

1. Title		Version 6, 2015
GES 11 Production of Ni salts from Ni metal		
Life cycle	End use – DU of Ni metal	
Free short title	Production of Ni salts from Ni metal Production of Ni salts to be used in production of catalysts	
Systematic title based on use descriptor	SU: SU 3 Industrial use SU9 Manufacture of fine chemicals PC: PC 19 intermediates ERC: ERC 6a: Industrial use resulting in manufacture of another substance (use of intermediates) PROC: PROC 1: Use in closed process, no likelihood of exposure PROC 2: Use in closed, continuous process with occasional controlled exposure PROC 3: Use in closed batch process PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC 26: Handling of solid inorganic substances at ambient temperature PROC 0: Cleaning and maintenance	
Processes, tasks, activities covered (environment)	Production of Ni salts from Ni metal	
Processes, tasks, activities covered (workers)	Raw material handling including weighing, semi-bulk delivery (e.g. bags, drums), storage, transfer and conveying Acid dissolution of Ni metal Drying Packing Cleaning and maintenance	
2. Operational conditions and risk management measures		
2.1 Control of environmental exposure		
Environmental related free short title	Production of Ni salts from Ni metal	
Systematic title based on use descriptor (environment)	ERC 6a: Industrial use resulting in manufacture of another substance (use of intermediates)	
Processes, tasks, activities covered (environment)	Production of Ni salts from Ni metal	
Environmental Assessment Method	Estimates based on monitoring local and regional concentrations are used for calculation of PEC	
Product characteristics		
Ni powder, pellets, briquettes or larger pieces		
Amounts used		
Maximum daily use at a site	4.4 – 5.7 tonnes Ni	
Maximum annual use at a site	ES1: 1542 tonnes Ni ES2: 1984 tonnes Ni	
Frequency and duration of use		
Pattern of release to the environment	350 days per year per site	
Environment factors not influenced by risk management		
Receiving surface water flow rate	198,000 m3/d (Effluent Site: 2000 m3/d)	
Dilution capacity, freshwater	ES1: 100	
Dilution capacity, marine	ES2: 100	
Other given operational conditions affecting environmental exposure		
None		

Technical conditions and measures at process level (source) to prevent release	
None	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Waste water:	
On-site wastewater treatment by chemical precipitation, sedimentation, filtration, ion-exchange or a combination of methods	
ES 1 Freshwater direct discharge: Release factor after on-site treatment: 184.5 g/T	
ES 2 Marine direct discharge: Release factor after on-site treatment: 184.5 g/T	
Air:	
Treatment of stack air emission (fabric or bag filters/ ceramic filters/ wet scrubbers).	
ES1 & 2: Release factor after on-site treatment: 72.5 g/T (50 th %)	
Organizational measures to prevent/limit release from site	
None	
Conditions and measures related to municipal sewage treatment plant	
Municipal Sewage Treatment Plant (STP)	No
Discharge rate of the Municipal STP	Not relevant
Incineration of the sludge of the Municipal STP	Not relevant
Conditions and measures related to external treatment of waste for disposal	
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.	
Fraction of daily/annual use expected in waste:	
<ul style="list-style-type: none"> - Nickel producers = 0.05 % - DU: stainless steel and alloy steels = 0.6 % - DU: nickel alloys, copper alloys, foundry, batteries, catalysts, chemicals, dyes and others = 0.5 % - DU: Plating = 3% 	
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	
<ul style="list-style-type: none"> - 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 _{max, local} (shredding)=26kg Ni/day	
(Note: This Q _{max, 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	
Production of Ni salts from Ni metal	
Workers related free short title	Production of Ni salts from Ni metal
Use descriptor covered	PROC 1: Use in closed process, no likelihood of exposure

