

<b>Industrial use of cobalt in the production of diamond tools</b>				
Systematic title based on use descriptor	SU3 (Industrial use), SU15 PC7, AC2, AC7, ERC12a (appropriate PROCs are given in Section 2 below)			
<b>2. Operational conditions and risk management measures</b>				
Workplace	Involved task		Involved PROCs	
Raw material handling	Loading/unloading		8b, 9, 26	
Wet processes	Weighing, mixing, moistening, granulation, drying, sieving, cold pressing		4, 5	
Hot (metallurgical) processes	Hot pressing, sintering		14, 22, 25	
Mechanical finishing processes	Machining, assembly		21, 24	
Packaging	Packaging		21	
Cleaning & maintenance	Manual cleaning, repair and maintenance operations, removal of residuals from e.g. filters/overspill or as waste		8a, 26	
<b>2.1 Control of workers exposure</b>				
<b>Product characteristics</b>				
Workplace	Use in preparation and content in preparation		Physical form of the product	
Raw material handling	Yes (cobalt-containing feed material). Varying content of cobalt (No restriction)		Various (Powder, Granulate)	
Wet processes			Solution	
Hot (metallurgical) processes	Yes. Varying content of cobalt (No restriction)		Massive	
Mechanical finishing processes	Yes (tool considered as article). (No restriction)		Massive	
Packaging				
Cleaning & maintenance	Not applicable		Powder, Dust	
<b>Amounts used</b>				
No restriction.				
<b>Frequency and duration of use/exposure</b>				
No restriction.				
<b>Human factors not influenced by risk management</b>				
The shift breathing volume 10 m <sup>3</sup> /8 h (full shift).				
<b>Other given operational conditions affecting workers exposure</b>				
Room volume/process temperature or pressure ambient or no restriction respectively for all workplaces except: hot (metallurgical) processes - process temperature 1200°C, process pressure 1500mPa. Cleaning & maintenance - room volume no restriction, process temperature or pressure ambient (system not in operation). Indoor use.				
<b>Technical conditions and measures at process level (source) to prevent release</b>				
Hot (metallurgical) processes closed system furnaces. Other workplace level of containment/segregation not required.				
<b>Technical conditions and measures to control dispersion from source towards the worker</b>				
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	Local exhaust ventilation is required	90%	Manual semi-automatic process
Wet processes		Local exhaust ventilation is required	78%	
Hot (metallurgical) processes		Exhaust ventilation in calcination area	90%	
Mechanical finishing processes		No measures required	Not applicable	
Packaging		No measures required	Not applicable	
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

<b>Organisational measures to prevent/limit releases, dispersion and exposure</b>			
Additional information See Section: 7, 8, 11 (SDS).			
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>			
<b>Workplace</b>	<b>Specification of respiratory protective equipment (RPE)</b>	<b>RPE efficiency (assigned protection factor, APF)</b>	<b>Specification of gloves and further personal protective equipment (PPE)</b>
<b>Raw material handling</b>	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.
<b>Wet processes</b>	No measures required	Not applicable	
<b>Hot (metallurgical) processes</b>	Mask type: FFP2	APF=10	
<b>Mechanical finishing processes</b>	No measures required	Not applicable	
<b>Packaging</b>	No measures required	Not applicable	
<b>Cleaning &amp; maintenance</b>	Mask type: FFP2 (low – medium dusty materials)	APF=10	
	Mask type: powered filtering device incorporating a hood or a helmet, TH3 (high dusty materials)	APF=40	
<b>2.2 Control of environmental exposure</b>			
<b>Amounts used</b>			
51 tonnes Co/annum/site			
<b>Frequency and duration of use/exposure</b>			
Continuous use/release. More than 236 days/year to the air compartment and water compartment.			
<b>Environment factors not influenced by risk management</b>			
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"> <li>- Dilution factor for the freshwater environment (Fresh water-STP ES): 100</li> <li>- Dilution factor for the freshwater environment (Fresh water-direct discharge ES): 200</li> <li>- Dilution factor for the marine environment: 100</li> </ul>			
<b>Other given operational conditions affecting environmental exposure</b>			
Not applicable.			
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>			
<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"> <li>- Chemical precipitation: used primarily to remove the metal ions</li> <li>- Sedimentation</li> <li>- Filtration: used as final clarification step</li> <li>- Electrolysis: for low metal concentration</li> <li>- Reverse Osmosis (OR): extensively used for the removal of dissolved metals</li> <li>- Ion exchange: final cleaning step in the removal of heavy metal from process wastewater</li> </ul>			

**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/Nm<sup>3</sup>
- Wet electrostatic precipitators: < 5 mg/Nm<sup>3</sup>
- Cyclones, but as primary collector: < 50 mg/Nm<sup>3</sup>
- Fabric or bag filters: high efficiency in controlling fine particulate (melting): achieve emission values < 5 mg/Nm<sup>3</sup>
- Membrane filtration techniques can achieve < 1 mg/Nm<sup>3</sup>
- Ceramic and metal mesh filters. PM10 particles are removed: 0.1 mg/Nm<sup>3</sup>
- Wet scrubbers: < 4 mg/Nm<sup>3</sup>

**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): 200 (SPERC use)
- Estimated fraction released to air (g Co/tonne): 30 (SPERC use)

**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<sup>3</sup>/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\*; 06 04 05\*; 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/m<sup>3</sup>.

Workplace	Method used for inhalation exposure assessment	Inhalation exposure estimate (RCR)	Method used for dermal exposure assessment	Dermal exposure estimate (RCR)
Raw material handling	analogous data	21 µg/m <sup>3</sup> (0.53)	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.	
Wet processes	MEASE	11 µg/m <sup>3</sup> (0.275)		
Hot (metallurgical) processes	analogous data	16 µg/m <sup>3</sup> (0.4)		
Mechanical finishing processes	analogous data	20 µg/m <sup>3</sup> (0.5)		
Packaging	analogous data	9 µg/m <sup>3</sup> (0.225)		
Cleaning & maintenance	analogous data	21 µg/m <sup>3</sup> (0.53) (low – medium dusty materials)		
		24 µg/m <sup>3</sup> (0.61) (high dusty materials)		

<b>Environmental emissions</b>			
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.			
<b>Compartment</b>	<b>Predicted Environmental Concentration</b>	<b>Predicted No Effect Concentration</b>	<b>Risk characterisation ratio</b>
Fresh water – STP	0.18 µg/l	0.51 µg/l	0.36
Fresh water – direct discharge	0.17 µg/l	0.51 µg/l	0.33
Sea water	0.11 µg/l	2.36 µg/l	0.05
Freshwater sediment – STP	7.41 mg/kg	9.5 mg/kg dw	0.78
Freshwater sediment – direct discharge	6.88 mg/kg	9.5 mg/kg dw	0.72
Marine water sediment	8.71 mg/kg	9.5 mg/kg dw	0.92
Terrestrial – sludge application	0.42 mg/kg	10.9 mg/kg dw	0.04
Terrestrial – no sludge application	0.01 mg/kg	10.9 mg/kg dw	0.001
Sewage treatment plant	0.013 mg/l	0.37 mg/l	0.04
<b>4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES</b>			
<b>Occupational and Environmental exposure</b>			
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 ( <a href="http://www.ebrc.de/mease.html">www.ebrc.de/mease.html</a> ) 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 ( <a href="http://www.arche-consulting.be/Metal-CSA-toolbox/duscaling-tool">http://www.arche-consulting.be/Metal-CSA-toolbox/duscaling-tool</a> ) to estimate PEC values.			