

9.3. Exposure scenario 3: Use at industrial sites - Use as an intermediate

Market sector: Manufacture of other substances

Sector of use: SU 14: Manufacture of basic metals, including alloys; SU 8: Manufacture of bulk, large scale chemicals (including petroleum products); SU 9: Manufacture of fine chemicals

Environment contributing scenario(s):		
CS 1	Use as an intermediate	ERC 6a
Worker contributing scenario(s):		
CS 2	Handling of liquid substance at non-dedicated facilities	PROC 8a
CS 3	Handling of liquid substance	PROC 8b
CS 4	Small scale handling of liquid substance	PROC 9
CS 5	Chemical reaction step in closed process	PROC 1
CS 6	Chemical reaction step in closed continuous process	PROC 2
CS 7	Chemical reaction step in closed batch process	PROC 3
CS 8	Chemical reaction step in open or semi-closed process	PROC 4
CS 9	Mixing or blending in batch process	PROC 5
CS 10	Laboratory analyses	PROC 15
CS 11	Production of metal powders in wet process	PROC 27b
CS 12	Wet cleaning	PROC 28

Explanation on the approach taken for the ES

It is noted that this exposure scenario focusses on exposure to the substance to be registered. Please refer to information on safe use for the handling of the individual manufactured substances for process steps commencing the chemical transformation step.

9.3.1. Env CS 1: Use as an intermediate (ERC 6a)

9.3.1.1. Conditions of use

The conditions of use are as described in the generic exposure scenario (GES) below.

9.3.1.2. Releases

The GES and associated risk assessment are concerned with releases of TCA to waste-water and air arising from the use of TCA as an intermediate. Waste-water is treated by an on-site waste-water treatment plant (WWTP) and at a municipal sewage treatment plant (STP) before discharge to freshwater. Airborne emissions are treated by in-stack mitigation systems prior to discharge. Exposure assessment for the environment is based on representative exposure characteristics from the TCA manufacturing sector, adjusted SpERC values and calculation of the maximum safe tonnage (Msafe) of TCA that can be manufactured without risk to the environment. Msafe is calculated using release factors adjusted to 10% of the values recommended in SpERCs on the basis of the monetary value of gold (see Section 9.0.2).

Data on environmental emissions of gold during manufacture of TCA were collected during 2015 from 5 sites across Europe. A very limited amount monitoring data are available and it should be noted these are based on emissions of total gold, often resulting from production and use of a variety of gold compounds. The use of adjusted release factors is supported by the available data on measured Au emissions in waste-water at sites producing TCA. In this assessment the release factor (RF) is set at

10% of the SpERC RF for 'manufacture of metal compounds'¹. For a substance with Kd of 10,000-25,000 L/kg for suspended matter the recommend RF is 0.2%. In this assessment the RF for TCA (Kd = 19,904 L/kg for suspended particulate matter) is set at 0.02% (equivalent to 200 g/T). The maximum reported RF based on site emission measurements at facilities producing TCA is 11.5 g/T, indicating that even use of the adjusted SpERC could be considered worst case, although only 2 sites reported data on emissions of Au or TCA in waste-water. Similarly, a 10% adjusted RF to air of 0.03% (adjusted from 0.3% and equivalent to 30 g/T) is much higher than the only available RF of 0.4 g/T based on measurements from one site manufacturing TCA.

The use of TCA as an industrial intermediate is considered to have the same operating conditions and emission characteristics as manufacture on the basis that many companies in this sector manufacture TCA for use as an intermediate and using facilities using this compounds as intermediate would be undertaking similar processes.

A summary of the emission characteristics used to quantify the environmental aspects of the generic exposure scenario (GES) for industrial use of TCA as used as an intermediate is detailed below.

