

Version 5, 2015	
<b>1. Title</b> GES 35 Use of nickel metal and nickel containing alloys for the production of steel and other alloys powder by atomization	
<b>Life cycle</b>	Formulation – DU of Ni metal
<b>Free short title</b>	Production of steel and alloys powder by atomisation
<b>Systematic title based on use descriptor</b>	SU: SU 3 Industrial use SU14: Manufacture of basic metals and alloys PC: PC7- Base metals and alloys ERC: ERC 3 Formulation in materials ERC 5: Industrial use resulting in inclusion into or onto a matrix PROC: PROC 1: Use in closed process, no likelihood of exposure PROC 8b: Transfer of substance or preparation from/to vessels/large containers PROC 22: Potentially closed processing operations with minerals/metals at elevated temperature PROC 23: Open processing and transfer operations with metals at elevated temperature PROC 26: Handling of solid inorganic substances at ambient temperature PROC 27a: Production of metal powders (hot processes) PROC 0: cleaning and maintenance
<b>Processes, tasks, activities covered (environment)</b>	Production of steel and alloys powder by atomisation: Raw material handling, melting, atomisation, sieving and filling containers, cold and hot isostatic pressing, cleaning and maintenance.
<b>Processes, tasks, activities covered (workers)</b>	Contributing exposure scenario ES 35.1: PROC 8b: Raw material handling Contributing exposure scenario ES 35.2: PROC1, PROC 22, PROC 23: Melting operations Contributing exposure scenario ES 35.3 PROC1, PROC 27a: Atomisation operations Contributing exposure scenario ES 35.4: PROC 1, PROC 8b, PROC 26: Sieving and Filling containers Contributing exposure scenario ES 35.5: PROC 1: Further processing , Hot Isostatic Pressing Contributing exposure scenario ES 35.6: PROC 0: Cleaning and maintenance
<b>2. Operational conditions and risk management measures</b>	
<b>2.1 Control of environmental exposure</b>	
<b>Environmental related free short title</b>	Production of steel and alloys powder by atomisation
<b>Systematic title based on use descriptor (environment)</b>	ERC 3 Formulation in materials ERC 5: Industrial use resulting in inclusion into or onto a matrix
<b>Processes, tasks, activities covered (environment)</b>	Production of steel and alloys powder by atomisation: Raw material handling, melting, atomisation, sieving and filling containers, Cold and Hot Isostatic Pressing, cleaning and maintenance.
<b>Environmental Assessment Method</b>	Estimates based on SPERC for Formulation of Ni alloys (ARCHE/EUROMETAUX, SPERC fact sheet, V1.1) are used for calculation of freshwater and marine environmental concentrations. Estimates based on monitoring local and regional concentrations are used for calculation of air PEC
<b>Product characteristics</b>	
<b>Amounts used</b>	

