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0. General provisions related to conditions of use and guidance to downstream users

All provisions given in this section apply to each exposure scenario (ES) contained in this document. They are to be supplemented or exchanged for more specific measures where indicated in the individual ES.

0.1. Good occupational hygiene practice

Good occupational hygiene practices are essential to ensure safe handling of the substance. Inhalation (e.g. dust should not be blown off with compressed air) and ingestion must be avoided (e.g. No eating and smoking in the workplace, regular cleaning with suitable cleaning devices). Contaminated clothing should not be taken home. Good general ventilation in the workplace must ensure an adequate supply of fresh air. Regular training in workplace hygiene practice and proper use of personal protective equipment (if relevant) is indispensable.

0.2. General provisions related to personal protective equipment for workers

Use of personal protective equipment (PPE) for each of the exposure routes listed below is required as described here, unless exposure to the substance can be excluded for the respective route(s) of exposure. Exposure exclusions may be determined by, for example:

(i) the physical appearance of the substance in the specific type of application (e.g. wetting the substance can effectively prevent from the emission of dust),
(ii) the emission potential resulting from the nature of the process (e.g. splashes, emission of dust can be excluded in a closed process),
(iii) exposure prevention measures in place (segregation of the emission source or separation of the worker from the emission source), and
(iv) the amount of handled/emitted material during use in relation to the room size (i.e. dilution factor), taking into consideration prevailing air exchange rates during use.

If PPE needs to be used, further information is provided in the applicable exposure scenarios, in the subsections of this document and in Section 8 of the SDS.

0.2.1. Dermal (Skin protection)

Skin protective equipment should be selected in consideration of mechanical (acc. to EN 388, mechanical risks), cold or heat stress (acc. to EN 407, thermal risks) or any other physico-chemical hazards as relevant for the conducted tasks and working environment in addition to the effectiveness of the equipment to control exposure. Certified safety clothing including coveralls and safety shoes have to be worn. The following requirements for gloves are to be met:

- Due to the classification of the substance, gloves and skin protective clothing have to be worn for precautionary reasons unless dermal exposure can be excluded (please see above).
- If gloves are to be worn, either due to these general provisions or due to specific requirements set in the ES, they must comply with EN 374.
- Any prescribed gloves must be changed according to manufacturer's information or when damaged, whatever is the earlier.

0.2.2. Inhalation (Respiratory protection)

Occasionally, specific information on the required assigned protection factor (APF) is provided in the occupational exposure scenarios. Respiratory protective equipment (RPE) should be selected based on the given APF according to EN 529 and should comply with national legislation. The following requirements for RPE are to be met in any case:

- Due to the classification of the substance, RPE has to be worn for precautionary reasons unless inhalation exposure can be excluded (please see above).
- If RPE has to be worn, either due to these general provisions or due to specific requirements set in the ES, an APF of 10 represents the required minimum level of protection.

If RPE is to be worn, the following should all be taken into account:

i) the additional physiological stress for the worker due to the increased breathing resistance,
ii) the mass of the RPE itself,
iii) the increased temperature by enclosing the head, and
iv) that the worker's capability of using tools and communicating are reduced whilst wearing RPE.

For the above-indicated reasons, the worker should therefore:

(i) be healthy (especially with regard to medical problems that may affect the use of RPE), and
(ii) have facial characteristics that ensure no leakages between face and mask (e.g. leakage risk from facial hair or scar tissue).

The devices recommended in the ES which rely on a tight face seal will not provide the required protection unless they fit the contours of the face properly and securely. The employer and self-employed persons have legal responsibilities for the supply and maintenance of respiratory protective devices, and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device programme, including worker training.

0.2.3. Eye/ face protection

Eye/face protective equipment is to be selected in consideration of local effects caused by the substance, mechanical, cold or heat stress or any other physico-chemical hazards as relevant for the conducted tasks and working environment in addition to the effectiveness of the equipment to control exposure. The following requirements for eye/face protective equipment are to be met :

- Avoid direct contact of the eyes with the substance.
- Suitable eye protection equipment (e.g. goggles or visors) must be worn.
- Face protection must be worn unless such protection is provided by any eye protection (e.g. face covering visor) and/or RPE used.

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

For the exposure scenarios (ES) in this document, the Downstream User (DU) works within the boundaries set by the ES if the given operational conditions (OCs) and risk management measures (RMMs) as described in the ES are met. If the DU's conditions are not explicitly included in the generic conditions described in the ES, the DU must ensure that his specific OCs and implemented RMMs are compliant. If the concentration of the substance in mixture is not explicitly stated in the ES this does not represent a restriction (i.e. up to 100 % of the substance could be used). Depending on the basis for the exposure assessment conducted for the ES, the assessment needs to be done in multiple ways as described individually for environmental and occupational ES below.

0.3.1. Occupational Exposure Scenario

The occupational exposure assessment may be either based on monitoring data (including analogous or published data) or based on exposure assessment models. Depending on which method has been used for exposure assessment, different ways for compliance checking are to be followed as given below. In any case, it needs to be ensured that the final exposure estimate remains well below the respective DNEL. For systemic effects (if relevant), the sum of the RCRs for the dermal and for the inhalation route needs to be below 1.

0.3.1.1. Monitoring data used as basis for assessment

If the exposure assessment in the ES is based on monitoring data, the same approach can be used by DUs for compliance checking. Please note that 6 measurements per workplace are required for an exposure assessment as a minimum. Depending on the variability of the data sets (expressed as the geometric standard deviation) and the level of the resulting risk characterisation ratio, additional measurements may be required. Only measurements of personal exposure to the inhalable fraction of airborne dust (according to EN 481) should be used. The exposure data shall either be applicable to the length of a specific task to be assessed or to a full-shift (i.e. sampled over a duration of at least 120 min) if the task to be assessed is conducted for a significant portion of the work shift. From the exposure data set, the 90^{th} percentile is to be used as a reasonable worst case estimate for comparison with the reported exposure level in the associated contributing ES (given that the dataset consists of at least 6 data points). Respiratory protective equipment (RPE) may be taken into account by applying the assigned protection factor as given in EN 529:2005.

0.3.1.1.1. Specific considerations for efficiency values for Risk Management Measures (RMMs) prescribed in occupational exposure scenarios

If your monitored exposure levels are following those reported for the ES after consideration of any PPE worn, the efficiency of the RMMs implemented at your facility can be considered compliant with the ES.

0.3.1.1.2. Deviations from the conditions of use if monitoring data were used for exposure assessment

Any deviations from the given conditions of use mean you need to either:

(i) inform the supplier of the eSDS about these deviations and request the ES be reviewed to include the identified deviations or
(ii) prepare your own DU CSR (according to Article 37(4)) which must be notified to ECHA and also be kept at your company as in-house documentation.

0.3.1.2. Use of exposure models

If the exposure assessment in the ES is based on modelled data, the same model can be used to justify specific slight deviations from the generic conditions described in the ES. All parameters needed to run the exposure estimation tool MEASE (version 1.02.01; available on www.ebrc.de/mease.html) or ART (version 1.5; available on https://www.advancedreachtool.com/), can be found in the contributing scenario (CS). In case of a multiple PROC assessment, the PROC used for the exposure estimation is provided in brackets with the corresponding exposure estimate. In cases where specific modifications of the tool estimate were required, further information for recalculation is provided with the corresponding exposure estimate. Please note regarding the five cobalt salts (i.e., cobalt carbonate, cobalt dichloride, cobalt dinitrate, cobalt sulphate, and cobalt di(acetate)) that if appropriate information on frequency and duration of tasks was available, derived exposure estimates were adopted to reflect actual exposure duration by calculating TWAs. It is noted that TWAs were not calculated by using the tool, but instead linear interpolation was conducted by considering zero exposure in the remaining time.

It is noted that the installation of the prescribed RMMs is mandatory and that only the modification of the personal protective equipment (PPE) used is allowed as a deviation. The only parameters which may therefore be modified in the exposure calculation are:

(i) concentration in mixture (only lower concentrations),
(ii) efficiency of the installed RMMs (only higher efficiencies), and
(iii) type of PPE to be used. (only lower efficiencies)

0.3.1.2.1. Specific considerations for efficiency values for RMMs prescribed in occupational exposure scenarios
Any efficiency values reported in the ES represent typical efficiencies for a given industry sector after evaluating conditions of use as made available to the consultants and are therefore considered to adequately approximate to actual efficiencies. If downstream users want to evaluate whether prescribed efficiencies are met, exposure monitoring could be conducted. In such a case, monitored exposure levels should be the same as or lower than those reported for the ES after consideration of any PPE worn. Further information on efficiency values can be found in the glossary of MEASE.

0.3.1.2.2. Deviations from the conditions of use if exposure models were used for exposure assessment
Further deviations from the given conditions of use, or if the DU assessment is to be based on monitoring data, require you either to:

(i) inform the supplier of the eSDS about these deviations and request the ES be reviewed to include the identified deviations or

(ii) prepare your own DU CSR (according to Article 37(4)) which must be notified to ECHA and also be kept at your company as in-house documentation.

0.3.2. Environmental Exposure Scenario

0.3.2.1. Deviations from the conditions of use
This can be done by using the MetalEUSES scaling tool (free download: http://www.arche-consulting.be/tools/du-scaling-tool/) to estimate the associated exposure. Following parameters can be scaled: amount used at local site, number of emission days, discharge effluent rate, dilution factor (or flow rate of the river), presence/absence of municipal sewage treatment plant (STP), removal rate municipal STP, use of municipal sludge on agricultural soil, and release factors to air and water.

1. Exposure Scenario 1: Manufacture; Manufacture of cobalt

SECTION 1:	**1.1 Title of exposure scenario**
	Manufacture; Manufacture of cobalt
Contributing scenario controlling environmental exposure	
Manufacture of cobalt ES 1 STP Discharge	ERC1
Manufacture of cobalt ES 2 Direct Discharge	ERC1
Manufacture of cobalt ES 3 Marine Discharge	ERC1
Contributing scenario controlling worker exposure	
Raw material handling	PROC 26, PROC 21, PROC 8b
Leaching unit	PROC 3, PROC 1
Solvent extraction unit	PROC 3, PROC 1
Tankhouse (electrowinning)	PROC 24, PROC 21, PROC 1, PROC 25
Shearhouse (cutting)	PROC 24, PROC 21
Powder production and milling	PROC 27a
Screening and packaging	PROC 26
Packaging of metal chips	PROC 21
Supervision	PROC 4
Cleaning & Maintenance	PROC 28
SECTION 2:	**1.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Manufacture of cobalt ES 1 STP Discharge (ERC 1)
Frequency and duration of use	
Daily amount per site <= 25.34 tonnes/day	
Annual amount per site <= 9.25E3 tonnes/year	
Emission days >= 365 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to municipal sewage treatment plant	
Provide onsite wastewater treatment.	
Assumed domestic sewage treatment plant flow >= 8.89E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	
Local freshwater dilution factor 1E3.	
2.1.2	Manufacture of cobalt ES 2 Direct Discharge (ERC 1)
Frequency and duration of use	
Daily amount per site <= 25.34 tonnes/day	
Annual amount per site <= 9.25E3 tonnes/year	
Emission days >= 365 days/year	

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 8.89E3 m^3/day	
No discharge to marine water assumed.	
Local freshwater dilution factor 1E3.	
2.1.3	Manufacture of cobalt ES 3 Marine Discharge (ERC 1)
Frequency and duration of use	
Daily amount per site <= 25.34 tonnes/day	
Annual amount per site <= 9.25E3 tonnes/year	
Emission days >= 365 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to freshwater assumed.	
Assumed effluent discharge flow from site >= 8.89E3 m^3/day	
Local marine water dilution factor 100.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Raw material handling (PROC 26, PROC 21, PROC 8b)
Product characteristics	
Physical form of product: Solid, high dustiness	
Additional physical form of product: Solid, Granulate	
Additional physical form of product: Aqueous solution	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Segregated ball mill (Ni matte)	
Covers use at ambient temperatures.	
Kept under low-pressure (partly encapsulated) when bags are opened and material is dropped.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). For further specification, refer to section 8 of the SDS.	

2.2.2	Leaching unit (PROC 3, PROC 1)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Additional physical form of product: Solid, Granulate	
Additional physical form of product: Aqueous solution	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Assumes process temperature up to 150 °C.	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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 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.	
2.2.3	Solvent extraction unit (PROC 3, PROC 1)
Product characteristics	
Physical form of product: Aqueous solution	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
2.2.4	Tankhouse (electrowinning) (PROC 24, PROC 21, PROC 1, PROC 25)
Product characteristics	
Physical form of product: Aqueous solution	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	

2.2.5	Shearhouse (cutting) (PROC 24, PROC 21)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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 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.	
2.2.6	Powder production and milling (PROC 27a)
Product characteristics	
Physical form of product: Solid, Powder / Dust	
Maximum emission potential: Low (temperature based)	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Use of an exterior local exhaust ventilation with an efficiency of at least 86% is required.	
Elevated temperature. Covers use at temperatures below melting point.	
Ensure enclosure of furnace operation.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.7	Screening and packaging (PROC 26)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Additional physical form of product: Solid, Granulate	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Semi-automated task.	
Covers use at ambient temperatures.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	

2.2.8	Packaging of metal chips (PROC 21)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.9	Supervision (PROC 4)
Product characteristics	
Physical form of product: Various	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
Other conditions affecting workers exposure	
For supervision activities it is important to also respect the RMMs as prescribed in the contributing scenarios for the specific process that are supervised, as relevant.	
2.2.10	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Solid, high dustiness	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Process is carried out at ambient temperature.	
Process is carried out at ambient pressure.	
Maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	

SECTION 3:	1.3 Exposure estimation

3.1 Environment

Release estimation method: Estimated release factor

	Release rate		
	Water	Air	Soil
Manufacture of cobalt ES 1 STP Discharge	0.963 kg/day	3.928 kg/day	0 kg/day
Manufacture of cobalt ES 2 Direct Discharge	0.963 kg/day	3.928 kg/day	0 kg/day
Manufacture of cobalt ES 3 Marine Discharge	0.963 kg/day	3.928 kg/day	0 kg/day

Manufacture of cobalt ES 1 STP Discharge

Protection target	Exposure concentration (PEC, Predicted Exposure Concentration)	Risk characterisation ratio (RCR)
Fresh water	1.41E-4 mg/l (EUSES 2.1.2)	0.133
Sedimentation (Fresh water)	5.86 mg/kg dw (PEC sediment calculation method for metals)	0.109
Sewage Treatment Plant	0.065 mg/l (EUSES 2.1.2)	0.176
Agricultural soil	2.087 mg/kg dw (EUSES 2.1.2)	0.191
Man via Environment - Inhalation (Systemic effects)	1.09E-3 mg/m³ (EUSES 2.1.2)	0.135
Man via Environment - Inhalation (Local effects)	1.09E-3 mg/m³ (EUSES 2.1.2)	0.173
Man via Environment - Oral	3.21E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.171

Manufacture of cobalt ES 2 Direct Discharge

Protection target	Exposure concentration (PEC, Predicted Exposure Concentration)	Risk characterisation ratio (RCR)
Fresh water	1.68E-4 mg/l (EUSES 2.1.2)	0.159
Sedimentation (Fresh water)	6.92 mg/kg dw (PEC sediment calculation method for metals)	0.129
Agricultural soil	0.263 mg/kg dw (EUSES 2.1.2)	0.024
Man via Environment - Inhalation (Systemic effects)	1.09E-3 mg/m³ (EUSES 2.1.2)	0.135
Man via Environment - Inhalation (Local effects)	1.09E-3 mg/m³ (EUSES 2.1.2)	0.173
Man via Environment - Oral	3.22E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.171

Manufacture of cobalt ES 3 Marine Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Marine water	0.485 µg/l (Clocal calculation with Kp susp. matter marine)	0.206
Sedimentation (Marine water)	54 mg/kg dw (PEC sediment calculation method for metals)	0.774
Agricultural soil	0.263 mg/kg dw (EUSES 2.1.2)	0.024
Man via Environment - Inhalation (Systemic effects)	1.09E-3 mg/m³ (EUSES 2.1.2)	0.135
Man via Environment - Inhalation (Local effects)	1.09E-3 mg/m³ (EUSES 2.1.2)	0.173
Man via Environment - Oral	3.17E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.17

3.2 Worker

Raw material handling (PROC 26, PROC 21, PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	9.6 µg/m³	0.177
Inhalation, Local effects, Long Term	9.6 µg/m³	0.24
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.19

Leaching unit (PROC 3, PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	6 µg/m³	0.111
Inhalation, Local effects, Long Term	6 µg/m³	0.15
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.111

Solvent extraction unit (PROC 3, PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	0.5 µg/m³	< 0.01
Inhalation, Local effects, Long Term	0.5 µg/m³	0.013
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		< 0.01

Tankhouse (electrowinning) (PROC 24, PROC 21, PROC 1, PROC 25)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	5.2 µg/m³	0.096
Inhalation, Local effects, Long Term	5.2 µg/m³	0.13
Dermal, Systemic effects, Long Term	1.3 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.096
Shearhouse (cutting) (PROC 24, PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	23.6 µg/m³	0.436
Inhalation, Local effects, Long Term	23.6 µg/m³	0.59
Dermal, Systemic effects, Long Term	106.9 µg/kg bw/day	0.015
Combined routes, Systemic effects, Long Term		0.451
Powder production and milling (PROC 27a)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	18 µg/m³	0.333
Inhalation, Local effects, Long Term	18 µg/m³	0.45
Dermal, Systemic effects, Long Term	1.3 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.333
Screening and packaging (PROC 26)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	23.5 µg/m³	0.434
Inhalation, Local effects, Long Term	23.5 µg/m³	0.588
Dermal, Systemic effects, Long Term	3.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.435
Packaging of metal chips (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	8.6 µg/m³	0.159
Inhalation, Local effects, Long Term	8.6 µg/m³	0.215
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.168

Supervision (PROC 4)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10 µg/m³	0.185
Inhalation, Local effects, Long Term	10 µg/m³	0.25
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.185
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10.9 µg/m³	0.201
Inhalation, Local effects, Long Term	10.9 µg/m³	0.273
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.214

SECTION 4:	**1.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**

Health/ Environment

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.

2. Exposure Scenario 2: Manufacture; Manufacture of cobalt within catalyst or catalyst precursors (including regeneration)

SECTION 1:	**2.1 Title of exposure scenario**
	Manufacture; Manufacture of cobalt within catalyst or catalyst precursors (including regeneration)
Contributing scenario controlling environmental exposure	
Manufacture of cobalt within catalyst or catalyst precursors (including regeneration) ES 1 STP Discharge	ERC1
Manufacture of cobalt within catalyst or catalyst precursors (including regeneration) ES 2 Direct Discharge	ERC1
Manufacture of cobalt within catalyst or catalyst precursors (including regeneration) ES 3 Marine Discharge	ERC1
Contributing scenario controlling worker exposure	
Reduction of cobalt carbonate and cobalt dihydroxide to form cobalt metal	PROC 1
Closed screening of cobalt metal containing catalysts	PROC 3
Closed filling and storage of final cobalt metal containing catalysts	PROC 8b
Cleaning & Maintenance	PROC 28
SECTION 2:	**2.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Manufacture of cobalt within catalyst or catalyst precursors (including regeneration) ES 1 STP Discharge (ERC 1)
Frequency and duration of use	
Daily amount per site <= 0.272 tonnes/day	
Annual amount per site <= 98 tonnes/year	
Emission days >= 360 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	
Local freshwater dilution factor 100.	
2.1.2	Manufacture of cobalt within catalyst or catalyst precursors (including regeneration) ES 2 Direct Discharge (ERC 1)
Frequency and duration of use	
Daily amount per site <= 0.272 tonnes/day	
Annual amount per site <= 98 tonnes/year	
Emission days >= 360 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	

Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 250 m^3/day	
No discharge to marine water assumed.	
Local freshwater dilution factor 500.	
2.1.3	Manufacture of cobalt within catalyst or catalyst precursors (including regeneration) ES 3 Marine Discharge (ERC 1)
Frequency and duration of use	
Daily amount per site <= 0.272 tonnes/day	
Annual amount per site <= 98 tonnes/year	
Emission days >= 360 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 250 m^3/day	
No discharge to freshwater assumed.	
Local marine water dilution factor 100.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Reduction of cobalt carbonate and cobalt dihydroxide to form cobalt metal (PROC 1)
Product characteristics	
Physical form of product: Solid, Powder / Dust, Shaped catalysts	
Covers percentage substance in the product up to 100 %.	
Maximum emission potential: High	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Assumes process temperature up to 600 °C.	
Use in closed process.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.2	Closed screening of cobalt metal containing catalysts (PROC 3)
Product characteristics	
Physical form of product: Solid, Powder / Dust, Shaped catalysts	
Covers percentage substance in the product up to 100 %.	
Maximum emission potential: High	

Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.3	Closed filling and storage of final cobalt metal containing catalysts (PROC 8b)
Product characteristics	
Physical form of product: Solid, Powder / Dust, Shaped catalysts	
Covers percentage substance in the product up to 100 %.	
Maximum emission potential: High	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Use in closed process.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.4	Closed filling and storage of final cobalt metal containing catalysts (PROC 8b)
Product characteristics	
Physical form of product: Solid, Powder / Dust, Shaped catalysts	
Covers percentage substance in the product up to 100 %.	
Maximum emission potential: High	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Use in closed process.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.5	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Various	

Covers percentage substance in the product up to 100 %.
Maximum emission potential: Low
Frequency and duration of use
Typical duration per shift = 120 min
Typical number of shifts per year = 48 Shifts/year
Technical conditions and measures to control dispersion from source towards the worker
Process is carried out at ambient pressure.
Covers use at ambient temperatures.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.

SECTION 3:	**2.3 Exposure estimation**

3.1 Environment

Release estimation method: Estimated release factor

	Release rate		
	Water	Air	Soil
Manufacture of cobalt within catalyst or catalyst precursors (including regeneration) ES 1 STP Discharge	8.7E-3 kg/day	7.89E-3 kg/day	0 kg/day
Manufacture of cobalt within catalyst or catalyst precursors (including regeneration) ES 2 Direct Discharge	8.7E-3 kg/day	7.89E-3 kg/day	0 kg/day
Manufacture of cobalt within catalyst or catalyst precursors (including regeneration) ES 3 Marine Discharge	8.7E-3 kg/day	7.89E-3 kg/day	0 kg/day

Manufacture of cobalt within catalyst or catalyst precursors (including regeneration) ES 1 STP Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	1.16E-4 mg/l (EUSES 2.1.2)	0.11
Sedimentation (Fresh water)	4.89 mg/kg dw (PEC sediment calculation method for metals)	0.091
Sewage Treatment Plant	2.61E-3 mg/l (EUSES 2.1.2)	< 0.01
Agricultural soil	0.312 mg/kg dw (EUSES 2.1.2)	0.029
Man via Environment - Inhalation (Systemic effects)	2.31E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	2.31E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.21E-4 mg/kg bw/day (Measured data)	0.036

Man via Environment - Combined routes		0.036
Manufacture of cobalt within catalyst or catalyst precursors (including regeneration) ES 2 Direct Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	1.44E-4 mg/l (EUSES 2.1.2)	0.136
Sedimentation (Fresh water)	5.95 mg/kg dw (PEC sediment calculation method for metals)	0.111
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	2.31E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	2.31E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.21E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036
Manufacture of cobalt within catalyst or catalyst precursors (including regeneration) ES 3 Marine Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Marine water	0.166 µg/l (Clocal calculation with Kp susp. matter marine)	0.07
Sedimentation (Marine water)	26.1 mg/kg dw (PEC sediment calculation method for metals)	0.374
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	2.31E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	2.31E-6 mg/m³ (EUSES 2.1.2)	0.036
Man via Environment - Oral	3.17E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036
3.2 Worker		
Reduction of cobalt carbonate and cobalt dihydroxide to form cobalt metal (PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	0.8 µg/m³	0.015
Inhalation, Local effects, Long Term	0.8 µg/m³	0.02
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.015

Closed screening of cobalt metal containing catalysts (PROC 3)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	0.8 µg/m³	0.015
Inhalation, Local effects, Long Term	0.8 µg/m³	0.02
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.015
Closed filling and storage of final cobalt metal containing catalysts (PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	0.8 µg/m³	0.015
Inhalation, Local effects, Long Term	0.8 µg/m³	0.02
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.015
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	2.4 µg/m³	0.044
Inhalation, Local effects, Long Term	2.4 µg/m³	0.06
Dermal, Systemic effects, Long Term	23.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.048

SECTION 4:	**2.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**

Health/ Environment

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.

