Exposure scenario 39: Use at industrial sites - Production of hardmetal powder for surface technology

Market sector: Use of cobalt in hardmetal
Product category used: PC 7: Base metals and alloys

Environment contributing scenario(s):		
CS 1	Production of hardmetal powder for surface technology ES1 STP Discharge	ERC 6a
CS 2	Production of hardmetal powder for surface technology ES2 Marine Discharge	ERC 6a
Worker contributing scenario(s):		
CS 3	Weighing powders for suspension	PROC 26
CS 4	Agglomeration	PROC 3
CS 5	Sieving	PROC 3
CS 6	Sintering	PROC 22
CS 7	Classifying of powder	PROC 3
CS 8	Packaging	PROC 26
CS 9	Cleaning & Maintenance	PROC 28

Subsequent service life exposure scenario(s):
ES35: Service life (worker at industrial site) - Service life of hardmetal articles in industrial settings

Explanation on the approach taken for the ES:

Please refer to IUCLID Section 13 for a detailed description of the specific methodology applied for the occupational exposure assessment.

9.39.1. Env CS 1: Production of hardmetal powder for surface technology ES1 STP Discharge (ERC 6a)

9.39.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: <= 0.65 tonnes/day
• Annual use amount at site: <= 170.0 tonnes/year *For the generic exposure scenario a tonnage based on company data was selected.*
• Number of release days per year: >= 260.0 days/year *Based on information received from hardmetal producers in the European Union.*
Technical and organisational conditions and measures
• Risk management measures to limit releases to air: *One or more of the following measures should be present to reduce emissions to air: Electrostatic precipitators, Wet electrostatic precipitators, Cyclones as primary collector, Fabric or bag filters, Ceramic/Metal mesh filters or Wet scrubbers.*
• Risk management measures to limit releases to water: *One or more of the following measures should be present to reduce emissions to water: Chemical precipitation, Sedimentation, Filtration, Electrolysis, Reverse osmosis or Ion exchange.*
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 40%]
• Discharge rate of STP: >= 2000 m3/day
• Application of the STP sludge on agricultural soil: Yes

Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: No (low amount) *Wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately or/and with other cobalt compounds waste to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the cobalt content of the waste is elevated enough, internal or external recovery/recycling might be considered. Appropriate waste codes: 01 03 07*, 02 01 10*, 06 05 02*, 06 03 13*, 06 03 15*, 06 04 05*, 10 08 04, 10 10 03, 10 10 05*, 10 10 07*, 10 10 10, 10 10 11*, 11 02 07*, 12 01 03*, 12 01 04, 15 01 04*, 15 01 10*, 16 01 04*, 16 01 06*, 16 01 18*, 16 03 03*, 16 06 02*, 16 06 05, 16 08 02*, 16 08 03, 16 10 01*, 17 04 07*, 17 04 09*, 17 09 04*, 19 10 02*, 19 12 03*,… Suitable disposal: Keep separate and dispose of to either - Hazardous waste incineration operated according to Council Directive 2008/98/EC on waste, Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006. - Hazardous landfill operated under Directive 1999/31/EC. A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2011)*
Other conditions affecting environmental exposure
• Discharge to: Freshwater only
• Dilution factor to freshwater: <= 100.0

9.39.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.262d. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (SpERC for formulation of massive metal or metal powder in alloys)	**Release factor before on site RMM:** 0.01% **Release factor after on site RMM:** 0.01% **Local release rate:** 0.065 kg/day **Explanation:** Eurométaux, 2012, version 2.1
Air	Estimated release factor (SpERC for formulation of massive metal or metal powder in alloys)	**Release factor before on site RMM:** 0.03% **Release factor after on site RMM:** 0.03% **Local release rate:** 0.196 kg/day **Explanation:** Eurométaux, 2012, version 2.1
Non agricultural soil	Estimated release factor	**Release factor after on site RMM:** 0% **Explanation:** No direct release to soil.

