover)	No	10	<5%
PC31	Polishes and wax blends	No	10	<5%

Organisational measures to prevent /limit releases, dispersion and exposure

Avoid inhalation or ingestion. General occupational hygiene measures are required to ensure a safe handling of the substance. These

measures involve good personal and housekeeping, no eating and smoking while using the substance. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.

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

PROC	Specification of RPE and efficiency	Specification of gloves	Specification of eye protection	Further PPE
All other applicable PROCS	Not required	Not required Avoid contact with skin	Not required Avoid contact with eyes	Not required

2.2 Control of environmental exposure

Amounts used

10 g/application

Frequency and duration of use

Intermittent (< 12 time per year)

3. Exposure estimation and reference to its source

Occupational exposure

ECTOC TRA was used for the inhalation and dermal exposure assessment. The risk characterisation ratio (RCR) for inhalation exposure is based on the DNELdermal for consumer for oxalic acid of 1.14 $mg.kg^{-1}$ day^{-1}.

PROC	Method used for inhalation exposure assessment	Inhalation exposure estimate mg/m3 (RCR)	Method used for dermal exposure assessment	Dermal exposure estimate mg/kg/day (RCR)
PC39	ECTOC TRA	**0.02**	ECTOC TRA	**0.238 (0.20)**
PC9a	ECTOC TRA	**0.02**	ECTOC TRA	**0.238 (0.20)**
PC31	ECTOC TRA	**0.02**	ECTOC TRA	**0.238 (0.20)**

Environmental exposure

The high water solubility and very low vapour pressure indicate that oxalic acid will be found predominantly in water. Significant emissions or exposure to air are not expected due to the low vapour pressure. Significant emissions or exposure to the terrestrial environment are not expected either for this exposure scenario.

Environmental emissions	
Exposure concentration in sediments	The sediment compartment is not included in this ES, because it is not considered relevant for oxalic acid: when oxalic acid is emitted to the aquatic compartment, sorption of to sediment particles is negligible.
Exposure concentrations in soil and groundwater	The terrestrial compartment is not included in this exposure scenario, because it is not considered to be relevant.
Exposure concentration in atmospheric compartment	The air compartment is not included in this CSA because it is considered not relevant for oxalic acid.
Exposure concentration relevant for the food chain (secondary poisoning)	Bioaccumulation in organisms is not relevant for oxalic acid: a risk assessment for secondary poisoning is therefore not required.

End of the safety data sheet