Table 9.28. The generic exposure scenario (GES) for industrial use of TCA as used as an intermediate

1. Title	
ES3: Industrial use as intermediate	
Life cycle	Industrial use as intermediate
Systematic title based on use descriptor	ERC: ERC 6A Use as an intermediate – industrial
2. Operational conditions and risk management measures	
2.1 Control of environmental exposure	
Environmental related free short title	Use as an industrial intermediate
Systematic title based on use descriptor (environment)	ERC 6A Use as an intermediate – industrial
Processes, tasks, activities covered (environment)	Use as an industrial intermediate: delivery and processing of TCA, cleaning & maintenance.
Environmental Assessment Method	Estimates based on monitoring data of emissions are used for calculation of maximum tonnage that can be manufactured or used safely without risk to the environment
Product characteristics	
TCA as solid or aqueous solution.	
Environmental assessment is based on the estimated emission of TCA in waste-water discharge and in stack emissions to air.	
Amounts used	
Maximum annual safe production/use at a site (Msafe)	30 tonnes TCA (17.4 tonnes Au metal equivalent)
Frequency and duration of use	
Pattern of release to the environment	300 days per year per site (50P from sector data)
Environment factors not influenced by risk management	

¹ <http://www.arche-consulting.be/content/documents/Eurometaux-1.2.v2.1.pdf>

Receiving surface water flow rate	STP: 2,000 m ³ /d (default) Receiving water: 18,000 m ³ /d (default)
Dilution capacity, freshwater	Discharge to freshwater via STP: DF = 10 (default)
Dilution capacity, marine	Not relevant
Other given operational conditions affecting environmental exposure	
None	
Technical conditions and measures at process level (source) to prevent release	
Appropriate process control systems shall be implemented.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
<p>Waste water:</p> <p>ES 1 Discharge to freshwater via STP: On-site wastewater treatment by chemical precipitation, sedimentation and/or filtration. Efficiency 99.8 % (sector data) Release factor after on-site treatment: 200 g/T (10% of SpERC RF for 'Manufacture of metal compounds'² based on TCA Kd of 19,904 L/kg)</p> <p>and off-site municipal sewage treatment plant (STP) Efficiency 88.7% (based on standard TGD parameters & measured partition coefficient for TCA in relation to SPM normalised to organic carbon)</p> <p>Air:</p> <p>Treatment of air emissions by filters (e.g. fabric, bag, HEPA) and/or wet scrubbers. Release factor after on-site treatment: 30 g/T (10% of SpERC RF for 'Manufacture of metal compounds'³)</p>	
Organizational measures to prevent/limit release from site	
Regular operator training.	
Conditions and measures related to municipal sewage treatment plant (if applicable)	
Municipal Sewage Treatment Plant (STP)	Yes,
Discharge rate of the Municipal STP	2 000 m ³ /d (default)
Fate of the sludge from Municipal STP	The sludge is incinerated (with ash going to landfill)
Conditions and measures related to external treatment of waste for disposal	
TCA- and other Au-containing waste is filled into containers and transported to licensed recycling facilities for recovery or disposed of at appropriate landfill facilities.	
Conditions and measures related to external recovery of waste	
TCA- and other Au-containing waste suitable for recycling may be recycled either internally or at licensed recycling facility. The sludge from the on-site treatment plant is processed for metal reclamation (recycling).	

² ARCHE (2013) Manufacture of metal compounds. spERC code Eurometaux 1.2.v2.1. Available online at <http://www.arche-consulting.be/metal-csa-toolbox/SPERCs-tool-for-metals/>

³ ARCHE (2013) Manufacture of metal compounds. spERC code Eurometaux 1.2.v2.1. Available online at <http://www.arche-consulting.be/metal-csa-toolbox/SPERCs-tool-for-metals/>

