

7. ES 7: Use at industrial sites; Use of nickel metal in 3D-printing

7.1. Title section

Product category: Base metals and alloys (PC 7)

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

Environment	
1: Use of nickel-containing powders in additive manufacturing (3D-printing) - no emissions	ERC 5
Worker	
2: Handling of dusty raw materials	PROC 26
3: 3D-printing in closed process	PROC 1
4: Handling and sieving of powder for reuse	PROC 26
5: Maintenance work	PROC 28
6: Cleaning/removal of dust	PROC 28

7.2. Conditions of use affecting exposure

7.2.1. Control of environmental exposure: Use of nickel-containing powders in additive manufacturing (3D-printing) - no emissions (ERC 5)

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 0.1 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site ≤ 1 tonnes/year
Technical and organisational conditions and measures
The substance should not be released to air
The substance should not be released to water
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.

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

Product (article) characteristics
Physical form of product; Solid, high dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Local exhaust ventilation
Semi-closed system
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 10 (90% respiratory 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.

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

Product (article) characteristics
Maximum emission potential covered in this ES: Low (temperature based).
Physical form of product: Solid, powder / dust.
Technical and organisational conditions and measures
Ensure automation of the process as far as technically feasible
Closed process with occasional opening
Use of an integrated local exhaust ventilation is required.
Elevated temperature

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

Product (article) characteristics
Physical form of product; Solid, high dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Local exhaust ventilation
Semi-closed system
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 10 (90% respiratory 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.

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

Product (article) characteristics
Physical form of product: Residual dust.
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Machinery to be maintained is to be turned off during work.
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 10 (90% respiratory 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.

7.2.6. Control of worker exposure: Cleaning/removal of dust (PROC 28)

Product (article) characteristics
Physical form of product: Residual dust.
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures

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

APF of RPE = 20 (95% respiratory protection). For further specification, refer to section 8 of the SDS.

7.3. Exposure estimation and reference to its source

7.3.1. Environmental release and exposure: Use of nickel-containing powders in additive manufacturing (3D-printing) - no emissions (ERC 5)

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

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

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.014 mg/m ³ (Measured data)	0.28
Inhalation, local, long term	0.014 mg/m ³ (Measured data)	0.28
Inhalation, local, acute	0.071 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm ² (Measured data)	0.148
Combined, systemic, long term		0.28

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

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.015 mg/m ³ (Measured data)	0.3
Inhalation, local, long term	0.015 mg/m ³ (Measured data)	0.3
Inhalation, local, acute	0.044 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.022
Combined, systemic, long term		0.3

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

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.014 mg/m ³ (Measured data)	0.28
Inhalation, local, long term	0.014 mg/m ³ (Measured data)	0.28
Inhalation, local, acute	0.071 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm ² (Measured data)	0.148
Combined, systemic, long term		0.28

7.3.5. Worker exposure: Maintenance work (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	5E-3 mg/m ³ (Measured data)	0.1
Inhalation, local, long term	5E-3 mg/m ³ (Measured data)	0.1
Inhalation, local, acute	0.023 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm ² (Measured data)	0.148
Combined, systemic, long term		0.1

7.3.6. Worker exposure: Cleaning/removal of dust (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.032 mg/m ³ (Measured data)	0.64
Inhalation, local, long term	0.032 mg/m ³ (Measured data)	0.64
Inhalation, local, acute	0.189 mg/m ³ (Measured data)	0.016
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.022
Combined, systemic, long term		0.64

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

Guidance: Please refer to Section 0.3 of this “ES for Communication”.