

1. Title		Version 3, 2015
GES 37: Use of nickel metal in formulating surface treatment products		
Life cycle	Use of nickel metal in formulating surface treatment products	
Free short title	Formulating surface treatment products	
Systematic title based on use descriptor	<p>SU: Not relevant PC: PC 14: Metal surface treatment products, including galvanic and electroplating products</p> <p>ERC: ERC 2: Formulation of preparations SpERC :Formulation of metal compounds (paints and coatings) PROC: PROC 1 Use in closed process, no likelihood of exposure PROC 2 Use in closed, continuous process with occasional controlled exposure (e.g. sampling) PROC 3 Use in closed batch process (synthesis or formulation) PROC: 5 Mixing or blending in batch processes for formulation of preparations* and articles (multistage and/or significant contact) PROC 8a Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities 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: 15 Use as laboratory reagent PROC 20: Heat and pressure transfer fluids in dispersive, professional use but closed systems PROC 26: Hand-mixing with intimate contact and only PPE available PROC 0: Cleaning and maintenance</p>	
Processes, tasks, activities covered (environment)	Formulating surface treatment products	
Processes, tasks, activities covered (workers)	Mixing nickel powder with resin Resin sieving Packaging Ni-containing resin Cleaning & Maintenance	
2. Operational conditions and risk management measures		
Use of nickel metal in formulating surface treatment products		
Use of nickel metal in formulating surface treatment products	Use of nickel metal in formulating surface treatment products	
Systematic title based on use descriptor (environment)	ERC 2: Formulation of preparations SpERC :Formulation of metal compounds (paints and coatings)	
Processes, tasks, activities covered (environment)	Formulation of all kinds of nickel compounds	
Environmental Assessment Method	Estimates based on SpERC and regional concentrations are used for calculation of PEC	
Product characteristics		
Nickel metal powder		
Amounts used		
Maximum daily use at a site	ES 1 & 2: 0.17 tonnes (max) ES 3: 0.088 tonnes (min)	
Maximum annual use at a site	ES 1 & 2: 41 ton (75P) ES 3: 21 tonnes (50P)	
Frequency and duration of use		
Pattern of release to the environment	240 days per site	
Environment factors not influenced by risk management		

Receiving surface water flow rate	ES 1 Discharge to STP: 18,000 m ³ /d (Effluent STP: 2000 m ³ /d) ES 2 Direct discharge: 4975 m ³ /d (Effluent Site: 25 m ³ /d)
Dilution capacity, freshwater	ES 1: Discharge to STP: 10 ES 2: Direct discharge: 200
Dilution capacity, marine	ES 3: 100 (default)
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	
<p>Wastewater: On-site wastewater treatment by chemical precipitation, sedimentation, filtration, ion-exchange or a combination of methods and off-site wastewater treatment in municipal STP for ES 1 (Efficiency 40%) ES 1 Freshwater discharge to STP: Release factor after on-site treatment: 116 g/T ES 2 Freshwater direct discharge: Release factor after on-site treatment: 116 g/T ES 3 Marine direct discharge: Release factor after on-site treatment: 116 g/T</p> <p>Air: Treatment in exhaust system (fabric or bag filters, electrostatic precipitation, ceramic filters, wet, dry or semi-dry scrubbers) ES 1, 2 & 3: Release factor after on-site treatment: 50 g/T (SpERC)</p>	
Organizational measures to prevent/limit release from site	
None	
Conditions and measures related to municipal sewage treatment plant	
Municipal Sewage Treatment Plant (STP)	Yes
Discharge rate of the Municipal STP	2000 m ³ /d (default)
Incineration of the sludge of the Municipal STP	Sludge is applied to agricultural soil
Conditions and measures related to external treatment of waste for disposal	
<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>Fraction of daily/annual use expected in waste:</p> <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% <p>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*</p> <p>Suitable disposal: Keep separate and dispose of to either</p> <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	
<p>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.</p> <p>Q_{max, local(shredding)}=26kg Ni/day</p>	

(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 37.1

Use of nickel metal in formulating surface treatment products

Workers related free short title Powder mixing

Use descriptor covered
 PROC: 5 Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)
 PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
 PROC: 15 Use as laboratory reagent
 PROC 26: Hand-mixing with intimate contact and only PPE available

Processes, tasks, activities covered
 Removal of the container of Ni powder from storage, transferring container to the work station from where addition to the mixer takes place, opening the container and emptying the contents into the mixer, blending of resin and other ingredients with the Ni powder and returning the empty container to the store.

