10. ES 10: Use at industrial sites; Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics

10.1. Title section

Product category: Metal surface treatment products (PC 14)
Sector of use: Manufacture of computer, electronic and optical products, electrical equipment (SU 16)

Environment	
1: Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics - Direct discharge to fresh water	ERC 5
2: Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics - Direct discharge to marine water	ERC 5
Worker	
3: Raw material handling	PROC 26, PROC 1
4: Preparation of slurry	PROC 5, PROC 4
5: Calcination	PROC 3, PROC 4
6: Sintering	PROC 22
7: Sawing/cutting of sintered objects	PROC 24
8: Assembly and packaging	PROC 21
9: Wet cleaning	PROC 28
10: Cleaning/removal of dust	PROC 28
Subsequent service life exposure scenario(s)	
ES 12: Service life (worker at industrial site); Machinery, mechanical appliances, electrical/electronic articles; Service life of nickel-containing electronics/ferrite cores in industrial settings	
ES 13: Service life (professional worker); Machinery, mechanical appliances, electrical/electronic articles; Service life of nickel-containing electronics/ferrite cores in professional settings	

10.2. Conditions of use affecting exposure

10.2.1. Control of environmental exposure: Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics - Direct discharge to fresh water (ERC 5)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 9.5E-4 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 <= 0.29 tonnes/year
Emission days >= 304 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or

ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Receiving water dilution (fresh or marine) >= 50
Receiving surface water flow >= 3.09E3 m3/day
Assumed effluent discharge flow from site >= 63 m3/day

10.2.2. Control of environmental exposure: Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics - Direct discharge to marine water (ERC 5)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 9.5E-4 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 <= 0.29 tonnes/year
Emission days >= 304 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to freshwater assumed
Receiving water dilution (fresh or marine) >= 100
Assumed effluent discharge flow from site >= 63 m3/day

10.2.3. Control of worker exposure: Raw material handling (PROC 26, PROC 1)

Product (article) characteristics
Physical form of product; Solid, high dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Amount per use < 1 kg
Technical and organisational conditions and measures
Semi-closed system

10.2.4. Control of worker exposure: Preparation of slurry (PROC 5, PROC 4)

Product (article) characteristics
Maximum emission potential covered in this ES: Very low.
Physical form of product: Solution and other liquid materials, e.g. suspensions are also covered.

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
Covers use at ambient temperatures.

10.2.5. Control of worker exposure: Calcination (PROC 3, PROC 4)

Product (article) characteristics
Maximum emission potential covered in this ES: Low.
Physical form of product: Damp solid.
Technical and organisational conditions and measures
Local exhaust ventilation
Ensure enclosure of furnace operation
Elevated temperature

10.2.6. Control of worker exposure: Sintering (PROC 22)

Product (article) characteristics
Maximum emission potential covered in this ES: Low (temperature based).
Physical form of product: Solids in various physical forms e.g. powders, pressed powders, pasted powders etc.
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.
Manufacturing and processing of minerals and/or metals at substantially elevated temperature. High temperature processes slightly below melting point / degradation temperature.

10.2.7. Control of worker exposure: Sawing/cutting of sintered objects (PROC 24)

Product (article) characteristics
Maximum emission potential covered in this ES: Medium (abrasion based).
Physical form of product; Massive object
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
Ensure automation of the process as far as technically feasible
Ensure segregation of worker from the source.

10.2.8. Control of worker exposure: Assembly and packaging (PROC 21)

Product (article) characteristics
Maximum emission potential covered in this ES: Low (abrasion based).
Physical form of product; Massive object

Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374.; For further specification, refer to section 8 of the SDS.

10.2.9. Control of worker exposure: Wet cleaning (PROC 28)

Product (article) characteristics
Maximum emission potential covered in this ES: Very low.
Physical form of product: Solution and other liquid materials, e.g. suspensions are also covered.
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 machines such as power sweeper, no direct manual cleaning.
Covers use at ambient temperatures.
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 10 (90% respiratory protection).

10.2.10. 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.

10.3. Exposure estimation and reference to its source

10.3.1. Environmental release and exposure: Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics - Direct discharge to fresh water (ERC 5)

Release route	Release rate	Release estimation method
Water	3.14E-3 kg/day	Estimated release factor
Air	9.5E-5 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	3.61E-3 mg/L (EUSES 2.1.2)	0.509
Sediment (freshwater)	52.4 mg/kg dw (PEC sediment calculation method for metals)	0.481
Agricultural soil	16.2 mg/kg dw (EUSES 2.1.2)	0.542

10.3.2. Environmental release and exposure: Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics - Direct discharge to marine water (ERC 5)

Release route	Release rate	Release estimation method
Water	3.14E-3 kg/day	Estimated release factor
Air	9.5E-5 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	6.57E-4 mg/L (EUSES 2.1.2)	0.076
Sediment (marine water)	25.5 mg/kg dw (PEC sediment calculation method for metals)	0.234
Agricultural soil	16.2 mg/kg dw (EUSES 2.1.2)	0.542

10.3.3. Worker exposure: Raw material handling (PROC 26, PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.04 mg/m³ (Measured data)	0.8
Inhalation, local, long term	0.04 mg/m³ (Measured data)	0.8
Inhalation, local, acute	0.12 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	3.73 µg/cm² (Measured data)	0.311
Combined, systemic, long term		0.8

10.3.4. Worker exposure: Preparation of slurry (PROC 5, PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.012 mg/m³ (Measured data)	0.24
Inhalation, local, long term	0.012 mg/m³ (Measured data)	0.24
Inhalation, local, acute	0.047 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063
Combined, systemic, long term		0.24

10.3.5. Worker exposure: Calcination (PROC 3, PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	5E-3 mg/m³ (Measured data)	0.1
Inhalation, local, long term	5E-3 mg/m³ (Measured data)	0.1
Inhalation, local, acute	0.016 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063
Combined, systemic, long term		0.1

10.3.6. Worker exposure: Sintering (PROC 22)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.015 mg/m³ (Measured data)	0.3
Inhalation, local, long term	0.015 mg/m³ (Measured data)	0.3
Inhalation, local, acute	0.044 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063
Combined, systemic, long term		0.3

10.3.7. Worker exposure: Sawing/cutting of sintered objects (PROC 24)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	4E-3 mg/m³ (Measured data)	0.08
Inhalation, local, long term	4E-3 mg/m³ (Measured data)	0.08
Inhalation, local, acute	0.012 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063
Combined, systemic, long term		0.08

10.3.8. Worker exposure: Assembly and packaging (PROC 21)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	9E-3 mg/m³ (Measured data)	0.18
Inhalation, local, long term	9E-3 mg/m³ (Measured data)	0.18
Inhalation, local, acute	0.037 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm² (Measured data)	0.432
Combined, systemic, long term		0.18

10.3.9. Worker exposure: Wet cleaning (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, acute	0.026 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063
Combined, systemic, long term		0.12

10.3.10. 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/m³ (Measured data)	0.64
Inhalation, local, long term	0.032 mg/m³ (Measured data)	0.64
Inhalation, local, acute	0.189 mg/m³ (Measured data)	0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063
Combined, systemic, long term		0.64

10.4. 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”.