

1. Title		Version 6, 2015
<b>GES 9 Stainless, special steels and special alloys manufacturing (S4A)</b>		
<b>Life cycle</b>	Formulation and article service life – DU of NiO	
<b>Free short title</b>	Stainless, special steels and special alloys manufacturing (S4A)	
<b>Systematic title based on use descriptor</b>	SU: Not relevant PC: PC 7- Base metals and alloys AC: AC 7 – Metal articles ERC: ERC 3: Formulation in materials ERC 10a: Wide dispersive outdoor use of long-life articles and materials with low release ERC 11a: Wide dispersive indoor use of long-life articles and materials with low release ERC 12a: Industrial processing of articles with abrasive techniques (low release) ERC 12b: Industrial processing of articles with abrasive techniques (high release) PROC: PROC 4: Use in a batch and other process where opportunity for exposure arises PROC 8b: Transfer of substance or preparation from/to vessels/large containers at dedicated facilities PROC 22: Potentially closed processing operations with minerals/metals at elevated temperature PROC 21: Low energy manipulation of substances bound in materials and/or articles PROC 23: Open processing and transfer operations with metals at elevated temperature PROC 24: High (mechanical) energy work-up of substance bound in materials PROC 25: Other hot work operations with metals PROC 0: Cleaning and maintenance	
<b>Processes, tasks, activities covered (environment)</b>	Stainless, special steels and special alloys manufacturing (S4A)	
<b>Processes, tasks, activities covered (workers)</b>	Contributing exposure scenario ES 9.1: PROC 8b: Raw material handling Contributing exposure scenario ES 9.2: PROC4, PROC 22, PROC 23: First processing Contributing exposure scenario ES 9.3: PROC 24: Further processing Contributing exposure scenario ES 9.4: PROC 24, PROC 25: Finishing Contributing exposure scenario ES 9.5: PROC 0: Cleaning and maintenance Contributing exposure scenario ES 9.6: PROC 21: Packaging, shipping and storage	
<b>2. Operational conditions and risk management measures</b>		
<b>2.1 Control of environmental exposure</b>		
<b>Environmental related free short title</b>	Stainless, special steels and special alloys manufacturing (S4A)	
<b>Systematic title based on use descriptor (environment)</b>	ERC 3: Formulation in materials ERC 10a: Wide dispersive outdoor use of long-life articles and materials with low release ERC 11a: Wide dispersive indoor use of long-life articles and materials with low release ERC 12a: Industrial processing of articles with abrasive techniques (low release) ERC 12b: Industrial processing of articles with abrasive techniques (high release)	
<b>Processes, tasks, activities covered (environment)</b>	Stainless, special steels and special alloys manufacturing (S4A)	
<b>Environmental Assessment Method</b>	Estimates based on monitoring local and regional concentrations are used	

	for calculation of PEC
<b>Product characteristics</b>	
Ni metal is used in the form of Ni briquettes, Ni plates, shots or ingots, part of steel or alloys scrap, FeNi (ingots and granules) and nickel sinter oxide.	
<b>Amounts used</b>	
<b>Maximum daily use at a site</b>	ES 1: 4.2 tonnes/day (median 50 <sup>th</sup> % emission days, 25 <sup>th</sup> % tonnage) ES 2: 38 tonnes/day (median 50 <sup>th</sup> % emission days, 50 <sup>th</sup> % tonnage) ES 3: 152 tonnes/day (median 50 <sup>th</sup> % emission days, 90 <sup>th</sup> % tonnage) ES 4: 152 tonnes/day (median 50 <sup>th</sup> % emission days, 90 <sup>th</sup> % tonnage)
<b>Maximum annual use at a site</b>	ES 1: 1520 tonnes (25 <sup>th</sup> %, 2007) ES 2: 14000 tonnes (50 <sup>th</sup> %, 2007) ES 3: 55300 tonnes (90 <sup>th</sup> %, 2007) ES 4: 55,300 tonnes (90 <sup>th</sup> %, 2007)
<b>Frequency and duration of use</b>	
<b>Pattern of release to the environment</b>	365 days per year per site (median 50 <sup>th</sup> %)
<b>Environment factors not influenced by risk management</b>	
<b>Receiving surface water flow rate</b>	ES 1: 18,000 m <sup>3</sup> /d (Effluent Site: 2000 m <sup>3</sup> /d) ES 2: 198,000 m <sup>3</sup> /d (Effluent Site: 2000 m <sup>3</sup> /d) ES 3: 1998,000 m <sup>3</sup> /d (Effluent Site: 2000 m <sup>3</sup> /d)
<b>Dilution capacity, freshwater</b>	ES 1: 10 (default) ES 2: 100 ES 3: 1000
<b>Dilution capacity, marine</b>	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>	
<b>Waste water:</b> On-site waste water treatment in a physico-chemical treatment plant by chemical precipitation, sedimentation, filtration, oiling removal or a combination of these methods. Release factor after on-site treatment to freshwater: ES 1: Release factor after on-site treatment: 13.80 g/T (90 <sup>th</sup> %, RAR dataset) ES 2: Release factor after on-site treatment: 13.80 g/T (90 <sup>th</sup> %, RAR dataset) ES 3: Release factor after on-site treatment: 13.80 g/T (90 <sup>th</sup> %, RAR dataset) ES 4: Release factor after on-site treatment to marine water: 7.25 g/T (75 <sup>th</sup> %, RAR dataset)	
<b>Air:</b> Treatment of stack air emission by fabric or bag filters, or wet scrubbers. (Efficiency min. 99%) Release factor after on-site treatment: 136.8 g/T (90 <sup>th</sup> %, RAR dataset)	
<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>	No
<b>Discharge rate of the Municipal STP</b>	Not relevant
<b>Incineration of the sludge of the Municipal STP</b>	Not relevant
<b>Conditions and measures related to external treatment of waste for disposal</b>	
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.	
<b>Fraction of daily/annual use expected in waste:</b>	
<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>	