3. Exposure and risk estimation							
Environment							
ERC 6A							
ES 3 Use of TCA as an industrial intermediate							
Compartment	Unit	PNEC	PEC_{regional}	C_{local}	PEC	RCR	Methods for calculation of environmental concentrations
Discharge to STP	mg TCA/L	0.2 mg/L	2.05 x10 ⁻⁷ mg/L	1.1 x 10 ⁻³ mg/L	1.1 x 10 ⁻³ mg/L	0.0056	Adjusted SpERC emission factors applied to Msafe tonnage and dilution factor at municipal STP
Freshwater via STP	mg TCA/L	1.04 x10 ⁻³ mg/L	2.05 x10 ⁻⁷ mg/L	8.63 x10 ⁻⁵ mg/L	8.65 x10 ⁻⁵ mg/L	0.083	Adjusted SpERC emission factors applied to Msafe tonnage and value for STP removal efficiency measured on measured partition coefficient. Plus dilution in ultimate receiving water body based on TGD default
Freshwater sediment via STP	mg TCA/kg w.w.	4.5 mg/kg	4.11 x10 ⁻⁴ mg/kg	0.374 mg/kg	0.375 mg/kg	0.83	Adjusted SpERC emission factors applied to Msafe tonnage. Partitioning to SPM/sediment based on measured partition coefficient.
Terrestrial (all scenarios)	mg TCA/kg ww	3.65 mg/kg	1.89 x10 ⁻³ mg/kg	1.8 x10 ⁻⁶ mg/kg	1.89 x10 ⁻³ mg/kg	0.0005	Modelled increase in soil concentrations due to deposition from atmospheric emissions (i.e. assuming no application of sewage sludge to land)
4. 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 and the efficiency of the air filter and wastewater treatment facility.
- Adjustment of the flow rate for the receiving water body and subsequent dilution factor.

9.3.1.3. Exposure and risks for man via the environment

Assessment of risks for man via the environment is based on inhalation exposure to airborne particulates containing TCA released to the atmosphere during the manufacture of TCA.

Table 9.29. Exposure and risks for man via the environment

Annual emission to air (kg TCA)	Emission days per year	Concentration in local air (mg TCA/m ³)	Annual average concentration in air (mg TCA/m ³)	DNEL (mg TCA/m ³)	RCR
0.90	300	8.3 x10 ⁻⁷	6.9 x10 ⁻⁷	0.007	1.2 x10 ⁻⁴

9.3.2. Worker CS 2: Handling of liquid substance at non-dedicated facilities (PROC 8a)

Task(s) covered with this contributing scenario: Transfer and filling process.

9.3.2.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> Physical form of substance: Liquid Maximum emission potential of the substance: Very low <i>Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.</i> Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]
Amount used (or contained in articles), frequency and duration of use/exposure
<ul style="list-style-type: none"> Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]
Technical and organisational conditions and measures
<ul style="list-style-type: none"> Pattern of use: Non-dispersive use Pattern of exposure control: Direct handling Contact level: Intermittent
Conditions and measures related to personal protection, hygiene and health evaluation
<ul style="list-style-type: none"> Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i> Gloves: Protective gloves according to EN 374 have to be worn. Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. [Effectiveness Dermal: 90%] Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>

9.3.2.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.30. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.05 mg/m ³ (MEASE: 1.02.01)	RCR = 0.357
Dermal, systemic, long term	3E-3 mg/kg bw/day (MEASE: 1.02.01)	RCR = 0.075
Combined routes, systemic, long-term		RCR = 0.432

Remarks on exposure data from external estimation tools:

MEASE 1.02.01

Explanations: Dermal, systemic, long term

For calculation of systemic exposure, the exposure estimate for total dermal loading as obtained in MEASE (reported in mg/day) is divided by a body weight of 70 kg for workers.

Risk characterisation

Further information on the risk characterisation for local effects or acute systemic effects via inhalation and via the dermal route and local effects to the eyes is given in Section 9.0.4.2.

Under the prescribed conditions of use, exposure is below the DNEL and local effects are not expected. Therefore, risks are adequately controlled.

9.3.3. Worker CS 3: Handling of liquid substance (PROC 8b)

Task(s) covered with this contributing scenario: Transfer and filling process.