3. Exposure Scenario 3: Manufacture; Recycling of hardmetal-containing scrap materials

SECTION 1:	**3.1 Title of exposure scenario**
	Manufacture; Recycling of hardmetal-containing scrap materials
Contributing scenario controlling environmental exposure	
Recycling of hardmetal-containing scrap materials ES 1 STP Discharge	ERC1
Recycling of hardmetal-containing scrap materials ES 2 Marine Discharge	ERC1
Contributing scenario controlling worker exposure	
Scrap handling	PROC 8b
Processing operation	PROC 5, PROC 21
Transfer to recycling unit	PROC 8b
Chemical recycling	PROC 1
Mechanical recycling (zinc or cold stream)	PROC 1
Transfer to milling after mechanical recycling	PROC 8b
Milling	PROC 3
Filling	PROC 9
Cleaning & Maintenance	PROC 28
SECTION 2:	**3.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Recycling of hardmetal-containing scrap materials ES 1 STP Discharge (ERC 1)
Frequency and duration of use	
Daily amount per site <= 0.654 tonnes/day	
Annual amount per site <= 170 tonnes/year	
Emission days >= 260 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	
Local freshwater dilution factor 100.	
2.1.2	Recycling of hardmetal-containing scrap materials ES 2 Marine Discharge (ERC 1)
Frequency and duration of use	
Daily amount per site <= 0.654 tonnes/day	
Annual amount per site <= 170 tonnes/year	
Emission days >= 260 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	

Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m^3/day	
No discharge to freshwater assumed.	
Local marine water dilution factor 100.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Scrap handling (PROC 8b)
Product characteristics	
Physical form of product: Bound in article.	
Covers percentage substance in the product up to 25 %.	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.2	Processing operation (PROC 5, PROC 21)
Product characteristics	
Physical form of product: Bound in article.	
Covers percentage substance in the product up to 25 %.	
Maximum emission potential: Medium (abrasion based)	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 84 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.3	Transfer to recycling unit (PROC 8b)
Product characteristics	
Physical form of product: Solid, Granulate	
Covers percentage substance in the product up to 25 %.	
Maximum emission potential: Very low	

Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.4	Chemical recycling (PROC 1)
Product characteristics	
Physical form of product: Solid, Granulate	
Covers percentage substance in the product up to 25 %.	
Maximum emission potential: Medium (abrasion based)	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Elevated temperature. Covers use at temperatures below melting point.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 84 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.5	Mechanical recycling (zinc or cold stream) (PROC 1)
Product characteristics	
Physical form of product: Solid, Granulate	
Covers percentage substance in the product up to 25 %.	
Maximum emission potential: Medium (abrasion based)	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Elevated temperature. Covers use at temperatures below melting point.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 84 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	

2.2.6	Transfer to milling after mechanical recycling (PROC 8b)
Product characteristics	
Physical form of product: Solid, Granulate	
Covers percentage substance in the product up to 25 %.	
Maximum emission potential: Low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.7	Milling (PROC 3)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.8	Filling (PROC 9)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 84 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.9	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Solid, medium dustiness	

Frequency and duration of use
Avoid carrying out activities involving exposure for more than 1 hour per day.
Technical conditions and measures to control dispersion from source towards the worker
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 84 %
Conditions and measures related to personal protection, hygiene and health evaluation
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.
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.

SECTION 3:	**3.3 Exposure estimation**

3.1 Environment

Release estimation method: Estimated release factor

	Release rate		
	Water	Air	Soil
Recycling of hardmetal-containing scrap materials ES 1 STP Discharge	0.065 kg/day	0.196 kg/day	0 kg/day
Recycling of hardmetal-containing scrap materials ES 2 Marine Discharge	0.065 kg/day	0.196 kg/day	0 kg/day

Recycling of hardmetal-containing scrap materials ES 1 STP Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	2.24E-4 mg/l (EUSES 2.1.2)	0.211
Sedimentation (Fresh water)	9.02 mg/kg dw (PEC sediment calculation method for metals)	0.168
Sewage Treatment Plant	0.02 mg/l (EUSES 2.1.2)	0.053
Agricultural soil	0.791 mg/kg dw (EUSES 2.1.2)	0.073
Man via Environment - Inhalation (Systemic effects)	3.9E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	3.9E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.24E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.041

Recycling of hardmetal-containing scrap materials ES 2 Marine Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Marine water	0.157 µg/l (Clocal calculation with Kp susp. matter marine)	0.067
Sedimentation (Marine water)	25.3 mg/kg dw (PEC sediment calculation method	0.362

	for metals)	
Agricultural soil	0.24 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	3.9E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	3.9E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.17E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.04

3.2 Worker

Scrap handling (PROC 8b)

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	3.3 µg/m³	0.061
Inhalation, Local effects, Long Term	3.3 µg/m³	0.083
Dermal, Systemic effects, Long Term	15.5 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.063

Processing operation (PROC 5, PROC 21)

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	15 µg/m³	0.277
Inhalation, Local effects, Long Term	15 µg/m³	0.375
Dermal, Systemic effects, Long Term	0.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.277

Transfer to recycling unit (PROC 8b)

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	12 µg/m³	0.222
Inhalation, Local effects, Long Term	12 µg/m³	0.3
Dermal, Systemic effects, Long Term	15.5 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.224

Chemical recycling (PROC 1)

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	20 µg/m³	0.37
Inhalation, Local effects, Long Term	20 µg/m³	0.5
Dermal, Systemic effects, Long Term	0.1 µg/kg bw/day	< 0.01

Combined routes, Systemic effects, Long Term		0.37
Mechanical recycling (zinc or cold stream) (PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	4.9 µg/m³	0.091
Inhalation, Local effects, Long Term	4.9 µg/m³	0.123
Dermal, Systemic effects, Long Term	0.1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.091
Transfer to milling after mechanical recycling (PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	4.9 µg/m³	0.091
Inhalation, Local effects, Long Term	4.9 µg/m³	0.123
Dermal, Systemic effects, Long Term	15.5 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.093
Milling (PROC 3)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	4.9 µg/m³	0.091
Inhalation, Local effects, Long Term	4.9 µg/m³	0.123
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.091
Filling (PROC 9)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	4.9 µg/m³	0.091
Inhalation, Local effects, Long Term	4.9 µg/m³	0.123
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.099
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	1.5 µg/m³	0.028
Inhalation, Local effects, Long Term	1.5 µg/m³	0.037
Dermal, Systemic effects, Long Term	7.8 µg/kg bw/day	< 0.01

Combined routes, Systemic effects, Long Term		0.029
SECTION 4:	**3.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**	
Health/ Environment		
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.		

4. Exposure Scenario 4: Use at industrial sites; Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use)

SECTION 1:	**4.1 Title of exposure scenario**
	Use at industrial sites; Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use)
Sectors of use [SU]	
Manufacture of bulk, large scale chemicals (including petroleum products)	SU 8
Manufacture of fine chemicals	SU 9
Contributing scenario controlling environmental exposure	
Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES 1 STP Discharge	ERC 6a
Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES 2 Direct Discharge	ERC 6a
Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES 3 Marine Discharge	ERC 6a
Contributing scenario controlling worker exposure	
Raw material handling	PROC 26, PROC 21, PROC 8b
Preparation of raw material	PROC 3, PROC 1
Wet process	PROC 4, PROC 1
Hot process	PROC 22, PROC 27a, PROC 1
Further processing	PROC 5, PROC 1
Filling of solutions	PROC 8b
Handling of powders with moderate dustiness potential	PROC 26
Handling of powders with high dustiness potential	PROC 26
Cleaning & Maintenance	PROC 28

SECTION 2:	4.2 Operational conditions and risk management measures
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES 1 STP Discharge (ERC 6a)
Frequency and duration of use	
Daily amount per site <= 1.48 tonnes/day	
Annual amount per site <= 533 tonnes/year	
Emission days >= 360 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	
Local freshwater dilution factor 100.	
2.1.2	Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES 2 Direct Discharge (ERC 6a)
Frequency and duration of use	
Daily amount per site <= 1.48 tonnes/day	
Annual amount per site <= 533 tonnes/year	
Emission days >= 360 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m^3/day	
No discharge to marine water assumed.	
Local marine water dilution factor 1E3.	
2.1.3	Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES 3 Marine Discharge (ERC 6a)
Frequency and duration of use	
Daily amount per site <= 1.48 tonnes/day	
Annual amount per site <= 533 tonnes/year	
Emission days >= 360 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	

Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m^3/day	
No discharge to freshwater assumed	
Local marine water dilution factor 100.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Raw material handling (PROC 26, PROC 21, PROC 8b)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Additional physical form of product: Massive object	
Additional physical form of product: Aqueous solution	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.2	Preparation of raw material (PROC 3, PROC 1)
Product characteristics	
Physical form of product: Aqueous solution	
Covers percentage substance in the product up to 100 %.	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Assumes process temperature up to 95 °C.	
Reactor equipped with local exhaust ventilation (Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %)	
Ensure enclosure of reaction vessel.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.3	Wet process (PROC 4, PROC 1)
Product characteristics	
Physical form of product: Aqueous solution	
Covers percentage substance in the product up to 100 %.	
Maximum emission potential: Very low	

Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Use in closed process.	
Semi-automated task.	
Vapour extraction units in the tank (Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %)	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
2.2.4	Hot process (PROC 22, PROC 27a, PROC 1)
Product characteristics	
Physical form of product: Solution / Filter cake / Damp powder / Dried powder	
Maximum emission potential: Low (temperature based)	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Elevated temperature. Covers use at temperatures below melting point.	
Use of an exterior local exhaust ventilation with an efficiency of at least 86% is required.	
Ensure enclosure of furnace operation.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
2.2.5	Further processing (PROC 5, PROC 1)
Product characteristics	
Physical form of product: Solid, high dustiness	
Additional physical form of product: Aqueous solution	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Use in closed process.	
Covers use at ambient temperatures.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
2.2.6	Filling of solutions (PROC 8b)
Product characteristics	
Physical form of product: Aqueous solution	

Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.7	Handling of powders with moderate dustiness potential (PROC 26)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.8	Handling of powders with high dustiness potential (PROC 26)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 40 (a minimum efficiency of 97.5%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.9	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Process is carried out at ambient pressure	
Covers use at ambient temperatures.	

Maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation.			
Conditions and measures related to personal protection, hygiene and health evaluation			
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.			
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.			
SECTION 3:	**4.3 Exposure estimation**		
3.1 Environment			
Release estimation method: Estimated release factor			
	Release rate		
	Water	Air	Soil
Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES 1 STP Discharge	0.075 kg/day	0.019 kg/day	0 kg/day
Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES 2 Direct Discharge	0.075 kg/day	0.019 kg/day	0 kg/day
Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES 3 Marine Discharge	0.075 kg/day	0.019 kg/day	0 kg/day

Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES 1 STP Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	1.14E-4 mg/l (EUSES 2.1.2)	0.108
Sedimentation (Fresh water)	4.82 mg/kg dw (PEC sediment calculation method for metals)	0.09
Sewage Treatment Plant	0.023 mg/l (EUSES 2.1.2)	0.061
Agricultural soil	0.875 mg/kg dw (EUSES 2.1.2)	0.08
Man via Environment - Inhalation (Systemic effects)	5.34E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	5.34E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.2E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.037

Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES 2 Direct Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	1.24E-4 mg/l (EUSES 2.1.2)	0.117

Sedimentation (Fresh water)	5.19 mg/kg dw (PEC sediment calculation method for metals)	0.096
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	5.43E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	5.43E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.21E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.037
Use of cobalt in the manufacture of inorganic cobalt substances (intermediate use) ES 2 Direct Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Marine water	0.179 µg/l (Clocal calculation with Kp susp. matter marine)	0.076
Sedimentation (Marine water)	27.36 mg/kg dw (PEC sediment calculation method for metals)	0.392
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	5.43E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	5.43E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.17E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036
3.2 Worker		
Raw material handling (PROC 26, PROC 21, PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	17.2 µg/m³	0.318
Inhalation, Local effects, Long Term	17.2 µg/m³	0.43
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.331
Preparation of raw material (PROC 3, PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	12 µg/m³	0.222
Inhalation, Local effects, Long Term	12 µg/m³	0.3
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01

Combined routes, Systemic effects, Long Term		0.222
Wet process (PROC 4, PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	2.1 µg/m³	0.039
Inhalation, Local effects, Long Term	2.1 µg/m³	0.053
Dermal, Systemic effects, Long Term	1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.039
Hot process (PROC 22, PROC 27a, PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	18.1 µg/m³	0.335
Inhalation, Local effects, Long Term	18.1 µg/m³	0.453
Dermal, Systemic effects, Long Term	1.3 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.335
Further processing (PROC 5, PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	23.9 µg/m³	0.442
Inhalation, Local effects, Long Term	23.9 µg/m³	0.597
Dermal, Systemic effects, Long Term	1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.442
Filling of solutions (PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10 µg/m³	0.185
Inhalation, Local effects, Long Term	10 µg/m³	0.25
Dermal, Systemic effects, Long Term	0.8 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.185
Handling of powders with moderate dustiness potential (PROC 26)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	14.9 µg/m³	0.275
Inhalation, Local effects, Long Term	14.9 µg/m³	0.372
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013

Combined routes, Systemic effects, Long Term		0.288
Handling of powders with high dustiness potential (PROC 26)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	20.8 µg/m³	0.384
Inhalation, Local effects, Long Term	20.8 µg/m³	0.52
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.397
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10.9 µg/m³	0.201
Inhalation, Local effects, Long Term	10.9 µg/m³	0.273
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.214

SECTION 4:	**4.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**

Health/ Environment

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.

5. Exposure Scenario 5: Use at industrial sites; Use of cobalt in the manufacture of cobalt carboxylates and resinates (intermediate use)

SECTION 1:	**5.1 Title of exposure scenario**
	Use at industrial sites; Use of cobalt in the manufacture of cobalt carboxylates and resinates (intermediate use)
Sectors of use [SU]	
Manufacture of bulk, large scale chemicals (including petroleum products)	SU 8
Manufacture of fine chemicals	SU 9
Contributing scenario controlling environmental exposure	
Use of cobalt in the manufacture of cobalt carboxylates and resinates (intermediate use)	ERC 6a
Contributing scenario controlling worker exposure	
Raw material handling	PROC 26, PROC 8b
Reaction	PROC 4, PROC 3, PROC 1
Packaging of powders	PROC 26
Filling of liquids	PROC 9, PROC 8b
Packaging of low and/or medium dusty materials	PROC 26, PROC 8b
Cleaning & Maintenance	PROC 28
SECTION 2:	**5.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Use of cobalt in the manufacture of cobalt carboxylates and resinates (intermediate use) (ERC 6a)
Frequency and duration of use	
Daily amount per site <= 1.8 tonnes/day	
Annual amount per site <= 250 tonnes/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to municipal sewage treatment plant	
Provide onsite wastewater treatment.	
Assumed domestic sewage treatment plant flow >= 4E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	
Local freshwater dilution factor 10.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Raw material handling (PROC 26, PROC 8b)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Additional physical form of product: Aqueous solution	
Covers percentage substance in the product up to 100 %.	

Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.2	Reaction (PROC 4, PROC 3, PROC 1)
Product characteristics	
Physical form of product: Aqueous solution	
Covers percentage substance in the product up to 100 %.	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Assumes process temperature up to 180 °C.	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.3	Packaging of powders (PROC 26)
Product characteristics	
Physical form of product: Solid, high dustiness	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Semi-automated task.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Semi-closed system.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.4	Filling of liquids (PROC 9, PROC 8b)
Product characteristics	
Physical form of product: Aqueous solution	

Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.5	Packaging of low and/or medium dusty materials (PROC 26, PROC 8b)
Product characteristics	
Physical form of product: Solid, Pellets / Pastille	
Covers percentage substance in the product up to 100 %.	
Maximum emission potential: Medium	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Semi-automated task.	
Covers use at ambient temperatures.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
2.2.6	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Solid, high dustiness	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Process is carried out at ambient pressure.	
Covers use at ambient temperatures.	
Maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	

SECTION 3:	5.3 Exposure estimation

3.1 Environment

Release estimation method: Estimated release factor

	Release rate		
	Water	Air	Soil
Use of cobalt in the manufacture of cobalt carboxylates and resinates (intermediate use)	0.061 kg/day	0.013 kg/day	0 kg/day

Use of cobalt in the manufacture of cobalt carboxylates and resinates (intermediate use)

Protection target	Exposure concentration (PEC, Predicted Exposure Concentration)	Risk characterisation ratio (RCR)
Fresh water	1.58E-4 mg/l (EUSES 2.1.2)	0.149
Sedimentation (Fresh water)	6.51 mg/kg dw (PEC sediment calculation method for metals)	0.121
Sewage Treatment Plant	9.18E-4 mg/l (EUSES 2.1.2)	< 0.01
Agricultural soil	0.265 mg/kg dw (EUSES 2.1.2)	0.024
Man via Environment - Inhalation (Systemic effects)	1.48E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	1.48E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.22E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036

3.2 Worker

Raw material handling (PROC 26, PROC 8b)

Exposure route	Exposure estimation	Risk characterisation ratio (RCR)
Inhalation, Systemic effects, Long Term	17.2 µg/m³	0.318
Inhalation, Local effects, Long Term	17.2 µg/m³	0.43
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.331

Reaction (PROC 4, PROC 3, PROC 1)

Exposure route	Exposure estimation	Risk characterisation ratio (RCR)
Inhalation, Systemic effects, Long Term	6 µg/m³	0.111
Inhalation, Local effects, Long Term	6 µg/m³	0.15
Dermal, Systemic effects, Long Term	1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.111

Packaging of powders (PROC 26)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	23.4 µg/m³	0.433
Inhalation, Local effects, Long Term	23.4 µg/m³	0.585
Dermal, Systemic effects, Long Term	3.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.433
Filling of liquids (PROC 9, PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10 µg/m³	0.185
Inhalation, Local effects, Long Term	10 µg/m³	0.25
Dermal, Systemic effects, Long Term	1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.185
Packaging of low and/or medium dusty materials (PROC 26, PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	14.9 µg/m³	0.275
Inhalation, Local effects, Long Term	14.9 µg/m³	0.372
Dermal, Systemic effects, Long Term	3.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.276
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10.9 µg/m³	0.201
Inhalation, Local effects, Long Term	10.9 µg/m³	0.273
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.214

SECTION 4:	**5.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**

Health/ Environment

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.

6. Exposure Scenario 6: Use at industrial sites; Industrial use of cobalt containing catalysts

SECTION 1:	**6.1 Title of exposure scenario**
	Use at industrial sites; Industrial use of cobalt containing catalysts
Chemical product category [PC]	
Other	PC 0
Products such as ph-regulators, flocculants, precipitants, neutralization agents	PC 20
Laboratory chemicals	PC 21
Sectors of use [SU]	
Manufacture of bulk, large scale chemicals (including petroleum products)	SU 8
Manufacture of fine chemicals	SU 9
Contributing scenario controlling environmental exposure	
Industrial use of cobalt containing catalysts	ERC 4
Industrial use of cobalt containing catalysts	ERC 6b
Contributing scenario controlling worker exposure	
Industrial use of cobalt containing catalysts in closed conditions	PROC 1, PROC 2
Industrial use of cobalt containing catalysts in semi-closed conditions	PROC 3, PROC 9, PROC 4, PROC 8b
Cleaning & Maintenance	PROC 28
SECTION 2:	**6.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Industrial use of cobalt containing catalysts (ERC 4)
Frequency and duration of use	
Daily amount per site <= 75 tonnes/day	
Annual amount per site <= 75 tonnes/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Fugitive dust emissions (during loading/unloading) should be minimized by use of LEV and vacuum extraction on equipment where possible. To prevent the contamination of air remove spillages immediately and dispose of waste safely.	
One or more of the following measures should be present to reduce emissions to water: Where possible, loading/unloading activities should be sited on impermeable surfaces and away from surface water drains. Where it is impractical or impossible to handle catalysts away from surface drains, appropriate protective equipment, such as drain covers and flexible dams, should be used. Appropriate containment systems, including bunding where necessary, should be in place to ensure that spills can be properly contained. Drainage from bunded or hard surfaced areas shall be diverted for collection and safe disposal.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
2.1.1	Industrial use of cobalt containing catalysts (ERC 6b)
Frequency and duration of use	
Daily amount per site <= 75 tonnes/day	
Annual amount per site <= 75 tonnes/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Fugitive dust emissions (during loading/unloading) should be minimized by use of LEV and vacuum extraction on equipment where possible. To prevent the contamination of air remove spillages immediately and dispose of waste safely.	
One or more of the following measures should be present to reduce emissions to water: Where possible, loading/unloading activities should be sited on impermeable surfaces and away from surface water drains. Where it is impractical or impossible to handle catalysts away from surface drains, appropriate protective equipment, such as drain covers and flexible dams, should be used. Appropriate containment systems, including bunding where necessary, should be in place to ensure that spills can be properly contained. Drainage from bunded or hard surfaced areas shall be diverted for collection and safe disposal.	

Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Industrial use of cobalt containing catalysts in closed conditions (PROC 1, PROC 2)
Product characteristics	
Physical form of product: Solid, Powder / Dust, Shaped catalysts	
Covers percentage substance in the product up to 100 %.	
Maximum emission potential: High	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Assumes process temperature up to 160 °C.	
Semi-closed system.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.2	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Various	
Covers percentage substance in the product up to 100 %.	
Maximum emission potential: Low	
Frequency and duration of use	
Typical duration per shift = 120 min	
Typical number of shifts per year = 48 Shifts/year	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Process is carried out at ambient pressure.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
SECTION 3:	**6.3 Exposure estimation**
3.1 Environment	
Release estimation method: Estimated release factor	

	Release rate		
	Water	Air	Soil
Industrial use of cobalt containing catalysts	0 kg/day	0 kg/day	0 kg/day
Industrial use of cobalt containing	0 kg/day	0 kg/day	0 kg/day

catalysts			

Industrial use of cobalt containing catalysts in closed conditions (PROC 1, PROC 2)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	0.8 µg/m³	0.015
Inhalation, Local effects, Long Term	0.8 µg/m³	0.02
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.015

Industrial use of cobalt containing catalysts in semi-closed conditions (PROC 3, PROC 9, PROC 4, PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	0.8 µg/m³	0.015
Inhalation, Local effects, Long Term	0.8 µg/m³	0.02
Dermal, Systemic effects, Long Term	1.3 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.015

Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	2.4 µg/m³	0.044
Inhalation, Local effects, Long Term	2.4 µg/m³	0.06
Dermal, Systemic effects, Long Term	23.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.048

SECTION 4:	**6.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**

Health/ Environment

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.

