

<b>Manufacture and industrial use of batteries using cobalt</b>		
<b>Systematic title based on use descriptor</b>	SU3 (Industrial use), SU16 AC3, ERC5 (appropriate PROCs are given in Section 2 below)	
<b>2. Operational conditions and risk management measures</b>		
<b>Workplace</b>	<b>Involved task</b>	<b>Involved PROCs</b>
<b>Raw material handling</b>	Powder handling, weighing	3, 4, 8b, 26
<b>Mix preparation</b>	Metal leaching, mixing	3 (5)
<b>Further processing</b>	Coating, pelletizing, tableting, impregnation, calendaring, drying, slitting	3, 4, 5, 6, 9, 13, 14, 21
<b>Final handling</b>	Packaging, battery assembly	21
<b>Further uses of batteries</b>	Since batteries are considered as sealed containers which cannot lead to exposure if correctly used the generation of an own exposure scenario for the professional use of batteries has been omitted. An assessment of potential exposure is provided in the consumer exposure scenarios in the addendum of the chemical safety report. This scenario is considered to demonstrate a safe use also for professional applications.	
<b>Cleaning &amp; maintenance</b>	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>		
<b>Workplace</b>	<b>Use in preparation and content in preparation</b>	<b>Physical form of the product</b>
<b>Raw material handling</b>	Yes Varying content of cobalt (No restriction)	Various
<b>Mix preparation</b>	Yes Varying content of cobalt (No restriction)	Solution
<b>Further processing</b>	Yes (No restriction)	Solid
<b>Final handling</b>	Cobalt is in a sealed container (battery). (<25% in preparation)	Massive
<b>Cleaning &amp; maintenance</b>	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 > 1,000 m <sup>3</sup> , process temperature or pressure ambient or no restriction respectively for all workplaces except: 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>		
Mix preparation closed reaction vessel. Other workplace level of containment/segregation not required.		
<b>Technical conditions and measures to control dispersion from source towards the worker</b>		
Localised controls (LC) not required for all workplace except: mix preparation (vapour extraction units in the tank, semi-automatic process with 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: cleaning & maintenance: 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).		

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.
Mix preparation	Mask type: FFP2		
Further processing			
Final handling	No measures required	Not applicable	
Cleaning & maintenance	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>			
28 tonnes/annum/site for the production of alkaline rechargeable batteries.			
<b>Frequency and duration of use/exposure</b>			
Continuous use/release. More than 319 days/year to the air 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 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>			
<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"> <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): < 5mg/Nm<sup>3</sup> (membrane filtration achieves > 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 Co): 109
- Estimated fraction released to air (g Co/tonne Co): 11.7

**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**

For the freshwater environment, the ES assumes that the wastewater is not connected with a STP. For the marine environment, the ES considers no off-site municipal STP (direct discharge) treatment. No sludge application to agricultural soil is assumed for both scenarios. An effluent flow of 513 m<sup>3</sup>/d was selected for the exposure scenarios.

**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/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	16 µg/m <sup>3</sup> (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.	
Mix preparation	analogous data	4 µg/m <sup>3</sup> (0.1)		
Further processing	analogous data	2 µg/m <sup>3</sup> (0.05)		
Final handling	Qualitative assessment	negligible exposure due to containment (RCR < 1)		
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>
<b>Fresh water</b>	0.22 µg/l	0.51 µg/l	0.43
<b>Sea water</b>	0.10 µg/l	2.36 µg/l	0.04
<b>Freshwater sediment</b>	8.78 mg/kg	9.5 mg/kg dw	0.92
<b>Marine water sediment</b>	7.60 mg/kg	9.5 mg/kg dw	0.80
<b>Terrestrial - no sludge application</b>	0.012 mg/kg	10.9 mg/kg dw	0.001
<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.			