9.3.3.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> Physical form of substance: Liquid Maximum emission potential of the substance: Very low <i>Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.</i> Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]
Amount used (or contained in articles), frequency and duration of use/exposure
<ul style="list-style-type: none"> Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]
Technical and organisational conditions and measures
<ul style="list-style-type: none"> Pattern of use: Non-dispersive use Pattern of exposure control: Direct handling Contact level: Intermittent
Conditions and measures related to personal protection, hygiene and health evaluation
<ul style="list-style-type: none"> Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i> Gloves: Protective gloves according to EN 374 have to be worn. Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. [Effectiveness Dermal: 90%] Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>

9.3.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.31. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.01 mg/m ³ (MEASE: 1.02.01)	RCR = 0.071
Dermal, systemic, long term	3E-3 mg/kg bw/day (MEASE: 1.02.01)	RCR = 0.075
Combined routes, systemic, long-term		RCR = 0.146

Remarks on exposure data from external estimation tools:

MEASE 1.02.01

Explanations: Dermal, systemic, long term

For calculation of systemic exposure, the exposure estimate for total dermal loading as obtained in MEASE (reported in mg/day) is divided by a body weight of 70 kg for workers.

Risk characterisation

Further information on the risk characterisation for local effects or acute systemic effects via inhalation and via the dermal route and local effects to the eyes is given in Section 9.0.4.2.

Under the prescribed conditions of use, exposure is below the DNEL and local effects are not expected. Therefore, risks are adequately controlled.

9.3.4. Worker CS 4: Small scale handling of liquid substance (PROC 9)

Task(s) covered with this contributing scenario: Small scale transfer and filling process.

9.3.4.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> Physical form of substance: Liquid Maximum emission potential of the substance: Very low <i>Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.</i> Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]
Amount used (or contained in articles), frequency and duration of use/exposure
<ul style="list-style-type: none"> Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]
Technical and organisational conditions and measures
<ul style="list-style-type: none"> Pattern of use: Non-dispersive use Pattern of exposure control: Direct handling Contact level: Intermittent
Conditions and measures related to personal protection, hygiene and health evaluation
<ul style="list-style-type: none"> Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i> Gloves: Protective gloves according to EN 374 have to be worn. Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. [Effectiveness Dermal: 90%] Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>

9.3.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.32. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.01 mg/m ³ (MEASE: 1.02.01)	RCR = 0.071
Dermal, systemic, long term	3E-3 mg/kg bw/day (MEASE: 1.02.01)	RCR = 0.075
Combined routes, systemic, long-term		RCR = 0.146

Remarks on exposure data from external estimation tools:

MEASE 1.02.01

Explanations: Dermal, systemic, long term

For calculation of systemic exposure, the exposure estimate for total dermal loading as obtained in MEASE (reported in mg/day) is divided by a body weight of 70 kg for workers.

Risk characterisation

Further information on the risk characterisation for local effects or acute systemic effects via inhalation and via the dermal route and local effects to the eyes is given in Section 9.0.4.2.

Under the prescribed conditions of use, exposure is below the DNEL and local effects are not expected. Therefore, risks are adequately controlled.

9.3.5. Worker CS 5: Chemical reaction step in closed process (PROC 1)

9.3.5.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> Physical form of substance: Liquid Maximum emission potential of the substance: Very low <i>Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.</i> Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]
Amount used (or contained in articles), frequency and duration of use/exposure
<ul style="list-style-type: none"> Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]
Technical and organisational conditions and measures
<ul style="list-style-type: none"> Closed process without likelihood of exposure Level of automation: Fully automated process Pattern of use: Closed system without breaches Pattern of exposure control: Non-direct handling
Conditions and measures related to personal protection, hygiene and health evaluation
<ul style="list-style-type: none"> Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i> Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i> Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>
Other conditions affecting workers exposure
<ul style="list-style-type: none"> Elevated temperature possible

9.3.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.33. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1E-3 mg/m ³ (MEASE: 1.02.01)	RCR < 0.01
Dermal, systemic, long term	1.7E-3 mg/kg bw/day (MEASE: 1.02.01)	RCR = 0.043
Combined routes, systemic, long-term		RCR = 0.05

Remarks on exposure data from external estimation tools:

MEASE 1.02.01

Explanations: Dermal, systemic, long term

For calculation of systemic exposure, the exposure estimate for total dermal loading as obtained in

MEASE (reported in mg/day) is divided by a body weight of 70 kg for workers.

Risk characterisation

Further information on the risk characterisation for local effects or acute systemic effects via inhalation and via the dermal route and local effects to the eyes is given in Section 9.0.4.2.

