

13. Exposure scenario 13: Use at industrial sites - Manufacture of inorganic pigments, frits, ceramic ware, glass (intermediate use)

Market sector: Inorganic pigments, frits, ceramic ware and glass (intermediate use)

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

Environment contributing scenario(s):		
CS 1	Manufacture of inorganic pigments, frits, ceramic ware, glass (intermediate use) ES1 STP Discharge	ERC 6a
CS 2	Manufacture of inorganic pigments, frits, ceramic ware, glass (intermediate use) ES2 Direct Discharge	ERC 6a
CS 3	Manufacture of inorganic pigments, frits, ceramic ware, glass (intermediate use) ES3 Marine Discharge	ERC 6a
Worker contributing scenario(s):		
CS 4	Raw material handling	PROC 26, PROC 21; PROC 8b
CS 5	Preparation of raw material	PROC 5, PROC 1; PROC 14; PROC 2; PROC 3; PROC 4
CS 6	Wet process	PROC 4, PROC 1
CS 7	Hot process	PROC 23, PROC 1; PROC 22
CS 8	Formulation and filling	PROC 9, PROC 3; PROC 8b
CS 9	Packaging of massive objects	PROC 21
CS 10	Cleaning & Maintenance	PROC 28

Explanation on the approach taken for the ES

Please refer to IUCLID Section 13 for a detailed description of the specific methodology applied for the occupational exposure assessment.

It is noted that the substance is used as an intermediate, i.e. the substance is chemically transformed into another substance during this use. Exposure from process steps with substances other than the registered substance are merely reported for the sake of completeness. Please refer to information on safe use for the handling of the individual manufactured substances for process steps commencing the chemical transformation step.

13.1. Env CS 1: Manufacture of inorganic pigments, frits, ceramic ware, glass (intermediate use) ES1 STP Discharge (ERC 6a)

13.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
<ul style="list-style-type: none"> Daily use at site: ≤ 0.108 tonnes/day <i>The tonnage and further exposure is always expressed in cobalt.</i>
<ul style="list-style-type: none"> Annual use at a site: ≤ 34 tonnes/year <i>For the generic exposure scenario a tonnage covering 50% of the sector tonnages was selected.</i>
<ul style="list-style-type: none"> Number of release days per year: ≥ 315 days/year <i>The selected number of production days per year is the median value based on data from 5</i>

<i>companies.</i>
Technical and organisational conditions and measures
• Risk management measures: One or more of the following measures should be present to reduce emissions to water: Chemical precipitation, Sedimentation, Filtration, Electrolysis, Reverse osmosis or Ion exchange.
• Risk management measures: One or more of the following measures should be present to reduce emissions to air: Electrostatic precipitators, Wet electrostatic precipitators, Cyclones, but as primary collector, Fabric or bag filters, Ceramic/Metal mesh filters or Wet scrubbers.
Conditions and measures related to sewage treatment plant
• Municipal STP: Yes
• Discharge rate of STP: $\geq 2E3$ m ³ /d
• Application of the STP sludge on agricultural soil: Yes
Conditions and measures related to treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: No (low amount) (Particular risks from waste treatment unlikely due to small fraction of used substance entering into the waste stage. Waste disposal according to national/local legislation is sufficient.) <i>Wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately or/and with other cobalt compounds waste to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the cobalt content of the waste is elevated enough, internal or external recovery/recycling might be considered. Appropriate waste codes: 01 03 07*, 02 01 10*, 06 05 02*, 06 03 13*, 06 03 15*, 06 04 05*, 10 08 04, 10 10 03, 10 10 05*, 10 10 07*, 10 10 10, 10 10 11*, 11 02 07*, 12 01 03*, 12 01 04, 15 01 04*, 15 01 10*, 16 01 04*, 16 01 06*, 16 01 18*, 16 03 03*, 16 06 02*, 16 06 05, 16 08 02*, 16 08 03, 16 10 01*, 17 04 07*, 17 04 09*, 17 09 04*, 19 10 02*, 19 12 03*,... Suitable disposal: Keep separate and dispose of to either - Hazardous waste incineration operated according to Council Directive 2008/98/EC on waste, Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006. - Hazardous landfill operated under Directive 1999/31/EC. A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2011)</i>
Other conditions affecting environmental exposure
• Discharge rate of effluent: $\geq 2E3$ m ³ /d
• Receiving surface water flow rate: $\geq 1.98E5$ m ³ /d
• Final dilution factor: ≥ 100

13.1.2. Releases

The local releases to the environment are reported in the following table.

Table 9.117. Local releases to the environment

Release	Release factor estimation method	Explanation / Justification
Water	Release factor (SpERC for production of metal compounds)	Initial release factor: 0.01% Final release factor: 0.01% Local release rate: 0.011 kg/day Explanation / Justification: Eurométaux, 2012, version 2.1
Air	Release factor (SpERC for production of metal compounds)	Initial release factor: 0.01% Final release factor: 0.01% Local release rate: 0.011 kg/day Explanation / Justification: Eurométaux, 2012, version 2.1
Soil	Release factor	Final release factor: 0% Explanation / Justification: No direct release to soil.