Releases to waste

Release factor to external waste: 0.1 %
A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2011)

9.39.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.262e. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 2.24E-4 mg/L	RCR = 0.361
Sediment (freshwater)	**Local PEC:** 9.02 mg/kg dw (Clocal: 4.76 mg/kg dw estimated by PEC sediment calculation method for metals (local PEC = Clocal,sed + PECreg,sed))	RCR = 0.168
Sewage Treatment Plant	**Local PEC:** 0.02 mg/L	RCR = 0.053
Agricultural soil	**Local PEC:** 0.791 mg/kg dw	RCR = 0.073
Man via environment - Inhalation	**Concentration in air:** 3.88E-5 mg/m³	RCR < 0.01
Man via Environment - Oral	**Exposure via food consumption:** 0.317 µg/kg/d	RCR = 0.011
Man via environment - combined routes		Not required (local and systemic effects)

Risk characterisation

MAN VIA ENVIRONMENT:
The use of EUSES to predict the concentration in food is difficult to apply for metals and associated with much higher uncertainties than using measured data. Therefore, deviations from the TGD food basket approach for the exposure route “ingestion of food”, have been applied as shortly described in the introductory section 9.0.
The oral exposure concentration in µg/kg bw/day has been derived by taking 2L of drinking water (PEC freshwater taken from the local environmental exposure assessment) + the worst case exposure from food (see introductory section 9.0.) and a default body weight of 60kg into account.
Furthermore, the exposure assessment is based on the cobalt ion, as this is the toxic species, as such for the risk characterisation the DNELs based on cobalt were used.

9.39.2. Env CS 2: Production of hardmetal powder for surface technology ES2 Marine Discharge (ERC 6a)

9.39.2.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: <= 0.65 tonnes/day
• Annual use amount at site: <= 170.0 tonnes/year *For the generic exposure scenario a tonnage based on company data was selected.*
• Number of release days per year: >= 260.0 days/year *Based on information received from hardmetal producers in the European Union.*
Technical and organisational conditions and measures
• Risk management measures to limit releases to air: *One or more of the following measures should be present to reduce emissions to air: Electrostatic precipitators, Wet electrostatic precipitators, Cyclones as primary collector, Fabric or bag filters, Ceramic/Metal mesh filters or Wet scrubbers.*
• Risk management measures to limit releases to water: *One or more of the following measures should be present to reduce emissions to water: Chemical precipitation, Sedimentation, Filtration, Electrolysis, Reverse osmosis or Ion exchange.*
Conditions and measures related to biological sewage treatment plant
• Biological STP: None [Effectiveness Water: 0%]
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: No (low amount) *Wastes from onsite risk management measures and solid or liquid wastes from production, use*

and cleaning processes should be disposed of separately or/and with other cobalt compounds waste to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the cobalt content of the waste is elevated enough, internal or external recovery/recycling might be considered. Appropriate waste codes: 01 03 07, 02 01 10*, 06 05 02*, 06 03 13*, 06 03 15*, 06 04 05*, 10 08 04, 10 10 03, 10 10 05*, 10 10 07*, 10 10 10, 10 10 11*, 11 02 07*, 12 01 03*, 12 01 04, 15 01 04*, 15 01 10*, 16 01 04*, 16 01 06*, 16 01 18*, 16 03 03*, 16 06 02*, 16 06 05, 16 08 02*, 16 08 03, 16 10 01*, 17 04 07*, 17 04 09*, 17 09 04*, 19 10 02*, 19 12 03*,… Suitable disposal: Keep separate and dispose of to either - Hazardous waste incineration operated according to Council Directive 2008/98/EC on waste, Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006. - Hazardous landfill operated under Directive 1999/31/EC. A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2011)*
Other conditions affecting environmental exposure
• Discharge rate of effluent: >= 2000 m3/day
• Dilution factor to marine water: <= 100.0

9.39.2.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.262f. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (SpERC for formulation of massive metal or metal powder in alloys)	**Release factor before on site RMM:** 0.01% **Release factor after on site RMM:** 0.01% **Local release rate:** 0.065 kg/day **Explanation:** Eurométaux, 2012, version 2.1
Air	Estimated release factor (SpERC for formulation of massive metal or metal powder in alloys)	**Release factor before on site RMM:** 0.03% **Release factor after on site RMM:** 0.03% **Local release rate:** 0.196 kg/day **Explanation:** Eurométaux, 2012, version 2.1
Non agricultural soil	Estimated release factor	**Release factor after on site RMM:** 0% **Explanation:** No direct release to soil.