Under the prescribed conditions of use, exposure is below the DNEL and local effects are not expected. Therefore, risks are adequately controlled.

9.3.6. Worker CS 6: Chemical reaction step in closed continuous process (PROC 2)

9.3.6.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> Physical form of substance: Liquid Maximum emission potential of the substance: Very low <p><i>Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.</i></p> <ul style="list-style-type: none"> Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]
Amount used (or contained in articles), frequency and duration of use/exposure
<ul style="list-style-type: none"> Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]
Technical and organisational conditions and measures
<ul style="list-style-type: none"> Closed continuous process with occasional controlled exposure Pattern of use: Non-dispersive use Pattern of exposure control: Non-direct handling
Conditions and measures related to personal protection, hygiene and health evaluation
<ul style="list-style-type: none"> Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <p><i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i></p> <ul style="list-style-type: none"> Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <p><i>Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i></p> <ul style="list-style-type: none"> Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <p><i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i></p>

9.3.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.34. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1E-3 mg/m ³ (MEASE: 1.02.01)	RCR < 0.01
Dermal, systemic, long term	3E-3 mg/kg bw/day (MEASE: 1.02.01)	RCR = 0.075
Combined routes, systemic, long-term		RCR = 0.082

Remarks on exposure data from external estimation tools:

MEASE 1.02.01

Explanations: Dermal, systemic, long term

For calculation of systemic exposure, the exposure estimate for total dermal loading as obtained in MEASE (reported in mg/day) is divided by a body weight of 70 kg for workers.

Risk characterisation

Further information on the risk characterisation for local effects or acute systemic effects via inhalation and via the dermal route and local effects to the eyes is given in Section 9.0.4.2.

Under the prescribed conditions of use, exposure is below the DNEL and local effects are not expected. Therefore, risks are adequately controlled.

9.3.7. Worker CS 7: Chemical reaction step in closed batch process (PROC 3)

9.3.7.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> Physical form of substance: Liquid Maximum emission potential of the substance: Very low <p><i>Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.</i></p> <ul style="list-style-type: none"> Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]
Amount used (or contained in articles), frequency and duration of use/exposure
<ul style="list-style-type: none"> Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]
Technical and organisational conditions and measures
<ul style="list-style-type: none"> Closed batch process with occasional controlled exposure Pattern of use: Non-dispersive use Pattern of exposure control: Non-direct handling
Conditions and measures related to personal protection, hygiene and health evaluation
<ul style="list-style-type: none"> Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <p><i>Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i></p> <ul style="list-style-type: none"> Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <p><i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i></p> <ul style="list-style-type: none"> Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <p><i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i></p>

9.3.7.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.35. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.01 mg/m ³ (MEASE: 1.02.01)	RCR = 0.071
Dermal, systemic, long term	1.7E-3 mg/kg bw/day (MEASE: 1.02.01)	RCR = 0.043
Combined routes, systemic, long-term		RCR = 0.114

Remarks on exposure data from external estimation tools:

MEASE 1.02.01

Explanations: Dermal, systemic, long term

For calculation of systemic exposure, the exposure estimate for total dermal loading as obtained in MEASE (reported in mg/day) is divided by a body weight of 70 kg for workers.

Risk characterisation

Further information on the risk characterisation for local effects or acute systemic effects via inhalation and via the dermal route and local effects to the eyes is given in Section 9.0.4.2.

Under the prescribed conditions of use, exposure is below the DNEL and local effects are not expected. Therefore, risks are adequately controlled.

9.3.8. Worker CS 8: Chemical reaction step in open or semi-closed process (PROC 4)

9.3.8.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> Physical form of substance: Liquid Maximum emission potential of the substance: Very low <i>Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.</i> Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]
Amount used (or contained in articles), frequency and duration of use/exposure
<ul style="list-style-type: none"> Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]
Technical and organisational conditions and measures
<ul style="list-style-type: none"> Pattern of use: Non-dispersive use Pattern of exposure control: Non-direct handling
Conditions and measures related to personal protection, hygiene and health evaluation
<ul style="list-style-type: none"> Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i> Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i> Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>

9.3.8.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.36. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.05 mg/m ³ (MEASE: 1.02.01)	RCR = 0.357
Dermal, systemic, long term	3E-3 mg/kg bw/day (MEASE: 1.02.01)	RCR = 0.075
Combined routes, systemic, long-term		RCR = 0.432

Remarks on exposure data from external estimation tools:

MEASE 1.02.01

Explanations: Dermal, systemic, long term

For calculation of systemic exposure, the exposure estimate for total dermal loading as obtained in MEASE (reported in mg/day) is divided by a body weight of 70 kg for workers.

