

4. ES 4: Use at industrial sites; Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use)

4.1. Title section

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

Environment	
1: Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES1 STP Discharge	ERC 6a
2: Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES2 Direct Discharge	ERC 6a
3: Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES3 Marine Discharge	ERC 6a
Worker	
4: Raw material handling	PROC 26, PROC 21, PROC 8b
5: Preparation of raw material	PROC 3, PROC 1
6: Wet process	PROC 4, PROC 1
7: Hot process	PROC 22, PROC 27a, PROC 1
8: Further processing	PROC 5, PROC 1
9: Filling of solutions	PROC 8b
10: Handling of powders with moderate dustiness potential	PROC 26
11: Handling of powders with high dustiness potential	PROC 26
12: Cleaning & Maintenance	PROC 28

4.2. Conditions of use affecting exposure

4.2.1. Control of environmental exposure: Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES1 STP Discharge (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 1.11 tonnes/day
Annual amount per site <= 400 tonnes/year
Emission days >= 360 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 1E3

4.2.2. Control of environmental exposure: Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES2 Direct Discharge (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 1.11 tonnes/day
Annual amount per site <= 400 tonnes/year
Emission days >= 360 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 m3/day
No discharge to marine water assumed
Local freshwater dilution factor 1E3

4.2.3. Control of environmental exposure: Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES3 Marine Discharge (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 1.11 tonnes/day
Annual amount per site <= 400 tonnes/year
Emission days >= 360 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 m3/day
No discharge to freshwater assumed
Local marine water dilution factor 100

4.2.4. 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.

4.2.5. Control of worker exposure: Preparation of raw material (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.

4.2.6. 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).

4.2.7. Control of worker exposure: Hot process (PROC 22, PROC 27a, PROC 1)

Product (article) characteristics
Maximum emission potential covered in this ES: Low (temperature based).
Physical form covered in this ES: Solution / filter cake / damp powder / dried powder.
Amount used (or contained in articles), frequency and duration of use/exposure
Duration of exposure: Not restricted.
Technical and organisational conditions and measures
Use of an exterior local exhaust ventilation with an efficiency of at least 86% is required.
Ensure enclosure of furnace operation.
Covers use at temperatures below melting point / degradation 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).

4.2.8. Control of worker exposure: Further processing (PROC 5, PROC 1)

Product (article) characteristics
Maximum emission potential covered in this ES: High.
Physical form covered in this ES: Solid, powder / dust.
Physical form of product; 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
Ensure full containment of the process.
Use of an integrated local exhaust ventilation with an efficiency of at least 90% is required.
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).

4.2.9. Control of worker exposure: Filling of solutions (PROC

8b)

Product (article) characteristics
Maximum emission potential covered in this ES: Very low.
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.

4.2.10. Control of worker exposure: Handling of powders with moderate dustiness potential (PROC 26)

Product (article) characteristics
Maximum emission potential covered in this ES: Medium.
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
Use of an integrated local exhaust ventilation with an efficiency of at least 90% is required.
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.

4.2.11. Control of worker exposure: Handling of powders with high dustiness potential (PROC 26)

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
Use of an integrated local exhaust ventilation with an efficiency of at least 90% is required.
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 = 40 (97.5% respiratory protection).
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.

4.2.12. 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.

4.3. Exposure estimation and reference to its source

4.3.1. Environmental release and exposure: Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES1 STP Discharge (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.083 kg/day	Estimated release factor
Air	0.05 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	1.16E-4 mg/L (EUSES 2.1.2)	0.187
Sediment (freshwater)	4.87 mg/kg dw (PEC sediment calculation method for metals)	0.091
Sewage Treatment Plant	0.025 mg/L (EUSES 2.1.2)	0.068
Agricultural soil	0.94 mg/kg dw (EUSES 2.1.2)	0.086
Man via environment - Inhalation	1.38E-5 mg/m ³ (EUSES 2.1.2)	< 0.01

4.3.2. Environmental release and exposure: Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES2 Direct Discharge (ERC 6a)

Release route	Release rate	Release estimation method
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Release route	Release rate	Release estimation method
Water	0.083 kg/day	Estimated release factor
Air	0.05 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	1.26E-4 mg/L (EUSES 2.1.2)	0.204
Sediment (freshwater)	5.28 mg/kg dw (PEC sediment calculation method for metals)	0.098
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via environment - Inhalation	1.38E-5 mg/m ³ (EUSES 2.1.2)	< 0.01

4.3.3. Environmental release and exposure: Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES3 Marine Discharge (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.083 kg/day	Estimated release factor
Air	0.05 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	0.196 µg/L (Clocal calculation with Kp susp. matter marine)	0.083
Sediment (marine water)	30.43 mg/kg dw (PEC sediment calculation method for metals)	0.436
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via environment - Inhalation	1.38E-5 mg/m ³ (EUSES 2.1.2)	< 0.01

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

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

4.3.5. Worker exposure: Preparation of raw material (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

4.3.6. 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

4.3.7. Worker exposure: Hot process (PROC 22, PROC 27a, PROC 1)

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

4.3.8. Worker exposure: Further processing (PROC 5, PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	23.9 µg/m ³ (Measured data)	0.597

4.3.9. Worker exposure: Filling of solutions (PROC 8b)

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

4.3.10. Worker exposure: Handling of powders with moderate dustiness potential (PROC 26)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	16.8 µg/m ³ (Measured data)	0.42

4.3.11. Worker exposure: Handling of powders with high dustiness potential (PROC 26)

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

4.3.12. 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

4.4. 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".