<b>Maximum daily use at a site</b>	0.9 – 4.1 tonnes (median 50 <sup>th</sup> % emission days)
<b>Maximum annual use at a site</b>	ES 1: 200 tonne Ni (75 <sup>th</sup> %) ES 2 & 3: 897 tonne Ni (90 <sup>th</sup> %)
<b>Frequency and duration of use</b>	
<b>Pattern of release to the environment</b>	Water: 221 days per year per site (50 <sup>th</sup> %, 2007-2009) Air: 220 days per year per site (50 <sup>th</sup> %, 2007-2009)
<b>Environment factors not influenced by risk management</b>	
<b>Receiving surface water flow rate</b>	ES 1 Discharge to STP: 18,000 m <sup>3</sup> /d (Effluent STP: 2000 m <sup>3</sup> /d) ES 2 Direct discharge: 198,000 m <sup>3</sup> /d (Effluent Site: 2000 m <sup>3</sup> /d)
<b>Dilution capacity, freshwater</b>	ES 1: Discharge to STP: 10 (default) ES 2: Direct discharge: 100 (default)
<b>Dilution capacity, marine</b>	ES 3: Marine discharge: 100 (default)
<b>Other given operational conditions affecting environmental exposure</b>	
None	
<b>Technical conditions and measures at process level (source) to prevent release</b>	
None	
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>	
<p><b>Waste water:</b> On-site wastewater treatment by chemical precipitation, sedimentation, filtration, electrolysis or a combination of these methods. Off-site wastewater treatment in municipal STP for ES 1 (Efficiency 40 %). ES 1 Discharge to STP: Release factor to water after on-site treatment: 50 g/T (Sperc for formulation in alloys) ES 2 Direct discharge: Release factor to water after on-site treatment: 50 g/T (Sperc for formulation in alloys) ES 3 Marine discharge: Release factor to water after on-site treatment: 50 g/T (Sperc for formulation in alloys)</p> <p><b>Air:</b> Treatment of stack air emission by fabric or bag filters (Efficiency &gt; 98%) ES 1, 2 &amp; 3: Release factor after on-site treatment: 20.5 g Ni/T (maximum)</p>	
<b>Organizational measures to prevent/limit release from site</b>	
None	
<b>Conditions and measures related to municipal sewage treatment plant</b>	
<b>Municipal Sewage Treatment Plant (STP)</b>	Yes for ES 1 Discharge to STP
<b>Discharge rate of the Municipal STP</b>	2000 m <sup>3</sup> /d (default)
<b>Incineration of the sludge of the Municipal STP</b>	The sludge is applied to agricultural soil
<b>Conditions and measures related to external treatment of waste for disposal</b>	
<p>Hazardous wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately 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 nickel content of the waste is elevated enough, internal or external recovery/recycling might be considered.</p> <p><b>Fraction of daily/annual use</b> expected in waste:</p> <ul style="list-style-type: none"> <li>- Nickel producers = 0.05 %</li> <li>- DU: stainless steel and alloy steels = 0.6 %</li> <li>- DU: nickel alloys, copper alloys, foundry, batteries, catalysts, chemicals, dyes and others = 0.5 %</li> <li>- DU: Plating = 3%</li> </ul> <p><b>Appropriate waste codes:</b> 01 03 07*, 02 01 10*, 06 03 13*, 06 03 15*, 06 04 05*, 06 05 02*, 10 08 04, 10 08 08*, 10 08 09, 10 08 15*, 10 08 16, 10 10 03, 10 10 05*, 10 10 07*, 10 10 09*, 10 10 10, 10 10 11*, 11 02 07*, 12 01 03*, 12 01 04, 15 01 04*, 15 01 10*, 16 01 04*,</p>	

16 01 06\*, 16 01 08\*, 16 06 02\*, 16 06 05, 16 08 02\*, 16 08 03\*, 17 04 07\*, 17 04 09\*, 19 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.

**Conditions and measures related to external recovery of waste**

Shredders pre-treating metal wastes should have a maximum release factors to air of 0.0015 after RMM and no releases to water and soil.

Qmax, local(shredding)=26kg Ni/day

(Note: This Qmax, local for shredders is based on the existing information at the moment of the update. It will be reviewed when new information is available from the BREF for shredding)

**2.2 Control of workers exposure for contributing exposure scenario ES 35.1**

Raw material handling

<b>Workers related free short title</b>	Production of steel and alloys powder by atomisation
<b>Use descriptor covered</b>	PROC 8b: Transfer of substance or preparation from / to vessels/large containers
<b>Processes, tasks, activities covered</b>	Raw material handling including unloading, transferring, storage and furnace charge
<b>Assessment Method</b>	Exposure estimated using Tier 1 model and measured data

**Product characteristic**

Ni metal is used in the form of Ni briquettes, Ni plates, shots or ingots, steel or alloys solid or powder scrap, FeNi (ingots and granules)

**Amounts used**

Not relevant

**Frequency and duration of use/exposure**

8 hour shifts.

**Human factors not influenced by risk management**

Respiration volume under conditions of use	Not relevant
Room size and ventilation rate	Not relevant
Area of skin contact with the substance under conditions of use	480 cm <sup>2</sup>
Body weight	Not relevant

**Other given operational conditions affecting workers exposure**

Dermal: Workplace and work process shall be designed to minimize direct contact with materials

Inhalation: Workplace and process shall be designed to minimize powder release to air as well as worker exposure during preparation of charge

