8. ES 8: Use at industrial sites; Intermediate use of nickel oxide sinter in carbonyl refining (nickel carbonyl process)

8.1. Title section

Product category: Base metals and alloys (PC 7)
Sector of use: Manufacture of basic metals, including alloys (SU 14)

Environment	
1: Intermediate use of nickel oxide sinter in carbonyl refining (nickel carbonyl process) - Direct discharge to fresh water	ERC 6a
2: Intermediate use of nickel oxide sinter in carbonyl refining (nickel carbonyl process) - Direct discharge to marine water	ERC 6a
Worker	
3: Raw material handling	PROC 26
4: Reduction and activation in rotary kilns	PROC 1
5: Wet cleaning	PROC 28
6: Cleaning/removal of dust	PROC 28

8.2. Conditions of use affecting exposure

8.2.1. Control of environmental exposure: Intermediate use of nickel oxide sinter in carbonyl refining (nickel carbonyl process) - Direct discharge to fresh water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 190 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 <= 6.94E4 tonnes/year
Emission days >= 365 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
Receiving surface water flow >= 1.78E6 m3/day
Assumed effluent discharge flow from site >= 2E3 m3/day
No discharge to marine water assumed
Receiving water dilution (fresh or marine) >= 892

8.2.2. Control of environmental exposure: Intermediate use of nickel oxide sinter in carbonyl refining (nickel carbonyl process) - Direct discharge to marine water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 78.3 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 <= 2.86E4 tonnes/year
Emission days >= 365 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
Assumed effluent discharge flow from site >= 2E3 m3/day
No discharge to freshwater assumed
Receiving water dilution (fresh or marine) >= 100

8.2.3. Control of worker exposure: Raw material handling (PROC 26)

Product (article) characteristics
Physical form of product: Solid, powder / dust (other solid materials, e.g. granules are also covered).
Maximum emission potential covered in this ES: High.
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.

8.2.4. Control of worker exposure: Reduction and activation in rotary kilns (PROC 1)

Product (article) characteristics
Physical form of product: Solid, powder / dust (other solid materials, e.g. granules are also covered).
Maximum emission potential covered in this ES: High.
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
Closed and ventilated (positive pressure) control room, contamination from outside is minimised by measures such as dust-captures for shoes.
Use in closed process
Automated task

Assumes process temperature up to 450 °C
Local exhaust ventilation cannot be used on the kilns because of the gaseous nature of the raw materials used in reduction and activation.
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.

8.2.5. 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).

8.2.6. 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.

8.3. Exposure estimation and reference to its source

8.3.1. Environmental release and exposure: Intermediate use of nickel oxide sinter in carbonyl refining (nickel carbonyl process) - Direct discharge to fresh water (ERC 6a)

Release route	Release rate	Release estimation method
Water	5.377 kg/day	Estimated release factor
Air	5.586 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	5.06E-3 mg/L (EUSES 2.1.2)	0.713
Sediment (freshwater)	90.2 mg/kg dw (PEC sediment calculation	0.828

Protection target	Exposure estimate	RCR
	method for metals)	
Agricultural soil	16.87 mg/kg dw (EUSES 2.1.2)	0.565

8.3.2. Environmental release and exposure: Intermediate use of nickel oxide sinter in carbonyl refining (nickel carbonyl process) - Direct discharge to marine water (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.806 kg/day	Estimated release factor
Air	2.302 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	3.19E-3 mg/L (EUSES 2.1.2)	0.371
Sediment (marine water)	92.1 mg/kg dw (PEC sediment calculation method for metals)	0.845
Agricultural soil	16.47 mg/kg dw (EUSES 2.1.2)	0.551

8.3.3. Worker exposure: Raw material handling (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)	0.432
Combined, systemic, long term		0.28

8.3.4. Worker exposure: Reduction and activation in rotary kilns (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	7E-3 mg/m³ (Measured data)	0.14
Inhalation, local, long term	7E-3 mg/m³ (Measured data)	0.14
Inhalation, local, acute	0.022 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063
Combined, systemic, long term		0.14

8.3.5. 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

8.3.6. 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/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

8.4. 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”.