Releases to waste

Release factor to external waste: 0.1 %

A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2011)

13.1.3. Exposure and risks for the environment and man via the environment

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

Table 9.118. Exposure concentrations and risks for the environment and man via the environment

Conclusion on risk characterisation

Protection target	Exposure concentration	Risk characterisation
Freshwater	Local PEC: 0.12 µg/l	0.20
Sediment (freshwater)	Local PEC: 5.05 mg/kg dw	0.53
Sewage treatment plant	Local PEC: 0.003 mg/l	0.01
Air	Local PEC: 2.6 ng/m ³	No environmental hazard
Agricultural soil	Local PEC: 0.11 mg/kg dw	0.01
Man via Environment - Inhalation	Local PEC: 2.6 ng/m ³	< 0.01
Man via Environment - Oral	Exposure via food consumption: 0.321 µg/kg/d	< 0.01

MAN VIA ENVIRONMENT:

The use of EUSES to predict the concentration in food is difficult to apply for metals and associated with much higher uncertainties than using measured data. Therefore, deviations from the TGD food basket approach for the exposure route "ingestion of food", have been applied as shortly described in section 9.0.3.6..

Furthermore, the exposure assessment is based on the cobalt ion, as this is the toxic species. The oral exposure concentration in µg/kg bw/day has been derived by taking 2L of drinking water (PEC freshwater taken from the local environmental exposure assessment) + the worst case exposure of 19 µg Co/d from food (97.5th percentile from the 1994 UK total diet study (please refer to section 9.0.3.6) and a default body weight of 60kg into account.

For the risk characterisation the following DNELs based on cobalt were used:

DNEL inhalation, local, long-term of 6.3 µg Co/m³

DNEL oral, systemic, long-term of 8.6 mg Co/kg bw/day

As such a combined RCR cannot be provided (local and systemic effects).

13.2. Env CS 2: Manufacture of inorganic pigments, frits, ceramic ware, glass (intermediate use) ES2 Direct Discharge (ERC 6a)**13.2.1. Conditions of use**

Amount used, frequency and duration of use (or from service life)
<ul style="list-style-type: none"> Daily use at site: ≤ 0.108 tonnes/day <i>The tonnage and further exposure is always expressed in cobalt.</i>
<ul style="list-style-type: none"> Annual use at a site: ≤ 34 tonnes/year <i>For the generic exposure scenario a tonnage covering 50% of the sector tonnages was selected.</i>
<ul style="list-style-type: none"> Number of release days per year: ≥ 315 days/year <i>The selected number of production days per year is the median value based on data from 5 companies.</i>
Technical and organisational conditions and measures
<ul style="list-style-type: none"> Risk management measures: One or more of the following measures should be present to reduce emissions to water: Chemical precipitation, Sedimentation, Filtration, Electrolysis, Reverse osmosis

or Ion exchange.
• Risk management measures: One or more of the following measures should be present to reduce emissions to air: Electrostatic precipitators, Wet electrostatic precipitators, Cyclones, but as primary collector, Fabric or bag filters, Ceramic/Metal mesh filters or Wet scrubbers.
Conditions and measures related to sewage treatment plant
• Municipal STP: No [Effectiveness Water: 0%]
Conditions and measures related to treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: No (low amount) (Particular risks from waste treatment unlikely due to small fraction of used substance entering into the waste stage. Waste disposal according to national/local legislation is sufficient.) <i>Wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately or/and with other cobalt compounds waste to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the cobalt content of the waste is elevated enough, internal or external recovery/recycling might be considered. Appropriate waste codes: 01 03 07*, 02 01 10*, 06 05 02*, 06 03 13*, 06 03 15*, 06 04 05*, 10 08 04, 10 10 03, 10 10 05*, 10 10 07*, 10 10 10, 10 10 11*, 11 02 07*, 12 01 03*, 12 01 04, 15 01 04*, 15 01 10*, 16 01 04*, 16 01 06*, 16 01 18*, 16 03 03*, 16 06 02*, 16 06 05, 16 08 02*, 16 08 03, 16 10 01*, 17 04 07*, 17 04 09*, 17 09 04*, 19 10 02*, 19 12 03*,... Suitable disposal: Keep separate and dispose of to either - Hazardous waste incineration operated according to Council Directive 2008/98/EC on waste, Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006. - Hazardous landfill operated under Directive 1999/31/EC. A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2011)</i>
Other conditions affecting environmental exposure
• Discharge rate of effluent: $\geq 2E3$ m ³ /d
• Receiving surface water flow rate: $\geq 1.98E5$ m ³ /d
• Final dilution factor: ≥ 100

13.2.2. Releases

The local releases to the environment are reported in the following table.

