

28. ES 28: Use at industrial sites; Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass

28.1. Title section

Product category: Semiconductors (PC 33)

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

Environment	
1: Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES1 STP Discharge	ERC 6a
2: Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES2 Direct Discharge	ERC 6a
3: Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES3 Marine Discharge	ERC 6a
Worker	
4: Raw material handling	PROC 26, PROC 21, PROC 8b
5: Preparation of raw material	PROC 5, PROC 4, PROC 2, PROC 3, PROC 1
6: Wet process	PROC 4, PROC 1
7: Hot process	PROC 23, PROC 1, PROC 22
8: Formulation and filling	PROC 9, PROC 3, PROC 8b
9: Packaging of massive objects	PROC 21
10: Cleaning & Maintenance	PROC 28

28.2. Conditions of use affecting exposure

28.2.1. Control of environmental exposure: Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES1 STP Discharge (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.198 tonnes/day
Annual amount per site <= 65 tonnes/year
Emission days >= 328 days/year
Technical and organisational conditions and measures
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow >= 2E3 m3/day
Conditions and measures related to external treatment of waste (including article waste)

Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Local freshwater dilution factor 200

28.2.2. Control of environmental exposure: Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES2 Direct Discharge (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.198 tonnes/day
Annual amount per site <= 65 tonnes/year
Emission days >= 328 days/year
Technical and organisational conditions and measures
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Assumed effluent discharge flow from site >= 2E3 m ³ /day
No discharge to marine water assumed
Local freshwater dilution factor 200

28.2.3. Control of environmental exposure: Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES3 Marine Discharge (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.198 tonnes/day
Annual amount per site <= 65 tonnes/year
Emission days >= 328 days/year
Technical and organisational conditions and measures
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Assumed effluent discharge flow from site >= 2E3 m ³ /day
No discharge to freshwater assumed
Local marine water dilution factor 100

28.2.4. Control of worker exposure: Raw material handling (PROC 26, PROC 21, PROC 8b)

Product (article) characteristics
Maximum emission potential covered in this ES: Medium.
Concentration of the substance in mixture is not restricted.
Physical form covered in this ES: Solid, powder / dust.
Physical form of product; Massive object
Physical form covered in this ES: Aqueous solution.
Amount used (or contained in articles), frequency and duration of use/exposure
Duration of exposure: Not restricted.
Technical and organisational conditions and measures
Process is carried out at ambient temperature.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374.; For further specification, refer to section 8 of the SDS.
Use suitable eye protection.; For further specification, refer to section 8 of the SDS.
APF of RPE = 10 (90% respiratory protection).
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.

28.2.5. Control of worker exposure: Preparation of raw material (PROC 5, PROC 4, PROC 2, PROC 3, PROC 1)

Product (article) characteristics
Maximum emission potential covered in this ES: Very low.
Concentration of the substance in mixture is not restricted.
Physical form covered in this ES: Aqueous solution.
Amount used (or contained in articles), frequency and duration of use/exposure
Duration of exposure: Not restricted.
Technical and organisational conditions and measures
Limit the process temperature to 95 °C.
Ensure enclosure of reaction vessel.
Use of an integrated local exhaust ventilation with an efficiency of at least 90% is required.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374.; For further specification, refer to section 8 of the SDS.
Use suitable eye protection.; For further specification, refer to section 8 of the SDS.
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%) unless inhalation exposure to the substance can be excluded. For further specification, refer to section 8 of the SDS.

28.2.6. Control of worker exposure: Wet process (PROC 4, PROC 1)

Product (article) characteristics
Maximum emission potential covered in this ES: Very low.
Concentration of the substance in mixture is not restricted.
Physical form covered in this ES: Aqueous solution.
Amount used (or contained in articles), frequency and duration of use/exposure
Duration of exposure: Not restricted.

Technical and organisational conditions and measures
Process is carried out at ambient temperature.
Ensure full containment of the process.
Level of automation should be semi-automated.
Use of an integrated local exhaust ventilation with an efficiency of at least 90% is required.
Conditions and measures related to personal protection, hygiene and health evaluation
Use suitable eye protection.; For further specification, refer to section 8 of the SDS.
Wear suitable gloves tested to EN374.; For further specification, refer to section 8 of the SDS.
APF of RPE = 10 (90% respiratory protection).

28.2.7. Control of worker exposure: Hot process (PROC 23, PROC 1, PROC 22)

Product (article) characteristics
Maximum emission potential covered in this ES: Medium (temperature based).
Concentration of the substance in mixture is not restricted.
Physical form covered in this ES: Molten.
Physical form covered in this ES: Solid, powder / dust.
Physical form covered in this ES: Solid.
Amount used (or contained in articles), frequency and duration of use/exposure
Duration of exposure: Not restricted.
Technical and organisational conditions and measures
Limit the process temperature to 1.6E3 °C.
Closed furnace or well-extracted open induction furnace.
Use of an integrated local exhaust ventilation with an efficiency of at least 90% is required.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374.; For further specification, refer to section 8 of the SDS.
Use suitable eye protection.; For further specification, refer to section 8 of the SDS.
APF of RPE = 10 (90% respiratory protection).