Releases to waste

Release factor to external waste: 0.1 %
A detailed assessment has been performed and is reported in the Waste report (ARCHE, 2011)

9.39.2.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.262g. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Marine water	**Local PEC:** 0.157 µg/L (Clocal: 0.142 µg/L estimated by Clocal calculation with Kp susp. matter marine (logKp = 4.94))	RCR = 0.067

Protection target	Exposure concentration	Risk quantification
Sediment (marine water)	**Local PEC:** 26.9 mg/kg dw (Clocal: 12.2 mg/kg dw estimated by PEC sediment calculation method for metals (local PEC = Clocal,sed + PECreg,sed))	RCR = 0.385
Agricultural soil	**Local PEC:** 0.24 mg/kg dw	RCR = 0.022
Man via environment - Inhalation	**Concentration in air:** 3.88E-5 mg/m³	RCR < 0.01
Man via Environment - Oral	**Exposure via food consumption:** 0.317 µg/kg/d	RCR = 0.011
Man via environment - combined routes		Not required (local and systemic effects)

Risk characterisation

MAN VIA ENVIRONMENT:
The use of EUSES to predict the concentration in food is difficult to apply for metals and associated with much higher uncertainties than using measured data. Therefore, deviations from the TGD food basket approach for the exposure route “ingestion of food”, have been applied as shortly described in the introductory section 9.0.
The oral exposure concentration in µg/kg bw/day has been derived by taking 2L of drinking water (PEC freshwater taken from the local environmental exposure assessment) + the worst case exposure from food (see introductory section 9.0.) and a default body weight of 60kg into account.
Furthermore, the exposure assessment is based on the cobalt ion, as this is the toxic species, as such for the risk characterisation the DNELs based on cobalt were used.

9.39.3. Worker CS 3: Weighing powders for suspension (PROC 26)

Task(s) covered with this contributing scenario: Weighing.

9.39.3.1. Conditions of use

	Method
Product (Article) characteristics	
• Maximum emission potential of the substance: Medium *Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.*	Analogous data
• Physical form of substance: Solid, powder / dust	Analogous data
• Content in preparation: 5 - 25 % [Effectiveness Inhalation: 40%, Dermal: 40%]	Analogous data
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]	Analogous data
Technical and organisational conditions and measures	
• Generic local exhaust ventilation: Lower confidence limit (industrial use) [Effectiveness Inhalation: 78%] *Standard efficiency*	Analogous data
Conditions and measures related to personal protection, hygiene and health evaluation	
• Gloves: Gloves protecting from sensitizing properties to skin, continuous supervision of workers required *Due to the skin sensitizing effect of the substance, protective gloves according to EN 374 have to be worn at all workplaces unless any exposure to the substance can be excluded when taking into account the nature of the*	

	Method
conducted process, applied exposure prevention measures and physical appearance of the substance of concern in the specific type of application (e.g. protecting from splashes by containment of emission source). Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. Additionally, face protection is required to be worn as appropriate. This level of protection is to be achieved by continuous supervision and training of workers wearing gloves.	
• Eye protection: Eye protection to be worn to protect from eye irritation (substance in form of a powder) *Eye protection to be worn to protect from eye irritation (Due to the eye irritating properties of the substance in powder form, direct contact with the eyes is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn, unless contact of the substance with the eyes can be excluded. Such exclusion is determined by: (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) and (iii) applied exposure prevention measures (segregation of the emission source or separation of the worker from the emission source). Additionally, face protection may be required to be worn in such cases as appropriate.)*	
• Respiratory protective equipment (RPE): RPE with minimum APF = 20 [Effectiveness Inhalation: 95%] *APF = assigned protection factor according to EN 529. At minimum any combination of particle filter class P3 with mask according to EN 140, EN 1827 or filtering half mask (FF P3) according to EN 149 or combination of P2 filter with face piece according to EN 12941 or EN 12942 or any RPE providing higher APFs according to EN 529 is required.*	Analogous data
• Certified safety clothing and shoes *Certified safety clothing including coveralls and safety shoes are to be worn as appropriate. Face protection may be worn if the type of process is associated with the risk of face injuries due to thermal or mechanical stress.*	
• General good occupational hygiene practices *Required good occupational hygiene practices to ensure a safe handling of the substance involve measures (e.g. shower and change clothes at end of work shift) to avoid any contamination of private households via the work-home-interface and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking in the workplace. In general, inhalation and ingestion should be avoided. Unless otherwise stated below, certified working clothing and shoes should be worn during work. Any contaminated clothing should not be taken home. Good general ventilation in the workplace should be ensured. Dust should not be blown off (e.g. from dried splashes) with compressed air. Regular training in workplace hygiene practice and proper use of personal protective equipment (if relevant) is required.*	Analogous data
• Chemical protective suit according to EN 13982 *In cases where direct contact with the substance cannot be avoided, a protective suit conforming to EN 13982 should be worn.*	

9.39.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.262h. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	27 µg/m³ (Measured data: Analogous data)	RCR = 0.675

Remarks on measured exposure:

Analogous data:
Identity of the substance used: Exposure reported as substance
Inhalation exposure, long term concentration: Number of measured data points: 11 ; GSD: 8.25
Explanation: Inhalation, local, long term
Information provided in this scenario is exclusively based on “Cobalt and tungsten exposure assessment in the hardmetal industry. Based on air monitoring data from 2010-2014” (Lemus, R., October 17, 2018).