**Technical conditions and measures at process level (source) to prevent release**

None

**Technical conditions and measures to control dispersion from source towards the worker**

None

**Organisational measures to prevent /limit releases, dispersion and exposure**

None

<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>	
Use of gloves, protective eye wear, and helmets are required Use of RPE (FFP3, APF 20 masks approved with regard to EN 149:2001) is required for each transfer of scrap powder.	
<b>2.3 Control of workers exposure for contributing exposure scenario ES 35.2</b>	
Melting Operations	
<b>Workers related free short title</b>	Production of steel and alloys powder by atomisation
<b>Use descriptor covered</b>	PROC1: Use in closed process, no likelihood of exposure PROC 22: Potentially closed processing operations with minerals/metals at elevated temperature PROC 23: Open processing and transfer operations with minerals/metals at elevated temperature
<b>Processes, tasks, activities covered</b>	First processing includes melting in induction furnace either under neutral gas (fully closed) or in air and transfer of liquid metal to a transport ladle and tapping to a tundish,
<b>Assessment Method</b>	Exposure estimated using Tier 1 model
<b>Product characteristic</b>	
Ni metal is used in the form of liquid or molten steel or alloy when transferred to a transport ladle or tapped to the tundish.	
<b>Amounts used</b>	
Not relevant	
<b>Frequency and duration of use/exposure</b>	
8 hour shifts. Duration of task maximum 4 hours per shift.	
<b>Human factors not influenced by risk management</b>	
Respiration volume under conditions of use	Light to medium level work, 10 m <sup>3</sup> /d
Room size and ventilation rate	Not relevant
Area of skin contact with the substance under conditions of use	1980 cm <sup>2</sup>
Body weight	70 kg
<b>Other given operational conditions affecting workers exposure</b>	
Dermal: Workplace and work process shall be designed to minimize direct contact with materials Inhalation: Workplace and process shall be designed to minimize exposure.	
<b>Technical conditions and measures at process level (source) to prevent release</b>	
System may be fully enclosed or not depending upon the facility and level of automation. During charging the furnace is open While in use the furnace is an open or a closed system, depending on the design During tapping the system may be closed or open.	
<b>Technical conditions and measures to control dispersion from source towards the worker</b>	
General ventilation and LEV systems are required for melting, and when adding alloying elements	
<b>Organisational measures to prevent /limit releases, dispersion and exposure</b>	
None	
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>	
Use of RPE (FFP3, APF 20 mask approved with regard to EN 149:2001) is required for work on furnace including transfer of raw materials, and melting. Use of gloves, protective eye covering and helmet are required	
<b>2.4 Control of workers exposure for contributing exposure scenario ES 35.3</b>	
Atomisation Operations	
<b>Workers related free short title</b>	Production of steel and alloys powder by atomisation

<b>Use descriptor covered</b>	PROC1:Use in closed process, no likelihood of PROC 27a: Production of metal powders (hot processes)
<b>Processes, tasks, activities covered</b>	Atomisation of steel and alloy powder in a closed system
<b>Assessment Method</b>	Exposure estimated using Tier 1 model and measured data
<b>Product characteristic</b>	
Ni metal is used in the form of liquid or molten steel or alloy	
<b>Amounts used</b>	
Not relevant	
<b>Frequency and duration of use/exposure</b>	
8 hour shifts (max 4 hours/shift for this routine)	
<b>Human factors not influenced by risk management</b>	
Respiration volume under conditions of use	Not relevant
Room size and ventilation rate	Not relevant
Area of skin contact with the substance under conditions of use	1980 cm <sup>2</sup>
Body weight	Not relevant
<b>Other given operational conditions affecting workers exposure</b>	
Dermal: Workplace and work process shall be designed to minimize direct contact with materials	
Inhalation: Workplace and process shall be designed to minimize exposure.	
<b>Technical conditions and measures at process level (source) to prevent release</b>	
The gas atomisation system is a fully closed system.	
<b>Technical conditions and measures to control dispersion from source towards the worker</b>	
General ventilation and LEV are required	
<b>Organisational measures to prevent /limit releases, dispersion and exposure</b>	
None	
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>	
Use of RPE (FFP3, APF 20 mask approved with regard to EN 149:2001) is required for work on furnace including atomisation. Gloves, protective eye covering and helmet are required.	
<b>2.5 Control of workers exposure for contributing exposure scenario ES 35.4</b>	
Sieving and filling containers	
<b>Workers related free short title</b>	Production of steel and alloys powder by atomisation
<b>Use descriptor covered</b>	PROC 1: Use in closed process, no likelihood of exposure PROC 8b: Transfer of substance or preparation from/to vessels/large containers PROC 26: Handling of solid inorganic substances at ambient temperature
<b>Processes, tasks, activities covered</b>	Powder transfer (open or closed), sieving (open or closed), and filling container (open or closed)
<b>Assessment Method</b>	Exposure estimated using Tier 1 model and measured data
<b>Product characteristic</b>	
Ni metal is incorporated in a chemical matrix such as steel or alloy powder	
<b>Amounts used</b>	
Not relevant	
<b>Frequency and duration of use/exposure</b>	
8 hour shifts.	
<b>Human factors not influenced by risk management</b>	
Respiration volume under conditions of use	Not relevant
Room size and ventilation rate	Not relevant
Area of skin contact with the substance under conditions of use	1980 cm <sup>2</sup>
Body weight	Not relevant