Table 9.119. Local releases to the environment

Release	Release factor estimation method	Explanation / Justification
Water	Release factor (SpERC for production of metal compounds)	Initial release factor: 0.01% Final release factor: 0.01% Local release rate: 0.011 kg/day Explanation / Justification: Eurométaux, 2012, version 2.1
Air	Release factor (SpERC for production of metal compounds)	Initial release factor: 0.01% Final release factor: 0.01% Local release rate: 0.011 kg/day Explanation / Justification: Eurométaux, 2012, version 2.1
Soil	Release factor	Final release factor: 0% Explanation / Justification: No direct release to soil.

Releases to waste

Release factor to external waste: 0.1 %

A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2011)

13.2.3. Exposure and risks for the environment and man via the environment

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

table.

Table 9.120. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk characterisation
Freshwater	Local PEC: 0.13 µg/l	0.22
Sediment (freshwater)	Local PEC: 5.57 mg/kg dw	0.59
Air	Local PEC: 2.6 ng/m ³	No environmental hazard
Agricultural soil	Local PEC: 0.01 mg/kg dw	< 0.01
Man via Environment - Inhalation	Local PEC: 2.6 ng/m ³	< 0.01
Man via Environment - Oral	Exposure via food consumption: 0.321 µg/kg/d	< 0.01

Conclusion on risk characterisation

MAN VIA ENVIRONMENT:

The use of EUSES to predict the concentration in food is difficult to apply for metals and associated with much higher uncertainties than using measured data. Therefore, deviations from the TGD food basket approach for the exposure route “ingestion of food”, have been applied as shortly described in section 9.0.3.6..

Furthermore, the exposure assessment is based on the cobalt ion, as this is the toxic species. The oral exposure concentration in µg/kg bw/day has been derived by taking 2L of drinking water (PEC freshwater taken from the local environmental exposure assessment) + the worst case exposure of 19 µg Co/d from food (97.5th percentile from the 1994 UK total diet study (please refer to section 9.0.3.6) and a default body weight of 60kg into account.

For the risk characterisation the following DNELs based on cobalt were used:

DNEL inhalation, local, long-term of 6.3 µg Co/m³

DNEL oral, systemic, long-term of 8.6 mg Co/kg bw/day

As such a combined RCR cannot be provided (local and systemic effects).

13.3. Env CS 3: Manufacture of inorganic pigments, frits, ceramic ware, glass (intermediate use) ES3 Marine Discharge (ERC 6a)

13.3.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
<ul style="list-style-type: none"> Daily use at site: ≤ 0.108 tonnes/day <i>The tonnage and further exposure is always expressed in cobalt.</i>
<ul style="list-style-type: none"> Annual use at a site: ≤ 34 tonnes/year <i>For the generic exposure scenario a tonnage covering 50% of the sector tonnages was selected.</i>
<ul style="list-style-type: none"> Number of release days per year: ≥ 315 days/year <i>The selected number of production days per year is the median value based on data from 5 companies.</i>
Technical and organisational conditions and measures
<ul style="list-style-type: none"> Risk management measures: One or more of the following measures should be present to reduce emissions to water: Chemical precipitation, Sedimentation, Filtration, Electrolysis, Reverse osmosis or Ion exchange.
<ul style="list-style-type: none"> Risk management measures: One or more of the following measures should be present to reduce emissions to air: Electrostatic precipitators, Wet electrostatic precipitators, Cyclones, but as primary collector, Fabric or bag filters, Ceramic/Metal mesh filters or Wet scrubbers.
Conditions and measures related to sewage treatment plant
<ul style="list-style-type: none"> Municipal STP: No [Effectiveness Water: 0%]

Conditions and measures related to treatment of waste (including article waste)
<ul style="list-style-type: none"> Particular considerations on the waste treatment operations: No (low amount) (Particular risks from waste treatment unlikely due to small fraction of used substance entering into the waste stage. Waste disposal according to national/local legislation is sufficient.) <p><i>Wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately or/and with other cobalt compounds waste to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the cobalt content of the waste is elevated enough, internal or external recovery/recycling might be considered. Appropriate waste codes: 01 03 07*, 02 01 10*, 06 05 02*, 06 03 13*, 06 03 15*, 06 04 05*, 10 08 04, 10 10 03, 10 10 05*, 10 10 07*, 10 10 10, 10 10 11*, 11 02 07*, 12 01 03*, 12 01 04, 15 01 04*, 15 01 10*, 16 01 04*, 16 01 06*, 16 01 18*, 16 03 03*, 16 06 02*, 16 06 05, 16 08 02*, 16 08 03, 16 10 01*, 17 04 07*, 17 04 09*, 17 09 04*, 19 10 02*, 19 12 03*,... Suitable disposal: Keep separate and dispose of to either - Hazardous waste incineration operated according to Council Directive 2008/98/EC on waste, Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006. - Hazardous landfill operated under Directive 1999/31/EC. A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2011)</i></p>
Other conditions affecting environmental exposure
<ul style="list-style-type: none"> Discharge rate of effluent: $\geq 2E3$ m³/d Receiving surface water flow rate: $\geq 1.98E5$ m³/d Final dilution factor: ≥ 100

13.3.2. Releases

The local releases to the environment are reported in the following table.