**Appropriate waste codes:**

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\*, 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.

Q<sub>max</sub>, local(shredding)=26kg Ni/day

(Note: This Q<sub>max</sub>, 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 9.1**

Raw material handling

<b>Workers related free short title</b>	Stainless, special steels and special alloys manufacturing (S4A)
<b>Use descriptor covered</b>	PROC 8b: Transfer of substance or preparation from / to vessels/large containers at dedicated facilities
<b>Processes, tasks, activities covered</b>	Raw material handling including unloading, transferring, storage and furnace charge
<b>Assessment Method</b>	Estimation of exposure based on measured data.

**Product characteristic**

Ni metal is used in the form of Ni briquettes, Ni plates, shots or ingots, part of steel or alloys scrap and FeNi (ingots and granules) and nickel sinter oxide

**Amounts used**

Not relevant

**Frequency and duration of use/exposure**

8 hour shifts. Exposure occurs in the process area for one third of the working day (160 minutes). The remaining time is spent in control room or pressure ventilated cabins.

**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	Not relevant
Body weight	Not relevant

**Other given operational conditions affecting workers exposure**

Work is taken place outdoor.

Oral: Good workplace hygiene practice

**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

**Conditions and measures related to personal protection, hygiene and health evaluation**

Gloves are required for hand protection, coveralls and eye protection is required when handling dusty materials.

**2.3 Control of workers exposure for contributing exposure scenario ES 9.2**

First processing

<b>Workers related free short title</b>	Stainless, special steels and special alloys manufacturing (S4A)
<b>Use descriptor covered</b>	PROC 4: Use in a batch and other process where opportunity for exposure arises