Risk characterisation

Qualitative risk characterisation:
Further information on the risk characterisation for local effects via inhalation and for local effects on the skin is given in Section 9.0.4.2.

9.39.4. Worker CS 4: Agglomeration (PROC 3)

Task(s) covered with this contributing scenario: Agglomeration.

9.35.4.1. Conditions of use

	Method
Product (Article) characteristics	
• Maximum emission potential of the substance: Medium *Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.*	Published data
• Physical form of substance: Solid, powder / dust	Published data
• Content in preparation: 5 - 25 % [Effectiveness Inhalation: 40%, Dermal: 40%]	Published data
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]	Published data
Technical and organisational conditions and measures	
• Level of containment: Closed process	Published data
Conditions and measures related to personal protection, hygiene and health evaluation	
• Gloves: Gloves protecting from sensitizing properties to skin, continuous supervision of workers required *Due to the skin sensitizing effect of the substance, protective gloves according to EN 374 have to be worn at all workplaces unless any exposure to the substance can be excluded when taking into account the nature of the conducted process, applied exposure prevention measures and physical appearance of the substance of concern in the specific type of application (e.g. protecting from splashes by containment of emission source). Gloves have to be changed according to manufacturer’s information or when damaged, whatever is the earlier. Additionally, face protection is required to be worn as appropriate. This level of protection is to be achieved by continuous supervision and training of workers wearing gloves.*	
• Eye protection: Eye protection to be worn to protect from eye irritation (substance in form of a powder) *Eye protection to be worn to protect from eye irritation (Due to the eye irritating properties of the substance in powder form, direct contact with the eyes is to be*	

	Method
avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn, unless contact of the substance with the eyes can be excluded. Such exclusion is determined by: (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) and (iii) applied exposure prevention measures (segregation of the emission source or separation of the worker from the emission source). Additionally, face protection may be required to be worn in such cases as appropriate.)	
• Respiratory protective equipment (RPE): RPE with minimum APF = 10 [Effectiveness Inhalation: 90%] *APF = assigned protection factor according to EN 529. At minimum any combination of particle filter class P2 with mask according to EN 140, EN 1827 or EN 136 or filtering half mask (FF P2) according to EN 149 or combination of P1 filter with face piece according EN 12942 or any RPE providing higher APFs according to EN 529 is required.*	Published data
• Certified safety clothing and shoes *Certified safety clothing including coveralls and safety shoes are to be worn as appropriate. Face protection may be worn if the type of process is associated with the risk of face injuries due to thermal or mechanical stress.*	
• General good occupational hygiene practices *Required good occupational hygiene practices to ensure a safe handling of the substance involve measures (e.g. shower and change clothes at end of work shift) to avoid any contamination of private households via the work-home-interface and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking in the workplace. In general, inhalation and ingestion should be avoided. Unless otherwise stated below, certified working clothing and shoes should be worn during work. Any contaminated clothing should not be taken home. Good general ventilation in the workplace should be ensured. Dust should not be blown off (e.g. from dried splashes) with compressed air. Regular training in workplace hygiene practice and proper use of personal protective equipment (if relevant) is required.*	Published data
• Chemical protective suit according to EN 13982 *In cases where direct contact with the substance cannot be avoided, a protective suit conforming to EN 13982 should be worn.*	

9.39.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.262i. Exposure concentrations and risks for workers

Route of exposure and type of effects	**Exposure concentration**	**Risk quantification**
Inhalation, local, long term	6.4 µg/m³ (Measured data: Published data)	RCR = 0.16

Remarks on measured exposure:

Published data:
Identity of the substance used: Exposure reported as substance
Inhalation exposure, long term concentration: Number of measured data points: 1
Explanation: Inhalation, local, long term
Information provided in this scenario is exclusively based on “Cobalt and tungsten exposure assessment in the hardmetal industry. Based on air monitoring data from 2010-2014” (Lemus, R., October 17, 2018).

Risk characterisation

Qualitative risk characterisation:
Further information on the risk characterisation for local effects via inhalation and for local effects on the skin is given in Section 9.0.4.2.

9.39.5. Worker CS 5: Sieving (PROC 3)

Task(s) covered with this contributing scenario: Sieving.