7. Exposure Scenario 7: Use at industrial sites; Production and industrial use of cobalt containing alloys, steels and tools

SECTION 1:	**7.1 Title of exposure scenario**
	Use at industrial sites; Production and industrial use of cobalt containing alloys, steels and tools
Chemical product category [PC]	
Base metals and alloys	PC 7
Metal surface treatment products	PC 14
Sectors of use [SU]	
Manufacture of basic metals, including alloys	SU 14
Manufacture of fabricated metal products, except machinery and equipment	SU 15
Contributing scenario controlling environmental exposure	
Production and industrial use of cobalt containing alloys, steels and tools ES 1 STP Discharge	ERC 5
Production and industrial use of cobalt containing alloys, steels and tools ES 2 Direct Discharge	ERC 5
Production and industrial use of cobalt containing alloys, steels and tools ES 3 Marine Discharge	ERC 5
Contributing scenario controlling worker exposure	
Handling of massive materials	PROC 21
Sintering, melting and casting	PROC 23, PROC 22
Finishing of massive objects	PROC 25, PROC 14, PROC 24, PROC 21, PROC 13
Handling of powders	PROC 26
Powder production	PROC 27a, PROC 27b, PROC 1
Further processing	PROC 24, PROC 1
Thermal spraying– fully automated	PROC 1, PROC 7
Thermal spraying– NOT fully automated	PROC 7
Cleaning & Maintenance	PROC 28
Subsequent service life exposure scenario(s)	
Service life (worker at industrial site); Service life of cobalt containing alloys, steels and tools in industrial settings	ES10
Service life (worker at industrial site); Welding in industrial settings	ES11
Service life (Professional worker); Welding in professional settings	ES12
Service life (Professional worker); Service life of cobalt-containing tools in professional settings	ES13
Service life (Professional worker); Service life of dental alloys containing cobalt in professional settings	ES14
Service life (Consumers); Service life of dental alloys	ES15
Service life (Consumers); Service life of diamond tools and other cobalt-containing tools other than hard metal used by consumers	ES16

SECTION 2:	7.2 Operational conditions and risk management measures
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Production and industrial use of cobalt containing alloys, steels and tools ES 1 STP Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 2.232 tonnes/day	
Annual amount per site <= 750 tonnes/year	
Emission days >= 336 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	
Local freshwater dilution factor 100.	
2.1.2	Production and industrial use of cobalt containing alloys, steels and tools ES 2 Direct Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 2.232 tonnes/day	
Annual amount per site <= 750 tonnes/year	
Emission days >= 336 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m^3/day	
No discharge to marine water assumed.	
Local freshwater dilution factor 150.	
2.1.3	Production and industrial use of cobalt containing alloys, steels and tools ES 3 Marine Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 2.232 tonnes/day	
Annual amount per site <= 750 tonnes/year	
Emission days >= 336 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	

Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to freshwater assumed.	
Assumed effluent discharge flow from site >= 2E3 m^3/day	
Local freshwater dilution factor 100.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Handling of massive materials (PROC 21)
Product characteristics	
Physical form of product: Massive cobalt and massive scrap (e.g. ingots, cathodes, rounds)	
Covers percentage substance in the product up to 100 %.	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.2	Sintering, melting and casting (PROC 23, PROC 22)
Product characteristics	
Physical form of product: Molten	
Additional physical form of product: Massive object (e.g., ingots, cathodes)	
Maximum emission potential: Medium (temperature based)	
Covers percentage substance in the product up to 100 %.	
Technical conditions and measures to control dispersion from source towards the worker	
Assumes process temperature up to 1.5E3 °C.	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Ensure enclosure of furnace operation.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.3	Finishing of massive objects (PROC 25, PROC 14, PROC 24, PROC 21, PROC 13)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 90 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	

Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.4	Handling of powders (PROC 26)
Product characteristics	
Physical form of product: Solid, Powder / Dust (scrap steel and alloy powders and solids)	
Maximum emission potential: Medium	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 40 (a minimum efficiency of 97.5%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.5	Powder production (PROC 27a, PROC 27b, PROC 1)
Product characteristics	
Physical form of product: Molten	
Maximum emission potential: Low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Assumes process temperature up to 1.5E3 °C.	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.6	Further processing (PROC 24, PROC 1)
Product characteristics	
Physical form of product: Massive object (cobalt in alloy)	
Maximum emission potential: Low (abrasion based)	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Assumes process temperature up to 1.2E3 °C.	
Process pressure may exceed ambient pressure.	

Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.7	Thermal spraying – fully automated (PROC 1, PROC 7)
Product characteristics	
Physical form of product: Solid, Powder / Dust	
Maximum emission potential: High (temperature based)	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Limit the process temperature during flame spraying to 3.1E3 °C.	
Limit the process temperature during plasma spraying to 3E4 °C.	
High pressure applied during plasma and high-velocity flame spraying.	
Ensure complete segregation.	
Automated task.	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.8	Thermal spraying – NOT fully automated (PROC 7)
Product characteristics	
Physical form of product: Solid, Powder / Dust	
Maximum emission potential: High (temperature based)	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Limit the process temperature during flame spraying to 3.1E3 °C.	
Limit the process temperature during plasma spraying to 3E4 °C.	
High pressure applied during plasma and high-velocity flame spraying.	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
2.2.9	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Solid, high dustiness	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	

Technical conditions and measures to control dispersion from source towards the worker
Process is carried out at ambient pressure.
Covers use at ambient temperatures.
Maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.

SECTION 3:	**7.3 Exposure estimation**

3.1 Environment

Release estimation method: Estimated release factor

	Release rate		
	Water	Air	Soil
Production and industrial use of cobalt containing alloys, steels and tools ES 1 STP Discharge	0.056 kg/day	0.942 kg/day	0 kg/day
Production and industrial use of cobalt containing alloys, steels and tools ES 2 Direct Discharge	0.056 kg/day	0.942 kg/day	0 kg/day
Production and industrial use of cobalt containing alloys, steels and tools ES 3 Marine Discharge	0.056 kg/day	0.942 kg/day	0 kg/day

Production and industrial use of cobalt containing alloys, steels and tools ES 1 STP Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	2.05E-4 mg/l (EUSES 2.1.2)	0.194
Sedimentation (Fresh water)	8.31 mg/kg dw (PEC sediment calculation method for metals)	0.154
Sewage Treatment Plant	0.017 mg/l (EUSES 2.1.2)	0.045
Agricultural soil	0.712 mg/kg dw (EUSES 2.1.2)	0.065
Man via Environment - Inhalation (Systemic effects)	2.41E-4 mg/m³ (EUSES 2.1.2)	0.03
Man via Environment - Inhalation (Local effects)	2.41E-4 mg/m³ (EUSES 2.1.2)	0.038
Man via Environment - Oral	3.24E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.066

Production and industrial use of cobalt containing alloys, steels and tools ES 2 Direct Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	2.17E-4 mg/l	0.205

	(EUSES 2.1.2)	
Sedimentation (Fresh water)	8.76 mg/kg dw (PEC sediment calculation method for metals)	0.163
Agricultural soil	0.244 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	2.41E-4 mg/m³ (EUSES 2.1.2)	0.03
Man via Environment - Inhalation (Local effects)	2.41E-4 mg/m³ (EUSES 2.1.2)	0.038
Man via Environment - Oral	3.24E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.066
Production and industrial use of cobalt containing alloys, steels and tools ES 3 Marine Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Marine water	0.135 µg/l (Clocal calculation with Kp susp. matter marine)	0.057
Sedimentation (Marine water)	23.47 mg/kg dw (PEC sediment calculation method for metals)	0.336
Agricultural soil	0.244 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	2.41E-4 mg/m³ (EUSES 2.1.2)	0.03
Man via Environment - Inhalation (Local effects)	2.41E-4 mg/m³ (EUSES 2.1.2)	0.038
Man via Environment - Oral	3.17E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.065
3.2 Worker		
Handling of massive materials (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	8.6 µg/m³	0.159
Inhalation, Local effects, Long Term	8.6 µg/m³	0.215
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.168
Sintering, melting and casting (PROC 23, PROC 22)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	1.4 µg/m³	0.026
Inhalation, Local effects, Long Term	1.4 µg/m³	0.035
Dermal, Systemic effects, Long Term	1.3 µg/kg bw/day	< 0.01

Combined routes, Systemic effects, Long Term		0.026
Finishing of massive objects (PROC 25, PROC 14, PROC 24, PROC 21, PROC 13)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	23.6 µg/m³	0.436
Inhalation, Local effects, Long Term	23.6 µg/m³	0.59
Dermal, Systemic effects, Long Term	106.9 µg/kg bw/day	0.015
Combined routes, Systemic effects, Long Term		0.451
Handling of powders (PROC 26)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	27.3 µg/m³	0.505
Inhalation, Local effects, Long Term	27.3 µg/m³	0.682
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.517
Powder production (PROC 27a, PROC 27b, PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10 µg/m³ (MEASE, PROC 1) *	0.185
Inhalation, Local effects, Long Term	10 µg/m³ (MEASE, PROC 1) *	0.25
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.185
*Due to the containment of the process, PROC 1 was used in MEASE for the exposure assessment.		
Further processing (PROC 24, PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10 µg/m³ (MEASE, PROC 1) *	0.185
Inhalation, Local effects, Long Term	10 µg/m³ (MEASE, PROC 1) *	0.25
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.185
*Due to the containment of the process, PROC 1 was used in MEASE for the exposure assessment.		
Thermal spraying – fully automated (PROC 1, PROC 7)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10 µg/m³ (MEASE, PROC 1) *	0.185

Inhalation, Local effects, Long Term	10 µg/m³ (MEASE, PROC 1) *	0.25
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.185
*Due to the containment of the process, PROC 1 was used in MEASE for the exposure assessment.		
Thermal spraying – NOT fully automated (PROC 7)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	19.5 µg/m³	0.36
Inhalation, Local effects, Long Term	19.5 µg/m³	0.487
Dermal, Systemic effects, Long Term	1.3 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.361
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10.9 µg/m³	0.201
Inhalation, Local effects, Long Term	10.9 µg/m³	0.273
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.214
SECTION 4:	**7.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**	
Health/ Environment		
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.		

8. Exposure Scenario 8: Use at industrial sites; Industrial use of cobalt in the production of diamond tools

SECTION 1:	**8.1 Title of exposure scenario**
	Use at industrial sites; Industrial use of cobalt in the production of diamond tools
Chemical product category [PC]	
Base metals and alloys	PC 7
Metal surface treatment products	PC 14
Sectors of use [SU]	
Manufacture of fabricated metal products, except machinery and equipment	SU 15
Contributing scenario controlling environmental exposure	
Industrial use of cobalt in the production of diamond tools ES 1 STP Discharge	ERC 5
Industrial use of cobalt in the production of diamond tools ES 2 Direct Discharge	ERC 5
Industrial use of cobalt in the production of diamond tools ES 3 Marine Discharge	ERC 5
Contributing scenario controlling worker exposure	
Raw material handling	PROC 26, PROC 9, PROC 8b
Wet process	PROC 5, PROC 4
Hot (metallurgical) processes	PROC 25, PROC 14, PROC 22
Mechanical finishing processes	PROC 24, PROC 21
Packaging	PROC 21
Cleaning & Maintenance	PROC 28
Subsequent service life exposure scenario(s)	
Service life (Professional worker); Service life of cobalt-containing tools in professional settings	ES13
Service life (Consumers); Service life of diamond tools and other cobalt-containing tools other than hard metal used by consumers	ES16
SECTION 2:	**8.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Industrial use of cobalt in the production of diamond tools ES 1 STP Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.216 tonnes/day	
Annual amount per site <= 51 tonnes/year	
Emission days >= 236 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	

Local freshwater dilution factor 100.	
2.1.2	Industrial use of cobalt in the production of diamond tools ES 2 Direct Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.216 tonnes/day	
Annual amount per site <= 51 tonnes/year	
Emission days >= 236 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m^3/day	
No discharge to marine water assumed.	
Local freshwater dilution factor 200.	
2.1.3	Industrial use of cobalt in the production of diamond tools ES 3 Marine Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.216 tonnes/day	
Annual amount per site <= 51 tonnes/year	
Emission days >= 236 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m^3/day	
No discharge to freshwater assumed.	
Local marine water dilution factor 100.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Raw material handling (PROC 26, PROC 9, PROC 8b)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Additional physical form of product: Solid, Granulate	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Semi-automated task.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.2	Wet process (PROC 5, PROC 4)
Product characteristics	
Physical form of product: Aqueous solution	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.3	Hot (metallurgical) processes (PROC 25, PROC 14, PROC 22)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Low (temperature based)	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Limit the process temperature to 1.2E3 °C.	
Limit the process pressure to 1.5E6kPa.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
2.2.4	Mechanical finishing processes (PROC 24, PROC 21)
Product characteristics	
Physical form of product: Bound in article.	
Maximum emission potential: Medium (abrasion based)	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	

Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.5	Packaging (PROC 21)
Product characteristics	
Physical form of product: Bound in article.	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.6	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Solid, high dustiness	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Process is carried out at ambient pressure.	
Covers use at ambient temperatures.	
Maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
SECTION 3:	**8.3 Exposure estimation**
3.1 Environment	
Release estimation method: Estimated release factor	

	Release rate		
	Water	Air	Soil
Industrial use of cobalt in the production of diamond tools ES 1 STP Discharge	0.043 kg/day	6.48E-3 kg/day	0 kg/day
Industrial use of cobalt in the production of diamond tools ES 2 Direct Discharge	0.043 kg/day	6.48E-3 kg/day	0 kg/day

Industrial use of cobalt in the production of diamond tools ES 3 Marine Discharge	0.043 kg/day	6.48E-3 kg/day	0 kg/day

Industrial use of cobalt in the production of diamond tools ES 1 STP Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	1.82E-4 mg/l (EUSES 2.1.2)	0.172
Sedimentation (Fresh water)	7.41 mg/kg dw (PEC sediment calculation method for metals)	0.138
Sewage Treatment Plant	0.013 mg/l (EUSES 2.1.2)	0.035
Agricultural soil	0.603 mg/kg dw (EUSES 2.1.2)	0.055
Man via Environment - Inhalation (Systemic effects)	1.32E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	1.32E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.23E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036

Industrial use of cobalt in the production of diamond tools ES 2 Direct Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	1.68E-4 mg/l (EUSES 2.1.2)	0.159
Sedimentation (Fresh water)	6.88 mg/kg dw (PEC sediment calculation method for metals)	0.128
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	1.32E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	1.32E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.23E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036

Industrial use of cobalt in the production of diamond tools ES 3 Marine Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Marine water	0.109 µg/l (Clocal calculation with Kp susp. matter marine)	0.046
Sedimentation (Marine water)	21.16 mg/kg dw (PEC sediment calculation method for metals)	0.303
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022

Man via Environment - Inhalation (Systemic effects)	1.32E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	1.32E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.17E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.065
3.2 Worker		
Raw material handling (PROC 26, PROC 9, PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	23.5 µg/m³	0.434
Inhalation, Local effects, Long Term	23.5 µg/m³	0.588
Dermal, Systemic effects, Long Term	3.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.435
Wet process (PROC 5, PROC 4)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	11 µg/m³ (MEASE, PROC 5)	0.203
Inhalation, Local effects, Long Term	11 µg/m³ (MEASE, PROC 5)	0.275
Dermal, Systemic effects, Long Term	1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.203
Hot (metallurgical) processes (PROC 25, PROC 14, PROC 22)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	18.1 µg/m³	0.335
Inhalation, Local effects, Long Term	18.1 µg/m³	0.453
Dermal, Systemic effects, Long Term	1.3 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.335
Mechanical finishing processes (PROC 24, PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	23.6 µg/m³	0.436
Inhalation, Local effects, Long Term	23.6 µg/m³	0.59
Dermal, Systemic effects, Long Term	106.9 µg/kg bw/day	0.015
Combined routes, Systemic effects, Long Term		0.451

Packaging (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	8.6 µg/m³	0.159
Inhalation, Local effects, Long Term	8.6 µg/m³	0.215
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.168
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10.9 µg/m³	0.201
Inhalation, Local effects, Long Term	10.9 µg/m³	0.273
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.214

SECTION 4:	**8.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**
Health/ Environment	
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.	

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

SECTION 1:	**9.1 Title of exposure scenario**
	Use at industrial sites; Industrial use of cobalt metal in additive manufacturing (3D-printing)
Chemical product category [PC]	
Base metals and alloys	PC 7
Sectors of use [SU]	
Manufacture of basic metals, including alloys	SU 14
Contributing scenario controlling environmental exposure	
Industrial use of cobalt metal in additive manufacturing (3D-printing)	ERC 5
Contributing scenario controlling worker exposure	
Handling of dusty raw materials	PROC 26

3D-printing in closed process	PROC 2
Handling and sieving of powder for reuse	PROC 26
Maintenance work	PROC 28
Cleaning & Maintenance	PROC 28
Subsequent service life exposure scenario(s)	
Service life (worker at industrial site); Service life of cobalt containing alloys, steels and tools in industrial settings	ES10
SECTION 2:	**9.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Industrial use of cobalt metal in additive manufacturing (3D-printing) (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.1 tonnes/day	
Annual amount per site <= 1 tonnes/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
The substance should not be released to air.	
The substance should not be released to water.	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Handling of dusty raw materials (PROC 26)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation	
Semi-closed system.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.2	3D-printing in closed process (PROC 2)
Product characteristics	
Physical form of product: Solid, Powder / Dust	
Maximum emission potential: Low (temperature based)	
Covers percentage substance in the product up to 100 %.	
Technical conditions and measures to control dispersion from source towards the worker	
Only very limited manual invention shall be required to run the process. Contact with the substance shall only be possible for a very limited duration of time.	

Closed process with occasional opening.	
Elevated temperature. Covers use at temperatures below melting point.	
Use of an integrated local exhaust ventilation is required.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.3	Handling and sieving of powder for reuse (PROC 26)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation	
Semi-closed system.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.4	Maintenance work (PROC 28)
Product characteristics	
Physical form of product: Residual dust.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Machinery to be maintained is to be turned off during work.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.5	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Residual dust.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Cleaning is conducted using cleaning machines, in particular hovering is applied and the use of compressed air is omitted.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 40 (a minimum efficiency of 97.5%). 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.			
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.			
SECTION 3:	**9.3 Exposure estimation**		
3.1 Environment			
Release estimation method: Estimated release factor			
	Release rate		
	Water	Air	Soil
Industrial use of cobalt metal in additive manufacturing (3D-printing)	0 kg/day	0 kg/day	0 kg/day
3.2 Worker			
Handling of dusty raw materials (PROC 26)			
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**	
Inhalation, Systemic effects, Long Term	12 µg/m³	0.222	
Inhalation, Local effects, Long Term	12 µg/m³	0.3	
Dermal, Systemic effects, Long Term	3.2 µg/kg bw/day	< 0.01	
Combined routes, Systemic effects, Long Term		0.222	
3D-printing in closed process (PROC 2)			
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**	
Inhalation, Systemic effects, Long Term	15 µg/m³	0.277	
Inhalation, Local effects, Long Term	15 µg/m³	0.375	
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01	
Combined routes, Systemic effects, Long Term		0.277	
Handling and sieving of powder for reuse (PROC 26)			
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**	
Inhalation, Systemic effects, Long Term	12 µg/m³	0.222	
Inhalation, Local effects, Long Term	12 µg/m³	0.3	
Dermal, Systemic effects, Long Term	3.2 µg/kg bw/day	< 0.01	
Combined routes, Systemic effects, Long Term		0.222	
Maintenance work (PROC 28)			
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**	
Inhalation, Systemic effects, Long Term	5 µg/m³	0.092	
Inhalation, Local effects, Long Term	5 µg/m³	0.125	

Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.105
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	16.9 µg/m³	0.312
Inhalation, Local effects, Long Term	16.9 µg/m³	0.422
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.325
SECTION 4:	**9.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**	
Health/ Environment		
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.		

10. Exposure Scenario 10: Service life (worker at industrial site); Service life of cobalt containing alloys, steels and tools in industrial settings

SECTION 1:	**10.1 Title of exposure scenario**
	Service life (worker at industrial site); Service life of cobalt containing alloys, steels and tools in industrial settings
Article Categories [AC]	
Vehicles	AC1
Machinery, mechanical appliances, electrical/electronic articles	AC2
Metal articles	AC7
Contributing scenario controlling environmental exposure	
Service life of cobalt containing alloys, steels and tools in industrial settings	ERC 12a
Contributing scenario controlling worker exposure	
Handling and mechanical treatment of metal or hard coated tools, metals and/or alloys - low kinetic energy	PROC 21
Use and mechanical treatment of metal or hard coated tools, metals and/or alloys - high kinetic energy	PROC 24
Use of cobalt alloy in laser surface treatment	PROC 25

Exposure scenario of the uses leading to the inclusion of the substance into the article	
Use at industrial sites; Production and industrial use of cobalt containing alloys, steels and tools	ES7
Use at industrial sites; Industrial use of cobalt metal in additive manufacturing (3D-printing)	ES9
SECTION 2:	**10.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Service life of cobalt containing alloys, steels and tools in industrial settings (ERC 12a)
Frequency and duration of use	
Daily amount per site <= 50 tonnes/day	
Annual amount per site <= 5E-3 tonnes/year	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Handling and mechanical treatment of metal or hard coated tools, metals and/or alloys - low kinetic energy (PROC 21)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Low (abrasion based)	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.2	Use and mechanical treatment of metal or hard coated tools, metals and/or alloys - high kinetic energy (PROC 24)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: High (abrasion based)	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	

2.2.3	Use of cobalt alloy in laser surface treatment (PROC 25)

Product characteristics

Physical form of product: Massive object

Technical conditions and measures to control dispersion from source towards the worker

Use in closed process.

Conditions and measures related to personal protection, hygiene and health evaluation

Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.