Table 9.121. Local releases to the environment

Release	Release factor estimation method	Explanation / Justification
Water	Release factor (SpERC for production of metal compounds)	Initial release factor: 0.01% Final release factor: 0.01% Local release rate: 0.011 kg/day Explanation / Justification: Eurométaux, 2012, version 2.1
Air	Release factor (SpERC for production of metal compounds)	Initial release factor: 0.01% Final release factor: 0.01% Local release rate: 0.011 kg/day Explanation / Justification: Eurométaux, 2012, version 2.1
Soil	Release factor	Final release factor: 0% Explanation / Justification: No direct release to soil.

Releases to waste

Release factor to external waste: 0.1 %

A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2011)

13.3.3. Exposure and risks for the environment and man via the environment

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

Table 9.122. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk characterisation
Marine water	Local PEC: 0.04 µg/l	0.02
Sediment (marine water)	Local PEC: 2.66 mg/kg dw	0.28

Protection target	Exposure concentration	Risk characterisation
Air	Local PEC: 2.6 ng/m ³	No environmental hazard
Agricultural soil	Local PEC: 0.01 mg/kg dw	< 0.01
Man via Environment - Inhalation	Local PEC: 2.6 ng/m ³	< 0.01
Man via Environment - Oral	Exposure via food consumption: 0.317 µg/kg/d	< 0.01

Conclusion on risk characterisation

MAN VIA ENVIRONMENT:

The use of EUSES to predict the concentration in food is difficult to apply for metals and associated with much higher uncertainties than using measured data. Therefore, deviations from the TGD food basket approach for the exposure route "ingestion of food", have been applied as shortly described in section 9.0.3.6..

Furthermore, the exposure assessment is based on the cobalt ion, as this is the toxic species. The oral exposure concentration in µg/kg bw/day has been derived by taking 2L of drinking water (PEC freshwater taken from the local environmental exposure assessment) + the worst case exposure of 19 µg Co/d from food (97.5th percentile from the 1994 UK total diet study (please refer to section 9.0.3.6) and a default body weight of 60kg into account.

For the risk characterisation the following DNELs based on cobalt were used:

DNEL inhalation, local, long-term of 6.3 µg Co/m³

DNEL oral, systemic, long-term of 8.6 mg Co/kg bw/day

As such a combined RCR cannot be provided (local and systemic effects).

13.4. Worker CS 4: Raw material handling (PROC 26, PROC 21; PROC 8b)

Task(s) covered with this contributing scenario: Handling, unloading, loading of reaction vessel, immediate removal of wet splashes.

13.4.1. Conditions of use

	Method
Product (Article) characteristics	
• Maximum emission potential of the substance: Medium <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%]	
• Physical form of substance: Solid, powder / dust	
• Additional physical form of substance: Massive object	
• Additional physical form of substance: Aqueous solution	
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration per shift: = 480.0 min	
• Shifts per year: = 240.0 Shifts/year <i>Typical number of shifts per year during which this task is conducted considering a single worker. This value has been taken into account in the calculation of excess cancer risk.</i>	
Technical and organisational conditions and measures	
• Process temperature: Ambient	
Conditions and measures related to personal protection, hygiene and health evaluation	
• General good occupational hygiene practices	

	Method
<p><i>Required good occupational hygiene practices to ensure a safe handling of the substance involve measures (e.g. shower and change clothes at end of work shift) to avoid any contamination of private households via the work-home-interface and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking in the workplace. In general, inhalation and ingestion should be avoided. Unless otherwise stated below, certified working clothing and shoes should be worn during work. Any contaminated clothing should not be taken home. Good general ventilation in the workplace should be ensured. Dust should not be blown off (e.g. from dried splashes) with compressed air. Regular training in workplace hygiene practice and proper use of personal protective equipment (if relevant) is required.</i></p>	
<p>• Gloves: Gloves protecting from sensitizing properties to skin, continuous supervision of workers required <i>Due to the skin sensitizing effect of the substance, protective gloves according to EN 374 have to be worn at all workplaces unless any exposure to the substance can be excluded when taking into account the nature of the conducted process, applied exposure prevention measures and physical appearance of the substance of concern in the specific type of application (e.g. protecting from splashes by containment of emission source). Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. Additionally, face protection is required to be worn as appropriate. This level of protection is to be achieved by continuous supervision and training of workers wearing gloves.</i></p>	
<p>• Certified safety clothing and shoes <i>Certified safety clothing including coveralls and safety shoes are to be worn as appropriate. Face protection may be worn if the type of process is associated with the risk of face injuries due to thermal or mechanical stress.</i></p>	
<p>• Chemical protective suit according to EN 13982 <i>In cases where direct contact with the substance cannot be avoided, a protective suit conforming to EN 13982 should be worn.</i></p>	

13.4.2. Exposure and risks for workers

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

Table 9.123. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	23 µg/m ³ (Measured data: Monitoring data)	RCR = 0.285

Remarks on measured exposure:

Monitoring data

Identity of the substance used: Exposure reported as substance

Inhalation exposure, long term concentration: Number of measured data points: 13; GSD: 3.1

Risk characterisation

Qualitative risk characterisation:

The risk characterisation for local dermal effects is given in Section 9.0.4.2.