9.39.5.1. Conditions of use

	Method
Product (Article) characteristics	
• Maximum emission potential of the substance: Medium *Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.*	Analogous data
• Physical form of substance: Solid, powder / dust	Analogous data
• Content in preparation: 5 - 25 % [Effectiveness Inhalation: 40%, Dermal: 40%]	Analogous data
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]	Analogous data
Technical and organisational conditions and measures	
• Level of containment: Closed process	Analogous data
• Generic local exhaust ventilation: Lower confidence limit (industrial use) [Effectiveness Inhalation: 78%] *Standard efficiency*	Analogous data
Conditions and measures related to personal protection, hygiene and health evaluation	
• Gloves: Gloves protecting from sensitizing properties to skin, continuous supervision of workers required *Due to the skin sensitizing effect of the substance, protective gloves according to EN 374 have to be worn at all workplaces unless any exposure to the substance can be excluded when taking into account the nature of the conducted process, applied exposure prevention measures and physical appearance of the substance of concern in the specific type of application (e.g. protecting from splashes by containment of emission source). Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. Additionally, face protection is required to be worn as appropriate. This level of protection is to be achieved by continuous supervision and training of workers wearing gloves.*	
• Eye protection: Eye protection to be worn to protect from eye irritation (substance in form of a powder) *Eye protection to be worn to protect from eye irritation (Due to the eye irritating properties of the substance in powder form, direct contact with the eyes is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn, unless contact of the substance with the eyes can be excluded. Such exclusion is determined by: (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) and (iii) applied exposure prevention measures (segregation of the emission source or separation of the worker from the emission source). Additionally, face protection may be required to be worn in such cases as appropriate.)*	

	Method
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation *Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.*	
• Certified safety clothing and shoes *Certified safety clothing including coveralls and safety shoes are to be worn as appropriate. Face protection may be worn if the type of process is associated with the risk of face injuries due to thermal or mechanical stress.*	
• General good occupational hygiene practices *Required good occupational hygiene practices to ensure a safe handling of the substance involve measures (e.g. shower and change clothes at end of work shift) to avoid any contamination of private households via the work-home-interface and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking in the workplace. In general, inhalation and ingestion should be avoided. Unless otherwise stated below, certified working clothing and shoes should be worn during work. Any contaminated clothing should not be taken home. Good general ventilation in the workplace should be ensured. Dust should not be blown off (e.g. from dried splashes) with compressed air. Regular training in workplace hygiene practice and proper use of personal protective equipment (if relevant) is required.*	Analogous data
• Chemical protective suit according to EN 13982 *In cases where direct contact with the substance cannot be avoided, a protective suit conforming to EN 13982 should be worn.*	

9.39.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.262j. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	16 µg/m³ (Measured data: Analogous data)	RCR = 0.4

Remarks on measured exposure:

Analogous data:
Identity of the substance used: Exposure reported as substance
Inhalation exposure, long term concentration: Number of measured data points: 56 ; GSD: 2.43
Explanation: Inhalation, local, long term
Information provided in this scenario is exclusively based on “Cobalt and tungsten exposure assessment in the hardmetal industry. Based on air monitoring data from 2010-2014” (Lemus, R., October 17, 2018).

Risk characterisation

Qualitative risk characterisation:
Further information on the risk characterisation for local effects via inhalation and for local effects on the skin is given in Section 9.0.4.2.

9.39.6. Worker CS 6: Sintering (PROC 22)

Task(s) covered with this contributing scenario: Sintering.

9.39.6.1. Conditions of use

	Method
Product (Article) characteristics	
• Maximum emission potential of the substance: Low (temperature based) *Only the highest emission potential (EP) is reported. Lower EPs (e.g. if processes are being conducted at lower temperatures in parallel) are thus automatically covered in this assessment.*	Published data
• Physical form of substance: Solid, powder / dust	Published data
• Content in preparation: 5 - 25 % [Effectiveness Inhalation: 40%, Dermal: 40%]	Published data
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]	Published data
Technical and organisational conditions and measures	
• Level of containment: Closed process	Published data
• Integrated local exhaust ventilation: Lower confidence limit (industrial use) [Effectiveness Inhalation: 84%] *Standard efficiency*	Published data
• Process temperature: Elevated	Published data
Conditions and measures related to personal protection, hygiene and health evaluation	
• Gloves: Gloves protecting from sensitizing properties to skin, continuous supervision of workers required *Due to the skin sensitizing effect of the substance, protective gloves according to EN 374 have to be worn at all workplaces unless any exposure to the substance can be excluded when taking into account the nature of the conducted process, applied exposure prevention measures and physical appearance of the substance of concern in the specific type of application (e.g. protecting from splashes by containment of emission source). Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. Additionally, face protection is required to be worn as appropriate. This level of protection is to be achieved by continuous supervision and training of workers wearing gloves.*	
• Eye protection: Eye protection to be worn to protect from eye irritation (substance in form of a powder) *Eye protection to be worn to protect from eye irritation (Due to the eye irritating properties of the substance in powder form, direct contact with the eyes is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn, unless contact of the substance with the eyes can be excluded. Such exclusion is determined by: (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) and (iii) applied exposure prevention measures (segregation of the emission source or separation of the worker from the emission source). Additionally, face protection may be required to be worn in such cases as appropriate.)*	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation *Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.*	
• Certified safety clothing and shoes *Certified safety clothing including coveralls and safety shoes are to be worn as appropriate. Face protection may be worn if the type of process is associated*	