<b>Other given operational conditions affecting workers exposure</b>	
Dermal: Workplace and work process shall be designed to minimize direct contact with materials Inhalation: Workplace and process shall be designed to minimize exposure.	
<b>Technical conditions and measures at process level (source) to prevent release</b>	
None	
<b>Technical conditions and measures to control dispersion from source towards the worker</b>	
General ventilation and LEV	
<b>Organisational measures to prevent /limit releases, dispersion and exposure</b>	
None	
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>	
Gloves and protective eye wear and half mask are required. Use of RPE (FFP3, APF 20 mask approved with regard to EN 149:2001) is required during open transfer and open filling of containers.	
<b>2.6 Control of workers exposure for contributing exposure scenario ES 35.5</b>	
Further processing : Cold Isostatic Pressing and Hot Isostatic Pressing	
<b>Workers related free short title</b>	Production of steel and alloys powder by atomisation
<b>Use descriptor covered</b>	PROC 1: Use in closed process, no likelihood of exposure
<b>Processes, tasks, activities covered</b>	Cold Isostatic Pressing and Hot Isostatic Pressing of steel and alloy powder contained in sealed containers
<b>Assessment Method</b>	Exposure estimated using Tier 1 model
<b>Product characteristic</b>	
Ni metal is incorporated in a chemical matrix such as steel or alloy powder	
<b>Amounts used</b>	
Not relevant	
<b>Frequency and duration of use/exposure</b>	
Duration of task maximum 4 hours per shift.	
<b>Human factors not influenced by risk management</b>	
Respiration volume under conditions of use	Light to medium level work, 10 m <sup>3</sup> /d
Room size and ventilation rate	Not relevant
Area of skin contact with the substance under conditions of use	1980 cm <sup>2</sup>
Body weight	70 kg
<b>Other given operational conditions affecting workers exposure</b>	
No exposure to alloy or steel powder is expected as the powder is in sealed (welded) containers.	
<b>Technical conditions and measures at process level (source) to prevent release</b>	
None	
<b>Technical conditions and measures to control dispersion from source towards the worker</b>	
None. This process is completely enclosed.	
<b>Organisational measures to prevent /limit releases, dispersion and exposure</b>	
None	
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>	
None	