	PROC 22: Potentially closed processing operations with metals at elevated temperature PROC 23: Open processing and transfer operations with metals at elevated temperature
<b>Processes, tasks, activities covered</b>	First processing including melting (EAF, VIM, BOF, induction furnace), decarburisation (AOD, VOD), secondary metallurgical processes ESR and VAR, and casting
<b>Assessment Method</b>	Estimation of exposure based on measured data and a Tier 1 model
<b>Product characteristic</b>	
Ni metal is used in the form of Ni briquettes, Ni plates, shots or ingots, part of steel or alloys scrap and FeNi (ingots and granules) and nickel sinter oxide. Ni metal is used in the form of molten metal charge when fed to the AOD, VOD, VIM, VAR or ESR and in the form of liquid or molten steel for casting.	
<b>Amounts used</b>	
Not relevant	
<b>Frequency and duration of use/exposure</b>	
8 hour shifts. Exposure occurs in the process area for one third of the working day (160 minutes). The remaining time is spent in control room or pressure ventilated cabins. Duration of task maximum 4 hours	
<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>	
Oral: Good workplace hygiene practice	
<b>Technical conditions and measures at process level (source) to prevent release</b>	
During charge and tapping the system is open, while in use the converters are considered as a closed system.	
<b>Technical conditions and measures to control dispersion from source towards the worker</b>	
General ventilation and LEV systems are required for steelmaking and casting and in dusty areas or when handling dusty materials. When adding alloying elements LEV system is 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>	
Gloves are required for hand protection, coveralls and eye protection is required when handling dusty materials. Steelmaking and casting: Gloves and coveralls suitable for handling hot metal are required. Eye/face protection against heat and splashing of hot metal is required.	
<b>2.4 Control of workers exposure for contributing exposure scenario ES 9.3</b>	
Further processing	
<b>Workers related free short title</b>	Stainless, special steels and special alloys manufacturing (S4A)
<b>Use descriptor covered</b>	PROC 24: High (mechanical) energy work-up of substance bound in materials
<b>Processes, tasks, activities covered</b>	Further processing including hot and cold rolling, forging, die-forging, grinding, and welding
<b>Assessment Method</b>	Estimation of exposure based on measured data and a Tier 1 model
<b>Product characteristic</b>	
After casting Ni metal is incorporated in a chemical matrix such as massive stainless steel	
<b>Amounts used</b>	
Not relevant	
<b>Frequency and duration of use/exposure</b>	
8 hour shifts. Exposure occurs in the process area for one third of the working day (160 minutes). The remaining time is spent in control room or pressure ventilated cabins. Duration of task maximum 4 hours	
<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>	
Oral: Good workplace hygiene practice	
<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 is required for hot and cold rolling.	
<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>	
Hot rolling: Gloves and coveralls suitable for handling hot surfaces are required. Eye/face protection is required against heat.	
Cold rolling: Gloves and overalls suitable for handling metal are required.	
<b>2.5 Control of workers exposure for contributing exposure scenario ES 9.4</b>	
Finishing	
<b>Workers related free short title</b>	Stainless, special steels and special alloys manufacturing (S4A)
<b>Use descriptor covered</b>	PROC24: High (mechanical) energy work-up of substance bound in materials PROC 25: Other hot operations with metals
<b>Processes, tasks, activities covered</b>	Finishing including annealing, pickling, grinding and welding
<b>Assessment Method</b>	Estimation of exposure based on measured data and a Tier 1 model
<b>Product characteristic</b>	
After casting and further processing Ni metal is incorporated in a chemical matrix such as massive stainless steel	
<b>Amounts used</b>	
Not relevant	
<b>Frequency and duration of use/exposure</b>	
8 hour shifts. Exposure occurs in the process area for one third of the working day (160 minutes). The remaining time is spent in control room or pressure ventilated cabins.	
Duration of task maximum 4 hours	
<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>	
Oral: Good workplace hygiene practice	
<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 is 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>	
Annealing and pickling: Gloves and overalls suitable for handling hot surfaces and pickling media are required. Eye/face protection against heat and pickling media is required.	
Welding and grinding: Eye/face protection when welding and grinding is required. For manual welding and grinding respiration protection – Air purifying full mask (for example APF 10) is required.	
<b>2.6 Control of workers exposure for contributing exposure scenario ES 9.5</b>	
Cleaning and maintenance	
<b>Workers related free short title</b>	Stainless, special steels and special alloys manufacturing (S4A)
<b>Use descriptor covered</b>	PROC 0 – cleaning and maintenance
<b>Processes, tasks, activities covered</b>	Cleaning and maintenance
<b>Assessment Method</b>	Estimation of exposure based on measured data
<b>Product characteristic</b>	
Ni metal is in the form of dust, pickling residues, incorporated in a chemical matrix such as massive stainless steel or in an	

article	
<b>Amounts used</b>	
Not relevant	
<b>Frequency and duration of use/exposure</b>	
8 hour shifts. Exposure occurs in the process area for one third of the working day (160 minutes). The remaining time is spent in control room or pressure ventilated cabins.	
<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	Not relevant
Body weight	Not relevant
<b>Other given operational conditions affecting workers exposure</b>	
Oral: Good workplace hygiene practice	
<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 system when applicable.	
<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 overalls suitable for handling metal should be worn when appropriate. Eye/face protection against dust and heat is required. Respiration protection, dust filter, half mask – P2 (APF=20) is required.	
<b>2.7 Control of workers exposure for contributing exposure scenario ES 9.6</b>	
Packing, shipping and storage	
<b>Workers related free short title</b>	Stainless, special steels and special alloys manufacturing (S4A)
<b>Use descriptor covered</b>	PROC 21 Low energy manipulation of substances bound in materials and/or articles
<b>Processes, tasks, activities covered</b>	Packing, shipping and storage
<b>Assessment Method</b>	Estimation of exposure based on a Tier 1 model
<b>Product characteristic</b>	
Ni metal is incorporated in a chemical matrix such as massive stainless steel or in an article. Composition maximum 38 % in stainless steel, >35% in nickel alloys, <20% in other nickel containing alloys	
<b>Amounts used</b>	
Not relevant	
<b>Frequency and duration of use/exposure</b>	
8 hour shifts. Exposure occurs in the process area for one third of the working day (160 minutes). The remaining time is spent in control room or pressure ventilated cabins. Duration of task maximum 4 hours	
<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 direct handling involved. Oral: Good workplace hygiene practice	
<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>	
Gloves and overalls suitable for handling metal are required.	
<b>3. Exposure and risk estimation</b>	
<b>Environment</b>	