	Method
with the risk of face injuries due to thermal or mechanical stress.	
• General good occupational hygiene practices *Required good occupational hygiene practices to ensure a safe handling of the substance involve measures (e.g. shower and change clothes at end of work shift) to avoid any contamination of private households via the work-home-interface and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking in the workplace. In general, inhalation and ingestion should be avoided. Unless otherwise stated below, certified working clothing and shoes should be worn during work. Any contaminated clothing should not be taken home. Good general ventilation in the workplace should be ensured. Dust should not be blown off (e.g. from dried splashes) with compressed air. Regular training in workplace hygiene practice and proper use of personal protective equipment (if relevant) is required.*	Published data
• Chemical protective suit according to EN 13982 *In cases where direct contact with the substance cannot be avoided, a protective suit conforming to EN 13982 should be worn.*	

9.39.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.262k. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	18.6 µg/m³ (Measured data: Published data)	RCR = 0.465

Remarks on measured exposure:

Published data:
Identity of the substance used: Exposure reported as substance
Inhalation exposure, long term concentration: Number of measured data points: 1
Explanation Inhalation, local, long term
Information provided in this scenario is exclusively based on “Cobalt and tungsten exposure assessment in the hardmetal industry. Based on air monitoring data from 2010-2014” (Lemus, R., October 17, 2018).

Risk characterisation

Qualitative risk characterisation:
Further information on the risk characterisation for local effects via inhalation and for local effects on the skin is given in Section 9.0.4.2.

9.39.7. Worker CS 7: Classifying of powder (PROC 3)

Task(s) covered with this contributing scenario: Classifying of powder.

9.39.7.1. Conditions of use

	Method
Product (Article) characteristics	
• Maximum emission potential of the substance: Medium *Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.*	Analogous data
• Physical form of substance: Solid, powder / dust	Analogous data
• Content in preparation: 5 - 25 % [Effectiveness Inhalation: 40%, Dermal: 40%]	Analogous data

	Method
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]	Analogous data
Technical and organisational conditions and measures	
• Level of containment: Closed process	Analogous data
• Generic local exhaust ventilation: Lower confidence limit (industrial use) [Effectiveness Inhalation: 78%] *Standard efficiency*	Analogous data
Conditions and measures related to personal protection, hygiene and health evaluation	
• Gloves: Gloves protecting from sensitizing properties to skin, continuous supervision of workers required *Due to the skin sensitizing effect of the substance, protective gloves according to EN 374 have to be worn at all workplaces unless any exposure to the substance can be excluded when taking into account the nature of the conducted process, applied exposure prevention measures and physical appearance of the substance of concern in the specific type of application (e.g. protecting from splashes by containment of emission source). Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. Additionally, face protection is required to be worn as appropriate. This level of protection is to be achieved by continuous supervision and training of workers wearing gloves.*	
• Eye protection: Eye protection to be worn to protect from eye irritation (substance in form of a powder) *Eye protection to be worn to protect from eye irritation (Due to the eye irritating properties of the substance in powder form, direct contact with the eyes is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn, unless contact of the substance with the eyes can be excluded. Such exclusion is determined by: (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) and (iii) applied exposure prevention measures (segregation of the emission source or separation of the worker from the emission source). Additionally, face protection may be required to be worn in such cases as appropriate.)*	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation *Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.*	
• Certified safety clothing and shoes *Certified safety clothing including coveralls and safety shoes are to be worn as appropriate. Face protection may be worn if the type of process is associated with the risk of face injuries due to thermal or mechanical stress.*	
• General good occupational hygiene practices *Required good occupational hygiene practices to ensure a safe handling of the substance involve measures (e.g. shower and change clothes at end of work shift) to avoid any contamination of private households via the work-home-interface and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking in the workplace. In general, inhalation and ingestion should be avoided. Unless otherwise stated below, certified working clothing and shoes should be worn during work. Any*	Analogous data