13.5. Worker CS 5: Preparation of raw material (PROC 5, PROC 1; PROC 14; PROC 2; PROC 3; PROC 4)

Task(s) covered with this contributing scenario: Weighing, mixing, sampling, dissolving, grinding in mills, spray drying, acid leaching, filtration, scraping, purification, cementation, de-ironing

(hydrolysis), tableting.

13.5.1. Conditions of use

	Method
Product (Article) characteristics	
<ul style="list-style-type: none"> 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> 	
<ul style="list-style-type: none"> Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%] 	
<ul style="list-style-type: none"> Physical form of substance: Aqueous solution 	
Amount used (or contained in articles), frequency and duration of use/exposure	
<ul style="list-style-type: none"> Duration per shift: = 480.0 min 	
<ul style="list-style-type: none"> Shifts per year: = 240.0 Shifts/year <i>Typical number of shifts per year during which this task is conducted considering a single worker. This value has been taken into account in the calculation of excess cancer risk.</i> 	
Technical and organisational conditions and measures	
<ul style="list-style-type: none"> Maximum process temperature: 95.0 °C 	
<ul style="list-style-type: none"> Level of containment: Closed reaction vessel 	
<ul style="list-style-type: none"> Integrated local exhaust ventilation: Upper confidence limit (industrial use) [Effectiveness Inhalation: 90%] <i>High efficiency Reactor equipped with local exhaust ventilation</i> 	
Conditions and measures related to personal protection, hygiene and health evaluation	
<ul style="list-style-type: none"> General good occupational hygiene practices <i>Required good occupational hygiene practices to ensure a safe handling of the substance involve measures (e.g. shower and change clothes at end of work shift) to avoid any contamination of private households via the work-home-interface and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking in the workplace. In general, inhalation and ingestion should be avoided. Unless otherwise stated below, certified working clothing and shoes should be worn during work. Any contaminated clothing should not be taken home. Good general ventilation in the workplace should be ensured. Dust should not be blown off (e.g. from dried splashes) with compressed air. Regular training in workplace hygiene practice and proper use of personal protective equipment (if relevant) is required.</i> 	
<ul style="list-style-type: none"> Gloves: Gloves protecting from sensitizing properties to skin, continuous supervision of workers required <i>Due to the skin sensitizing effect of the substance, protective gloves according to EN 374 have to be worn at all workplaces unless any exposure to the substance can be excluded when taking into account the nature of the conducted process, applied exposure prevention measures and physical appearance of the substance of concern in the specific type of application (e.g. protecting from splashes by containment of emission source). Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. Additionally, face protection is required to be worn as appropriate. This level of protection is to be achieved by continuous supervision and training of workers wearing gloves.</i> 	
<ul style="list-style-type: none"> Certified safety clothing and shoes <i>Certified safety clothing including coveralls and safety shoes are to be worn as appropriate. Face protection may be worn if the type of process is associated</i> 	

	Method
<i>with the risk of face injuries due to thermal or mechanical stress.</i>	

13.5.2. Exposure and risks for workers

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

Table 9.124. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	24.2 µg/m ³ (Measured data: Analogous data)	RCR = 0.3

Remarks on measured exposure:

Analogous data

Identity of the substance used: Exposure reported as substance

Inhalation exposure, long term concentration: Number of measured data points: 135; GSD: 3.2

Risk characterisation

Qualitative risk characterisation:

The risk characterisation for local dermal effects is given in Section 9.0.4.2.

13.6. Worker CS 6: Wet process (PROC 4, PROC 1)

Task(s) covered with this contributing scenario: Solvent extraction, back stripping, precipitation, drying.