ERC 3, ERC 10a, ERC 11a, ERC12a, ERC12b Stainless, special steels and special alloys manufacturing (S4A)							
Compartment	Unit	PNEC	PEC <sub>Regional</sub>	C <sub>local</sub>	PEC	RCR	Methods for calculation of environmental concentrations
ES 1: Freshwater direct discharge D10							Measured values, Tier 3-RWC
Freshwater	µg Ni/L	7.1	2.9	2.06	4.96	0.70	
Sediment	mg Ni/kg	136	33.5	54.2	87.7	0.65	
Terrestrial	mg Ni/kg	29.9	16.2	0.07	16.27	0.54	
ES 2: Freshwater direct discharge D100							
Freshwater	µg Ni/L	7.1	2.9	1.90	4.80	0.68	
Sediment	mg Ni/kg	136	33.5	49.9	83.4	0.61	
Terrestrial	mg Ni/kg	29.9	16.2	0.64	16.84	0.56	
ES 3: Freshwater direct discharge D1000							
Freshwater	µg Ni/L	7.1	2.9	0.75	3.65	0.51	
Sediment	mg Ni/kg	136	33.5	19.7	53.2	0.39	
Terrestrial	mg Ni/kg	29.9	16.2	2.52	18.72	0.63	
ES 4: Marine direct discharge							
Marine water	µg Ni/L	8.6	0.3	3.94	4.24	0.49	
Sediment	mg Ni/kg	136	16.1	103.6	119.7	0.88	
Terrestrial	mg Ni/kg	29.9	16.2	2.52	18.72	0.63	

### Workers

ES 9.1 PROC 8b: Raw material handling					
	Unit	DNEL	Exposure concentration	RCR	Methods for calculation of exposure
<b>Dermal</b>					
Acute systemic	mgNi/kg/day	-	NR		
Acute local	mgNi/cm <sup>2</sup> /day	-	NR		
<b>systemic</b>					
Long-term	mgNi/kg/day	-	NR		
Long-term local	mgNi/cm <sup>2</sup> /day	0.012	0.0001	0.008	75 <sup>th</sup> percentile for alloy handler and raw material inspector
<b>Inhalation</b>					
Acute local	mgNi/m <sup>3</sup>	3.9	0.018	0.004	3 x 90 <sup>th</sup> percentile long-term inhalation exposure
Long-term systemic and local	mgNi/m <sup>3</sup>	0.05	0.006	0.12	90 <sup>th</sup> percentile long-term inhalation exposure for raw material handling, personal samples (n=5), inhalable measurement
<b>ES 9.2 PROC 4, PROC 22, PROC 23: First Processing</b>					
	Unit	DNEL	Exposure concentration	RCR	Methods for calculation of exposure
<b>Dermal</b>					
Acute systemic	mgNi/kg/day	-	NR		
Acute local	mgNi/cm <sup>2</sup> /day	-	NR		
Long-term	mgNi/kg/day	-	NR		

systemic						
Long-term local	mgNi/cm <sup>2</sup> /day	0.012	0.00003	0.0025		Exposure estimated using a Tier 1 model for PROC 22 (concentration > 25%, non-dispersive use, non-direct handling, intermittent exposure for the maximum of 4 hours, and the use of properly designed gloves).
Inhalation						
Acute local	mgNi/m <sup>3</sup>	3.9	0.036	0.009		3 x 75 <sup>th</sup> percentile long-term exposure for steelmaking and casting
Long-term systemic and local	mgNi/m <sup>3</sup>	0.05	0.012	0.24		75 <sup>th</sup> percentile for steelmaking and casting, personal samples (n=194), inhalable measurement
<b>ES 9.3</b>						
PROC 24: Further processing						
	Unit	DNEL	Exposure concentration	RCR		Methods for calculation of exposure
Dermal						
Acute systemic	mgNi/kg/day	-	NR			
Acute local	mgNi/cm <sup>2</sup> /day	-	NR			
Long-term systemic	mgNi/kg/day	-	NR			
Long-term local	mgNi/cm <sup>2</sup> /day	0.012	0.00003	0.0025		Exposure estimated using a Tier 1 model for PROC 22 (concentration > 25%, non-dispersive use, non-direct handling, intermittent exposure for the maximum of 4 hours, and the use of properly designed gloves).
Inhalation						
Acute local	mgNi/m <sup>3</sup>	3.9	0.09	0.0225		3 x 75 <sup>th</sup> percentile long-term exposure for hot rolling
Long-term systemic and local	mgNi/m <sup>3</sup>	0.05	0.03	0.6		75 <sup>th</sup> percentile for hot rolling, personal samples (n=61), inhalable measurement
			0.009	0.18		75 <sup>th</sup> percentile for cold rolling, personal



