3. ES 3: Formulation or re-packing; Use of nickel metal in electric arc furnace carbon steel manufacturing

3.1. Title section

Product category: Base metals and alloys (PC 7)

Environment	
1: Use of nickel metal in electric arc furnace carbon steel manufacturing - Direct discharge to fresh water_D=10	ERC 3
2: Use of nickel metal in electric arc furnace carbon steel manufacturing - Direct discharge to fresh water_D=100	ERC 3
3: Use of nickel metal in electric arc furnace carbon steel manufacturing - Direct discharge to marine water	ERC 3
Worker	
4: Handling of dusty raw materials	PROC 26
5: Handling of massive raw materials	PROC 21
6: Smelting, melting and casting	PROC 22, PROC 4, PROC 23
7: Rolling, milling or forging	PROC 24
8: Grinding	PROC 24
9: Annealing and pickling	PROC 22, PROC 13
10: Welding	PROC 25
11: Low energy handling of massive objects	PROC 21
12: Packaging, shipping and storage	PROC 21
13: Wet cleaning	PROC 28
14: Cleaning/removal of dust	PROC 28

3.2. Conditions of use affecting exposure

3.2.1. Control of environmental exposure: Use of nickel metal in electric arc furnace carbon steel manufacturing - Direct discharge to fresh water_D=10 (ERC 3)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.286 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 <= 100 tonnes/year
Emission days >= 350 days/year
Technical and organisational conditions and measures
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 (including article waste)
Dispose of waste product or used containers according to local regulations.

Other conditions affecting environmental exposure
Receiving surface water flow >= 1.8E4 m3/day
No discharge to marine water assumed
Receiving water dilution (fresh or marine) >= 10
Assumed effluent discharge flow from site >= 2E3 m3/day

3.2.2. Control of environmental exposure: Use of nickel metal in electric arc furnace carbon steel manufacturing - Direct discharge to fresh water_D=100 (ERC 3)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 22.85 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 <= 8E3 tonnes/year
Emission days >= 350 days/year
Technical and organisational conditions and measures
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 (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Receiving surface water flow >= 1.98E5 m3/day
No discharge to marine water assumed
Receiving water dilution (fresh or marine) >= 100
Assumed effluent discharge flow from site >= 2E3 m3/day

3.2.3. Control of environmental exposure: Use of nickel metal in electric arc furnace carbon steel manufacturing - Direct discharge to marine water (ERC 3)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 28.57 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 <= 1E4 tonnes/year
Emission days >= 350 days/year
Technical and organisational conditions and measures
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 (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 >= 2E3 m3/day

3.2.4. 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.

3.2.5. Control of worker exposure: Handling of massive raw materials (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.

3.2.6. Control of worker exposure: Smelting, melting and casting (PROC 22, PROC 4, PROC 23)

Product (article) characteristics
Physical form of product: Molten.
Maximum emission potential covered in this ES: High (temperature based).
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
High temperature

3.2.7. Control of worker exposure: Rolling, milling or forging (PROC 24)

Product (article) characteristics
Physical form of product; Solid
Maximum emission potential covered in this ES: High (temperature based). Low to high level of abrasion possible.
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
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

3.2.8. Control of worker exposure: Grinding (PROC 24)

Product (article) characteristics
Physical form of product; Massive object
Maximum emission potential covered in this ES: High (abrasion based).
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
Use in closed process
Use of an integrated local exhaust ventilation with high efficiency is required.

3.2.9. Control of worker exposure: Annealing and pickling (PROC 22, PROC 13)

Product (article) characteristics
Maximum emission potential covered in this ES: Low.
Physical form of product; Massive object
Amount used (or contained in articles), frequency and duration of use/exposure
Covers exposure up to 180 minutes
Technical and organisational conditions and measures
Elevated temperature (process temperature may vary depending on the conducted process but is maintained well below the melting point of the substance).
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

3.2.10. Control of worker exposure: Welding (PROC 25)

Product (article) characteristics
Physical form of product; Massive object
Maximum emission potential covered in this ES: High (temperature based).
Technical and organisational conditions and measures
High temperature
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Dermal contact with the substance has to be excluded.