13.6.1. Conditions of use

	Method
Product (Article) characteristics	
<ul style="list-style-type: none"> 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> 	
<ul style="list-style-type: none"> Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%] 	
<ul style="list-style-type: none"> Physical form of substance: Aqueous solution 	
Amount used (or contained in articles), frequency and duration of use/exposure	
<ul style="list-style-type: none"> Duration per shift: = 480.0 min 	
<ul style="list-style-type: none"> Shifts per year: = 240.0 Shifts/year <i>Typical number of shifts per year during which this task is conducted considering a single worker. This value has been taken into account in the calculation of excess cancer risk.</i> 	
Technical and organisational conditions and measures	
<ul style="list-style-type: none"> Level of containment: Closed process <i>Closed pipe system, closed reaction vessels</i> 	
<ul style="list-style-type: none"> Level of automation: Semi-automated process 	
<ul style="list-style-type: none"> Process temperature: Ambient 	
<ul style="list-style-type: none"> Integrated local exhaust ventilation: Upper confidence limit (industrial use) [Effectiveness Inhalation: 90%] <i>High efficiency Vapour extraction units in the tank</i> 	

	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
<ul style="list-style-type: none"> • General good occupational hygiene practices <i>Required good occupational hygiene practices to ensure a safe handling of the substance involve measures (e.g. shower and change clothes at end of work shift) to avoid any contamination of private households via the work-home-interface and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking in the workplace. In general, inhalation and ingestion should be avoided. Unless otherwise stated below, certified working clothing and shoes should be worn during work. Any contaminated clothing should not be taken home. Good general ventilation in the workplace should be ensured. Dust should not be blown off (e.g. from dried splashes) with compressed air. Regular training in workplace hygiene practice and proper use of personal protective equipment (if relevant) is required.</i> 	
<ul style="list-style-type: none"> • Gloves: Gloves protecting from sensitizing properties to skin, continuous supervision of workers required <i>Due to the skin sensitizing effect of the substance, protective gloves according to EN 374 have to be worn at all workplaces unless any exposure to the substance can be excluded when taking into account the nature of the conducted process, applied exposure prevention measures and physical appearance of the substance of concern in the specific type of application (e.g. protecting from splashes by containment of emission source). Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. Additionally, face protection is required to be worn as appropriate. This level of protection is to be achieved by continuous supervision and training of workers wearing gloves.</i> 	
<ul style="list-style-type: none"> • Certified safety clothing and shoes <i>Certified safety clothing including coveralls and safety shoes are to be worn as appropriate. Face protection may be worn if the type of process is associated with the risk of face injuries due to thermal or mechanical stress.</i> 	
<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> 	

13.6.2. Exposure and risks for workers

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

Table 9.125. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	5.8 µg/m ³ (Measured data: Analogous data)	RCR = 0.072

Remarks on measured exposure:

Analogous data

Identity of the substance used: Exposure reported as substance

Inhalation exposure, long term concentration: Number of measured data points: 68; GSD: 3.7

Risk characterisation

Qualitative risk characterisation:

The risk characterisation for local dermal effects is given in Section 9.0.4.2.

13.7. Worker CS 7: Hot process (PROC 23, PROC 1; PROC 22)

Task(s) covered with this contributing scenario: Casting, pyrolysis, calcination, melting, thermal treatment.

It is noted that the substance is used as an intermediate so that the substance is chemically transformed into another substance in this step.

13.7.1. Conditions of use

	Method
Product (Article) characteristics	
• Maximum emission potential of the substance: Medium (temperature based)	
• Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%]	
• Physical form of substance: Solid, powder / dust	
• Additional physical form of substance: Molten	
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration per shift: = 480.0 min	
• Shifts per year: = 240.0 Shifts/year <i>Typical number of shifts per year during which this task is conducted considering a single worker. This value has been taken into account in the calculation of excess cancer risk.</i>	
Technical and organisational conditions and measures	
• Maximum process temperature: 1600 °C	
• Level of containment: Closed furnace <i>Closed furnace or well-extracted open induction furnace</i>	
• Integrated local exhaust ventilation: Upper confidence limit (industrial use) [Effectiveness Inhalation: 90%] <i>High efficiency</i>	
Conditions and measures related to personal protection, hygiene and health evaluation	
• General good occupational hygiene practices <i>Required good occupational hygiene practices to ensure a safe handling of the substance involve measures (e.g. shower and change clothes at end of work shift) to avoid any contamination of private households via the work-home-interface and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking in the workplace. In general, inhalation and ingestion should be avoided. Unless otherwise stated below, certified working clothing and shoes should be worn during work. Any contaminated clothing should not be taken home. Good general ventilation in the workplace should be ensured. Dust should not be blown off (e.g. from dried splashes) with compressed air. Regular training in workplace hygiene practice and proper use of personal protective equipment (if relevant) is required.</i>	
• Gloves: Gloves protecting from sensitizing properties to skin, continuous supervision of workers required <i>Due to the skin sensitizing effect of the substance, protective gloves according to EN 374 have to be worn at all workplaces unless any exposure to the substance can be excluded when taking into account the nature of the conducted process, applied exposure prevention measures and physical appearance of the substance of concern in the specific type of application (e.g. protecting from splashes by containment of emission source). Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. Additionally, face protection is required to be worn as</i>	

	Method
<i>appropriate. This level of protection is to be achieved by continuous supervision and training of workers wearing gloves.</i>	
<ul style="list-style-type: none"> • Certified safety clothing and shoes <i>Certified safety clothing including coveralls and safety shoes are to be worn as appropriate. Face protection may be worn if the type of process is associated with the risk of face injuries due to thermal or mechanical stress.</i> 	
<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> 	

13.7.2. Exposure and risks for workers

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

Table 9.126. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	36.5 µg/m ³ (Measured data: Analogous data)	RCR = 0.452

Remarks on measured exposure:

Analogous data

Identity of the substance used: Exposure reported as substance

Inhalation exposure, long term concentration: Number of measured data points: 25; GSD: 3.7

Risk characterisation

Qualitative risk characterisation:

The risk characterisation for local dermal effects is given in Section 9.0.4.2.