28.2.8. Control of worker exposure: Formulation and filling (PROC 9, PROC 3, PROC 8b)

Product (article) characteristics
Maximum emission potential covered in this ES: Very low.
Concentration of the substance in mixture is not restricted.
Physical form covered in this ES: Aqueous solution.
Amount used (or contained in articles), frequency and duration of use/exposure
Duration of exposure: Not restricted.
Technical and organisational conditions and measures
Process is carried out at ambient temperature.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374.; For further specification, refer to section 8 of the SDS.
Use suitable eye protection.; For further specification, refer to section 8 of the SDS.
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%) unless inhalation exposure to the substance can be excluded. For further

specification, refer to section 8 of the SDS.

28.2.9. Control of worker exposure: Packaging of massive objects (PROC 21)

Product (article) characteristics
Maximum emission potential covered in this ES: Very low.
Limit the concentration of the substance in mixture to <= 5 %.
Physical form covered in this ES: Bound in article.
Amount used (or contained in articles), frequency and duration of use/exposure
Duration of exposure: Not restricted.
Technical and organisational conditions and measures
Process is carried out at ambient temperature.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374.; For further specification, refer to section 8 of the SDS.
Use suitable eye protection.; For further specification, refer to section 8 of the SDS.
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%) unless inhalation exposure to the substance can be excluded. For further specification, refer to section 8 of the SDS.

28.2.10. Control of worker exposure: Cleaning & Maintenance (PROC 28)

Product (article) characteristics
Maximum emission potential covered in this ES: High.
Physical form covered in this ES: Solid, powder / dust.
Amount used (or contained in articles), frequency and duration of use/exposure
Duration of exposure: Not restricted.
Technical and organisational conditions and measures
Process is carried out at ambient temperature.
Process is carried out at ambient pressure.
Maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374.; For further specification, refer to section 8 of the SDS.
Use suitable eye protection.; For further specification, refer to section 8 of the SDS.
APF of RPE = 40 (97.5% respiratory protection).
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.

28.3. Exposure estimation and reference to its source

28.3.1. Environmental release and exposure: Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES1 STP Discharge (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.079 kg/day	Estimated release factor
Air	0.059 kg/day	Estimated release factor

Release route	Release rate	Release estimation method
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	1.75E-4 mg/L (EUSES 2.1.2)	0.282
Sediment (freshwater)	7.15 mg/kg dw (PEC sediment calculation method for metals)	0.133
Sewage Treatment Plant	0.024 mg/L (EUSES 2.1.2)	0.064
Agricultural soil	0.906 mg/kg dw (EUSES 2.1.2)	0.083
Man via environment - Inhalation	1.49E-5 mg/m ³ (EUSES 2.1.2)	< 0.01

28.3.2. Environmental release and exposure: Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES2 Direct Discharge (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.079 kg/day	Estimated release factor
Air	0.059 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	2.25E-4 mg/L (EUSES 2.1.2)	0.363
Sediment (freshwater)	9.07 mg/kg dw (PEC sediment calculation method for metals)	0.169
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via environment - Inhalation	1.49E-5 mg/m ³ (EUSES 2.1.2)	< 0.01

28.3.3. Environmental release and exposure: Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES3 Marine Discharge (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.079 kg/day	Estimated release factor
Air	0.059 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	0.187 µg/L (Clocal calculation with Kp susp. matter marine)	0.079
Sediment (marine water)	29.49 mg/kg dw (PEC sediment calculation method for metals)	0.422
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via environment - Inhalation	1.49E-5 mg/m ³ (EUSES 2.1.2)	< 0.01

28.3.4. Worker exposure: Raw material handling (PROC 26, PROC 21, PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
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Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	15.3 µg/m ³ (Measured data)	0.383

28.3.5. Worker exposure: Preparation of raw material (PROC 5, PROC 4, PROC 2, PROC 3, PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	12 µg/m ³ (Measured data)	0.3

28.3.6. Worker exposure: Wet process (PROC 4, PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	2.9 µg/m ³ (Measured data)	0.072

28.3.7. Worker exposure: Hot process (PROC 23, PROC 1, PROC 22)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	18.1 µg/m ³ (Measured data)	0.453

28.3.8. Worker exposure: Formulation and filling (PROC 9, PROC 3, PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	10 µg/m ³ (MEASE)	0.25

28.3.9. Worker exposure: Packaging of massive objects (PROC 21)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	10 µg/m ³ (MEASE)	0.25

28.3.10. Worker exposure: Cleaning & Maintenance (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	20.2 µg/m ³ (Measured data)	0.505

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

Guidance: Please refer to Section 0.3 of this "ES for Communication".