

Manufacture of cobalt in the catalyst industry				
Systematic title based on use descriptor	SU3 (Industrial use), SU8, SU9, SU10 PC19, PC 20, PC21, ERC1, ERC3, ERC6a (appropriate PROCs are given in Section 2 below)			
2. Operational conditions and risk management measures				
Workplace	Involved task		Involved PROCs	
Production or regeneration of catalyst	Storage, delivery, transfer, conveying, loading, extrusion, drying, milling, mixing, screening, reduction, dissolving, precipitation, filtration, forming, impregnation, calcination, stabilisation, coating filling, unloading, regeneration, stripping, cleaning, maintenance, packaging		1, 2, 3, 4, 8a, 8b, 9, 14, 22	
2.1 Control of workers exposure				
Product characteristics				
Workplace	Use in preparation and content in preparation		Physical form of the product	
Production or regeneration of catalyst	No restriction		Various (Powder, Shaped)	
Amounts used				
No restriction.				
Frequency and duration of use/exposure				
No restriction.				
Human factors not influenced by risk management				
The shift breathing volume 10 m ³ /8 h (full shift).				
Other given operational conditions affecting workers exposure				
Workplace	Room volume	Indoor use/Outdoor use	Process temperature	Process pressure
Production or regeneration of catalyst	>1,000 m ³	Indoor use	< 160°C (for closed processes < 600°C)	No restriction
Technical conditions and measures at process level (source) to prevent release				
Production or regeneration of catalyst - Automation and complete enclosure of powder processing and transfer, handling and filling operations are not likely to give rise to significant exposures to inhalable cobalt-containing powder or dust. Level of segregation not required.				
Technical conditions and measures to control dispersion from source towards the worker				
Production or regeneration of catalyst (local exhaust ventilation, efficiency up to 90 %). Level of separation if required see frequency and duration of exposure section. Installation of ventilated (positive pressure) control rooms can also reduce exposure. Additional information: Any localised controls have to be applied considering the emission potential of the material handled as well as the release potential resulting from the containment and level of automation (i.e. semi- and fully automated) of the conducted processes.				
Organisational measures to prevent/limit releases, dispersion and exposure				
Additional information See Section: 7, 8, 11 (SDS).				
Conditions and measures related to personal protection, hygiene and health evaluation				
Workplace	Specification of respiratory protective equipment (RPE)	RPE efficiency (assigned protection factor, APF)	Specification of gloves and further personal protective equipment (PPE)	
Production or regeneration of catalyst	An approved dust mask should be worn if dust is generated during handling. Mask type: FFP3. Half-face particle respirator (DIN EN 143)/Half-face particle mask (DIN EN 149)	APF= 20	In cases where direct contact with cobalt cannot be avoided, a protective suit conforming to EN13982-1 type 5 and suitable chemical resistant gloves (EN 374) providing protection for the duration of activity (e.g. nitrile rubber (0.4 mm), chloroprene rubber (0.5 mm), butyl rubber (0.7 mm) should be worn. As a general requirement for the conducted processes: standard working clothes (long-sleeve overall) and safety shoes during all process steps, additional use of goggles during manual operations.	