SECTION 3:	10.3 Exposure estimation

3.1 Environment

Release estimation method: Estimated release factor

	Release rate		
	Water	Air	Soil
Service life of cobalt containing alloys, steels and tools in industrial settings	0 kg/day	0 kg/day	0 kg/day

3.2 Worker

Handling and mechanical treatment of metal or hard coated tools, metals and/or alloys - low kinetic energy (PROC 21)

Exposure route	Exposure estimation	Risk characterisation ratio (RCR)
Inhalation, Systemic effects, Long Term	10 µg/m³	0.185
Inhalation, Local effects, Long Term	10 µg/m³	0.25
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.193

Use and mechanical treatment of metal or hard coated tools, metals and/or alloys - high kinetic energy (PROC 24)

Exposure route	Exposure estimation	Risk characterisation ratio (RCR)
Inhalation, Systemic effects, Long Term	11 µg/m³	0.203
Inhalation, Local effects, Long Term	11 µg/m³	0.275
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.216

Use of cobalt alloy in laser surface treatment (PROC 25)

Exposure route	Exposure estimation	Risk characterisation ratio (RCR)
Inhalation, Systemic effects, Long Term	1 µg/m³ (MEASE, PROC 3) *	0.018
Inhalation, Local effects, Long Term	1 µg/m³ (MEASE, PROC 3) *	0.025
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01

Combined routes, Systemic effects, Long Term		0.019
*Because of the enclosure of the process, PROC 3 was used for the assessment.		
SECTION 4:	**10.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**	
Health/ Environment		
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.		

11. Exposure Scenario 11: Service life (worker at industrial site); Welding in industrial settings

SECTION 1:	**11.1 Title of exposure scenario**	
	Service life (worker at industrial site); Welding in industrial settings	
Article Categories [AC]		
Metal articles		AC7
Contributing scenario controlling environmental exposure		
Welding in industrial settings		ERC 12a
Contributing scenario controlling worker exposure		
Welding in industrial settings		PROC 25
Furnace brazing		PROC 25
Exposure scenario of the uses leading to the inclusion of the substance into the article		
Use at industrial sites; Production and industrial use of cobalt containing alloys, steels and tools		ES7
SECTION 2:	**11.2 Operational conditions and risk management measures**	
2.1	**Contributing scenario controlling environmental exposure**	
2.1.1	Welding in industrial settings (ERC 12a)	
Frequency and duration of use		
Daily amount per site <= 50 tonnes/day		
Annual amount per site <= 5E-3 tonnes/year		
Conditions and measures related to municipal sewage treatment plant		
Municipal sewage treatment plant is assumed.		
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day		
Conditions and measures related to external treatment of waste for disposal		
Dispose of waste product or used containers according to local regulations.		

2.2	**Contributing scenario controlling worker exposure**
2.2.1	Welding in industrial settings (PROC 25)
Product characteristics	
Physical form of product: Molten	
Additional physical form of product: Gaseous	
Maximum emission potential: High (temperature based)	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 40 (a minimum efficiency of 97.5%). For further specification, refer to section 8 of the SDS.	
Specific RPE may be required depending on the type of the conducted welding process and compliance with national regulations has to be assured. Please refer to e.g. http://european-welding.org/wp-content/uploads/2016/10/Communication-statements_july_2010.pdf.	
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.	
2.2.2	Furnace brazing (PROC 25)
Product characteristics	
Physical form of product: Molten	
Additional physical form of product: Gaseous	
Maximum emission potential: Low (temperature based)	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Assumes process temperature up to 900 °C.	
Automated task.	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
SECTION 3:	**11.3 Exposure estimation**
3.1 Environment	
Release estimation method: Estimated release factor	

	Release rate		
	Water	Air	Soil
Welding in industrial settings	0 kg/day	0 kg/day	0 kg/day

3.2 Worker		
Welding in industrial settings (PROC 25)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	30 µg/m³ (MEASE)	0.555

Inhalation, Local effects, Long Term	30 µg/m³ (MEASE)	0.75
Dermal, Systemic effects, Long Term	0.3 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.555
Furnace brazing (PROC 25)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	1.4 µg/m³	0.026
Inhalation, Local effects, Long Term	1.4 µg/m³	0.035
Dermal, Systemic effects, Long Term	1.3 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.026
Use of cobalt alloy in laser surface treatment (PROC 25)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	1 µg/m³ (MEASE, PROC 3) *	0.018
Inhalation, Local effects, Long Term	1 µg/m³ (MEASE, PROC 3) *	0.025
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.019
*Because of the enclosure of the process, PROC 3 was used for the assessment.		
SECTION 4:	**11.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**	
Health/ Environment		
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.		

12. Exposure Scenario 12: Service life (Professional worker); Welding in professional settings

SECTION 1:	**12.1 Title of exposure scenario**
	Service life (Professional worker); Welding in professional settings
Article Categories [AC]	
Metal articles	AC7
Contributing scenario controlling environmental exposure	
Welding in professional settings	ERC 10a, ERC 11a
Contributing scenario controlling worker exposure	
Welding in professional settings	PROC 25
Exposure scenario of the uses leading to the inclusion of the substance into the article	
Use at industrial sites; Production and industrial use of cobalt containing alloys, steels and tools	ES7
SECTION 2:	**12.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Welding in professional settings (ERC 10a, ERC 11a)
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Welding in professional settings (PROC 25)
Product characteristics	
Physical form of product: Molten	
Additional physical form of product: Gaseous	
Maximum emission potential: High (temperature based)	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Avoid carrying out activities involving exposure for more than 4 hours per day.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 40 (a minimum efficiency of 97.5%). For further specification, refer to section 8 of the SDS.	
Specific RPE may be required depending on the type of the conducted welding process and compliance with national regulations has to be assured. Please refer to e.g. http://european-welding.org/wp-content/uploads/2016/10/Communication-statements_july_2010.pdf.	
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.	

SECTION 3:	12.3 Exposure estimation		
3.1 Environment			
Release estimation method: Estimated release factor			
	Release rate		
	Water	Air	Soil
Welding in professional settings	0 kg/day	0 kg/day	0 kg/day
3.2 Worker			
Welding in professional settings (PROC 25)			
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**	
Inhalation, Systemic effects, Long Term	36 µg/m³ (MEASE)	0.655	
Inhalation, Local effects, Long Term	36 µg/m³ (MEASE)	0.9	
Dermal, Systemic effects, Long Term	0.2 µg/kg bw/day	< 0.01	
Combined routes, Systemic effects, Long Term		0.665	
SECTION 4:	**12.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**		
Health/ Environment			
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.			

13. Exposure Scenario 13: Service life (Professional worker); Service life of cobalt-containing tools in professional settings

SECTION 1:	13.1 Title of exposure scenario
	Service life (Professional worker); Service life of cobalt-containing tools in professional settings
Article Categories [AC]	
Machinery, mechanical appliances, electrical/electronic articles	AC2
Metal articles	AC7
Contributing scenario controlling environmental exposure	
Service life of cobalt-containing tools in professional settings	ERC 10a, ERC 11a
Contributing scenario controlling worker exposure	
Automated use of cobalt-containing tools with confined and/or extracted machines	PROC 21

Manual tasks using cobalt-containing tools	PROC 24
Exposure scenario of the uses leading to the inclusion of the substance into the article	
Use at industrial sites; Production and industrial use of cobalt containing alloys, steels and tools	ES7
Use at industrial sites; Industrial use of cobalt in the production of diamond tools	ES8
SECTION 2:	**13.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Service life of cobalt-containing tools in professional settings (ERC 10a, ERC 11a)
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Automated use of cobalt-containing tools with confined and/or extracted machines (PROC 21)
Product characteristics	
Physical form of product: Bound in article.	
Maximum emission potential: Medium (abrasion based)	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Automated task.	
local exhaust ventilation. Inhalation - minimum efficiency of 72 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
2.2.2	Manual tasks using cobalt-containing tools (PROC 24)
Product characteristics	
Physical form of product: Bound in article.	
Maximum emission potential: High (abrasion based)	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	

SECTION 3:	13.3 Exposure estimation		
3.1 Environment			
Release estimation method: Estimated release factor			
	Release rate		
	Water	Air	Soil
Service life of cobalt-containing tools in professional settings	0 kg/day	0 kg/day	0 kg/day
3.2 Worker			
Automated use of cobalt-containing tools with confined and/or extracted machines (PROC 21)			
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**	
Inhalation, Systemic effects, Long Term	17 µg/m³ (MEASE) *	0.314	
Inhalation, Local effects, Long Term	17 µg/m³ (MEASE) *	0.425	
Dermal, Systemic effects, Long Term	0.2 µg/kg bw/day	< 0.01	
Combined routes, Systemic effects, Long Term		0.314	
* The implementation of the use descriptor system in IUCLID and Chesar only allows for a selection of specific PROCs for service life ES. However, PROC 3 was used for exposure estimation (PROC 1, 2, 4, 21, 24 may also apply depending on the individual interpretation of PROCs) as this is considered most appropriately describing the exposure situation.			
Manual tasks using cobalt-containing tools (PROC 24)			
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**	
Inhalation, Systemic effects, Long Term	11 µg/m³	0.203	
Inhalation, Local effects, Long Term	11 µg/m³	0.275	
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013	
Combined routes, Systemic effects, Long Term		0.216	
SECTION 4:	**13.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**		
Health/ Environment			
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.			

14. Exposure Scenario 14: Service life (Professional worker); Service life of dental alloys containing cobalt in professional settings

SECTION 1:	**14.1 Title of exposure scenario**
	Service life (Professional worker); Service life of dental alloys containing cobalt in professional settings
Article Categories [AC]	
Metal articles	AC7
Contributing scenario controlling environmental exposure	
Service life of dental alloys containing cobalt in professional settings	ERC 11a
Contributing scenario controlling worker exposure	
Handling of ingots	PROC 21
Melting and casting	PROC 23, PROC 22
Hand fettling	PROC 24
Exposure scenario of the uses leading to the inclusion of the substance into the article	
Use at industrial sites; Production and industrial use of cobalt containing alloys, steels and tools	ES7
SECTION 2:	**14.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Service life of dental alloys containing cobalt in professional settings (ERC 11a)
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Handling of ingots (PROC 21)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.3	Hand fettling (PROC 24)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Medium (abrasion based)	
Covers percentage substance in the product up to 100 %.	

Frequency and duration of use
Covers daily exposures up to 8 hours.
Technical conditions and measures to control dispersion from source towards the worker
Covers use at ambient temperatures.
Use of an integrated tool / machine extraction is required. Inhalation - minimum efficiency of 80 %
Conditions and measures related to personal protection, hygiene and health evaluation
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.

SECTION 3:	**14.3 Exposure estimation**

3.1 Environment

Release estimation method: Estimated release factor

	Release rate		
	Water	Air	Soil
Service life of dental alloys containing cobalt in professional settings	0 kg/day	0 kg/day	0 kg/day

3.2 Worker

Handling of ingots (PROC 21)

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	25 µg/m³	0.462
Inhalation, Local effects, Long Term	25 µg/m³	0.625
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.471

Melting and casting (PROC 23, PROC 22)

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	25 µg/m³	0.462
Inhalation, Local effects, Long Term	25 µg/m³	0.625
Dermal, Systemic effects, Long Term	1.3 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.462

Hand fettling (PROC 24)

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	25 µg/m³	0.462
Inhalation, Local effects, Long Term	25 µg/m³	0.625
Dermal, Systemic effects, Long Term	106.9 µg/kg bw/day	0.015
Combined routes, Systemic effects, Long Term		0.477

SECTION 4:	14.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES
Health/ Environment	
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.	

15. Exposure Scenario 15: Service life (Consumers); Service life of dental alloys

SECTION 1:	15.1 Title of exposure scenario
	Service life (Consumers); Service life of dental alloys
Article Categories [AC]	
Metal articles	AC7
Contributing scenario controlling environmental exposure	
Service life of dental alloys	ERC 10a, ERC 11a
Contributing scenario controlling consumer exposure	
Service life of dental alloys after installation	AC7
Exposure scenario of the uses leading to the inclusion of the substance into the article	
Use at industrial sites; Production and industrial use of cobalt containing alloys, steels and tools	ES7
SECTION 2:	**15.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Service life of dental alloys (ERC 10a, ERC 11a)
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Municipal sewage treatment plant is assumed.	
2.2	**Contributing scenario controlling consumer exposure**
2.2.1	Service life of dental alloys after installation (AC 7)
Product characteristics	
Physical form of product: Massive object	
Covers a release rate in artificial plaque solution acc. to ISO 10271:2001 of up to 2 µg Co/cm²/7 days.	
Inhalation exposure is considered to be not relevant.	
Dermal exposure assumed to be negligible.	

Frequency and duration of use			
Duration of contact: 24 hour(s).			
Frequency of use: 365 events/year			
Other given operational conditions affecting consumers exposure			
Covers adult use.			
Covers a surface area of a dental appliance of up to 20 cm².			
SECTION 3:	**15.3 Exposure estimation**		
3.1 Environment			
Release estimation method: Estimated release factor			
	Release rate		
	Water	Air	Soil
Service life of dental alloys	0 kg/day	0 kg/day	0 kg/day
3.2 Consumer			
Service life of dental alloys after installation (AC 7)			

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	0 mg/m³ (Qualitative assessment)	< 0.01
Inhalation, Local effects, Long Term	0 mg/m³ (Qualitative assessment)	< 0.01
Dermal, Systemic effects, Long Term	0 mg/kg bw/day (Quantitative assessment)	< 0.01
Oral, Systemic effects, Long Term	0.097 µg/kg bw/day (Quantitative assessment)	0.011
Combined routes, Systemic effects, Long Term		0.011

SECTION 4:	**15.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**
Health/ Environment	
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.	

16. Exposure Scenario 16: Service life (Consumers); Service life of diamond tools and other cobalt-containing tools other than hard metal used by consumers

SECTION 1:	**16.1 Title of exposure scenario**
	Service life (Consumers); Service life of diamond tools and other cobalt-containing tools other than hard metal used by consumers
Article Categories [AC]	
Machinery, mechanical appliances, electrical/electronic articles	AC2
Metal articles	AC7
Contributing scenario controlling environmental exposure	
Service life of diamond tools and other cobalt-containing tools other than hard metal used by consumers	ERC 10a, ERC 11a
Contributing scenario controlling consumer exposure	
Use of cutting tools	AC2
Use of cutting tools	AC7
Exposure scenario of the uses leading to the inclusion of the substance into the article	
Use at industrial sites; Production and industrial use of cobalt containing alloys, steels and tools	ES7
Use at industrial sites; Industrial use of cobalt in the production of diamond tools	ES8
SECTION 2:	**16.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Service life of diamond tools and other cobalt-containing tools other than hard metal used by consumers (ERC 10a, ERC 11a)
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Municipal sewage treatment plant is assumed.	
2.2	**Contributing scenario controlling consumer exposure**
2.2.1	Use of cutting tools (AC 2)
Product characteristics	
Physical form of product: Bound in article.	
Inhalation exposure is considered to be not relevant.	
Dermal exposure assumed to be negligible.	
Oral exposure is considered to be not relevant.	
Conditions and measures related to information and behavioural advice to consumers	
Do follow the manufacturers recommended specification for material being cut, drilled or sawed.	
2.2.2	Use of cutting tools (AC 7)
Product characteristics	
Physical form of product: Bound in article.	
Inhalation exposure is considered to be not relevant.	
Dermal exposure assumed to be negligible.	
Oral exposure is considered to be not relevant.	
Conditions and measures related to information and behavioural advice to consumers	
Do follow the manufacturers recommended specification for material being cut, drilled or sawed.	

SECTION 3:	16.3 Exposure estimation		
3.1 Environment			
Release estimation method: Estimated release factor			
	Release rate		
	Water	Air	Soil
Service life of diamond tools and other cobalt-containing tools other than hard metal used by consumers	0 kg/day	0 kg/day	0 kg/day
3.2 Consumer			
Use of cutting tools (AC 2)			
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**	
Inhalation, Systemic effects, Long Term	0 µg/m³ (Qualitative assessment)	< 0.01	
Inhalation, Local effects, Long Term	0 µg/m³ (Qualitative assessment)	< 0.01	
Dermal, Systemic effects, Long Term	0 mg/kg bw/day (Qualitative assessment)	< 0.01	
Oral, Systemic effects, Long Term	0.097 µg/kg bw/day (Qualitative assessment)	< 0.01	
Combined routes, Systemic effects, Long Term		< 0.01	
Use of cutting tools (AC 7)			
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**	
Inhalation, Systemic effects, Long Term	0 µg/m³ (Qualitative assessment)	< 0.01	
Inhalation, Local effects, Long Term	0 µg/m³ (Qualitative assessment)	< 0.01	
Dermal, Systemic effects, Long Term	0 mg/kg bw/day (Qualitative assessment)	< 0.01	
Oral, Systemic effects, Long Term	0.097 µg/kg bw/day (Qualitative assessment)	< 0.01	
Combined routes, Systemic effects, Long Term		< 0.01	

SECTION 4:	16.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES
Health/ Environment	
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.	

17. Exposure Scenario 17: Use at industrial sites; Industrial use of cobalt in passivation processes in surface treatment

SECTION 1:	**17.1 Title of exposure scenario**
	Use at industrial sites; Industrial use of cobalt in passivation processes in surface treatment
Chemical product category [PC]	
Metal surface treatment products	PC 14
Contributing scenario controlling environmental exposure	
Industrial use of cobalt in passivation processes in surface treatment ES 1 STP Discharge	ERC5
Industrial use of cobalt in passivation processes in surface treatment ES 2 Direct Discharge	ERC5
Industrial use of cobalt in passivation processes in surface treatment ES 3 Marine Discharge	ERC5
Contributing scenario controlling worker exposure	
Raw material handling	PROC 21
Wet processes	PROC 2, PROC 1
Passivation	PROC 13
Packaging and handling of passivated articles	PROC 21
Cleaning & Maintenance	PROC 28
Subsequent service life exposure scenario(s)	
Service life (worker at industrial site); Industrial handling of surface treated articles (passivated/plated/sprayed)	ES21
Service life (Professional worker); Professional handling of surface treated articles (passivated/plated/sprayed)	ES22
Service life (Consumer); Handling of heat and wear resistant vehicle parts	ES23
SECTION 2:	**17.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Industrial use of cobalt in passivation processes in surface treatment ES 1 STP Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.025 tonnes/day	
Annual amount per site <= 4 tonnes/year	
Emission days >= 160 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	

Local freshwater dilution factor 200.	
2.1.2	Industrial use of cobalt in passivation processes in surface treatment ES 2 Direct Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.025 tonnes/day	
Annual amount per site <= 4 tonnes/year	
Emission days >= 160 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m3/day	
Local freshwater dilution factor 300.	
2.1.3	Industrial use of cobalt in passivation processes in surface treatment ES 3 Marine Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.025 tonnes/day	
Annual amount per site <= 4 tonnes/year	
Emission days >= 160 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m3/day	
No discharge to freshwater assumed.	
Local marine water dilution factor 100	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Raw material handling (PROC 21)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.2	Wet processes (PROC 2, PROC 1)
Product characteristics	
Physical form of product: Aqueous solution	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Semi-automated task.	
Use in closed process.	
Vapour extraction units in the tank: Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
2.2.3	Passivation (PROC 13)
Product characteristics	
Physical form of product: Aqueous solution	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 5 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.4	Packaging and handling of passivated articles (PROC 21)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	

2.2.5	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Dried splashes/overspill.	
Maximum emission potential: Medium	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Process is carried out at ambient pressure.	
Covers use at ambient temperatures.	
Maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
SECTION 3:	**17.3 Exposure estimation**
3.1 Environment	
Release estimation method: Estimated release factor	

	Release rate		
	Water	Air	Soil
Industrial use of cobalt in passivation processes in surface treatment ES 1 STP Discharge	0.125 kg/day	0.05 kg/day	0 kg/day
Industrial use of cobalt in passivation processes in surface treatment ES 2 Direct Discharge	0.125 kg/day	0.05 kg/day	0 kg/day
Industrial use of cobalt in passivation processes in surface treatment ES 3 Marine Discharge	0.125 kg/day	0.05 kg/day	0 kg/day

Industrial use of cobalt in passivation processes in surface treatment ES 1 STP Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	2.18E-4 mg/l (EUSES 2.1.2)	0.206
Sedimentation (Fresh water)	8.81 mg/kg dw (PEC sediment calculation method for metals)	0.164
Sewage Treatment Plant	0.037 mg/l (EUSES 2.1.2)	0.101
Agricultural soil	1.292 mg/kg dw (EUSES 2.1.2)	0.119
Man via Environment - Inhalation (Systemic effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.2E-4 mg/kg bw/day (Measured data)	0.036

Man via Environment - Combined routes		0.037
Industrial use of cobalt in passivation processes in surface treatment ES 2 Direct Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	2.32E-4 mg/l (EUSES 2.1.2)	0.218
Sedimentation (Fresh water)	9.32 mg/kg dw (PEC sediment calculation method for metals)	0.173
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.24E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.037
Industrial use of cobalt in passivation processes in surface treatment ES 3 Marine Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Marine water	0.286 µg/l (Clocal calculation with Kp susp. matter marine)	0.121
Sedimentation (Marine water)	36.42 mg/kg dw (PEC sediment calculation method for metals)	0.522
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.17E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036
3.2 Worker		
Raw material handling (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	8.6 µg/m³	0.159
Inhalation, Local effects, Long Term	8.6 µg/m³	0.215
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.168

Wet processes (PROC 2, PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	2.1 µg/m³	0.039
Inhalation, Local effects, Long Term	2.1 µg/m³	0.053
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.039
Passivation (PROC 13)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	2 µg/m³ (MEASE)	0.037
Inhalation, Local effects, Long Term	2 µg/m³ (MEASE)	0.05
Dermal, Systemic effects, Long Term	0.1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.037
Packaging and handling of passivated articles (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	8.6 µg/m³	0.159
Inhalation, Local effects, Long Term	8.6 µg/m³	0.215
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.168
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10.9 µg/m³	0.201
Inhalation, Local effects, Long Term	10.9 µg/m³	0.273
Dermal, Systemic effects, Long Term	74.7 µg/kg bw/day	0.01
Combined routes, Systemic effects, Long Term		0.212

SECTION 4:	**17.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**

Health/ Environment

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.

18. Exposure Scenario 18: Use at industrial sites; Passivation processes in surface treatment at large industrial sites with continuous processes

SECTION 1:	**18.1 Title of exposure scenario**
	Use at industrial sites; Passivation processes in surface treatment at large industrial sites with continuous processes
Chemical product category [PC]	
Metal surface treatment products	PC 14
Sectors of use [SU]	
Manufacture of fabricated metal products, except machinery and equipment	SU 15
Contributing scenario controlling environmental exposure	
Passivation processes in surface treatment at large industrial sites with continuous processes ES 1 STP Discharge	ERC5
Passivation processes in surface treatment at large industrial sites with continuous processes ES 2 Direct Discharge	ERC5
Passivation processes in surface treatment at large industrial sites with continuous processes ES 3 Marine Discharge	ERC5
Contributing scenario controlling worker exposure	
Raw material handling (exclusively very low dusty forms as input materials)	PROC 21
Passivation	PROC 2, PROC 13
Packaging and handling of passivated articles	PROC 21
Subsequent service life exposure scenario(s)	
Service life (worker at industrial site); Industrial handling of surface treated articles (passivated/plated/sprayed)	ES21
Service life (Professional worker); Professional handling of surface treated articles (passivated/plated/sprayed)	ES22
SECTION 2:	**18.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Passivation processes in surface treatment at large industrial sites with continuous processes ES 1 STP Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.025 tonnes/day	
Annual amount per site <= 4 tonnes/year	
Emission days >= 160 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	
Local freshwater dilution factor 200.	