2.7 Control of workers exposure for contributing exposure scenario ES 35.6							
Cleaning and maintenance							
<b>Workers related free short title</b>				Production of steel and alloys powder by atomisation			
<b>Use descriptor covered</b>				PROC 0 – cleaning and maintenance			
<b>Processes, tasks, activities covered</b>				Cleaning and maintenance			
<b>Assessment Method</b>				Exposure estimated using Tier 1 model and measured data			
<b>Product characteristic</b>							
Ni metal is in the form of dust incorporated in a chemical matrix such as steel or alloy powder							
<b>Amounts used</b>							
Not relevant							
<b>Frequency and duration of use/exposure</b>							
8 hour shifts, maximum 20days / month when changing the grade or 30 min every shift for current cleaning depending on the facility and type of maintenance to be carried out.							
<b>Human factors not influenced by risk management</b>							
Respiration volume under conditions of use				Not relevant			
Room size and ventilation rate				Not relevant			
Area of skin contact with the substance under conditions of use				960 cm <sup>2</sup>			
Body weight				Not relevant			
<b>Other given operational conditions affecting workers exposure</b>							
Dermal: Workplace and work process shall be designed to minimize direct contact with materials Inhalation: Workplace and process shall be designed to minimize exposure, such as use of water cleanings and vacuums cleaners to minimize dust.							
<b>Technical conditions and measures at process level (source) to prevent release</b>							
None							
<b>Technical conditions and measures to control dispersion from source towards the worker</b>							
None							
<b>Organisational measures to prevent /limit releases, dispersion and exposure</b>							
None							
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>							
Use of RPE (FFP3, APF 20 mask approved with regard to EN 149:2001), protective eye wear and gloves are required							
3. Exposure and risk estimation							
<b>Environment</b>							
ERC 3, 5 Production of steel and alloys powder by atomisation							
Compartment	Unit	PNEC	PEC <sub>Regional</sub>	C <sub>local</sub>	PEC	RCR	Methods for calculation of environmental concentrations
ES 1: Freshwater STP discharge							Measured values, Tier 3-RWC SPERC for Formulation of Ni alloys
Freshwater	µg Ni/L	7.1	2.9	0.97	3.87	0.55	
STP	mg Ni/L	0.33	-	-	0.014	0.04	
Sediment	mg Ni/kg	136	33.5	25.6	59.1	0.44	
Terrestrial	mg Ni/kg	29.9	16.2	0.42	16.62	0.56	
ES 2: Freshwater direct discharge							
Freshwater	µg Ni/L	7.1	2.9	0.73	3.63	0.51	
Sediment	mg Ni/kg	136	33.5	19.1	52.6	0.39	
Terrestrial	mg Ni/kg	29.9	16.2	0.01	16.21	0.54	

ES 3: Marine direct discharge						
Marine water	µg Ni/L	8.6	0.3	0.73	1.03	0.12
Sediment	mg Ni/kg	136	16.1	19.1	35.2	0.26
Terrestrial	mg Ni/kg	29.9	16.2	0.01	16.21	0.54

**Workers**

<b>ES 35.1</b>						
PROC 8b: Raw material handling						
	Unit	DNEL	Exposure concentration	RCR	Methods for calculation of exposure	
<b>Dermal</b>						
Acute systemic	mg/kg/day	-	NR			
Acute local	mg/cm <sup>2</sup> /day	-	NR			
Long-term systemic	mg/kg/day	-	NR			
Long-term local	mg/cm <sup>2</sup> /day	0.035	0.0003	0.008	Calculated using MEASE Tier 1 model for PROC 8b. Non-dispersive use with direct handling and only incidental exposure assumed. Use of properly designed and selected gloves is also assumed.	
<b>Inhalation</b>						
Acute local	mg/m <sup>3</sup>	4.0	42.93	10.73 excluding RPE  By use of RPE (APF 20): 0.53	10 x long-term exposure estimate for 'preparation of charge (gas)'. This allows for the extreme short term variability of exposure concentrations that is associated with handling powders in this process step	
Long-term systemic and local	mg/m <sup>3</sup>	0.05	4.293	85.86 excluding RPE  4.293 (APF=20)  2.14 (APF=40)  0.47 by use of LEV and RPE (APF=40)	Maximum Ni concentration from four personal samples available taken during 'preparation of charge (gas)'. The chosen value is measured over 136 minutes. FFP3 mask mandatory, gloves voluntary, no LEV	
<b>ES 35.2</b>						
PROC1, PROC 22, PROC 23: Melting Operations						
	Unit	DNEL	Exposure concentration	RCR	Methods for calculation of exposure	
<b>Dermal</b>						
Acute systemic	mg/kg/day	-	NR			