	Method
contaminated clothing should not be taken home. Good general ventilation in the workplace should be ensured. Dust should not be blown off (e.g. from dried splashes) with compressed air. Regular training in workplace hygiene practice and proper use of personal protective equipment (if relevant) is required.	
• Chemical protective suit according to EN 13982 *In cases where direct contact with the substance cannot be avoided, a protective suit conforming to EN 13982 should be worn.*	

9.39.7.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.262l. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	16 µg/m³ (Measured data: Analogous data)	RCR = 0.4

Remarks on measured exposure:

Analogous data:
Identity of the substance used: Exposure reported as substance
Inhalation exposure, long term concentration: Number of measured data points: 56 ; GSD: 2.43
Explanation: Inhalation, local, long term
Information provided in this scenario is exclusively based on “Cobalt and tungsten exposure assessment in the hardmetal industry. Based on air monitoring data from 2010-2014” (Lemus, R., October 17, 2018).

Risk characterisation

Qualitative risk characterisation:
Further information on the risk characterisation for local effects via inhalation and for local effects on the skin is given in Section 9.0.4.2.

9.39.8. Worker CS 8: Packaging (PROC 26)

Task(s) covered with this contributing scenario: Packaging.

9.39.8.1. Conditions of use

	Method
Product (Article) characteristics	
• Maximum emission potential of the substance: Medium *Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.*	Published data
• Physical form of substance: Solid, powder / dust	Published data
• Content in preparation: 5 - 25 % [Effectiveness Inhalation: 40%, Dermal: 40%]	Published data
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]	Published data
Technical and organisational conditions and measures	
• General ventilation: Lower confidence limit (industrial use) [Effectiveness Inhalation: 17%] *Standard efficiency*	Published data

	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
• Gloves: Gloves protecting from sensitizing properties to skin, continuous supervision of workers required *Due to the skin sensitizing effect of the substance, protective gloves according to EN 374 have to be worn at all workplaces unless any exposure to the substance can be excluded when taking into account the nature of the conducted process, applied exposure prevention measures and physical appearance of the substance of concern in the specific type of application (e.g. protecting from splashes by containment of emission source). Gloves have to be changed according to manufacturer's information or when damaged, whatever is the earlier. Additionally, face protection is required to be worn as appropriate. This level of protection is to be achieved by continuous supervision and training of workers wearing gloves.*	
• Eye protection: Eye protection to be worn to protect from eye irritation (substance in form of a powder) *Eye protection to be worn to protect from eye irritation (Due to the eye irritating properties of the substance in powder form, direct contact with the eyes is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn, unless contact of the substance with the eyes can be excluded. Such exclusion is determined by: (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) and (iii) applied exposure prevention measures (segregation of the emission source or separation of the worker from the emission source). Additionally, face protection may be required to be worn in such cases as appropriate.)*	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation *Due to potential adverse effects of the substance to the respiratory tract, RPE (minimum assigned protection factor of 10) is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.*	
• Certified safety clothing and shoes *Certified safety clothing including coveralls and safety shoes are to be worn as appropriate. Face protection may be worn if the type of process is associated with the risk of face injuries due to thermal or mechanical stress.*	
• General good occupational hygiene practices *Required good occupational hygiene practices to ensure a safe handling of the substance involve measures (e.g. shower and change clothes at end of work shift) to avoid any contamination of private households via the work-home-interface and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking in the workplace. In general, inhalation and ingestion should be avoided. Unless otherwise stated below, certified working clothing and shoes should be worn during work. Any contaminated clothing should not be taken home. Good general ventilation in the workplace should be ensured. Dust should not be blown off (e.g. from dried splashes) with compressed air. Regular training in workplace hygiene practice and proper use of personal protective equipment (if relevant) is required.*	Published data
• Chemical protective suit according to EN 13982 *In cases where direct contact with the substance cannot be avoided, a protective suit conforming to EN 13982 should be worn.*	

9.39.8.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.262m. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	5.8 µg/m³ (Measured data: Published data)	RCR = 0.145

Remarks on measured exposure:

Published data:
Identity of the substance used: Exposure reported as substance
Inhalation exposure, long term concentration: Number of measured data points: 1
Explanation: Inhalation, local, long term
Information provided in this scenario is exclusively based on “Cobalt and tungsten exposure assessment in the hardmetal industry. Based on air monitoring data from 2010-2014” (Lemus, R., October 17, 2018).