2.1.2	Passivation processes in surface treatment at large industrial sites with continuous processes ES 2 Direct Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.025 tonnes/day	
Annual amount per site <= 4 tonnes/year	
Emission days >= 160 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m3/day	
Local freshwater dilution factor 300.	
2.1.3	Passivation processes in surface treatment at large industrial sites with continuous processes ES 3 Marine Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.025 tonnes/day	
Annual amount per site <= 4 tonnes/year	
Emission days >= 160 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m3/day	
No discharge to freshwater assumed.	
Local marine water dilution factor 100.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Raw material handling (exclusively very low dusty forms as input materials) (PROC 21)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Automated task.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	

2.2.2	Passivation (PROC 2, PROC 13)
Product characteristics	
Physical form of product: Aqueous solution	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 5 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Automated task.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.3	Packaging and handling of passivated articles (PROC 21)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Automated task.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
SECTION 3:	**18.3 Exposure estimation**
3.1 Environment	
Release estimation method: Estimated release factor	

	Release rate		
	Water	Air	Soil
Passivation processes in surface treatment at large industrial sites with continuous processes ES 1 STP Discharge	0.125 kg/day	0.05 kg/day	0 kg/day
Passivation processes in surface treatment at large industrial sites with continuous processes ES 2 Direct Discharge	0.125 kg/day	0.05 kg/day	0 kg/day
Passivation processes in surface treatment at large industrial sites with continuous processes ES 3	0.125 kg/day	0.05 kg/day	0 kg/day

Marine Discharge			

Passivation processes in surface treatment at large industrial sites with continuous processes ES 1 STP Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	2.18E-4 mg/l (EUSES 2.1.2)	0.206
Sedimentation (Fresh water)	8.81 mg/kg dw (PEC sediment calculation method for metals)	0.164
Sewage Treatment Plant	0.037 mg/l (EUSES 2.1.2)	0.101
Agricultural soil	1.292 mg/kg dw (EUSES 2.1.2)	0.119
Man via Environment - Inhalation (Systemic effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.2E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.037

Passivation processes in surface treatment at large industrial sites with continuous processes ES 2 Direct Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	2.32E-4 mg/l (EUSES 2.1.2)	0.218
Sedimentation (Fresh water)	9.32 mg/kg dw (PEC sediment calculation method for metals)	0.173
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.24E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.037

Passivation processes in surface treatment at large industrial sites with continuous processes ES 3 Marine Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Marine water	0.286 µg/l (Clocal calculation with Kp susp. matter marine)	0.121
Sedimentation (Marine water)	36.42 mg/kg dw (PEC sediment calculation method for metals)	0.522
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	6.24E-6 mg/m³	< 0.01

	(EUSES 2.1.2)	
Man via Environment - Inhalation (Local effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.17E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036
3.2 Worker		
Raw material handling (exclusively very low dusty forms as input materials) (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	8.6 µg/m³	0.159
Inhalation, Local effects, Long Term	8.6 µg/m³	0.215
Dermal, Systemic effects, Long Term	0.8 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.159
Passivation (PROC 2, PROC 13)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	1 µg/m³ (MEASE, PROC 2)	0.018
Inhalation, Local effects, Long Term	1 µg/m³ (MEASE, PROC 2)	0.025
Dermal, Systemic effects, Long Term	0.024 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.018
Packaging and handling of passivated articles (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	8.6 µg/m³	0.159
Inhalation, Local effects, Long Term	8.6 µg/m³	0.215
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.168
SECTION 4:	**18.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**	
Health/ Environment		
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.		

19. Exposure Scenario 19: Use at industrial sites; Industrial use of cobalt in plating processes in surface treatment

SECTION 1:	**19.1 Title of exposure scenario**
	Use at industrial sites; Industrial use of cobalt in plating processes in surface treatment
Chemical product category [PC]	
Metal surface treatment products	PC 14
Contributing scenario controlling environmental exposure	
Industrial use of cobalt in plating processes in surface treatment ES 1 STP Discharge	ERC5
Industrial use of cobalt in plating processes in surface treatment ES 2 Direct Discharge	ERC5
Industrial use of cobalt in plating processes in surface treatment ES 3 Marine Discharge	ERC5
Contributing scenario controlling worker exposure	
Raw material handling	PROC 21
Wet processes	PROC 2, PROC 1
Plating	PROC 13
Handling of coated/plated articles	PROC 21
Cleaning & Maintenance	PROC 28
Subsequent service life exposure scenario(s)	
Service life (worker at industrial site); Industrial handling of surface treated articles (passivated/plated/sprayed)	ES21
Service life (Professional worker); Professional handling of surface treated articles (passivated/plated/sprayed)	ES22
Service life (Consumer); Handling of heat and wear resistant vehicle parts	ES23
SECTION 2:	**19.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Industrial use of cobalt in plating processes in surface treatment ES 1 STP Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.025 tonnes/day	
Annual amount per site <= 4 tonnes/year	
Emission days >= 160 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	
Local freshwater dilution factor 200.	

2.1.2	Industrial use of cobalt in plating processes in surface treatment ES 2 Direct Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.025 tonnes/day	
Annual amount per site <= 4 tonnes/year	
Emission days >= 160 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m3/day	
Local freshwater dilution factor 300.	
2.1.3	Industrial use of cobalt in plating processes in surface treatment ES 3 Marine Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.025 tonnes/day	
Annual amount per site <= 4 tonnes/year	
Emission days >= 160 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m3/day	
No discharge to freshwater assumed.	
Local marine water dilution factor 100.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Raw material handling (PROC 21)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	

2.2.2	Wet processes (PROC 2, PROC 1)
Product characteristics	
Physical form of product: Aqueous solution	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Semi-automated task.	
Vapour extraction units in the tank: Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
2.2.3	Plating (PROC 13)
Product characteristics	
Physical form of product: Aqueous solution	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Semi-automated task.	
Vapour extraction units in the tank: Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
2.2.4	Handling of coated/plated articles (PROC 21)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	

Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.5	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Dried splashes/overspill.	
Maximum emission potential: Medium	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Process is carried out at ambient pressure.	
Covers use at ambient temperatures.	
Maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
SECTION 3:	**19.3 Exposure estimation**
3.1 Environment	
Release estimation method: Estimated release factor	

	Release rate		
	Water	Air	Soil
Industrial use of cobalt in plating processes in surface treatment ES 1 STP Discharge	0.125 kg/day	0.05 kg/day	0 kg/day
Industrial use of cobalt in plating processes in surface treatment ES 2 Direct Discharge	0.125 kg/day	0.05 kg/day	0 kg/day
Industrial use of cobalt in plating processes in surface treatment ES 3 Marine Discharge	0.125 kg/day	0.05 kg/day	0 kg/day

Industrial use of cobalt in plating processes in surface treatment ES 1 STP Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	2.18E-4 mg/l (EUSES 2.1.2)	0.206
Sedimentation (Fresh water)	8.81 mg/kg dw (PEC sediment calculation method for metals)	0.164
Sewage Treatment Plant	0.037 mg/l (EUSES 2.1.2)	0.101
Agricultural soil	1.292 mg/kg dw (EUSES 2.1.2)	0.119

Man via Environment - Inhalation (Systemic effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.2E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.037
Industrial use of cobalt in plating processes in surface treatment ES 2 Direct Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	2.32E-4 mg/l (EUSES 2.1.2)	0.218
Sedimentation (Fresh water)	9.32 mg/kg dw (PEC sediment calculation method for metals)	0.173
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.24E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.037
Industrial use of cobalt in plating processes in surface treatment ES 3 Marine Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Marine water	0.286 µg/l (Clocal calculation with Kp susp. matter marine)	0.121
Sedimentation (Marine water)	36.42 mg/kg dw (PEC sediment calculation method for metals)	0.522
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.17E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036
3.2 Worker		
Raw material handling (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	8.6 µg/m³	0.159
Inhalation, Local effects, Long Term	8.6 µg/m³	0.215

Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.168
Wet processes (PROC 2, PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	2.1 µg/m³	0.039
Inhalation, Local effects, Long Term	2.1 µg/m³	0.053
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.039
Plating (PROC 13)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	2.1 µg/m³	0.039
Inhalation, Local effects, Long Term	2.1 µg/m³	0.053
Dermal, Systemic effects, Long Term	1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.039
Handling of coated/plated articles (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	8.6 µg/m³	0.159
Inhalation, Local effects, Long Term	8.6 µg/m³	0.215
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.168
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10.9 µg/m³	0.201
Inhalation, Local effects, Long Term	10.9 µg/m³	0.273
Dermal, Systemic effects, Long Term	74.7 µg/kg bw/day	0.01
Combined routes, Systemic effects, Long Term		0.212

SECTION 4:	**19.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**

Health/ Environment

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.

20. Exposure Scenario 20: Use at industrial sites; Industrial use of cobalt in thermal spraying in surface treatment

SECTION 1:	**20.1 Title of exposure scenario**
	Use at industrial sites; Industrial use of cobalt in thermal spraying in surface treatment
Chemical product category [PC]	
Metal surface treatment products	PC 14
Contributing scenario controlling environmental exposure	
Industrial use of cobalt in thermal spraying in surface treatment ES 1 STP Discharge	ERC5
Industrial use of cobalt in thermal spraying in surface treatment ES 2 Direct Discharge	ERC5
Industrial use of cobalt in thermal spraying in surface treatment ES 3 Marine Discharge	ERC5
Contributing scenario controlling worker exposure	
Preparation of massive spraying materials (e.g. wires)	PROC 21
Preparation of dusty spraying materials	PROC 26
Thermal spraying– fully automated	PROC 1, PROC 7
Finishing of massive objects	PROC 24
Handling and packaging of finished massive	PROC 21
Cleaning & Maintenance	PROC 28
Subsequent service life exposure scenario(s)	
Service life (worker at industrial site); Industrial handling of surface treated articles (passivated/plated/sprayed)	ES21
Service life (Professional worker); Professional handling of surface treated articles (passivated/plated/sprayed)	ES22
Service life (Consumer); Handling of heat and wear resistant vehicle parts	ES23

SECTION 2:	**20.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Industrial use of cobalt in thermal spraying in surface treatment ES 1 STP Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.025 tonnes/day	
Annual amount per site <= 4 tonnes/year	
Emission days >= 160 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	

Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	
Local freshwater dilution factor 200.	
2.1.2	Industrial use of cobalt in thermal spraying in surface treatment ES 2 Direct Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.025 tonnes/day	
Annual amount per site <= 4 tonnes/year	
Emission days >= 160 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m3/day	
Local freshwater dilution factor 300.	
2.1.3	Industrial use of cobalt in thermal spraying in surface treatment ES 3 Marine Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.025 tonnes/day	
Annual amount per site <= 4 tonnes/year	
Emission days >= 160 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m3/day	
No discharge to freshwater assumed.	
Local marine water dilution factor 100.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Preparation of massive spraying materials (e.g. wires) (PROC 21)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	

Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.2	Preparation of dusty spraying materials (PROC 26)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.3	Thermal spraying – fully automated (PROC 1, PROC 7)
Product characteristics	
Physical form of product: Solid, Powder / Dust	
Maximum emission potential: High (temperature based)	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Limit the process temperature during flame spraying to 3.1E3 °C.	
Limit the process temperature during plasma spraying to 3E4 °C.	
High pressure applied during plasma and high-velocity flame spraying.	
Automated task.	
Ensure complete segregation.	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	

2.2.4	Finishing of massive objects (PROC 24)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Low (abrasion based)	
Covers percentage substance in the product up to 90 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.5	Handling and packaging of finished massive (PROC 21)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Process is carried out at ambient pressure.	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.6	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Solid, high dustiness	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Process is carried out at ambient pressure.	
Covers use at ambient temperatures.	
Maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	

SECTION 3:	20.3 Exposure estimation

3.1 Environment

Release estimation method: Estimated release factor

	Release rate		
	Water	Air	Soil
Industrial use of cobalt in thermal spraying in surface treatment ES 1 STP Discharge	0.125 kg/day	0.05 kg/day	0 kg/day
Industrial use of cobalt in thermal spraying in surface treatment ES 2 Direct Discharge	0.125 kg/day	0.05 kg/day	0 kg/day
Industrial use of cobalt in thermal spraying in surface treatment ES 3 Marine Discharge	0.125 kg/day	0.05 kg/day	0 kg/day

Industrial use of cobalt in thermal spraying in surface treatment ES 1 STP Discharge

Protection target	Exposure concentration (PEC, Predicted Exposure Concentration)	Risk characterisation ratio (RCR)
Fresh water	2.18E-4 mg/l (EUSES 2.1.2)	0.206
Sedimentation (Fresh water)	8.81 mg/kg dw (PEC sediment calculation method for metals)	0.164
Sewage Treatment Plant	0.037 mg/l (EUSES 2.1.2)	0.101
Agricultural soil	1.292 mg/kg dw (EUSES 2.1.2)	0.119
Man via Environment - Inhalation (Systemic effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.2E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.037

Industrial use of cobalt in thermal spraying in surface treatment ES 2 Direct Discharge

Protection target	Exposure concentration (PEC, Predicted Exposure Concentration)	Risk characterisation ratio (RCR)
Fresh water	2.32E-4 mg/l (EUSES 2.1.2)	0.218
Sedimentation (Fresh water)	9.32 mg/kg dw (PEC sediment calculation method for metals)	0.173
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.24E-4 mg/kg bw/day (Measured data)	0.036

Man via Environment - Combined routes		0.037
Industrial use of cobalt in thermal spraying in surface treatment ES 3 Marine Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Marine water	0.286 µg/l (Clocal calculation with Kp susp. matter marine)	0.121
Sedimentation (Marine water)	36.42 mg/kg dw (PEC sediment calculation method for metals)	0.522
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	6.24E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.17E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036
3.2 Worker		
Preparation of massive spraying materials (e.g. wires) (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	8.6 µg/m³	0.159
Inhalation, Local effects, Long Term	8.6 µg/m³	0.215
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.168
Preparation of dusty spraying materials (PROC 26)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	23.5 µg/m³	0.434
Inhalation, Local effects, Long Term	23.5 µg/m³	0.588
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.447
Thermal spraying – fully automated (PROC 1, PROC 7)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10 µg/m³ (MEASE, PROC 1)	0.185
Inhalation, Local effects, Long Term	10 µg/m³ (MEASE, PROC 1)	0.25
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.185

Finishing of massive objects (PROC 24)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	23.6 µg/m³	0.436
Inhalation, Local effects, Long Term	23.6 µg/m³	0.59
Dermal, Systemic effects, Long Term	106.9 µg/kg bw/day	0.015
Combined routes, Systemic effects, Long Term		0.451
Handling and packaging of finished massive (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	8.6 µg/m³	0.159
Inhalation, Local effects, Long Term	8.6 µg/m³	0.215
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.168
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10.9 µg/m³	0.201
Inhalation, Local effects, Long Term	10.9 µg/m³	0.273
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.214

SECTION 4:	**20.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**

Health/ Environment

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.

21. Exposure Scenario 21: Service life (worker at industrial site); Industrial handling of surface treated articles (passivated/plated/sprayed)

SECTION 1:	**21.1 Title of exposure scenario**
	Service life (worker at industrial site); Industrial handling of surface treated articles (passivated/plated/sprayed)
Article Categories [AC]	
Machinery, mechanical appliances, electrical/electronic articles	AC2
Metal articles	AC7
Contributing scenario controlling environmental exposure	
Handling of surface treated articles (passivated/plated/sprayed)	ERC 12a
Contributing scenario controlling worker exposure	
Handling of articles	PROC 21
Subsequent service life exposure scenario(s)	
Use at industrial sites; Industrial use of cobalt in passivation processes in surface treatment	ES17
Use at industrial sites; Passivation processes in surface treatment at large industrial sites with continuous processes	ES18
Use at industrial sites; Industrial use of cobalt in plating processes in surface treatment	ES19
Use at industrial sites; Industrial use of cobalt in thermal spraying in surface treatment	ES20
SECTION 2:	**21.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Handling of surface treated articles (passivated/plated/sprayed) (ERC 12a)
Frequency and duration of use	
Daily amount per site <= 6E-3 tonnes/day	
Annual amount per site <= 2.007 tonnes/year	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Handling of articles (PROC 21)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Use in room with a volume of minimum 1E3 m^3.	
Indoor use.	

Conditions and measures related to personal protection, hygiene and health evaluation
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.

SECTION 3:	**21.3 Exposure estimation**

3.1 Environment

Release estimation method: Estimated release factor

	Release rate		
	Water	Air	Soil
Handling of surface treated articles (passivated/plated/sprayed)	0 kg/day	0 kg/day	0 kg/day

3.2 Worker

Handling of articles (PROC 21)

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	8.6 µg/m³	0.159
Inhalation, Local effects, Long Term	8.6 µg/m³	0.215
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.168

SECTION 4:	**21.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**

Health/ Environment

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.

22. Exposure Scenario 22: Service life (Professional worker); Professional handling of surface treated articles (passivated/plated/sprayed)

SECTION 1:	**22.1 Title of exposure scenario**
	Service life (Professional worker); Professional handling of surface treated articles (passivated/plated/sprayed)
Article Categories [AC]	
Machinery, mechanical appliances, electrical/electronic articles	AC2
Metal articles	AC7
Contributing scenario controlling environmental exposure	
Handling of surface treated articles (passivated/plated/sprayed)	ERC 10a, ERC 11a
Contributing scenario controlling worker exposure	
Handling of articles	PROC 21
Subsequent service life exposure scenario(s)	
Use at industrial sites; Industrial use of cobalt in passivation processes in surface treatment	ES17
Use at industrial sites; Passivation processes in surface treatment at large industrial sites with continuous processes	ES18
Use at industrial sites; Industrial use of cobalt in plating processes in surface treatment	ES19
Use at industrial sites; Industrial use of cobalt in thermal spraying in surface treatment	ES20
SECTION 2:	**22.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Handling of surface treated articles (passivated/plated/sprayed) (ERC 10a, ERC 11a)
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Handling of articles (PROC 21)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Use in room with a volume of minimum 1E3 m^3.	
Indoor use.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	

SECTION 3:	22.3 Exposure estimation		
3.1 Environment			
Release estimation method: Estimated release factor			
	Release rate		
	Water	Air	Soil
Handling of surface treated articles (passivated/plated/sprayed)	0 kg/day	0 kg/day	0 kg/day
3.2 Worker			
Handling of articles (PROC 21)			
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**	
Inhalation, Systemic effects, Long Term	8.6 µg/m³	0.159	
Inhalation, Local effects, Long Term	8.6 µg/m³	0.215	
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01	
Combined routes, Systemic effects, Long Term		0.168	
SECTION 4:	**22.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**		
Health/ Environment			
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.			

23. Exposure Scenario 23: Service life (Consumer); Handling of heat and wear resistant vehicle parts

SECTION 1:	23.1 Title of exposure scenario
	Service life (Consumer); Handling of heat and wear resistant vehicle parts
Article Categories [AC]	
Vehicles	AC1
Metal articles	AC7
Contributing scenario controlling environmental exposure	
Handling of heat and wear resistant vehicle parts	ERC 10a, ERC 11a
Contributing scenario controlling consumer exposure	
Handling/ exchange of heat and wear resistant vehicle parts	AC1
Handling/ exchange of heat and wear resistant vehicle parts	AC 7

Subsequent service life exposure scenario(s)	
Use at industrial sites; Industrial use of cobalt in passivation processes in surface treatment	ES17
Use at industrial sites; Industrial use of cobalt in plating processes in surface treatment	ES19
Use at industrial sites; Industrial use of cobalt in thermal spraying in surface treatment	ES20

SECTION 2:	**23.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Handling of heat and wear resistant vehicle parts (ERC 10a, ERC 11a)

Conditions and measures related to external treatment of waste for disposal
Dispose of waste product or used containers according to local regulations.
Other given operational conditions affecting environmental exposure
Municipal sewage treatment plant is assumed.

2.2	**Contributing scenario controlling consumer exposure**
2.2.1	Handling/ exchange of heat and wear resistant vehicle parts (AC1)

Product characteristics
Physical form of product: Massive object
Inhalation exposure is considered to be not relevant.
Dermal exposure assumed to be negligible.
Oral exposure is considered to be not relevant.

2.2.2	Handling/ exchange of heat and wear resistant vehicle parts (AC7)

Product characteristics
Physical form of product: Massive object
Inhalation exposure is considered to be not relevant.
Dermal exposure assumed to be negligible.
Oral exposure is considered to be not relevant.

SECTION 3:	**23.3 Exposure estimation**

3.1 Environment

Release estimation method: Estimated release factor

	Release rate		
	Water	Air	Soil
Handling of heat and wear resistant vehicle parts	0 kg/day	0 kg/day	0 kg/day

3.2 Consumer

Handling/ exchange of heat and wear resistant vehicle parts (AC1)

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Local effects, Long Term	0 µg/m³ (Qualitative assessment)	< 0.01
Dermal, Systemic effects, Long Term	0 mg/kg bw/day (Qualitative assessment)	< 0.01
Oral, Systemic effects, Long Term	0 µg/kg bw/day (Qualitative assessment)	< 0.01

SECTION 4:	23.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES
Health/ Environment	
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.	

24. Exposure Scenario 24: Use at industrial sites; Production of cobalt-containing batteries

SECTION 1:	24.1 Title of exposure scenario
	Use at industrial sites; Production of cobalt-containing batteries
Sectors of use [SU]	
Manufacture of computer, electronic and optical products, electrical equipment	SU 16
Contributing scenario controlling environmental exposure	
Production of cobalt-containing batteries ES 1 Direct Discharge	ERC5
Production of cobalt-containing batteries ES 2 Marine Discharge	ERC5
Contributing scenario controlling worker exposure	
Raw material handling	PROC 26, PROC 4, PROC 3, PROC 8b
Mix preparation	PROC 5, PROC 3
Further processing	PROC 13, PROC 9, PROC 4, PROC 5, PROC 6, PROC 3
Final processing and handling	PROC 14, PROC 21
Cleaning & Maintenance	PROC 28
Subsequent service life exposure scenario(s)	
Service life (worker at industrial site); Service life of cobalt-containing batteries in industrial settings	ES25
Service life (Professional worker); Service life of cobalt-containing batteries in professional settings	ES26
SECTION 2:	**24.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Production of cobalt-containing batteries ES 1 Direct Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.088 tonnes/day	
Annual amount per site <= 28 tonnes/year	
Emission days >= 319 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet	

scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 513 m^3/day	
No discharge to marine water assumed.	
Local freshwater dilution factor 100.	
2.1.2	Production of cobalt-containing batteries ES 2 Marine Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 0.088 tonnes/day	
Annual amount per site <= 28 tonnes/year	
Emission days >= 319 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 513 m^3/day	
No discharge to freshwater assumed.	
Local marine water dilution factor 100.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Raw material handling (PROC 26, PROC 4, PROC 3, PROC 8b)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.2	Mix preparation (PROC 5, PROC 3)
Product characteristics	
Physical form of product: Aqueous solution	
Covers percentage substance in the product up to 100 %.	
Maximum emission potential: Very low	

Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Semi-automated task.	
Vapour extraction units in the tank (Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %)	
Ensure enclosure of reaction vessel.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
2.2.3	Further processing (PROC 13, PROC 9, PROC 4, PROC 5, PROC 6, PROC 3)
Product characteristics	
Physical form of product: Solid, low dustiness	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
2.2.4	Final processing and handling (PROC 14, PROC 21)
Product characteristics	
Physical form of product: Included in closed container	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Process is carried out at ambient pressure.	
Covers use at ambient temperatures.	
2.2.5	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Solid, high dustiness	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Process is carried out at ambient pressure.	
Covers use at ambient temperatures.	
Maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation.	