Acute local	mg/cm <sup>2</sup> /day	-	NR		
Long-term systemic	mg/kg/day	-	NR		
Long-term local	mg/cm <sup>2</sup> /day	0.035	0.0003	0.008	Calculated using MEASE Tier 1 model for PROC 22. Non-dispersive use with direct handling and only incidental exposure assumed. Use of properly designed and selected gloves is also assumed.
Inhalation					
Acute local	mg/m <sup>3</sup>	4.0	9.53	2.38 excluding RPE  By use of RPE (APF 20): 0.11	3 x long-term exposure estimate for "work on the furnace: transfer of raw material in the furnace, melting, atomization".
Long-term systemic and local	mg/m <sup>3</sup>	0.05	3.178	63.56 excluding RPE  3.18 APF=20  1.58 AFP=40	Maximum Ni concentration from four available personal samples taken during "work on the furnace: transfer of raw material in the furnace, melting, atomization". The chosen value is measured over 275 minutes. FFP3 mask mandatory, gloves voluntary, use of LEV
<b>ES 35.3</b>					
PROC1, PROC 27a: Atomisation Operations					
	Unit	DNEL	Exposure concentration	RCR	Methods for calculation of exposure
Dermal					
Acute systemic	mg/kg/day	-	NR		
Acute local	mg/cm <sup>2</sup> /day	-	NR		
Long-term systemic	mg/kg/day	-	NR		
Long-term local	mg/cm <sup>2</sup> /day	0.035	0.0003	0.008	Calculated using MEASE Tier 1 model for PROC 27a. Non-dispersive use with direct handling and only incidental exposure assumed. Use of properly designed and selected gloves is also assumed.
Inhalation					
Acute local	mg/m <sup>3</sup>	4.0	9.53	2.38 excluding	3 x long-term exposure estimate for "work on

				RPE By use of RPE (APF 20): 0.11	the furnace: transfer of raw material in the furnace, melting, atomization”.
Long-term systemic and local	mg/m <sup>3</sup>	0.05	3.178	63.56 excluding RPE 3.18 APF=20 1.58 APF=40	Maximum Ni concentration from four available personal samples taken during “work on the furnace: transfer of raw material in the furnace, melting, atomization”. The chosen value is measured over 275 minutes. FFP3 mask mandatory, gloves voluntary, use of LEV
<b>ES 35.4</b>					
PROC 1, PROC 8b, PROC 26: Sieving and filling containers					
	Unit	DNEL	Exposure concentration	RCR	Methods for calculation of exposure
Dermal					
Acute systemic	mg/kg/day	-	NR		
Acute local	mg/cm <sup>2</sup> /day	-	NR		
Long-term systemic	mg/kg/day	-	NR		
Long-term local	mg/cm <sup>2</sup> /day	0.035	0.0003	0.008	Calculated using MEASE Tier 1 model for PROC 26. Non-dispersive use with direct handling and only incidental exposure assumed. Use of properly designed and selected gloves is also assumed.
Inhalation					
Acute local	mg/m <sup>3</sup>	4.0	7.17 <sup>1</sup>	1.79 excluding RPE By use of RPE (APF 20): 0.09	10 x long-term exposure estimate for ‘transfer of powder to the hoppers, handling of powder (gas)’.
Long-term systemic and local	mg/m <sup>3</sup>	0.05	0.717	14.34 excluding RPE By use of RPE (APF 20): 0.72	Maximum Ni concentration from four available personal samples taken during ‘transfer of powder to the hoppers, handling of powder (gas)’. The chosen value is measured over 149 minutes. FFP3 mask

					mandatory, gloves voluntary, LEV
<b>ES 35.5</b>					
PROC1: Cold and hot isostatic pressing					
	Unit	DNEL	Exposure concentration	RCR	Methods for calculation of exposure
<b>Dermal</b>					
Acute systemic	mg/kg/day	-	NR		
Acute local	mg/cm <sup>2</sup> /day	-	NR		
Long-term systemic	mg/kg/day	-	NR		
Long-term local	mg/cm <sup>2</sup> /day	0.035	0.0003	0.008	Calculated using MEASE Tier 1 model for PROC 1. Non- dispersive use with direct handling and only incidental exposure assumed. No LEV or RPE is assumed for this process. No gloves assumed for this process.
<b>Inhalation</b>					
Acute local	mg/m <sup>3</sup>	4.0	0.002	<0.001	3 x long-term exposure estimate.
Long-term systemic and local	mg/m <sup>3</sup>	0.05	0.0006	0.012	Calculated using MEASE Tier 1 model for PROC 1. Non- dispersive use for 60- 240 minutes with only incidental exposure assumed. No LEV or RPE is assumed for this process.
<b>ES 35.6</b>					
PROC 0: Cleaning and maintenance					
	Unit	DNEL	Exposure concentration	RCR	Methods for calculation of exposure
<b>Dermal</b>					
Acute systemic	mg/kg/day	-	NR		
Acute local	mg/cm <sup>2</sup> /day	-	NR		
Long-term systemic	mg/kg/day	-	NR		
Long-term local	mg/cm <sup>2</sup> /day	0.035	0.0003	0.008	Calculated using MEASE Tier 1 model for PROC 10. Non- dispersive use with direct handling and only incidental exposure assumed. Use of properly designed and selected gloves mandatory.
<b>Inhalation</b>					
Acute local	mg/m <sup>3</sup>	4.0	6.522	1.63 excluding RPE	3 x long-term exposure estimate for 'maintenance &