Risk characterisation

Further information on the risk characterisation for local effects or acute systemic effects via inhalation and via the dermal route and local effects to the eyes is given in Section 9.0.4.2.

Under the prescribed conditions of use, exposure is below the DNEL and local effects are not expected. Therefore, risks are adequately controlled.

9.3.9. Worker CS 9: Mixing or blending in batch process (PROC 5)

9.3.9.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> Physical form of substance: Liquid Maximum emission potential of the substance: Very low <i>Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.</i> Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]
Amount used (or contained in articles), frequency and duration of use/exposure
<ul style="list-style-type: none"> Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]
Technical and organisational conditions and measures
<ul style="list-style-type: none"> Pattern of use: Non-dispersive use Pattern of exposure control: Non-direct handling
Conditions and measures related to personal protection, hygiene and health evaluation
<ul style="list-style-type: none"> Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i> Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i> Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>

9.3.9.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.37. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.05 mg/m ³ (MEASE: 1.02.01)	RCR = 0.357
Dermal, systemic, long term	3E-3 mg/kg bw/day (MEASE: 1.02.01)	RCR = 0.075
Combined routes, systemic, long-term		RCR = 0.432

Remarks on exposure data from external estimation tools:

MEASE 1.02.01

Explanations: Dermal, systemic, long term

For calculation of systemic exposure, the exposure estimate for total dermal loading as obtained in MEASE (reported in mg/day) is divided by a body weight of 70 kg for workers.

Risk characterisation

Further information on the risk characterisation for local effects or acute systemic effects via inhalation and via the dermal route and local effects to the eyes is given in Section 9.0.4.2.

Under the prescribed conditions of use, exposure is below the DNEL and local effects are not expected. Therefore, risks are adequately controlled.

9.3.10. Worker CS 10: Laboratory analyses (PROC 15)

Task(s) covered with this contributing scenario: Quality control, sampling.

9.3.10.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> Physical form of substance: Liquid Maximum emission potential of the substance: Very low <i>Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.</i> Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]
Amount used (or contained in articles), frequency and duration of use/exposure
<ul style="list-style-type: none"> Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]
Technical and organisational conditions and measures
<ul style="list-style-type: none"> Pattern of use: Non-dispersive use Pattern of exposure control: Direct handling Contact level: Intermittent
Conditions and measures related to personal protection, hygiene and health evaluation
<ul style="list-style-type: none"> Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i> Gloves: Protective gloves according to EN 374 have to be worn. Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. [Effectiveness Dermal: 90%] Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>

9.3.10.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.38. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.01 mg/m ³ (MEASE: 1.02.01)	RCR = 0.071
Dermal, systemic, long term	1.7E-3 mg/kg bw/day (MEASE: 1.02.01)	RCR = 0.043
Combined routes, systemic, long-term		RCR = 0.114

Remarks on exposure data from external estimation tools:

MEASE 1.02.01

Explanations: Dermal, systemic, long term

For calculation of systemic exposure, the exposure estimate for total dermal loading as obtained in MEASE (reported in mg/day) is divided by a body weight of 70 kg for workers.

Risk characterisation

Further information on the risk characterisation for local effects or acute systemic effects via inhalation and via the dermal route and local effects to the eyes is given in Section 9.0.4.2.

Under the prescribed conditions of use, exposure is below the DNEL and local effects are not expected. Therefore, risks are adequately controlled.

