

Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use)

Systematic title based on use descriptor	SU3 (Industrial use), SU8, SU9 PC19, ERC1, ERC6a (appropriate PROCs are given in Section 2 below)
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2. Operational conditions and risk management measures

Workplace	Involved task	Involved PROCs
Raw material handling	Loading of reaction vessel	8b (Solution), 21 (Chips), 26 (Powder)
Preparation of raw material	Sampling, weighing, acid leaching, dissolving, filtration, scraping, purification, cementation, de-ironing (Hydrolysis)	1, 3
Wet process	Precipitation, solvent extraction, back stripping, drying	1, 4
Hot process	Pyrolysis, calcination	1, 22, 27a
Further processing	Milling, sieving, blending	1, 5
Filling of solutions	Filling	8b (Solution) <small>Note: Cobalt has been chemically transformed into another substance (used as an intermediate).</small>
Handling of powders with moderate dustiness potential	Packaging, drying	26 (Powder) <small>Note: Cobalt has been chemically transformed into another substance (used as an intermediate).</small>
Handling of powders with high dustiness potential	Packaging	26 (Powder) <small>Note: Cobalt has been chemically transformed into another substance (used as an intermediate).</small>
Cleaning & maintenance	Manual cleaning, repair and maintenance operations, removal of residuals from e.g. filters/overspill or as waste	8a, 26

2.1 Control of workers exposure

Product characteristics

Workplace	Use in preparation and content in preparation	Physical form of the product
Raw material handling	Yes (cobalt-containing feed material)	Various (Powder, Chips, Solution)
Preparation of raw material		Solution
Wet process		Solution
Hot process	Not applicable	Not applicable
Further processing	Not applicable	Various (Powder, Solution)
Filling of solutions	Not applicable	Various (Powder, Solution)
Handling of powders with moderate dustiness potential	Not applicable	Powder
Handling of powders with high dustiness potential	Not applicable	Powder
Cleaning & maintenance	Not applicable	Powder, Dust

Amounts used

No restriction.

Frequency and duration of use/exposure

No restriction.

Human factors not influenced by risk management

The shift breathing volume 10 m³/8 h (full shift).

Other given operational conditions affecting workers exposure				
Room volume >1,000 m ³ , process temperature or pressure ambient or no restriction respectively for all workplace except: preparation of raw material – process temperature up to 95°C, hot process – elevated process temperatures, cleaning & maintenance - room volume no restriction, process temperature or pressure ambient (system not in operation). Indoor use.				
Technical conditions and measures at process level (source) to prevent release				
Workplace	Level of containment	Level of segregation		
Raw material handling	No measures required	No measures required		
Preparation of raw material	Closed system(s) – reaction vessel			
Wet process	Closed system(s) – closed pipe system, closed reaction vessels			
Hot process	Closed system(s) – furnace			
Further processing	Closed system(s) – closed transfer system, closed mil			
Filling of solutions	No measures required			
Handling of powders with moderate dustiness potential	No measures required			
Handling of powders with high dustiness potential	No measures required			
Cleaning & maintenance	No measures required			
Technical conditions and measures to control dispersion from source towards the worker				
Workplace	Level of separation	Localised controls (LC)	Efficiency of LC (according to MEASE)	Additional Information
Raw material handling	Level of separation if required see frequency and duration of exposure section. Installation of ventilated (positive pressure) control rooms can also reduce exposure.	No measures required	Not applicable	-
Preparation of raw material		Reactor equipped with local exhaust ventilation	90 %	-
Wet process		Vapour extraction units in the tank	90 %	Semi-automatic process
Hot process		Extraction device in the surrounding calcination area	90 %	-
Further processing		Local exhaust ventilation is required	90 %	-
Filling of solutions		No measures required	Not applicable	-
Handling of powders with moderate dustiness potential		Local exhaust ventilation is required	90 %	-
Handling of powders with high dustiness potential		Local exhaust ventilation is required	90 %	-
Cleaning & maintenance		No measures required	Not applicable	Maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation
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)
Raw material handling	Mask type: FFP2 (Handling: Powder)	APF=10	Since cobalt has sensitising properties, the use of 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) is a prerequisite for all process steps in which direct contact to cobalt substances is possible. In cases where direct contact with cobalt cannot be avoided, a protective suit conforming to EN13982 should be worn. As a general requirement for the conducted processes: standard working clothes (long-sleeve overall) and safety shoes.
Preparation of raw material	Mask type: FFP2		
Wet process			
Hot process			
Further processing			
Filling of solutions			
Handling of powders with moderate dustiness potential			
Handling of powders with high dustiness potential	Powered filtering device incorporating a hood or a helmet, TH3	APF=10	
Cleaning & maintenance	Mask type: FFP2 (low – medium dusty materials)		
	Mask type: powered filtering device incorporating a hood or a helmet, TH3 (high dusty materials)	APF=40	
2.2 Control of environmental exposure			
Amounts used			
400 tonnes Co/annum/site			
Frequency and duration of use/exposure			
Continuous use/release. More than 360 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): 1000 - Dilution factor for the freshwater environment (Fresh water – direct discharge ES): 1000 - Dilution factor for the marine environment: 1000 			
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			
<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: <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 			

Air: 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:

- 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

Soil: No measures to reduce emissions to soil

The release factors to both the water and air compartments after on-site treatment are:

- Estimated fraction released to water (g Co/tonne Co): 87.2
- Estimated fraction released to air (g Co/tonne Co): 45.2

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 m³/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

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% **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

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)
Raw material handling	measured data	16 µg/m ³ (0.4)	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.	
Preparation of raw material	measured data	5 µg/m ³ (0.13)		
Wet process	measured data	4 µg/m ³ (0.1)		
Hot process	measured data	17 µg/m ³ (0.41)		
Further processing	measured data	4 µg/m ³ (0.1)		
Filling of solutions	MEASE	10 µg/m ³ (0.25)		
Handling of powders with moderate dustiness potential	measured data	21 µg/m ³ (0.53)		
Handling of powders with high dustiness potential	measured data	24 µg/m ³ (0.61)		
Cleaning & maintenance	analogous data	21 µg/m ³ (0.53) (low – medium dusty materials)		
		24 µg/m ³ (0.61) (high dusty materials)		

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	0.12 µg/l	0.51 µg/l	0.23
Fresh water – direct discharge	0.19 µg/l	0.51 µg/l	0.27
Sea water	0.04 µg/l	2.36 µg/l	0.02
Freshwater sediment – STP	4.97 mg/kg	9.5 mg/kg dw	0.52
Freshwater sediment – direct discharge	5.45 mg/kg	9.5 mg/kg dw	0.57
Marine water sediment	2.48 mg/kg	9.5 mg/kg dw	0.26
Terrestrial – sludge application	0.93 mg/kg	10.9 mg/kg dw	0.085
Terrestrial – no sludge application	0.02 mg/kg	10.9 mg/kg dw	0.002
Sewage treatment plant	0.03 mg/l	0.37 mg/l	0.08
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.			