Conditions and measures related to personal protection, hygiene and health evaluation
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.

SECTION 3:	**24.3 Exposure estimation**

3.1 Environment

Release estimation method: Estimated release factor

	Release rate		
	Water	Air	Soil
Production of cobalt-containing batteries ES 1 Direct Discharge	9.57E-3 kg/day	1.03E-3 kg/day	0 kg/day
Production of cobalt-containing batteries ES 2 Marine Discharge	9.57E-3 kg/day	1.03E-3 kg/day	0 kg/day

Production of cobalt-containing batteries ES 1 Direct Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	2.18E-4 mg/l (EUSES 2.1.2)	0.205
Sedimentation (Fresh water)	8.78 mg/kg dw (PEC sediment calculation method for metals)	0.163
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	4E-7 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	4E-7 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.24E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036

Production of cobalt-containing batteries ES 2 Marine Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Marine water	0.095 µg/l (Clocal calculation with Kp susp. matter marine)	0.04
Sedimentation (Marine water)	20.05 mg/kg dw (PEC sediment calculation method for metals)	0.287
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	4E-7 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	4E-7 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.17E-4 mg/kg bw/day	0.036

	(Measured data)	
Man via Environment - Combined routes		0.036
3.2 Worker		
Raw material handling (PROC 26, PROC 4, PROC 3, PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	17.2 µg/m³	0.318
Inhalation, Local effects, Long Term	17.2 µg/m³	0.43
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.331
Mix preparation (PROC 5, PROC 3)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	2.1 µg/m³	0.039
Inhalation, Local effects, Long Term	2.1 µg/m³	0.053
Dermal, Systemic effects, Long Term	1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.039
Further processing (PROC 13, PROC 9, PROC 4, PROC 5, PROC 6, PROC 3)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	2.4 µg/m³	0.044
Inhalation, Local effects, Long Term	2.4 µg/m³	0.06
Dermal, Systemic effects, Long Term	74.7 µg/kg bw/day	0.01
Combined routes, Systemic effects, Long Term		0.055
Final processing and handling (PROC 14, PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	1E-3 µg/m³ (Qualitative assessment)	< 0.01
Inhalation, Local effects, Long Term	1E-3 µg/m³ (Qualitative assessment)	< 0.01
Dermal, Systemic effects, Long Term	1E-3 µg/kg bw/day (Qualitative assessment)	< 0.01
Combined routes, Systemic effects, Long Term		< 0.01
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10.9 µg/m³	0.201

Inhalation, Local effects, Long Term	10.9 µg/m³	0.273
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.214

SECTION 4:	**24.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**
Health/ Environment	
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.	

25. Exposure Scenario 25: Service life (worker at industrial site); Service life of cobalt-containing batteries in industrial settings

SECTION 1:	**25.1 Title of exposure scenario**
	Service life (worker at industrial site); Service life of cobalt-containing batteries in industrial settings
Article Categories [AC]	
Electrical batteries and accumulators	AC3
Contributing scenario controlling environmental exposure	
Service life of cobalt-containing batteries in industrial settings	ERC 12a
Contributing scenario controlling worker exposure	
Handling of sealed containers	PROC 21
Exposure scenario of the uses leading to the inclusion of the substance into the article	
Use at industrial sites; Production of cobalt-containing batteries	ES24
SECTION 2:	**25.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Service life of cobalt-containing batteries in industrial settings (ERC 12a)
Frequency and duration of use	
Daily amount per site <= 6E-3 tonnes/day	
Annual amount per site <= 2.007 tonnes/year	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	

2.2	Contributing scenario controlling worker exposure
2.2.1	Handling of sealed containers (PROC 21)

Product characteristics

Physical form of product: Included in closed container

Maximum emission potential: Very low

Covers percentage substance in the product up to 100 %.

Frequency and duration of use

Covers daily exposures up to 8 hours.

Technical conditions and measures to control dispersion from source towards the worker

Process is carried out at ambient pressure.

Covers use at ambient temperatures.

SECTION 3:	25.3 Exposure estimation

3.1 Environment

Release estimation method: Estimated release factor

	Release rate		
	Water	Air	Soil
Service life of cobalt-containing batteries in industrial settings	0 kg/day	0 kg/day	0 kg/day

3.2 Worker

Handling of sealed containers (PROC 21)

Exposure route	Exposure estimation	Risk characterisation ratio (RCR)
Inhalation, Systemic effects, Long Term	1E-3 µg/m³ (Qualitative assessment)	< 0.01
Inhalation, Local effects, Long Term	1E-3 µg/m³ (Qualitative assessment)	< 0.01
Dermal, Systemic effects, Long Term	1E-3 µg/kg bw/day (Qualitative assessment)	< 0.01
Combined routes, Systemic effects, Long Term		< 0.01

SECTION 4:	25.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Health/ Environment

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.

26. Exposure Scenario 26: Service life (Professional worker); Service life of cobalt-containing batteries in professional settings

SECTION 1:	**26.1 Title of exposure scenario**
	Service life (Professional worker); Service life of cobalt-containing batteries in professional settings

Article Categories [AC]	
Electrical batteries and accumulators	AC3
Contributing scenario controlling environmental exposure	
Service life of cobalt-containing batteries in professional settings	ERC 10a, ERC 11a
Contributing scenario controlling worker exposure	
Handling of sealed containers	PROC 21
Exposure scenario of the uses leading to the inclusion of the substance into the article	
Use at industrial sites; Production of cobalt-containing batteries	ES24

SECTION 2:	**26.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Service life of cobalt-containing batteries in professional settings (ERC 10a, ERC 11a)

Conditions and measures related to municipal sewage treatment plant
Municipal sewage treatment plant is assumed.
Conditions and measures related to external treatment of waste for disposal
Dispose of waste product or used containers according to local regulations.

2.2	**Contributing scenario controlling worker exposure**
2.2.1	Handling of sealed containers (PROC 21)

Product characteristics
Physical form of product: Included in closed container
Maximum emission potential: Very low
Covers percentage substance in the product up to 100 %.
Frequency and duration of use
Covers daily exposures up to 8 hours.
Technical conditions and measures to control dispersion from source towards the worker
Process is carried out at ambient pressure.
Covers use at ambient temperatures.

SECTION 3:	**26.3 Exposure estimation**

3.1 Environment

Release estimation method: Estimated release factor

	Release rate		
	Water	Air	Soil
Service life of cobalt-containing batteries in professional settings	0 kg/day	0 kg/day	0 kg/day

3.2 Worker

Handling of sealed containers (PROC 21)

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	1E-3 µg/m³ (Qualitative assessment)	< 0.01

Inhalation, Local effects, Long Term	1E-3 µg/m³ (Qualitative assessment)	< 0.01
Dermal, Systemic effects, Long Term	1E-3 µg/kg bw/day (Qualitative assessment)	< 0.01
Combined routes, Systemic effects, Long Term		< 0.01

SECTION 4:	**26.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**
Health/ Environment	
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.	

27. Exposure Scenario 27: Use at industrial sites; Industrial use of cobalt in the production of varistors and magnets (calcination/sintering processes)

SECTION 1:	**27.1 Title of exposure scenario**
	Use at industrial sites; Industrial use of cobalt in the production of varistors and magnets (calcination/sintering processes)
Chemical product category [PC]	
Semiconductors	PC 33
Sectors of use [SU]	
Manufacture of other non-metallic mineral products, e.g. plasters, cement	SU 13
Manufacture of fabricated metal products, except machinery and equipment	SU 15
Manufacture of computer, electronic and optical products, electrical equipment	SU 16
Contributing scenario controlling environmental exposure	
Industrial use of cobalt in the production of varistors and magnets (calcination/sintering processes) ES 1 STP Discharge	ERC 5
Industrial use of cobalt in the production of varistors and magnets (calcination/sintering processes) ES 2 Direct Discharge	ERC 5
Industrial use of cobalt in the production of varistors and magnets (calcination/sintering processes) ES 3 Marine Discharge	ERC 5
Contributing scenario controlling worker exposure	
Raw material handling	PROC 26, PROC 21, PROC 8b
Preparation of raw material	PROC 5, PROC 4, PROC 2, PROC 3, PROC 1
Wet process	PROC 4, PROC 1
Preparation of pre-sintered materials	PROC 26, PROC 14, PROC 5, PROC 3, PROC 8b
Hot process/sintering	PROC 22, PROC 1

Formulation and filling	PROC 9, PROC 3, PROC 8b
Packaging of varistors	PROC 21
Packaging of magnets	PROC 21
Cleaning & Maintenance	PROC 28
Subsequent service life exposure scenario(s)	
Service life (worker at industrial site); Service life of cobalt-containing varistors and magnets in industrial settings	ES29
Service life (Professional worker); Service life of cobalt-containing varistors and magnets in professional settings	ES30
Service life (Consumer); Service life of articles containing cobalt being encapsulated in the internal part of the product	ES31
SECTION 2:	**27.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Industrial use of cobalt in the production of varistors and magnets (calcination/sintering processes) ES 1 STP Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 4.1E-3 tonnes/day	
Annual amount per site <= 1.5 tonnes/year	
Emission days >= 365 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	
Local freshwater dilution factor 100.	
2.1.2	Industrial use of cobalt in the production of varistors and magnets (calcination/sintering processes) ES 2 Direct Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 4.1E-3 tonnes/day	
Annual amount per site <= 1.5 tonnes/year	
Emission days >= 365 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m^3/day	
No discharge to marine water assumed.	

Local freshwater dilution factor 100.	
2.1.3	Industrial use of cobalt in the production of varistors and magnets (calcination/sintering processes) ES 3 Marine Discharge (ERC 5)
Frequency and duration of use	
Daily amount per site <= 4.1E-3 tonnes/day	
Annual amount per site <= 1.5 tonnes/year	
Emission days >= 365 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m^3/day	
No discharge to freshwater assumed	
Local marine water dilution factor 100.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Raw material handling (PROC 26, PROC 21, PROC 8b)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Additional physical form of product: Massive object	
Additional physical form of product: Aqueous solution	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.2	Preparation of raw material (PROC 5, PROC 4, PROC 2, PROC 3, PROC 1)
Product characteristics	
Physical form of product: Aqueous solution	
Covers percentage substance in the product up to 100 %.	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Assumes process temperature up to 95 °C.	
Reactor equipped with local exhaust ventilation (Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Ensure enclosure of reaction vessel.	

Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.3	Wet process (PROC 4, PROC 1)
Product characteristics	
Physical form of product: Aqueous solution	
Covers percentage substance in the product up to 100 %.	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Use in closed process.	
Semi-automated task.	
Vapour extraction units in the tank (Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %)	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
2.2.4	Preparation of pre-sintered materials (PROC 26, PROC 14, PROC 5, PROC 3, PROC 8b)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Local exhaust ventilation in powder handling areas. Inhalation - minimum efficiency of 78 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.5	Hot process/sintering (PROC 22, PROC 1)
Product characteristics	
Physical form of product: Molten	
Additional physical form of product: Solid, Powder / Dust	
Additional physical form of product: Massive object	
Maximum emission potential: Medium (temperature based)	
Covers percentage substance in the product up to 100 %.	

Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Assumes process temperature up to 1.6E3 °C.	
Ensure that worker is in a separated (control) room.	
Closed furnace or well-extracted open induction furnace.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
2.2.6	Formulation and filling (PROC 9, PROC 3, PROC 8b)
Product characteristics	
Physical form of product: Aqueous solution	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.7	Packaging of varistors (PROC 21)
Product characteristics	
Physical form of product: Bound in article.	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 5 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.8	Packaging of magnets (PROC 21)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	

Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.9	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Process is carried out at ambient pressure	
Covers use at ambient temperatures.	
Maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
SECTION 3:	**27.3 Exposure estimation**
3.1 Environment	
Release estimation method: Estimated release factor	

	Release rate		
	Water	Air	Soil
Industrial use of cobalt in the production of varistors and magnets (calcination/sintering processes) ES 1 STP Discharge	0.012 kg/day	8.2E-3 kg/day	0 kg/day
Industrial use of cobalt in the production of varistors and magnets (calcination/sintering processes) ES 2 Direct Discharge	0.012 kg/day	8.2E-3 kg/day	0 kg/day
Industrial use of cobalt in the production of varistors and magnets (calcination/sintering processes) ES 3 Marine Discharge	0.012 kg/day	8.2E-3 kg/day	0 kg/day

Industrial use of cobalt in the production of varistors and magnets (calcination/sintering processes) ES 1 STP Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	1.23E-4 mg/l (EUSES 2.1.2)	0.116
Sedimentation (Fresh water)	5.16 mg/kg dw (PEC sediment calculation method for metals)	0.096
Sewage Treatment Plant	3.69E-3 mg/l (EUSES 2.1.2)	< 0.01

Agricultural soil	0.343 mg/kg dw (EUSES 2.1.2)	0.031
Man via Environment - Inhalation (Systemic effects)	2.43E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	2.43E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.21E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036
Industrial use of cobalt in the production of varistors and magnets (calcination/sintering processes) ES 2 Direct Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	1.39E-4 mg/l (EUSES 2.1.2)	0.131
Sedimentation (Fresh water)	5.76 mg/kg dw (PEC sediment calculation method for metals)	0.107
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	2.43E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	2.43E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.21E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.037
Industrial use of cobalt in the production of varistors and magnets (calcination/sintering processes) ES 3 Marine Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Marine water	0.045 µg/l (Clocal calculation with Kp susp. matter marine)	0.019
Sedimentation (Marine water)	15.4 mg/kg dw (PEC sediment calculation method for metals)	0.221
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	2.43E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	2.43E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.17E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036

3.2 Worker		
Raw material handling (PROC 26, PROC 21, PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	17.2 µg/m³	0.318
Inhalation, Local effects, Long Term	17.2 µg/m³	0.43
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.331
Preparation of raw material (PROC 5, PROC 4, PROC 2, PROC 3, PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	12 µg/m³	0.222
Inhalation, Local effects, Long Term	12 µg/m³	0.3
Dermal, Systemic effects, Long Term	1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.222
Wet process (PROC 4, PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	2.1 µg/m³	0.039
Inhalation, Local effects, Long Term	2.1 µg/m³	0.053
Dermal, Systemic effects, Long Term	1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.039
Preparation of pre-sintered materials (PROC 26, PROC 14, PROC 5, PROC 3, PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	11 µg/m³	0.203
Inhalation, Local effects, Long Term	11 µg/m³	0.275
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.216
Hot process/sintering (PROC 22, PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	18.1 µg/m³	0.335
Inhalation, Local effects, Long Term	18.1 µg/m³	0.453
Dermal, Systemic effects, Long Term	1.3 µg/kg bw/day	< 0.01

Combined routes, Systemic effects, Long Term		0.335
Formulation and filling (PROC 9, PROC 3, PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10 µg/m³ (MEASE, PROC 9)	0.185
Inhalation, Local effects, Long Term	10 µg/m³ (MEASE, PROC 9)	0.25
Dermal, Systemic effects, Long Term	0.8 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.185
Packaging of varistors (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10 µg/m³	0.185
Inhalation, Local effects, Long Term	10 µg/m³	0.25
Dermal, Systemic effects, Long Term	3.1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.185
Packaging of magnets (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	8.6 µg/m³	0.159
Inhalation, Local effects, Long Term	8.6 µg/m³	0.215
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.168
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10.9 µg/m³	0.201
Inhalation, Local effects, Long Term	10.9 µg/m³	0.273
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.214
SECTION 4:	**27.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**	
Health/ Environment		
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.

28. Exposure Scenario 28: Use at industrial sites; Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass

SECTION 1:	**28.1 Title of exposure scenario**
	Use at industrial sites; Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass
Chemical product category [PC]	
Semiconductors	PC 33
Sectors of use [SU]	
Manufacture of bulk, large scale chemicals (including petroleum products)	SU 8
Manufacture of fine chemicals	SU 9
Contributing scenario controlling environmental exposure	
Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES 1 STP Discharge	ERC 6a
Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES 2 Direct Discharge	ERC 6a
Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES 3 Marine Discharge	ERC 6a
Industrial use of cobalt in the manufacture of inorganic pigments and frits ES4 High volume with low emission factor	ERC 6a
Contributing scenario controlling worker exposure	
Raw material handling	PROC 26, PROC 21, PROC 8b
Preparation of raw material	PROC 5, PROC 4, PROC 2, PROC 3, PROC 1
Wet process	PROC 4, PROC 1
Hot process	PROC 23, PROC 1, PROC 22
Formulation and filling	PROC 9, PROC 3, PROC 8b
Packaging of massive objects	PROC 21
Cleaning & Maintenance	PROC 28
SECTION 2:	**28.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES 1 STP Discharge (ERC 6a)
Frequency and duration of use	
Daily amount per site <= 0.198 tonnes/day	
Annual amount per site <= 65 tonnes/year	
Emission days >= 328 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet	

scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	
Local freshwater dilution factor 200.	
2.1.2	Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES 2 Direct Discharge (ERC 6a)
Frequency and duration of use	
Daily amount per site <= 0.198 tonnes/day	
Annual amount per site <= 65 tonnes/year	
Emission days >= 328 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m^3/day	
No discharge to marine water assumed.	
Local freshwater dilution factor 200.	
2.1.3	Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES 3 Marine Discharge (ERC 6a)
Frequency and duration of use	
Daily amount per site <= 0.198 tonnes/day	
Annual amount per site <= 65 tonnes/year	
Emission days >= 328 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m^3/day	
No discharge to freshwater assumed	
Local marine water dilution factor 100.	
2.1.4	Industrial use of cobalt in the manufacture of inorganic pigments and frits ES4 High volume with low emission factor (ERC 6a)
Frequency and duration of use	
Daily amount per site <= 1.39 tonnes/day	

Annual amount per site <= 500 tonnes/year	
Emission days >= 360 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	
Local freshwater dilution factor 10.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Raw material handling (PROC 26, PROC 21, PROC 8b)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Additional physical form of product: Massive object	
Additional physical form of product: Aqueous solution	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.2	Preparation of raw material (PROC 5, PROC 4, PROC 2, PROC 3, PROC 1)
Product characteristics	
Physical form of product: Aqueous solution	
Covers percentage substance in the product up to 100 %.	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Assumes process temperature up to 95 °C.	
Reactor equipped with local exhaust ventilation (Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %)	
Ensure enclosure of reaction vessel.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.3	Wet process (PROC 4, PROC 1)
Product characteristics	
Physical form of product: Aqueous solution	
Covers percentage substance in the product up to 100 %.	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Use in closed process.	
Semi-automated task.	
Vapour extraction units in the tank: Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
2.2.4	Hot process (PROC 23, PROC 1, PROC 22)
Product characteristics	
Physical form of product: Molten	
Additional physical form of product: Solid, Powder / Dust	
Additional physical form of product: Solid	
Maximum emission potential: Medium (temperature based)	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Assumes process temperature up to 1.6E3 °C.	
Closed furnace or well-extracted open induction furnace.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
2.2.5	Formulation and filling (PROC 9, PROC 3, PROC 8b)
Product characteristics	
Physical form of product: Aqueous solution	
Covers percentage substance in the product up to 100 %.	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	

Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.6	Packaging of massive objects (PROC 21)
Product characteristics	
Physical form of product: Bound in article.	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 5 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.7	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Process is carried out at ambient pressure	
Covers use at ambient temperatures.	
Maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
SECTION 3:	**28.3 Exposure estimation**
3.1 Environment	
Release estimation method: Estimated release factor	

	Release rate		
	Water	Air	Soil
Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES 1 STP Discharge	0.079 kg/day	0.059 kg/day	0 kg/day

Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES 2 Direct Discharge	0.079 kg/day	0.059 kg/day	0 kg/day
Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES 3 Marine Discharge	0.079 kg/day	0.059 kg/day	0 kg/day
Industrial use of cobalt in the manufacture of inorganic pigments and frits ES4 High volume with low emission factor (ERC 6a)	0.032 kg/day	7.92E-3 kg/day	0 kg/day

Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES 1 STP Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	1.75E-4 mg/l (EUSES 2.1.2)	0.165
Sedimentation (Fresh water)	7.15 mg/kg dw (PEC sediment calculation method for metals)	0.133
Sewage Treatment Plant	0.024 mg/l (EUSES 2.1.2)	0.064
Agricultural soil	0.906 mg/kg dw (EUSES 2.1.2)	0.083
Man via Environment - Inhalation (Systemic effects)	1.5E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	1.5E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.23E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.038

Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES 2 Direct Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	2.25E-4 mg/l (EUSES 2.1.2)	0.212
Sedimentation (Fresh water)	9.07 mg/kg dw (PEC sediment calculation method for metals)	0.169
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	1.5E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	1.5E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.24E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.038

Industrial use of cobalt in the manufacture of inorganic pigments, frits, ceramic ware, glass ES 3 Marine Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Marine water	0.187 µg/l (Clocal calculation with Kp susp. matter marine)	0.079
Sedimentation (Marine water)	27.89 mg/kg dw (PEC sediment calculation method for metals)	0.4
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	1.5E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	1.5E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.17E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.037
Industrial use of cobalt in the manufacture of inorganic pigments and frits ES4 High volume with low emission factor (ERC 6a)		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Marine water	7.06E-4 mg/l (EUSES 2.1.2)	0.666
Sedimentation (Marine water)	27.56 mg/kg dw (PEC sediment calculation method for metals)	0.512
Sewage Treatment Plant	9.59E-3 mg/l (EUSES 2.1.2)	0.026
Agricultural soil	0.508 mg/kg dw (EUSES 2.1.2)	0.047
Man via Environment - Inhalation (Systemic effects)	2.32E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	2.32E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3. 4E-4 mg/kg bw/day (Measured data)	0.038
Man via Environment - Combined routes		0.038
3.2 Worker		
Raw material handling (PROC 26, PROC 21, PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	17.2 µg/m³	0.318
Inhalation, Local effects, Long Term	17.2 µg/m³	0.43
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.331

Preparation of raw material (PROC 5, PROC 4, PROC 2, PROC 3, PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	12 µg/m³	0.222
Inhalation, Local effects, Long Term	12 µg/m³	0.3
Dermal, Systemic effects, Long Term	1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.222
Wet process (PROC 4, PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	2.1 µg/m³	0.039
Inhalation, Local effects, Long Term	2.1 µg/m³	0.053
Dermal, Systemic effects, Long Term	1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.039
Hot process (PROC 23, PROC 1, PROC 22)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	18.1 µg/m³	0.335
Inhalation, Local effects, Long Term	18.1 µg/m³	0.453
Dermal, Systemic effects, Long Term	1.3 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.335
Formulation and filling (PROC 9, PROC 3, PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10 µg/m³ (MEASE, PROC 9)	0.185
Inhalation, Local effects, Long Term	10 µg/m³ (MEASE, PROC 9)	0.25
Dermal, Systemic effects, Long Term	0.8 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.185
Packaging of massive objects (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10 µg/m³ (MEASE)	0.185
Inhalation, Local effects, Long Term	10 µg/m³ (MEASE)	0.25
Dermal, Systemic effects, Long Term	3.1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.185

Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10.9 µg/m³	0.201
Inhalation, Local effects, Long Term	10.9 µg/m³	0.273
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.214
SECTION 4:	**28.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**	
Health/ Environment		
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.		