3.2.11. Control of worker exposure: Low energy handling of massive objects (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.

3.2.12. Control of worker exposure: Packaging, shipping and storage (PROC 21)

Product (article) characteristics
Maximum emission potential covered in this ES: Very low.
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.

3.2.13. 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).

3.2.14. 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.

3.3. Exposure estimation and reference to its source

3.3.1. Environmental release and exposure: Use of nickel metal in electric arc furnace carbon steel manufacturing - Direct discharge to fresh water_D=10 (ERC 3)

Release route	Release rate	Release estimation method
Water	8.87E-3 kg/day	Estimated release factor
Air	0.033 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	3.22E-3 mg/L (EUSES 2.1.2)	0.453
Sediment (freshwater)	41.9 mg/kg dw (PEC sediment calculation method for metals)	0.384

Protection target	Exposure estimate	RCR
Agricultural soil	16.20 mg/kg dw (EUSES 2.1.2)	0.542

3.3.2. Environmental release and exposure: Use of nickel metal in electric arc furnace carbon steel manufacturing - Direct discharge to fresh water_D=100 (ERC 3)

Release route	Release rate	Release estimation method
Water	0.709 kg/day	Estimated release factor
Air	2.629 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	5.44E-3 mg/L (EUSES 2.1.2)	0.766
Sediment (freshwater)	100.3 mg/kg dw (PEC sediment calculation method for metals)	0.92
Agricultural soil	16.50 mg/kg dw (EUSES 2.1.2)	0.552

3.3.3. Environmental release and exposure: Use of nickel metal in electric arc furnace carbon steel manufacturing - Direct discharge to marine water (ERC 3)

Release route	Release rate	Release estimation method
Water	0.886 kg/day	Estimated release factor
Air	3.286 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	3.48E-3 mg/L (EUSES 2.1.2)	0.404
Sediment (marine water)	99.6 mg/kg dw (PEC sediment calculation method for metals)	0.914
Agricultural soil	16.58 mg/kg dw (EUSES 2.1.2)	0.555

3.3.4. 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/m³ (Measured data)	0.28
Inhalation, local, long term	0.014 mg/m³ (Measured data)	0.28
Inhalation, local, acute	0.071 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm² (Measured data)	0.148
Combined, systemic, long term		0.28

3.3.5. Worker exposure: Handling of massive raw materials (PROC 21)

Route of exposure and type of effects	Exposure estimate	RCR

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)	0.148
Combined, systemic, long term		0.18

3.3.6. Worker exposure: Smelting, melting and casting (PROC 22, PROC 4, PROC 23)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.021 mg/m³ (Measured data)	0.42
Inhalation, local, long term	0.021 mg/m³ (Measured data)	0.42
Inhalation, local, acute	0.085 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.022
Combined, systemic, long term		0.42

3.3.7. Worker exposure: Rolling, milling or forging (PROC 24)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.024 mg/m³ (Measured data)	0.48
Inhalation, local, long term	0.024 mg/m³ (Measured data)	0.48
Inhalation, local, acute	0.096 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.022
Combined, systemic, long term		0.48

3.3.8. Worker exposure: Grinding (PROC 24)

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	0.014 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.022
Combined, systemic, long term		0.1

3.3.9. Worker exposure: Annealing and pickling (PROC 22, PROC 13)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.037 mg/m³ (Measured data)	0.74
Inhalation, local, long term	0.037 mg/m³ (Measured data)	0.74
Inhalation, local, acute	0.11 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.022
Combined, systemic, long term		0.74

3.3.10. Worker exposure: Welding (PROC 25)

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)	0.022
Combined, systemic, long term		0.3

3.3.11. Worker exposure: Low energy handling of massive objects (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)	0.148
Combined, systemic, long term		0.18

3.3.12. Worker exposure: Packaging, shipping and storage (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)	0.148
Combined, systemic, long term		0.18

3.3.13. 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)	0.022
Combined, systemic, long term		0.12

3.3.14. 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)	0.016
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.022

Route of exposure and type of effects	Exposure estimate	RCR
Combined, systemic, long term		0.64

3.4. 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”.