

## 9. ES 9: Use at industrial sites; Industrial use of cobalt metal in additive manufacturing (3D-printing)

### 9.1. Title section

Product category: Base metals and alloys (PC 7)

Sector of use: Manufacture of basic metals, including alloys (SU 14)

<b>Environment</b>	
1: Industrial use of cobalt metal in additive manufacturing (3D-printing)	ERC 5
<b>Worker</b>	
2: Handling of dusty raw materials	PROC 26
3: 3D-printing in closed process	PROC 1
4: Handling and sieving of powder for reuse	PROC 26
5: Maintenance work	PROC 28
6: Cleaning & Maintenance	PROC 28
<b>Subsequent service life exposure scenario(s)</b>	
ES 10: Service life (worker at industrial site); Various articles; Service life of cobalt containing alloys, steels and tools in industrial settings	

### 9.2. Conditions of use affecting exposure

#### 9.2.1. Control of environmental exposure: Industrial use of cobalt metal in additive manufacturing (3D-printing) (ERC 5)

<b>Amount used, frequency and duration of use (or from service life)</b>
Daily amount per site <= 0.1 tonnes/day
Annual amount per site <= 1 tonnes/year
<b>Conditions and measures related to biological sewage treatment plant</b>
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow >= 2E3 m3/day
<b>Conditions and measures related to external treatment of waste (including article waste)</b>
Dispose of waste product or used containers according to local regulations.

#### 9.2.2. Control of worker exposure: Handling of dusty raw materials (PROC 26)

<b>Product (article) characteristics</b>
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.
<b>Amount used (or contained in articles), frequency and duration of use/exposure</b>
Duration of exposure: Not restricted.
<b>Technical and organisational conditions and measures</b>
Use of a local exhaust ventilation with standard efficiency is required.
Ensure containment of the process as far as technically feasible.
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>

APF of RPE = 10 (90% respiratory protection).
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.
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.

### 9.2.3. Control of worker exposure: 3D-printing in closed process (PROC 1)

<b>Product (article) characteristics</b>
Maximum emission potential covered in this ES: Low (temperature based).
Concentration of the substance in mixture is not restricted.
Physical form covered in this ES: Solid, powder / dust.
<b>Technical and organisational conditions and measures</b>
Use of an integrated local exhaust ventilation with standard efficiency is required.
Closed process with occasional opening.
Ensure automation of the process as far as technically feasible.
Covers use at temperatures below melting point / degradation temperature.
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>
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.
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.

### 9.2.4. Control of worker exposure: Handling and sieving of powder for reuse (PROC 26)

<b>Product (article) characteristics</b>
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.
<b>Amount used (or contained in articles), frequency and duration of use/exposure</b>
Duration of exposure: Not restricted.
<b>Technical and organisational conditions and measures</b>
Use of a local exhaust ventilation with standard efficiency is required.
Ensure containment of the process as far as technically feasible.
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>
APF of RPE = 10 (90% respiratory protection).
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.
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.

### 9.2.5. Control of worker exposure: Maintenance work (PROC 28)

<b>Product (article) characteristics</b>
Physical form covered in this ES: Residual dust.

<b>Amount used (or contained in articles), frequency and duration of use/exposure</b>
Duration of exposure: Not restricted.
<b>Technical and organisational conditions and measures</b>
Machinery to be maintained is to be turned off during work.
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>
APF of RPE = 10 (90% respiratory protection).
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.
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.

### 9.2.6. Control of worker exposure: Cleaning & Maintenance (PROC 28)

<b>Product (article) characteristics</b>
Physical form covered in this ES: Residual dust.
<b>Amount used (or contained in articles), frequency and duration of use/exposure</b>
Duration of exposure: Not restricted.
<b>Technical and organisational conditions and measures</b>
Cleaning is conducted using cleaning machines, in particular hovering is applied and the use of compressed air is omitted.
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>
APF of RPE = 20 (95% respiratory protection).
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.
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.

## 9.3. Exposure estimation and reference to its source

### 9.3.1. Environmental release and exposure: Industrial use of cobalt metal in additive manufacturing (3D-printing) (ERC 5)

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

### 9.3.2. Worker exposure: Handling of dusty raw materials (PROC 26)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	12 µg/m <sup>3</sup> (Measured data)	0.3

### 9.3.3. Worker exposure: 3D-printing in closed process (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	10 µg/m <sup>3</sup> (Measured data)	0.25

### 9.3.4. Worker exposure: Handling and sieving of powder for reuse (PROC 26)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	12 µg/m <sup>3</sup> (Measured data)	0.3

### 9.3.5. Worker exposure: Maintenance work (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	5 µg/m <sup>3</sup> (Measured data)	0.125

### 9.3.6. Worker exposure: Cleaning & Maintenance (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	3.4 µg/m <sup>3</sup> (Measured data)	0.085

## 9.4. 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".