29. Exposure Scenario 29: Service life (worker at industrial site); Service life of cobalt-containing varistors and magnets in industrial settings

SECTION 1:	**29.1 Title of exposure scenario**
	Service life (worker at industrial site); Service life of cobalt-containing varistors and magnets in industrial settings
Article Categories [AC]	
Machinery, mechanical appliances, electrical/electronic articles	AC2
Metal articles	AC7
Contributing scenario controlling environmental exposure	
Service life of cobalt-containing varistors and magnets in industrial settings	ERC 12a
Contributing scenario controlling worker exposure	
Handling of varistors	PROC 21
Handling of magnets	PROC 21
Exposure scenario of the uses leading to the inclusion of the substance into the article	
Use at industrial sites; Industrial use of cobalt in the production of varistors and magnets (calcination/sintering processes)	ES27
SECTION 2:	**29.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Service life of cobalt-containing varistors and magnets in industrial settings (ERC 12a)
Frequency and duration of use	

Daily amount per site <= 0.5 tonnes/day	
Annual amount per site <= 10 tonnes/year	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Handling of varistors (PROC 21)
Product characteristics	
Physical form of product: Bound in article.	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 5 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
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.	
2.2.2	Handling of magnets (PROC 21)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Technical conditions and measures to control dispersion from source towards the worker	
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.	
SECTION 3:	**29.3 Exposure estimation**
3.1 Environment	
Release estimation method: Estimated release factor	

	Release rate		
	Water	Air	Soil
Service life of cobalt-containing varistors and magnets in industrial settings	0 kg/day	0 kg/day	0 kg/day

3.2 Worker	
Handling of varistors (PROC 21)	

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10 µg/m³ (MEASE)	0.185

Inhalation, Local effects, Long Term	10 µg/m³ (MEASE)	0.25
Dermal, Systemic effects, Long Term	3.1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.185
Handling of magnets (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	8.6 µg/m³	0.159
Inhalation, Local effects, Long Term	8.6 µg/m³	0.215
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.168

SECTION 4:	**29.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**
Health/ Environment	
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.	

30. Exposure Scenario 30: Service life (Professional worker); Service life of cobalt-containing varistors and magnets in professional settings

SECTION 1:	**30.1 Title of exposure scenario**
	Service life (Professional worker); Service life of cobalt-containing varistors and magnets in professional settings
Article Categories [AC]	
Machinery, mechanical appliances, electrical/electronic articles	AC2
Metal articles	AC7
Contributing scenario controlling environmental exposure	
Service life of cobalt-containing varistors and magnets in professional settings	ERC 10a, ERC 11a
Contributing scenario controlling worker exposure	
Handling of varistors	PROC 21
Handling of magnets	PROC 21
Exposure scenario of the uses leading to the inclusion of the substance into the article	
Use at industrial sites; Industrial use of cobalt in the production of varistors and magnets (calcination/sintering processes)	ES27

SECTION 2:	**30.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Service life of cobalt-containing varistors and magnets in professional settings (ERC 10a, ERC 11a)
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Handling of varistors (PROC 21)
Product characteristics	
Physical form of product: Bound in article.	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 5 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.2	Handling of magnets (PROC 21)
Product characteristics	
Physical form of product: Massive object	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
SECTION 3:	**30.3 Exposure estimation**
3.1 Environment	
Release estimation method: Estimated release factor	

	Release rate		
	Water	Air	Soil
Service life of cobalt-containing varistors and magnets in professional settings	0 kg/day	0 kg/day	0 kg/day

3.2 Worker		
Handling of varistors (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10 µg/m³ (MEASE)	0.185
Inhalation, Local effects, Long Term	10 µg/m³ (MEASE)	0.25
Dermal, Systemic effects, Long Term	3.1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.185
Handling of magnets (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	8.6 µg/m³	0.159
Inhalation, Local effects, Long Term	8.6 µg/m³	0.215
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.168
SECTION 4:	**30.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**	
Health/ Environment		
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.		

31. Exposure Scenario 31: Service life (Consumers); Service life of articles containing cobalt being encapsulated in the internal part of the product

SECTION 1:	**31.1 Title of exposure scenario**
	Service life (Consumers); Service life of articles containing cobalt being encapsulated in the internal part of the product
Article Categories [AC]	
Machinery, mechanical appliances, electrical/electronic articles	AC2
Contributing scenario controlling environmental exposure	
Service life of articles containing cobalt being encapsulated in the internal part of the product	ERC 10a, ERC 11a
Contributing scenario controlling consumer exposure	
Handling of electronic articles	AC2

Exposure scenario of the uses leading to the inclusion of the substance into the article	
Use at industrial sites; Industrial use of cobalt in the production of varistors and magnets (calcination/sintering processes)	ES27
SECTION 2:	**31.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Service life of articles containing cobalt being encapsulated in the internal part of the product (ERC 10a, ERC 11a)
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Municipal sewage treatment plant is assumed.	
2.2	**Contributing scenario controlling consumer exposure**
2.2.1	Handling of electronic articles (AC 2)
Product characteristics	
Physical form of product: encapsulated in the internal part	
Inhalation exposure is considered to be not relevant.	
Assumes no dermal contact.	
Oral exposure is considered to be not relevant.	
SECTION 3:	**31.3 Exposure estimation**
3.1 Environment	
Release estimation method: Estimated release factor	

	Release rate		
	Water	Air	Soil
Service life of articles containing cobalt being encapsulated in the internal part of the product	0 kg/day	0 kg/day	0 kg/day

3.2 Consumer		
Handling of electronic articles (AC 2)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	0 µg/m³ (Qualitative assessment)	< 0.01
Inhalation, Local effects, Long Term	0 µg/m³ (Qualitative assessment)	< 0.01
Dermal, Systemic effects, Long Term	0 mg/kg bw/day (Qualitative assessment)	< 0.01
Oral, Systemic effects, Long Term	0 µg/kg bw/day (Qualitative assessment)	< 0.01
Combined routes, Systemic effects, Long Term		< 0.01

SECTION 4:	**31.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**
Health/ Environment	
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.

32. Exposure Scenario 32: Use at industrial sites; Production of hardmetal powder

SECTION 1:	**32.1 Title of exposure scenario**
	Use at industrial sites; Production of hardmetal powder
Chemical product category [PC]	
Base metals and alloys	PC 7
Contributing scenario controlling environmental exposure	
Production of hardmetal powder ES 1 STP Discharge	ERC 6a
Production of hardmetal powder ES 2 Marine Discharge	ERC 6a
Contributing scenario controlling worker exposure	
Weighing Powders & Filling the Mill	PROC 26
Milling	PROC 3
Emptying the mill	PROC 8b
Drying	PROC 9, PROC 3
Cleaning & Maintenance	PROC 28
Subsequent service life exposure scenario(s)	
Service life (worker at industrial site); Service life of hardmetal articles in industrial settings	ES35
SECTION 2:	**32.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Production of hardmetal powder ES 1 STP Discharge (ERC 6a)
Frequency and duration of use	
Daily amount per site <= 0.654 tonnes/day	
Annual amount per site <= 170 tonnes/year	
Emission days >= 260 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	

Local freshwater dilution factor 100.	
2.1.2	Production of hardmetal powder ES 2 Marine Discharge (ERC 6a)
Frequency and duration of use	
Daily amount per site <= 0.654 tonnes/day	
Annual amount per site <= 170 tonnes/year	
Emission days >= 260 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m^3/day	
Local marine water dilution factor 100.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Weighing Powders & Filling the Mill (PROC 26)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.2	Milling (PROC 3)
Product characteristics	
Physical form of product: Aqueous solution	
Covers percentage substance in the product up to 25 %.	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	

Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.3	Emptying the mill (PROC 8b)
Product characteristics	
Physical form of product: Aqueous solution	
Covers percentage substance in the product up to 25 %.	
Maximum emission potential: Very low	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.4	Drying (PROC 9, PROC 3)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Elevated temperature. Covers use at temperatures below melting point.	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.5	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	

SECTION 3:	32.3 Exposure estimation		
3.1 Environment			
Release estimation method: Estimated release factor			
	Release rate		
	Water	Air	Soil
Production of hardmetal powder ES 1 STP Discharge	0.065 kg/day	0.196 kg/day	0 kg/day
Production of hardmetal powder ES 2 Marine Discharge	0.065 kg/day	0.196 kg/day	0 kg/day

Production of hardmetal powder ES 1 STP Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	2.24E-4 mg/l (EUSES 2.1.2)	0.211
Sedimentation (Fresh water)	9.08 mg/kg dw (PEC sediment calculation method for metals)	0.168
Sewage Treatment Plant	0.02 mg/l (EUSES 2.1.2)	0.053
Agricultural soil	0.791 mg/kg dw (EUSES 2.1.2)	0.073
Man via Environment - Inhalation (Systemic effects)	3.9E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	3.9E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.24E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.041

Production of hardmetal powder ES 2 Marine Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Marine water	0.157 µg/l (Clocal calculation with Kp susp. matter marine)	0.067
Sedimentation (Marine water)	25.3 mg/kg dw (PEC sediment calculation method for metals)	0.362
Agricultural soil	0.24 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	3.9E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	3.9E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.17E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.04

3.2 Worker		
Weighing Powders & Filling the Mill (PROC 26)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	27 µg/m³	0.499
Inhalation, Local effects, Long Term	27 µg/m³	0.675
Dermal, Systemic effects, Long Term	23.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.502
Milling (PROC 3)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10 µg/m³	0.185
Inhalation, Local effects, Long Term	10 µg/m³	0.25
Dermal, Systemic effects, Long Term	0.1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.185
Emptying the mill (PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	12 µg/m³	0.222
Inhalation, Local effects, Long Term	12 µg/m³	0.3
Dermal, Systemic effects, Long Term	0.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.222
Drying (PROC 9, PROC 3)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	16 µg/m³	0.296
Inhalation, Local effects, Long Term	16 µg/m³	0.4
Dermal, Systemic effects, Long Term	0.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.296
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	18.6 µg/m³	0.344
Inhalation, Local effects, Long Term	18.6 µg/m³	0.465
Dermal, Systemic effects, Long Term	62.6 µg/kg bw/day	< 0.01

Combined routes, Systemic effects, Long Term		0.352

SECTION 4:	**32.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**
Health/ Environment	
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.	

33. Exposure Scenario 33: Use at industrial sites; Production of sintered hardmetal articles

SECTION 1:	**33.1 Title of exposure scenario**
	Use at industrial sites; Production of sintered hardmetal articles
Chemical product category [PC]	
Base metals and alloys	PC 7
Contributing scenario controlling environmental exposure	
Production of sintered hardmetal articles ES 1 STP Discharge	ERC 6a
Production of sintered hardmetal articles ES 2 Marine Discharge	ERC 6a
Contributing scenario controlling worker exposure	
Transfer to mixer	PROC 8b
Mixing	PROC 3
Press charging	PROC 8b
Pressing	PROC 14
Shaping	PROC 21
Sintering	PROC 22
Grinding and/or turning	PROC 24
Edge rounding	PROC 24
Coating	PROC 1
Brazing or welding	PROC 25
Marking	PROC 21
Packaging	PROC 21
Cleaning & Maintenance	PROC 28
Subsequent service life exposure scenario(s)	
Service life (worker at industrial site); Service life of hardmetal articles in industrial settings	ES35

Service life (Professional worker); Service life of hardmetal articles in professional settings	ES36
Service life (Consumers); Service life of hard metal articles used by consumers	ES37
SECTION 2:	**33.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Production of sintered hardmetal articles ES 1 STP Discharge (ERC 6a)
Frequency and duration of use	
Daily amount per site <= 0.654 tonnes/day	
Annual amount per site <= 170 tonnes/year	
Emission days >= 260 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	
Local freshwater dilution factor 100.	
2.1.2	Production of sintered hardmetal articles ES 2 Marine Discharge
Frequency and duration of use	
Daily amount per site <= 0.654 tonnes/day	
Annual amount per site <= 170 tonnes/year	
Emission days >= 260 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m^3/day	
Local marine water dilution factor 100.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Transfer to mixer (PROC 8b)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Avoid carrying out activities involving exposure for more than 1 hour per day.	
Technical conditions and measures to control dispersion from source towards the worker	
Point ventilation (Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 84 %)	

Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.2	Mixing (PROC 3)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.3	Press charging (PROC 8b)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.4	Pressing (PROC 14)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.5	Shaping (PROC 21)
Product characteristics	
Physical form of product: Solid, Powder / Dust	
Maximum emission potential: Medium (abrasion based)	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.6	Sintering (PROC 22)
Product characteristics	
Physical form of product: Solid, Powder / Dust	
Maximum emission potential: Low (temperature based)	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Assumes process temperature up to 1.49E3 °C.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 84 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.7	Grinding and/or turning (PROC 24)
Product characteristics	
Physical form of product: Bound in article.	
Maximum emission potential: High (abrasion based)	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.8	Edge rounding (PROC 24)
Product characteristics	
Physical form of product: Bound in article.	
Maximum emission potential: High (abrasion based)	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.9	Coating (PROC 1)
Product characteristics	
Physical form of product: Bound in article.	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 84 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.10	Brazing or welding (PROC 25)
Product characteristics	
Physical form of product: Molten	
Maximum emission potential: High (temperature based)	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Elevated temperature. Covers use at temperatures below melting point.	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	

Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.11	Marking (PROC 21)
Product characteristics	
Physical form of product: Bound in article.	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 84 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.12	Packaging (PROC 21)
Product characteristics	
Physical form of product: Bound in article.	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 84 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.13	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Process is carried out at ambient pressure.	
Covers use at ambient temperatures.	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	

Conditions and measures related to personal protection, hygiene and health evaluation
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.
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.

SECTION 3:	**33.3 Exposure estimation**

3.1 Environment

Release estimation method: Estimated release factor

	Release rate		
	Water	Air	Soil
Production of sintered hardmetal articles ES 1 STP Discharge	0.065 kg/day	0.196 kg/day	0 kg/day
Production of sintered hardmetal articles ES 2 Marine Discharge	0.065 kg/day	0.196 kg/day	0 kg/day

Production of sintered hardmetal articles ES 1 STP Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	2.24E-4 mg/l (EUSES 2.1.2)	0.211
Sedimentation (Fresh water)	9.02 mg/kg dw (PEC sediment calculation method for metals)	0.168
Sewage Treatment Plant	0.02 mg/l (EUSES 2.1.2)	0.053
Agricultural soil	0.791 mg/kg dw (EUSES 2.1.2)	0.073
Man via Environment - Inhalation (Systemic effects)	3.9E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	3.9E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.24E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.041

Production of sintered hardmetal articles ES 2 Marine Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	0.157 µg/l (Clocal calculation with Kp susp. matter marine)	0.067
Sedimentation (Fresh water)	25.3 mg/kg dw (PEC sediment calculation method for metals)	0.362
Agricultural soil	0.24 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	3.9E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	3.9E-5 mg/m³	< 0.01

	(EUSES 2.1.2)	
Man via Environment - Oral	3.17E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.04
3.2 Worker		
Transfer to mixer (PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	0.5 µg/m³	< 0.01
Inhalation, Local effects, Long Term	0.5 µg/m³	0.013
Dermal, Systemic effects, Long Term	1.9 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		< 0.01
Mixing (PROC 3)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	4 µg/m³	0.074
Inhalation, Local effects, Long Term	4 µg/m³	0.1
Dermal, Systemic effects, Long Term	0.1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.074
Press charging (PROC 8b)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	17.6 µg/m³	0.325
Inhalation, Local effects, Long Term	17.6 µg/m³	0.44
Dermal, Systemic effects, Long Term	15.5 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.327
Pressing (PROC 14)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	17.6 µg/m³	0.325
Inhalation, Local effects, Long Term	17.6 µg/m³	0.44
Dermal, Systemic effects, Long Term	15.5 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.326

Shaping (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	15 µg/m³	0.277
Inhalation, Local effects, Long Term	15 µg/m³	0.375
Dermal, Systemic effects, Long Term	15.5 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.279
Sintering (PROC 22)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	6 µg/m³ (MEASE, PROC 9)	0.111
Inhalation, Local effects, Long Term	6 µg/m³ (MEASE, PROC 9)	0.15
Dermal, Systemic effects, Long Term	0.3 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.111
Grinding and/or turning (PROC 24)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	18 µg/m³	0.333
Inhalation, Local effects, Long Term	18 µg/m³	0.45
Dermal, Systemic effects, Long Term	23.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.336
Edge rounding (PROC 24)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	3 µg/m³	0.055
Inhalation, Local effects, Long Term	3 µg/m³	0.075
Dermal, Systemic effects, Long Term	23.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.059
Coating (PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	7.4 µg/m³	0.137
Inhalation, Local effects, Long Term	7.4 µg/m³	0.185
Dermal, Systemic effects, Long Term	0.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.137

Brazing or welding (PROC 25)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	24 µg/m³	0.444
Inhalation, Local effects, Long Term	24 µg/m³	0.6
Dermal, Systemic effects, Long Term	0.3 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.444
Marking (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	24 µg/m³	0.444
Inhalation, Local effects, Long Term	24 µg/m³	0.6
Dermal, Systemic effects, Long Term	15.5 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.444
Packaging (PROC 21)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	4.5 µg/m³	0.083
Inhalation, Local effects, Long Term	4.5 µg/m³	0.112
Dermal, Systemic effects, Long Term	15.5 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.085
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	11 µg/m³	0.203
Inhalation, Local effects, Long Term	11 µg/m³	0.275
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.212

SECTION 4:	**33.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**

Health/ Environment

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.

34. Exposure Scenario 34: Use at industrial sites; Production of hardmetal powder for surface technology

SECTION 1:	**34.1 Title of exposure scenario**
	Use at industrial sites; Production of hardmetal powder for surface technology
Chemical product category [PC]	
Base metals and alloys	PC 7
Contributing scenario controlling environmental exposure	
Production of hardmetal powder for surface technology ES 1 STP Discharge	ERC 6a
Production of hardmetal powder for surface technology ES 2 Marine Discharge	ERC 6a
Contributing scenario controlling worker exposure	
Weighing powders for suspension	PROC 26
Agglomeration	PROC 3
Sieving	PROC 3
Sintering	PROC 22
Classifying of powder	PROC 3
Packaging	PROC 26
Cleaning & Maintenance	PROC 28
Subsequent service life exposure scenario(s)	
Service life (worker at industrial site); Service life of hardmetal articles in industrial settings	ES35
SECTION 2:	**34.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Production of hardmetal powder for surface technology ES 1 STP Discharge (ERC 6a)
Frequency and duration of use	
Daily amount per site <= 0.654 tonnes/day	
Annual amount per site <= 170 tonnes/year	
Emission days >= 260 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	
Local freshwater dilution factor 100.	
2.1.2	Production of hardmetal powder for surface technology ES 2 Marine Discharge (ERC 6a)
Frequency and duration of use	
Daily amount per site <= 0.654 tonnes/day	
Annual amount per site <= 170 tonnes/year	

Emission days >= 260 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 2E3 m^3/day	
Local marine water dilution factor 100.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Weighing powders for suspension (PROC 26)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.2	Agglomeration (PROC 3)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.3	Sieving (PROC 3)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	

Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.4	Sintering (PROC 22)
Product characteristics	
Physical form of product: Solid, Powder / Dust	
Maximum emission potential: Low (temperature based)	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Elevated temperature. Covers use at temperatures below melting point.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 84 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.5	Classifying of powder (PROC 3)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Covers percentage substance in the product up to 25 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.6	Packaging (PROC 26)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Covers percentage substance in the product up to 25 %.	

Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Use of general ventilation with an efficiency of at least 17% is required.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.13	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
SECTION 3:	**34.3 Exposure estimation**
3.1 Environment	
Release estimation method: Estimated release factor	

	Release rate		
	Water	Air	Soil
Production of hardmetal powder for surface technology ES 1 STP Discharge	0.065 kg/day	0.196 kg/day	0 kg/day
Production of hardmetal powder for surface technology ES 2 Marine Discharge	0.065 kg/day	0.196 kg/day	0 kg/day

Production of hardmetal powder for surface technology ES 1 STP Discharge

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	2.24E-4 mg/l (EUSES 2.1.2)	0.211
Sedimentation (Fresh water)	9.02 mg/kg dw (PEC sediment calculation method for metals)	0.168
Sewage Treatment Plant	0.02 mg/l (EUSES 2.1.2)	0.053
Agricultural soil	0.791 mg/kg dw (EUSES 2.1.2)	0.073

Man via Environment - Inhalation (Systemic effects)	3.9E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	3.9E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.24E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.041
Production of hardmetal powder for surface technology ES 2 Marine Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	0.157 µg/l (Clocal calculation with Kp susp. matter marine)	0.067
Sedimentation (Fresh water)	25.3 mg/kg dw (PEC sediment calculation method for metals)	0.362
Agricultural soil	0.24 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	3.9E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	3.9E-5 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.17E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.04
3.2 Worker		
Weighing powders for suspension (PROC 26)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	27 µg/m³	0.499
Inhalation, Local effects, Long Term	27 µg/m³	0.675
Dermal, Systemic effects, Long Term	23.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.502
Agglomeration (PROC 3)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	6.4 µg/m³	0.118
Inhalation, Local effects, Long Term	6.4 µg/m³	0.16
Dermal, Systemic effects, Long Term	0.1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.118

Sieving (PROC 3)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	16 µg/m³	0.296
Inhalation, Local effects, Long Term	16 µg/m³	0.4
Dermal, Systemic effects, Long Term	0.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.296
Sintering (PROC 22)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	18.6 µg/m³	0.344
Inhalation, Local effects, Long Term	18.6 µg/m³	0.465
Dermal, Systemic effects, Long Term	0.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.344
Classifying of powder (PROC 3)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	16 µg/m³	0.296
Inhalation, Local effects, Long Term	16 µg/m³	0.4
Dermal, Systemic effects, Long Term	0.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.296
Packaging (PROC 26)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	5.8 µg/m³	0.107
Inhalation, Local effects, Long Term	5.8 µg/m³	0.145
Dermal, Systemic effects, Long Term	26.7 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.111
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	18.6 µg/m³	0.344
Inhalation, Local effects, Long Term	18.6 µg/m³	0.465
Dermal, Systemic effects, Long Term	62.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.352

SECTION 4:	34.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES
Health/ Environment	
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.	