					samples (n=14), inhalable measurement
<b>ES 9.4</b>					
PROC 13, PROC 24, PROC 25: Finishing					
	Unit	DNEL	Exposure concentration	RCR	Methods for calculation of exposure
<b>Dermal</b>					
Acute systemic	mgNi/kg/day	-	NR		
Acute local	mgNi/cm <sup>2</sup> /day	-	NR		
Long-term systemic	mgNi/kg/day	-	NR		
Long-term local	mgNi/cm <sup>2</sup> /day	0.012	0.00003	< 0.001	Exposure estimated using a Tier 1 model for PROC 25 (concentration > 25%, non-dispersive use, non-direct handling, intermittent exposure for the maximum of 4 hours, and the use of properly designed gloves).
<b>Inhalation</b>					
Acute local	mgNi/m <sup>3</sup>	3.9	0.114	0.029	3 x 75 <sup>th</sup> percentile long-term exposure for annealing, pickling, and welding
Long-term systemic and local	mgNi/m <sup>3</sup>	0.05	0.038	0.76	75 <sup>th</sup> percentile for annealing, pickling, and welding, personal samples (n=41), inhalable measurements
<b>ES 9.5</b>					
PROC 0: Cleaning and maintenance					
	Unit	DNEL	Exposure concentration	RCR	Methods for calculation of exposure
<b>Dermal</b>					
Acute systemic	mgNi/kg/day	-	NR		
Acute local	mgNi/cm <sup>2</sup> /day	-	NR		
Long-term systemic	mgNi/kg/day	-	NR		
Long-term local	mgNi/cm <sup>2</sup> /day	0.012	0.00035	0.029	75 <sup>th</sup> percentile for maintenance (short-term exposure)
<b>Inhalation</b>					
Acute local	mgNi/m <sup>3</sup>	3.9	0.34	0.087	3 x 75 <sup>th</sup> percentile for cleaning and maintenance (full shift)
Long-term systemic and local	mgNi/m <sup>3</sup>	0.05	0.115	2.3 excl. RPE By use of	75 <sup>th</sup> percentile for cleaning and maintenance,

				RPE (P2, APF 20): 0.115	personal samples (n=13), inhalable measurements
<b>ES 9.6</b>					
PROC 21: Packing, shipping and storage					
	Unit	DNE	Exposure concentration	RCR	Methods for calculation of exposure
Dermal					
Acute systemic	mgNi/kg/day	-	NR		
Acute local	mgNi/cm <sup>2</sup> /day	-	NR		
Long-term systemic	mgNi/kg/day	-	NR		
Long-term local	mgNi/cm <sup>2</sup> /day	0.012	0.0003	0.025	Exposure estimated using MEASE, a tier 1 model for PROC 21 for a massive object, >25% composition, and industrial use <240 min assumed. It is also assumed that properly designed gloves for direct handling and incidental exposure occurs.
Inhalation					
Acute local	mgNi/m <sup>3</sup>	3.9	0.09	0.023	Acute exposure assumed to be 3X long term calculated with MEASE
Long-term systemic and local	mgNi/m <sup>3</sup>	0.05	0.03	0.6	Exposure estimated using MEASE, a tier 1 model for PROC 21 for a massive object, >25% composition, and industrial use <240 min assumed. Exposure estimated using MEASE, a tier 1 model for PROC 21 for a massive object, >25% composition, and industrial use <240 min assumed.
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					
<b>4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES</b>					
<b>Environment</b>					
Scaling tool: Metals EUSES IT tool (free download: <a href="http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool">http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool</a> )					
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 stainless, special steel and special alloys manufacturing (S4A)**

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)	$C_{local}$ (ng/m <sup>3</sup> )	$C_{regional}$ (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