9.3.11. Worker CS 11: Production of metal powders in wet process (PROC 27b)

9.3.11.1. Conditions of use

Product (Article) characteristics
<ul style="list-style-type: none"> Physical form of substance: Liquid Maximum emission potential of the substance: Very low <p><i>Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.</i></p> <ul style="list-style-type: none"> Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]
Amount used (or contained in articles), frequency and duration of use/exposure
<ul style="list-style-type: none"> Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]
Technical and organisational conditions and measures
<ul style="list-style-type: none"> Pattern of use: Non-dispersive use Pattern of exposure control: Non-direct handling
Conditions and measures related to personal protection, hygiene and health evaluation
<ul style="list-style-type: none"> Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <p><i>Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i></p> <ul style="list-style-type: none"> Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <p><i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i></p> <ul style="list-style-type: none"> Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <p><i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i></p>

9.3.11.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.39. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.1 mg/m ³ (MEASE: 1.02.01)	RCR = 0.714
Dermal, systemic, long term	3E-3 mg/kg bw/day (MEASE: 1.02.01)	RCR = 0.075
Combined routes, systemic, long-term		RCR = 0.789

Remarks on exposure data from external estimation tools:

MEASE 1.02.01

Explanations: Dermal, systemic, long term

For calculation of systemic exposure, the exposure estimate for total dermal loading as obtained in MEASE (reported in mg/day) is divided by a body weight of 70 kg for workers.

Risk characterisation

Further information on the risk characterisation for local effects or acute systemic effects via inhalation and via the dermal route and local effects to the eyes is given in Section 9.0.4.2.

Under the prescribed conditions of use, exposure is below the DNEL and local effects are not expected. Therefore, risks are adequately controlled.

9.3.12. Worker CS 12: Wet cleaning (PROC 28)**9.3.12.1. Conditions of use**

Product (Article) characteristics
<ul style="list-style-type: none"> Physical form of substance: Liquid Maximum emission potential of the substance: Very low <i>Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.</i> Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]
Amount used (or contained in articles), frequency and duration of use/exposure
<ul style="list-style-type: none"> Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]
Technical and organisational conditions and measures
<ul style="list-style-type: none"> Pattern of use: Non-dispersive use Pattern of exposure control: Direct handling Contact level: Extensive Additional operational conditions for cleaning and maintenance: Maintenance and repair work only at machinery/systems which are not in operation. Minor cleaning tasks may be conducted under operation.
Conditions and measures related to personal protection, hygiene and health evaluation
<ul style="list-style-type: none"> Respiratory protective equipment (RPE): RPE with minimum APF = 10 [Effectiveness Inhalation: 90%] <i>APF = assigned protection factor according to EN 529. At minimum any combination of particle filter class P2 with mask according to EN 140, EN 1827 or EN 136 or filtering half mask (FF P2) according to EN 149 or combination of P1 filter with face piece according EN 12942 or any RPE providing higher APFs according to EN 529 is required.</i> Gloves: Protective gloves according to EN 374 have to be worn. Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. [Effectiveness Dermal: 90%] Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>

9.3.12.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.40. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5E-3 mg/m ³ (MEASE: 1.02.01)	RCR = 0.036
Dermal, systemic, long term	0.03 mg/kg bw/day (MEASE: 1.02.01)	RCR = 0.75
Combined routes, systemic,		RCR = 0.786

Route of exposure and type of effects	Exposure concentration	Risk quantification
long-term		

Remarks on exposure data from external estimation tools:

MEASE 1.02.01

Explanations: According to ECHA Guidance R. 12 (Version 3.0, December 2015) PROC 28 should be used as descriptor for cleaning and maintenance activities. In MEASE, Version 1.02.01, PROC 28 is not available and PROC 8a was used as surrogate in MEASE for the exposure calculation.

Dermal, systemic, long term

For calculation of dermal systemic exposure, the exposure estimate for total dermal loading as obtained in MEASE (reported in mg/day) is divided by a body weight of 70 kg for workers.

Risk characterisation

Further information on the risk characterisation for local effects or acute systemic effects via inhalation and via the dermal route and local effects to the eyes is given in Section 9.0.4.2.

Under the prescribed conditions of use, exposure is below the DNEL and local effects are not expected. Therefore, risks are adequately controlled.