35. Exposure Scenario 35: Service life (worker at industrial site); Service life of hardmetal articles in industrial settings

SECTION 1:	35.1 Title of exposure scenario	
	Service life (worker at industrial site); Service life of hardmetal articles in industrial settings	
Article Categories [AC]		
Machinery, mechanical appliances, electrical/electronic articles		AC2
Contributing scenario controlling environmental exposure		
Service life of hardmetal articles in industrial settings		ERC 12a
Contributing scenario controlling worker exposure		
Handling and use of hardmetal articles		PROC 24
Exposure scenario of the uses leading to the inclusion of the substance into the article		
Use at industrial sites; Production of hardmetal powder		ES32
Use at industrial sites; Production of sintered hardmetal articles		ES33
Use at industrial sites; Production of hardmetal powder for surface technology		ES34
SECTION 2:	**35.2 Operational conditions and risk management measures**	
2.1	**Contributing scenario controlling environmental exposure**	
2.1.1	Service life of hardmetal articles in industrial settings (ERC 12a)	
Frequency and duration of use		
Daily amount per site <= 10 tonnes/day		
Annual amount per site <= 1E3 tonnes/year		
Conditions and measures related to municipal sewage treatment plant		
Municipal sewage treatment plant is assumed.		
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day		
Conditions and measures related to external treatment of waste for disposal		
Dispose of waste product or used containers according to local regulations.		

2.2	Contributing scenario controlling worker exposure
2.2.1	Handling and use of hardmetal articles (PROC 24)

Product characteristics

Physical form of product: Bound in article.

Maximum emission potential: Low (abrasion based)

Covers percentage substance in the product up to 25 %.

Conditions and measures related to personal protection, hygiene and health evaluation

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.

SECTION 3:	35.3 Exposure estimation

3.1 Environment

Release estimation method: Estimated release factor

	Release rate		
	Water	Air	Soil
Service life of hardmetal articles in industrial settings	0 kg/day	0 kg/day	0 kg/day

3.2 Worker

Handling and use of hardmetal articles (PROC 24)

Exposure route	Exposure estimation	Risk characterisation ratio (RCR)
Inhalation, Systemic effects, Long Term	0.1 µg/m³	< 0.01
Inhalation, Local effects, Long Term	0.1 µg/m³	< 0.01
Dermal, Systemic effects, Long Term	26.7 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		< 0.01

SECTION 4:	35.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Health/ Environment

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.

36. Exposure Scenario 36: Service life (Professional worker); Service life of hardmetal articles in professional settings

SECTION 1:	**36.1 Title of exposure scenario**	
	Service life (Professional worker); Service life of hardmetal articles in professional settings	
Article Categories [AC]		
Machinery, mechanical appliances, electrical/electronic articles	AC2	
Contributing scenario controlling environmental exposure		
Service life of hardmetal articles in professional settings	ERC 10a, ERC 11a	
Contributing scenario controlling worker exposure		
Handling and use of hardmetal articles	PROC 24	
Exposure scenario of the uses leading to the inclusion of the substance into the article		
Use at industrial sites; Production of sintered hardmetal articles	ES33	
SECTION 2:	**36.2 Operational conditions and risk management measures**	
2.1	**Contributing scenario controlling environmental exposure**	
2.1.1	Service life of hardmetal articles in professional settings (ERC 10a, ERC 11a)	
Conditions and measures related to municipal sewage treatment plant		
Municipal sewage treatment plant is assumed.		
Conditions and measures related to external treatment of waste for disposal		
Dispose of waste product or used containers according to local regulations.		
2.2	**Contributing scenario controlling worker exposure**	
2.2.1	Handling and use of hardmetal articles (PROC 24)	
Product characteristics		
Physical form of product: Bound in article.		
Maximum emission potential: Low (abrasion based)		
Covers percentage substance in the product up to 25 %.		
Conditions and measures related to personal protection, hygiene and health evaluation		
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.		
SECTION 3:	**36.3 Exposure estimation**	
3.1 Environment		
Release estimation method: Estimated release factor		

	Release rate		
	Water	Air	Soil
Service life of hardmetal articles in professional settings	0 kg/day	0 kg/day	0 kg/day

3.2 Worker		
Handling and use of hardmetal articles (PROC 24)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	0.1 µg/m³	< 0.01

Inhalation, Local effects, Long Term	0.1 µg/m³	< 0.01
Dermal, Systemic effects, Long Term	26.7 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		< 0.01

SECTION 4:	**36.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**
Health/ Environment	
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.	

37. Exposure Scenario 37: Service life (Consumers); Service life of hard metal articles used by consumers

SECTION 1:	**37.1 Title of exposure scenario**
	Service life (Consumers); Service life of hard metal articles used by consumers
Article Categories [AC]	
Machinery, mechanical appliances, electrical/electronic articles	AC2
Contributing scenario controlling environmental exposure	
Service life of hard metal articles used by consumers	ERC 10a, ERC 11a
Contributing scenario controlling consumer exposure	
Handling of hard metal articles	AC2
Exposure scenario of the uses leading to the inclusion of the substance into the article	
Use at industrial sites; Production of sintered hardmetal articles	ES33
SECTION 2:	**37.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Service life of hard metal articles used by consumers (ERC 10a, ERC 11a)
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Municipal sewage treatment plant is assumed.	
2.2	**Contributing scenario controlling consumer exposure**
2.2.1	Handling of hard metal articles (AC 2)
Product characteristics	
Physical form of product: Bound in article.	
Inhalation exposure is considered to be not relevant.	

Dermal exposure assumed to be negligible.

Oral exposure is considered to be not relevant.

SECTION 3:	**37.3 Exposure estimation**

3.1 Environment

Release estimation method: Estimated release factor

	Release rate		
	Water	Air	Soil
Service life of hard metal articles used by consumers	0 kg/day	0 kg/day	0 kg/day

3.2 Consumer

Handling of hard metal articles (AC 2)

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	0 µg/m³ (Qualitative assessment)	< 0.01
Inhalation, Local effects, Long Term	0 µg/m³ (Qualitative assessment)	< 0.01
Dermal, Systemic effects, Long Term	0 mg/kg bw/day (Qualitative assessment)	< 0.01
Inhalation, Systemic effects, Long Term	0 µg/kg bw/day (Qualitative assessment)	< 0.01
Combined routes, Systemic effects, Long Term		< 0.01

SECTION 4:	**37.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**

Health/ Environment

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.

38. Exposure Scenario 38: Use at industrial sites; Use of cobalt as an intermediate in the manufacture of catalysts

SECTION 1:	**38.1 Title of exposure scenario**
	Use at industrial sites; Use of cobalt as an intermediate in the manufacture of catalysts
Sectors of use [SU]	
Manufacture of bulk, large scale chemicals (including petroleum products)	SU 8
Manufacture of fine chemicals	SU 9
Contributing scenario controlling environmental exposure	
Use of cobalt as an intermediate in the manufacture of catalysts ES 1 STP Discharge	ERC 6a
Use of cobalt as an intermediate in the manufacture of catalysts ES 2 Direct Discharge	ERC 6a
Use of cobalt as an intermediate in the manufacture of catalysts ES 3 Marine Discharge	ERC 6a
Contributing scenario controlling worker exposure	
Use of cobalt as an intermediate in the manufacture of catalysts in closed conditions	PROC 1, PROC 2
Use of cobalt as an intermediate in the manufacture of catalysts in semi-closed conditions	PROC 3, PROC 9, PROC 4, PROC 8b
Cleaning & Maintenance	PROC 28
SECTION 2:	**38.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Use of cobalt as an intermediate in the manufacture of catalysts ES 1 STP Discharge (ERC 6a)
Frequency and duration of use	
Daily amount per site <= 0.272 tonnes/day	
Annual amount per site <= 98 tonnes/year	
Emission days >= 360 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
No discharge to marine water assumed.	
Local freshwater dilution factor 100.	
2.1.2	Use of cobalt as an intermediate in the manufacture of catalysts ES 2 Direct Discharge (ERC 6a)
Frequency and duration of use	
Daily amount per site <= 0.272 tonnes/day	
Annual amount per site <= 98 tonnes/year	
Emission days >= 360 days/year	

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 250 m^3/day	
No discharge to marine water assumed.	
Local freshwater dilution factor 500.	
2.1.3	Use of cobalt as an intermediate in the manufacture of catalysts ES 3 Marine Discharge (ERC 6a)
Frequency and duration of use	
Daily amount per site <= 0.272 tonnes/day	
Annual amount per site <= 98 tonnes/year	
Emission days >= 360 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Assumed effluent discharge flow from site >= 250 m^3/day	
No discharge to freshwater assumed.	
Local marine water dilution factor 100.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Use of cobalt as an intermediate in the manufacture of catalysts in closed conditions (PROC 1, PROC 2)
Product characteristics	
Physical form of product: Solid, Powder / Dust, Shaped catalysts	
Maximum emission potential: High	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Assumes process temperature up to 600 °C.	
Use in closed process.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	

2.2.2	Use of cobalt as an intermediate in the manufacture of catalysts in semi-closed conditions (PROC 3, PROC 9, PROC 4, PROC 8b)
Product characteristics	
Physical form of product: Solid, Powder / Dust, Shaped catalysts	
Maximum emission potential: High	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Assumes process temperature up to 160 °C.	
Semi-closed system.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.3	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Various	
Maximum emission potential: Low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Typical duration per shift = 120 min	
Typical number of shifts per year = 48 Shifts/year	
Technical conditions and measures to control dispersion from source towards the worker	
Process is carried out at ambient pressure	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
SECTION 3:	**38.3 Exposure estimation**
3.1 Environment	
Release estimation method: Estimated release factor	

	Release rate		
	Water	Air	Soil
Use of cobalt as an intermediate in the manufacture of catalysts ES 1 STP Discharge	8.7E-3 kg/day	7.89E-3 kg/day	0 kg/day
Use of cobalt as an intermediate in the manufacture of catalysts ES 2 Direct Discharge	8.7E-3 kg/day	7.89E-3 kg/day	0 kg/day

Use of cobalt as an intermediate in the manufacture of catalysts ES 3 Marine Discharge	8.7E-3 kg/day	7.89E-3 kg/day	0 kg/day

Use of cobalt as an intermediate in the manufacture of catalysts ES 1 STP Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	1.16E-4 mg/l (EUSES 2.1.2)	0.11
Sedimentation (Fresh water)	4.89 mg/kg dw (PEC sediment calculation method for metals)	0.091
Sewage Treatment Plant	2.61E-3 mg/l (EUSES 2.1.2)	< 0.01
Agricultural soil	0.312 mg/kg dw (EUSES 2.1.2)	0.029
Man via Environment - Inhalation (Systemic effects)	2.31E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	2.31E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.21E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036

Use of cobalt as an intermediate in the manufacture of catalysts ES 2 Direct Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	1.44E-4 mg/l (EUSES 2.1.2)	0.136
Sedimentation (Fresh water)	5.95 mg/kg dw (PEC sediment calculation method for metals)	0.111
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	2.31E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	2.31E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.21E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036

Use of cobalt as an intermediate in the manufacture of catalysts ES 3 Marine Discharge		
Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Marine water	0.166 µg/l (Clocal calculation with Kp susp. matter marine)	0.07
Sedimentation (Marine water)	26.1 mg/kg dw (PEC sediment calculation method for metals)	0.374
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022

Man via Environment - Inhalation (Systemic effects)	2.31E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	2.31E-6 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.17E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036

3.2 Worker

Use of cobalt as an intermediate in the manufacture of catalysts in closed conditions (PROC 1, PROC 2)

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	0.8 µg/m³	0.015
Inhalation, Local effects, Long Term	0.8 µg/m³	0.02
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.015

Use of cobalt as an intermediate in the manufacture of catalysts in semi-closed conditions (PROC 3, PROC 9, PROC 4, PROC 8b)

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	0.8 µg/m³	0.015
Inhalation, Local effects, Long Term	0.8 µg/m³	0.02
Dermal, Systemic effects, Long Term	1.3 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.015

Cleaning & Maintenance (PROC 28)

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	2.4 µg/m³	0.044
Inhalation, Local effects, Long Term	2.4 µg/m³	0.06
Dermal, Systemic effects, Long Term	23.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.048

SECTION 4:	**38.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**

Health/ Environment

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.

39. Exposure Scenario 39: Formulation or re-packing; Formulation of cobalt for the use in brazing techniques

SECTION 1:	**39.1 Title of exposure scenario**
	Formulation or re-packing; Formulation of cobalt for the use in brazing techniques
Chemical product category [PC]	
Welding and soldering products, flux products	PC 38
Contributing scenario controlling environmental exposure	
Formulation of cobalt for the use in brazing techniques	ERC 2
Contributing scenario controlling worker exposure	
Raw material handling	PROC 26, PROC 8b, PROC 9
Formulation process	PROC 5, PROC 4
Handling of formulated end-product	PROC 8b, PROC 9
Cleaning & Maintenance	PROC 28
SECTION 2:	**39.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Formulation of cobalt for the use in brazing techniques (ERC 2)
Frequency and duration of use	
Daily amount per site <= 0.1 tonnes/day	
Annual amount per site <= 1 tonnes/year	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Receiving surface water flow >= 1.8E4 m^3/day	
No discharge to marine water assumed.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Raw material handling (PROC 26, PROC 8b, PROC 9)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Additional physical form of product: Solid, Granulate	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Semi-automated task.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.2	Formulation process (PROC 5, PROC 4)
Product characteristics	
Physical form of product: Pastes	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
local exhaust ventilation. Inhalation - minimum efficiency of 78 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.3	Handling of formulated end-product (PROC 8b, PROC 9)
Product characteristics	
Physical form of product: Pastes	
Additional physical form of product: Brazing tape	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.3	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Solid, high dustiness	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Process is carried out at ambient pressure	
Covers use at ambient temperatures.	
Maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation.	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 10 (a minimum efficiency of 90%). 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.			
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.			
SECTION 3:	**39.3 Exposure estimation**		
3.1 Environment			
Release estimation method: Estimated release factor			
	Release rate		
	Water	Air	Soil
Formulation of cobalt for the use in brazing techniques	5E-3 kg/day	5E-3 kg/day	0 kg/day
Formulation of cobalt for the use in brazing techniques (ERC 2)			

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	1.95E-4 mg/l (EUSES 2.1.2)	0.184
Sedimentation (Fresh water)	7.95 mg/kg dw (PEC sediment calculation method for metals)	0.148
Sewage Treatment Plant	1.5E-3 mg/l (EUSES 2.1.2)	< 0.01
Agricultural soil	0.281 mg/kg dw (EUSES 2.1.2)	0.026
Man via Environment - Inhalation (Systemic effects)	1.88E-7 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	1.88E-7 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.23E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036

3.2 Worker

Raw material handling (PROC 26, PROC 8b, PROC 9)

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	23.5 µg/m³	0.434
Inhalation, Local effects, Long Term	23.5 µg/m³	0.588
Dermal, Systemic effects, Long Term	3.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.435

Formulation process (PROC 5, PROC 4)

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	11 µg/m³ (MEASE, PROC 5)	0.203
Inhalation, Local effects, Long Term	11 µg/m³ (MEASE, PROC 5)	0.275
Dermal, Systemic effects, Long Term	1 µg/kg bw/day	< 0.01

Combined routes, Systemic effects, Long Term		0.203
Handling of formulated end-product (PROC 8b, PROC 9)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10 µg/m³ (MEASE, PROC 8b)	0.185
Inhalation, Local effects, Long Term	10 µg/m³ (MEASE, PROC 8b)	0.25
Dermal, Systemic effects, Long Term	1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.185
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10.9 µg/m³	0.201
Inhalation, Local effects, Long Term	10.9 µg/m³	0.273
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.214
SECTION 4:	**39.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**	
Health/ Environment		
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.		

40. Exposure Scenario 40: Use at industrial sites; Industrial use of cobalt-containing mixtures in brazing techniques

SECTION 1:	**40.1 Title of exposure scenario**
	Use at industrial sites; Industrial use of cobalt-containing mixtures in brazing techniques
Chemical product category [PC]	
Welding and soldering products, flux products	PC 38
Contributing scenario controlling environmental exposure	
Industrial use of cobalt-containing mixtures in brazing techniques	ERC 5
Contributing scenario controlling worker exposure	
Raw material handling	PROC 8b, PROC 9
Brazing in industrial settings	PROC 25
SECTION 2:	**40.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Industrial use of cobalt-containing mixtures in brazing techniques (ERC 5)
Frequency and duration of use	
Daily amount per site <= 5E-6 tonnes/day	
Annual amount per site <= 1E-4 tonnes/year	
Conditions and measures related to municipal sewage treatment plant	
Municipal sewage treatment plant is assumed.	
Assumed domestic sewage treatment plant flow >= 2E3 m^3/day	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
Other given operational conditions affecting environmental exposure	
Receiving surface water flow >= 1.8E4 m^3/day	
No discharge to marine water assumed.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Raw material handling (PROC 8b, PROC 9)
Product characteristics	
Physical form of product: Pastes	
Additional physical form of product: Brazing tape	
Maximum emission potential: Very low	
Covers percentage substance in the product up to 100 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.2	Brazing in industrial settings (PROC 25)
Product characteristics	
Physical form of product: Molten	
Additional physical form of product: Gaseous	

Maximum emission potential: Low (temperature based)
Covers percentage substance in the product up to 100 %.
Frequency and duration of use
Covers daily exposures up to 8 hours.
Technical conditions and measures to control dispersion from source towards the worker
Assumes process temperature up to 900 °C.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.

SECTION 3:	**40.3 Exposure estimation**

3.1 Environment

Release estimation method: Estimated release factor

	Release rate		
	Water	Air	Soil
Industrial use of cobalt-containing mixtures in brazing techniques	2.5E-3 kg/day	2.5E-3 kg/day	5E-5 kg/day

Industrial use of cobalt-containing mixtures in brazing techniques (ERC 5)

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Fresh water	1.47E-4 mg/l (EUSES 2.1.2)	0.139
Sedimentation (Fresh water)	6.1 mg/kg dw (PEC sediment calculation method for metals)	0.113
Sewage Treatment Plant	7.5E-4 mg/l (EUSES 2.1.2)	< 0.01
Agricultural soil	0.26 mg/kg dw (EUSES 2.1.2)	0.024
Man via Environment - Inhalation (Systemic effects)	1.88E-7 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	1.88E-7 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.22E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036

3.2 Worker

Raw material handling (PROC 8b, PROC 9)

Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10 µg/m³	0.185
Inhalation, Local effects, Long Term	10 µg/m³	0.25
Dermal, Systemic effects, Long Term	1 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.185

Brazing in industrial settings (PROC 25)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	25 µg/m³ (MEASE)	0.462
Inhalation, Local effects, Long Term	25 µg/m³ (MEASE)	0.625
Dermal, Systemic effects, Long Term	8.8 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.463

SECTION 4:	**40.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**
Health/ Environment	
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.	

41. Exposure Scenario 41: Use at industrial sites; Use of cobalt-containing alloys for sandblasting in industrial settings

SECTION 1:	**41.1 Title of exposure scenario**
	Use at industrial sites; Use of cobalt-containing alloys for sandblasting in industrial settings
Chemical product category [PC]	
Base metals and alloys	PC 7
Sectors of use [SU]	
Manufacture of fabricated metal products, except machinery and equipment	SU 15
Contributing scenario controlling environmental exposure	
Use of cobalt-containing alloys for sandblasting in industrial settings	ERC 4
Contributing scenario controlling worker exposure	
Raw material handling	PROC 26
Blasting operations	PROC 1
Cleaning & Maintenance	PROC 28
SECTION 2:	**41.2 Operational conditions and risk management measures**
2.1	**Contributing scenario controlling environmental exposure**
2.1.1	Use of cobalt-containing alloys for sandblasting in industrial settings (ERC 4)
Frequency and duration of use	
Daily amount per site <= 7.5E-6 tonnes/day	

Annual amount per site <= 1.5E-3 tonnes/year	
Emission days >= 200 days/year	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber.	
The substance should not be released to water.	
Conditions and measures related to external treatment of waste for disposal	
Dispose of waste product or used containers according to local regulations.	
2.2	**Contributing scenario controlling worker exposure**
2.2.1	Raw material handling (PROC 26)
Product characteristics	
Physical form of product: Solid, medium dustiness	
Additional physical form of product: Solid, Granulate	
Covers percentage substance in the product up to 5 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Covers use at ambient temperatures.	
Semi-automated task.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Conditions and measures related to personal protection, hygiene and health evaluation	
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.	
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.	
2.2.2	Blasting operations (PROC 1)
Product characteristics	
Physical form of product: Solid, Powder / Dust	
Additional physical form of product: Solid, Granulate	
Maximum emission potential: High (abrasion based)	
Covers percentage substance in the product up to 5 %.	
Frequency and duration of use	
Covers daily exposures up to 8 hours.	
Technical conditions and measures to control dispersion from source towards the worker	
Automated task.	
Use of an integrated local exhaust ventilation is required. Inhalation - minimum efficiency of 90 %	
Use in closed process.	
Conditions and measures related to personal protection, hygiene and health evaluation	
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.	
2.2.2	Cleaning & Maintenance (PROC 28)
Product characteristics	
Physical form of product: Solid, high dustiness	

Frequency and duration of use			
Covers daily exposures up to 8 hours.			
Technical conditions and measures to control dispersion from source towards the worker			
Process is carried out at ambient pressure.			
Covers use at ambient temperatures.			
Maintenance and repair work only at facilities which are not in operation. Minor cleaning tasks may be conducted under operation.			
Conditions and measures related to personal protection, hygiene and health evaluation			
Wear respiratory protection providing a minimum assigned protection factor of 20 (a minimum efficiency of 95%). 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.			
Wear protective suit conforming to EN 13982 in cases where direct contact with the substance cannot be avoided.			
SECTION 3:	**41.3 Exposure estimation**		
3.1 Environment			
Release estimation method: Estimated release factor			
	Release rate		
	Water	Air	Soil
Use of cobalt-containing alloys for sandblasting in industrial settings	0 kg/day	1.5E-5 kg/day	0 kg/day
Use of cobalt-containing alloys for sandblasting in industrial settings (ERC 4)			

Protection target	**Exposure concentration (PEC, Predicted Exposure Concentration)**	**Risk characterisation ratio (RCR)**
Agricultural soil	0.239 mg/kg dw (EUSES 2.1.2)	0.022
Man via Environment - Inhalation (Systemic effects)	1.52E-7 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Inhalation (Local effects)	1.52E-7 mg/m³ (EUSES 2.1.2)	< 0.01
Man via Environment - Oral	3.17E-4 mg/kg bw/day (Measured data)	0.036
Man via Environment - Combined routes		0.036

3.2 Worker		
Raw material handling (PROC 26)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	4 µg/m³ (MEASE)	0.074
Inhalation, Local effects, Long Term	4 µg/m³ (MEASE)	0.1
Dermal, Systemic effects, Long Term	3.2 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.074

Blasting operations (PROC 1)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	2 µg/m³ (MEASE)	0.037
Inhalation, Local effects, Long Term	2 µg/m³ (MEASE)	0.05
Dermal, Systemic effects, Long Term	0.4 µg/kg bw/day	< 0.01
Combined routes, Systemic effects, Long Term		0.037
Cleaning & Maintenance (PROC 28)		
Exposure route	**Exposure estimation**	**Risk characterisation ratio (RCR)**
Inhalation, Systemic effects, Long Term	10.9 µg/m³ (MEASE)	0.201
Inhalation, Local effects, Long Term	10.9 µg/m³ (MEASE)	0.273
Dermal, Systemic effects, Long Term	92.8 µg/kg bw/day	0.013
Combined routes, Systemic effects, Long Term		0.214

SECTION 4:	**41.4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES**

Health/ Environment

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.