				0.08 APF=20	reparation on the equipment'.
Long-term systemic and local	mg/m <sup>3</sup>	0.05	2.174	43.48 excluding RPE  2.17 APF=20  1.09 APF=40  0.24 by use of LEV	Maximum Ni concentration from four available personal samples taken during 'maintenance & reparation on the equipment'. The chosen value is measured over 120 minutes. FFP3 mask mandatory, gloves mandatory, no LEV
NR: Not Relevant					
<u>Acute local inhalation</u> DNEL based on respirable size aerosols. Equivalent inhalable fraction levels expected to be at least 3-fold higher					

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

##### Environment

Scaling tool: Metals EUSES IT tool (free download: <http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool>)

Scaling of the release to air and water environment includes:

Refining of the release factor to air and waste water and/or and the efficiency of the air filter and wastewater treatment facility.

Scaling of the PNEC for aquatic environment by using a tiered approach for correction for bioavailability and background concentration ( $C_{local}$  approach).

Scaling of the PNEC for soil compartment by using a tiered approach for correction for bioavailability and background concentration ( $C_{local}$  approach).

##### Workers

Scaling considering duration and frequency of use

Collect process monitoring data with an inhalable sampler. The simultaneous use of a respirable sampler is encouraged. Use aerosol particle size information, when available, to confirm the appropriate use of the inhalable DNEL of 0.05 mg Ni/m<sup>3</sup>. Respirable fraction exposure levels should be kept below 0.01 mg Ni/m<sup>3</sup>.

For further information and guidance on exposure scenarios, available tools, and scaling options, please visit the Nickel Consortia exposure scenario library at the following link: <http://www.nickelconsortia.eu/exposure-scenario-library.html>

### Man via Environment exposure and risk characterisation assessments for the use of nickel metal and nickel containing alloys for the production of steel and other alloys powder by atomization

Inhalation is the critical exposure pathway for humans via the environment. The PEC for air at site neighbouring residential areas should be lower than the chronic inhalation DNEL for the general public of 20 ng Ni/m<sup>3</sup> as annual average in PM<sub>10</sub> in order to demonstrate adequate control of risk (RCR < 1) for Man via the Environment (MvE).

Hereto a Generic safe use Exposure Scenario for MvE was developed based on the EUSES model. The MvE GES is defined as the product of tonnage (T) and emission factor to air (EF) being lower than 18000 g Ni/year. The value of 18000 g Ni/year is derived by using EUSES model to back-calculate the product of T and EF that results in a local air concentration ( $C_{local}$ ) of 15.5 ng Ni/m<sup>3</sup>. The value of 15.5 is derived from the difference between the DNEL of 20 ng Ni/m<sup>3</sup> and the EU regional background concentration ( $C_{regional}$ ) of 4.5 ng Ni/m<sup>3</sup> (P90 annual concentration for 2012).

**Generic safe use ES for all sectors according to Tier 1 (EUSES model)**

Sector	Tonnage (Ni T /year)	Emission factor (g Ni/T)	Tonnage × emission factor (g /year)	C <sub>local</sub> (ng/m <sup>3</sup> )	C <sub>regional</sub> (ng/m <sup>3</sup> )	PEC <sub>local</sub> (ng/m <sup>3</sup> )	RCR = PEC/DNEL (DNEL= 20 ng/m <sup>3</sup> )
All	T	EF	T × EF < 18000	<15.5	4.5*	<20	<1

\*: EU average of country P90 annual Ni concentrations (2012)

If a site is not compliant with these conditions, meaning that the product of tonnage and emission factor is above 18000 g Ni/year, a tiered approach including site-specific modelling can be applied to demonstrate safe use