Risk characterisation

Qualitative risk characterisation:
Further information on the risk characterisation for local effects via inhalation and for local effects on the skin is given in Section 9.0.4.2.

9.39.9. Worker CS 9: Cleaning & Maintenance (PROC 28)

Task(s) covered with this contributing scenario: Various maintenance and cleaning operations inside and outside the equipment.

9.39.9.1. Conditions of use

	Method
Product (Article) characteristics	
• Maximum emission potential of the substance: Medium *Only the highest emission potential (EP) is reported. Lower EPs (e.g. if materials of lower dustiness are being handled in parallel) are thus automatically covered in this assessment.*	Analogous data
• Physical form of substance: Solid, powder / dust	Analogous data
Amount used (or contained in articles), frequency and duration of use/exposure	
• Maximum duration of exposure: > 240 min (not restricted) [Effectiveness Inhalation: 0%, Dermal: 0%]	Analogous data
Technical and organisational conditions and measures	
• Generic local exhaust ventilation: Lower confidence limit (industrial use) [Effectiveness Inhalation: 78%] *Standard efficiency*	Analogous data
Conditions and measures related to personal protection, hygiene and health evaluation	
• Gloves: Gloves protecting from sensitizing properties to skin, continuous supervision of workers required *Due to the skin sensitizing effect of the substance, protective gloves according to EN 374 have to be worn at all workplaces unless any exposure to the substance can be excluded when taking into account the nature of the conducted process, applied exposure prevention measures and physical appearance of the substance of concern in the specific type of application (e.g. protecting from splashes by containment of emission source). Gloves have to be changed according to manufacturer’s information or when damaged, whatever is the earlier. Additionally, face protection is required to be worn as appropriate. This level of protection is to be achieved by continuous supervision*	

	Method
and training of workers wearing gloves.	
• Eye protection: Eye protection to be worn to protect from eye irritation (substance in form of a powder) *Eye protection to be worn to protect from eye irritation (Due to the eye irritating properties of the substance in powder form, direct contact with the eyes is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn, unless contact of the substance with the eyes can be excluded. Such exclusion is determined by: (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) and (iii) applied exposure prevention measures (segregation of the emission source or separation of the worker from the emission source). Additionally, face protection may be required to be worn in such cases as appropriate.)*	
• Respiratory protective equipment (RPE): RPE with minimum APF = 20 [Effectiveness Inhalation: 95%] *APF = assigned protection factor according to EN 529. At minimum any combination of particle filter class P3 with mask according to EN 140, EN 1827 or filtering half mask (FF P3) according to EN 149 or combination of P2 filter with face piece according to EN 12941 or EN 12942 or any RPE providing higher APFs according to EN 529 is required.*	Analogous data
• Certified safety clothing and shoes *Certified safety clothing including coveralls and safety shoes are to be worn as appropriate. Face protection may be worn if the type of process is associated with the risk of face injuries due to thermal or mechanical stress.*	
• General good occupational hygiene practices *Required good occupational hygiene practices to ensure a safe handling of the substance involve measures (e.g. shower and change clothes at end of work shift) to avoid any contamination of private households via the work-home-interface and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking in the workplace. In general, inhalation and ingestion should be avoided. Unless otherwise stated below, certified working clothing and shoes should be worn during work. Any contaminated clothing should not be taken home. Good general ventilation in the workplace should be ensured. Dust should not be blown off (e.g. from dried splashes) with compressed air. Regular training in workplace hygiene practice and proper use of personal protective equipment (if relevant) is required.*	Analogous data
• Chemical protective suit according to EN 13982 *In cases where direct contact with the substance cannot be avoided, a protective suit conforming to EN 13982 should be worn.*	

9.39.9.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.262n. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	18.55 µg/m³ (Measured data: Analogous data)	RCR = 0.464

Remarks on measured exposure:

Analogous data:

Identity of the substance used: Exposure reported as substance
Inhalation exposure, long term concentration: Number of measured data points: 9 ; GSD: 5.81
Explanation: Inhalation, local, long term
Information provided in this scenario is exclusively based on “Cobalt and tungsten exposure assessment in the hardmetal industry. Based on air monitoring data from 2010-2014” (Lemus, R., October 17, 2018).

Risk characterisation

Qualitative risk characterisation:
Further information on the risk characterisation for local effects via inhalation and for local effects on the skin is given in Section 9.0.4.2