13.8. Worker CS 8: Formulation and filling (PROC 9, PROC 3; PROC 8b)

Task(s) covered with this contributing scenario: Formulation, filling, immediate removal of wet splashes.

It is noted that the substance is used as an intermediate so that the substance has been chemically transformed into another substance.

13.8.1. Conditions of use

	Method
Product (Article) characteristics	
<ul style="list-style-type: none"> • 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> 	
<ul style="list-style-type: none"> • Content in preparation: Not restricted [Effectiveness Inhalation: 0%, Dermal: 0%] 	
<ul style="list-style-type: none"> • Physical form of substance: Aqueous solution 	
Amount used (or contained in articles), frequency and duration of use/exposure	
<ul style="list-style-type: none"> • Duration per shift: = 480.0 min 	

	Method
<ul style="list-style-type: none"> • Shifts per year: = 240.0 Shifts/year <i>Typical number of shifts per year during which this task is conducted considering a single worker. This value has been taken into account in the calculation of excess cancer risk.</i> 	
Technical and organisational conditions and measures	
<ul style="list-style-type: none"> • Process temperature: Ambient 	
Conditions and measures related to personal protection, hygiene and health evaluation	
<ul style="list-style-type: none"> • General good occupational hygiene practices <i>Required good occupational hygiene practices to ensure a safe handling of the substance involve measures (e.g. shower and change clothes at end of work shift) to avoid any contamination of private households via the work-home-interface and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking in the workplace. In general, inhalation and ingestion should be avoided. Unless otherwise stated below, certified working clothing and shoes should be worn during work. Any contaminated clothing should not be taken home. Good general ventilation in the workplace should be ensured. Dust should not be blown off (e.g. from dried splashes) with compressed air. Regular training in workplace hygiene practice and proper use of personal protective equipment (if relevant) is required.</i> 	
<ul style="list-style-type: none"> • Gloves: Gloves protecting from sensitizing properties to skin, continuous supervision of workers required <i>Due to the skin sensitizing effect of the substance, protective gloves according to EN 374 have to be worn at all workplaces unless any exposure to the substance can be excluded when taking into account the nature of the conducted process, applied exposure prevention measures and physical appearance of the substance of concern in the specific type of application (e.g. protecting from splashes by containment of emission source). Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. Additionally, face protection is required to be worn as appropriate. This level of protection is to be achieved by continuous supervision and training of workers wearing gloves.</i> 	
<ul style="list-style-type: none"> • Certified safety clothing and shoes <i>Certified safety clothing including coveralls and safety shoes are to be worn as appropriate. Face protection may be worn if the type of process is associated with the risk of face injuries due to thermal or mechanical stress.</i> 	

13.8.2. Exposure and risks for workers

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

Table 9.127. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	8.6 µg/m ³ (Measured data: Analogous data)	RCR = 0.107

Remarks on measured exposure:

Analogous data

Identity of the substance used: Exposure reported as substance

Inhalation exposure, long term concentration: Number of measured data points: 1; GSD: 9

Risk characterisation

Qualitative risk characterisation:

The risk characterisation for local dermal effects is given in Section 9.0.4.2.

13.9. Worker CS 9: Packaging of massive objects (PROC 21)

Task(s) covered with this contributing scenario: Packaging.

It is noted that the substance is used as an intermediate so that the substance has been chemically transformed into another substance.