	PROC 2: Use in closed, continuous process with occasional controlled exposure PROC 3: Use in closed batch process PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC 26: Handling of solid inorganic substances at ambient temperature PROC 0: Cleaning and maintenance						
Processes, tasks, activities covered	Raw material handling including weighing semi-bulk delivery (e.g. bags, drums), storage, transfer and conveying Acid dissolution of Ni metal Drying Packing Cleaning and maintenance						
Assessment Method	Estimation of exposure based on measured data						
Product characteristic							
Ni supplied in metallic form: Ni powders, pellets, briquettes or larger pieces Ni salts							
Amounts used							
1-50 kg of Ni per activity or time							
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				Not relevant			
Body weight				Not relevant			
Other given operational conditions affecting workers exposure							
Use of vacuum cleaner with HEPA filter for cleaning operations where dry powders are involved and wetting is impractical Workers shall undertake a variety of tasks during the working day. Dermal: Design workplace and work processes to minimise direct contact with the materials. Oral: Good workplace hygiene practice							
Technical conditions and measures at process level (source) to prevent release							
Use of Ni powder as raw material requires that addition of Ni powder to the acid is enclosed and LEV is in place. The acid dissolution is required to take place in closed reaction vessels. Drying of salt shall take place in closed drying vessels. Packaging of dry product (Ni salt rather than Ni metal) shall be automated and enclosed with LEV							
Technical conditions and measures to control dispersion from source towards the worker							
LEV is required at processes involving Ni powders							
Organisational measures to prevent /limit releases, dispersion and exposure							
None							
Conditions and measures related to personal protection, hygiene and health evaluation							
Inhalation: RPE is required (e.g. P2, APF = 10). Maintain clean workplace to prevent accumulation of powders and dust on surfaces. Use of granules and pellets rather than Ni powders where technically possible. Dermal: Gloves and other appropriate protective clothing suitable for handling powders are required.							
3. Exposure and risk estimation							
Environment							
ERC 6a Production of Ni salts from Ni metal							
Compartment	Unit	PNEC	PEC _{Regional}	C _{local}	PEC	RCR	Methods for calculation of environmental concentrations

ES 1: Freshwater direct discharge						
Freshwater	µg Ni/L	7.1	2.9	2.91	5.81	0.82
Sediment	mg Ni/kg	136	33.5	76.7	110.2	0.81
Terrestrial	mg Ni/kg	29.9	16.2	0.04	16.24	0.54
ES 2: Marine direct discharge						
Marine water	µg Ni/L	8.6	0.3	3.75	4.05	0.47
Sediment	mg Ni/kg	136	16.1	98.6	114.7	0.84
Terrestrial	mg Ni/kg	29.9	16.2	0.05	16.25	0.54

Workers

Production of Ni salts from Ni metal					
	Unit	DNEL	Exposure concentration	RCR	Methods for calculation of exposure
Dermal					
Acute systemic	mg Ni/kg/day	-	NR		
Acute local	mg Ni/cm ² /day	-	NR		
Long-term systemic	mg Ni/kg/day	-	NR		
Long-term local	mg Ni/cm ² /day	0.035	0.009	0.257 ¹	Estimated 75 th percentile for dermal exposure to insoluble Ni

¹This process involves significant dermal exposure to soluble nickel compounds in addition to the reported insoluble nickel exposures. Gloves and other suitable protective clothing should be used where direct dermal contact with soluble Ni could occur.

Inhalation					
Acute local	mg Ni/m ³	4.0	1.0	0.25	10 x 75 th percentile of long-term average for powder handling. This allows for the extreme short term variability of exposure concentrations that is associated with handling powders.
Long-term systemic and local	mg Ni/m ³	0.05	0.1	2 excl. RPE By use of RPE (P2, APF 10): 0.2	Estimate of the 75 th percentile long-term mean exposure based on expert judgements from limited measurement data discussed in the EU RAR (2008-2009) and information on exposures to Ni associated with powder handling in other sectors. Assumes LEV

NR: Not Relevant

Acute local inhalation

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
<p>Environment</p> <p>Scaling tool: Metals EUSES IT tool (free download: http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool)</p> <p>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.</p> <p>Scaling of the PNEC for aquatic environment by using a tiered approach for correction for bioavailability and background concentration (C_{local} approach).</p> <p>Scaling of the PNEC for soil compartment by using a tiered approach for correction for bioavailability and background concentration (C_{local} approach).</p> <p>Workers</p> <p>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/m³. Respirable fraction exposure levels should be kept below 0.01 mg Ni/m³.</p> <p>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</p>

Man via Environment exposure and risk characterisation assessments for the production of nickel salts from nickel metal

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/m³ as annual average in PM₁₀ 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/m³. The value of 15.5 is derived from the difference between the DNEL of 20 ng Ni/m³ and the EU regional background concentration ($C_{regional}$) of 4.5 ng Ni/m³ (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 ³)	$C_{regional}$ (ng/m ³)	PEC _{local} (ng/m ³)	RCR = PEC/DNEL (DNEL= 20 ng/m ³)
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