2.2 Control of environmental exposure
Amounts used
226.1 tonnes Co/annum/site
Frequency and duration of use/exposure
Continuous use/release. More than 295 days/year to the air and water compartment.
Environment factors not influenced by risk management
The dilution capacity of the receiving surface water (calculated as the ratio between the flow rate of the river/lake/estuary/sea to the effluent discharge rate): <ul style="list-style-type: none"> - Dilution factor for the freshwater environment (Fresh water – STP ES): 100 - Dilution factor for the freshwater environment (Fresh water – direct discharge ES): 200 - Dilution factor for the marine environment: 150
Other given operational conditions affecting environmental exposure
Not applicable.
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil
<p><u>Water</u>: One or more of the following measures (as set out in the BAT Reference Document on Non-Ferrous Metal Processes), to be taken for emissions to water:</p> <ul style="list-style-type: none"> - Chemical precipitation: used primarily to remove the metal ions - Sedimentation - Filtration: used as final clarification step - Electrolysis: for low metal concentration - Reverse Osmosis (OR): extensively used for the removal of dissolved metals - Ion exchange: final cleaning step in the removal of heavy metal from process wastewater <p><u>Air</u>: One or more of the following measures (as set out in the BAT Reference Document on Non-Ferrous Metal Processes) to be taken for emissions to air:</p> <ul style="list-style-type: none"> - Electrostatic precipitators using wide electrode spacing: 5 – 15 mg/Nm³ - Wet electrostatic precipitators: < 5 mg/Nm³ - Cyclones, but as primary collector: < 50 mg/Nm³ - Fabric or bag filters: high efficiency in controlling fine particulate (melting): < 5mg/Nm³ (membrane filtration achieves > 1 mg/Nm³) - Ceramic and metal mesh filters. PM10 particles are removed: 0.1 mg/Nm³ - Wet scrubbers: < 4 mg/Nm³ <p><u>Soil</u>: No measures to reduce emissions to soil</p> <p>The release factors to both the water and air compartments after on-site treatment are:</p> <ul style="list-style-type: none"> - Estimated fraction released to water (g Co/tonne Co): 32 - Estimated fraction released to air (g Co/tonne Co): 38.9
Organisational measures to prevent/limit release from site
Please see section 8 SDS for more details.
Conditions and measures related to municipal sewage treatment plant
Two different exposure scenarios (ES) for the freshwater environment were considered. As default exposure scenario, an offsite municipal STP is included and sludge is applied to agricultural soil. As a second exposure scenario, no off-site municipal STP (direct discharge) is included and no sludge is applied to agricultural soil. For the marine environment, the ES considers no off-site municipal STP (direct discharge) treatment and no sludge application to agricultural soil. The assumption by default for the off site municipal sewage treatment plant is 2,000 m ³ /day. The fraction of Co removed by the municipal STP is set at 40 %.
Conditions and measures related to external treatment of waste for disposal
<p>Suitable disposal: Wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants (Council Directive 2008/98/EC, Directive 2000/76/EC and BAT Reference Document 2006) or hazardous waste landfills as hazardous waste (Directive 1999/31/EC). 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. Fraction of daily/annual use expected in waste: 0.001 or 0.1%</p> <p>Appropriate waste codes: 01 03 07*; 11 02 07*; 06 05 02*; 15 01 10*; 10 08 04; 10 10 11*; 12 01 03; 12 01 04; 06 03 13*; 06 03 15*; 10 10 03; 10 10 05*; 10 10 07*; 16 06 05; 16 08 02* 16 08 03</p>

3. Exposure estimation and reference to its source

Occupational exposure

The risk characterisation ratio (RCR) is the quotient of the exposure estimate and the respective Derived No Effect Level (DNEL) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on a DNEL for cobalt of 40 µg/m³.

Workplace	Method used for inhalation exposure assessment	Inhalation exposure estimate (RCR)	Method used for dermal exposure assessment	Dermal exposure estimate (RCR)
Production or regeneration of catalyst	measured data	19 µg/m ³ (0.48)	Since cobalt has sensitising properties, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario.	

Environmental emissions

The risk characterisation ratio (RCR) is the quotient of the local Predicted Environmental Concentration (PEC) and the respective PNEC (Predicted No Effect Concentration) and has to be below 1 to demonstrate a safe use.

Compartment	Predicted Environmental Concentration	Predicted No Effect Concentration	Risk characterisation ratio
Fresh water – STP	0.15 µg/l	0.51 µg/l	0.29
Fresh water – direct discharge	0.19 µg/l	0.51 µg/l	0.38
Sea water	0.10 µg/l	2.36 µg/l	0.04
Freshwater sediment – STP	6.05 mg/kg	9.5 mg/kg dw	0.64
Freshwater sediment – direct discharge	7.90 mg/kg	9.5 mg/kg dw	0.83
Marine water sediment	8.11 mg/kg	9.5 mg/kg dw	0.85
Terrestrial – sludge application	0.25 mg/kg	10.9 mg/kg dw	0.023
Terrestrial – no sludge application	0.015 mg/kg	10.9 mg/kg dw	0.001
Sewage treatment plant	0.01 mg/l	0.37 mg/l	0.03

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

Occupational and Environmental exposure

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. For human health, this has to be done by showing that they limit the inhalation exposure to a level below the DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (www.ebrc.de/mease.html) to estimate the associated exposure. For the environment, this has to be done by showing that they limit the PEC below the PNEC for the respective environmental compartment. If measured data are not available, the DU may make use of an appropriate scaling tool such as the DU-Scaling tool (<http://www.arche-consulting.be/Metal-CSA-toolbox/duscaling-tool>) to estimate PEC values.