13.9.1. Conditions of use

	Method
Product (Article) characteristics	
<ul style="list-style-type: none"> 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> 	
<ul style="list-style-type: none"> Content in preparation: 1 - 5 % [Effectiveness Inhalation: 80%, Dermal: 80%] 	
<ul style="list-style-type: none"> Physical form of substance: Bound in article 	
Amount used (or contained in articles), frequency and duration of use/exposure	
<ul style="list-style-type: none"> Duration per shift: = 480.0 min 	
<ul style="list-style-type: none"> Shifts per year: = 240.0 Shifts/year <i>Typical number of shifts per year during which this task is conducted considering a single worker. This value has been taken into account in the calculation of excess cancer risk.</i> 	
Technical and organisational conditions and measures	
<ul style="list-style-type: none"> Process temperature: Ambient 	
Conditions and measures related to personal protection, hygiene and health evaluation	
<ul style="list-style-type: none"> General good occupational hygiene practices <i>Required good occupational hygiene practices to ensure a safe handling of the substance involve measures (e.g. shower and change clothes at end of work shift) to avoid any contamination of private households via the work-home-interface and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking in the workplace. In general, inhalation and ingestion should be avoided. Unless otherwise stated below, certified working clothing and shoes should be worn during work. Any contaminated clothing should not be taken home. Good general ventilation in the workplace should be ensured. Dust should not be blown off (e.g. from dried splashes) with compressed air. Regular training in workplace hygiene practice and proper use of personal protective equipment (if relevant) is required.</i> 	
<ul style="list-style-type: none"> Gloves: Gloves protecting from sensitizing properties to skin, continuous supervision of workers required <i>Due to the skin sensitizing effect of the substance, protective gloves according to EN 374 have to be worn at all workplaces unless any exposure to the substance can be excluded when taking into account the nature of the conducted process, applied exposure prevention measures and physical appearance of the substance of concern in the specific type of application (e.g. protecting from splashes by containment of emission source). Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. Additionally, face protection is required to be worn as appropriate. This level of protection is to be achieved by continuous supervision and training of workers wearing gloves.</i> 	
<ul style="list-style-type: none"> Certified safety clothing and shoes <i>Certified safety clothing including coveralls and safety shoes are to be worn as appropriate. Face protection may be worn if the type of process is associated with the risk of face injuries due to thermal or mechanical stress.</i> 	

13.9.2. Exposure and risks for workers

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

Table 9.128. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	8.6 µg/m ³ (Measured data: Analogous data)	RCR = 0.107

Remarks on measured exposure:

Analogous data

Identity of the substance used: Exposure reported as substance

Inhalation exposure, long term concentration: Number of measured data points: 10; GSD: 2.6

Risk characterisation

Qualitative risk characterisation:

The risk characterisation for local dermal effects is given in Section 9.0.4.2.

13.10. Worker CS 10: Cleaning & Maintenance (PROC 28)

Task(s) covered with this contributing scenario: Manual cleaning, repair and maintenance operations, removal of residuals from e.g. filters/overspill or as waste.

13.10.1. Conditions of use

	Method
Product (Article) characteristics	
<ul style="list-style-type: none"> Maximum emission potential of the substance: High <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> 	
<ul style="list-style-type: none"> Physical form of substance: Solid, powder / dust 	
Amount used (or contained in articles), frequency and duration of use/exposure	
<ul style="list-style-type: none"> Duration per shift: = 480.0 min 	
<ul style="list-style-type: none"> Shifts per year: = 48.0 Shifts/year <i>Typical number of shifts per year during which this task is conducted considering a single worker. This value has been taken into account in the calculation of excess cancer risk.</i> 	
Technical and organisational conditions and measures	
<ul style="list-style-type: none"> Process temperature: Ambient 	
<ul style="list-style-type: none"> Process pressure: Ambient 	
<ul style="list-style-type: none"> 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"> General good occupational hygiene practices <i>Required good occupational hygiene practices to ensure a safe handling of the substance involve measures (e.g. shower and change clothes at end of work shift) to avoid any contamination of private households via the work-home-interface and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking in the workplace. In general, inhalation and ingestion should be avoided. Unless otherwise stated below, certified working clothing and shoes should be worn during work. Any contaminated clothing should not be taken home. Good general ventilation in</i> 	

	Method
<i>the workplace should be ensured. Dust should not be blown off (e.g. from dried splashes) with compressed air. Regular training in workplace hygiene practice and proper use of personal protective equipment (if relevant) is required.</i>	
<ul style="list-style-type: none"> Gloves: Gloves protecting from sensitizing properties to skin, continuous supervision of workers required <i>Due to the skin sensitizing effect of the substance, protective gloves according to EN 374 have to be worn at all workplaces unless any exposure to the substance can be excluded when taking into account the nature of the conducted process, applied exposure prevention measures and physical appearance of the substance of concern in the specific type of application (e.g. protecting from splashes by containment of emission source). Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. Additionally, face protection is required to be worn as appropriate. This level of protection is to be achieved by continuous supervision and training of workers wearing gloves.</i> 	
<ul style="list-style-type: none"> Certified safety clothing and shoes <i>Certified safety clothing including coveralls and safety shoes are to be worn as appropriate. Face protection may be worn if the type of process is associated with the risk of face injuries due to thermal or mechanical stress.</i> 	
<ul style="list-style-type: none"> Chemical protective suit according to EN 13982 <i>In cases where direct contact with the substance cannot be avoided, a protective suit conforming to EN 13982 should be worn.</i> 	
<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> 	

13.10.2. Exposure and risks for workers

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

Table 9.129. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	16.5 µg/m ³ (Measured data: Analogous data)	RCR = 0.205

Remarks on measured exposure:

Analogous data

Identity of the substance used: Exposure reported as substance

Inhalation exposure, long term concentration: Number of measured data points: 106; GSD: 4.2

Risk characterisation

Qualitative risk characterisation:

The risk characterisation for local dermal effects is given in Section 9.0.4.2.