Assessment Method Estimation of dermal exposure using a Tier 1 model (MEASE)

Product characteristic

Nickel metal

Amounts used

Not relevant

Frequency and duration of use/exposure

The powder mixing process is continuous for up to 4 hours over every shift

Human factors not influenced by risk management

Respiration volume under conditions of use Not relevant

Room size and ventilation rate Not relevant

Not relevant Not relevant

Body weight Not relevant

Other given operational conditions affecting workers exposure

Mixing of the Ni powder and other ingredient in the mixer and conveying of powder and resin is enclosed and automated.

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

Opening of container and charging (tipping of the Ni powder from the containers into the dispensing bin and piping from the bin into the mixer) and emptying the mixer is automated and enclosed where possible.

The process needs to be ventilated where not fully enclosed in order to control inhalation exposure to Ni metal dust.

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

LEV is required to extract the dust from processes that are not fully enclosed and are likely to give rise to Ni metal particulate such as opening of containers of raw materials and charging and discharging of mixers to prepare the Ni-containing conductive resin

Organisational measures to prevent /limit releases, dispersion and exposure

Training to reinforce good practice and hygiene issues.

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

Inhalation: Powered respirators with mask or hood (TH1 EN12941:1998 & TM1, 12492:1998), full face mask (EN136) fitted with a P2 (EN143) filter, half mask respirator {FMP2 filter EN 1827 mask & P2 filter (EN 143:2000) 140 mask} or FFP2 respirator (EN 149:2001) is required at process steps that are not fully enclosed and are likely to give rise to Ni dust or fumes and where there is contamination with nickel-containing dust.

Dermal: Suitable gloves (EN 374, protection level 6, PVC or equivalent), goggles and special safety clothing are required. Other protective equipment should be chosen based on activities being undertaken, potential for exposure to airborne nickel-containing dust and other relevant workplace hazards may include protective suit with hood (conforming to EN13982-1 Type 5) and safety shoes (e.g. according to EN 20346).

2.3 Control of workers exposure for contributing exposure scenario 37.2

Use of nickel metal in formulating surface treatment products

Workers related free short title Screening

Use descriptor covered
 PROC 1 Use in closed process, no likelihood of exposure
 PROC 2 Use in closed, continuous process with occasional controlled exposure (e.g. sampling)
 PROC 3 Use in closed batch process (synthesis or formulation)
 PROC 20: Heat and pressure transfer fluids in dispersive, professional use but closed systems

Processes, tasks, activities covered	The Ni-containing conductive resin is passed through a 250µm sieve to remove any impurities.	
Assessment Method	Estimation of dermal exposure using a Tier 1 model (MEASE)	
Product characteristic		
Nickel metal		
Amounts used		
Not relevant		
Frequency and duration of use/exposure		
The Ni-containing conductive resin sieving process is continuous for 4 hours over every shift		
Human factors not influenced by risk management		
Respiration volume under conditions of use	Not relevant	
Room size and ventilation rate	Not relevant	
Not relevant	Not relevant	
Body weight	Not relevant	
Other given operational conditions affecting workers exposure		
Screen is enclosed and uses vacuum filtration.		
Technical conditions and measures at process level (source) to prevent release		
Screening is automated and enclosed where possible and is under vacuum to aid the filtering operation. The process needs to be ventilated where not fully enclosed in order to control inhalation exposure to Ni metal dust.		
Technical conditions and measures to control dispersion from source towards the worker		
LEV is required to extract the dust from processes that are not fully enclosed and are likely to give rise to Ni metal particulate such as releasing the form from the mould		
Organisational measures to prevent /limit releases, dispersion and exposure		
Training to reinforce good practice and hygiene issues.		
Conditions and measures related to personal protection, hygiene and health evaluation		
<p><u>Inhalation</u>: Appropriate suitable RPE such as powered respirators with mask or hood (EN12941:1998, TM3 or 12492:1998, TH3), FFP3 respirator (EN 149:2001) or FFP2 respirator (EN 149:2001) is required to deal with the airborne nickel-containing dust levels at process steps that are not fully enclosed and are likely to give rise to Ni dust or fumes and for emergencies and non-routine tasks where exposure to nickel-containing dust is possible.</p> <p><u>Dermal</u>: Suitable gloves (EN 374, protection level 6, PVC or equivalent), goggles and special safety clothing are required. Other protective equipment should be chosen based on activities being undertaken, potential for exposure to airborne nickel-containing dust and other relevant workplace hazards may include protective suit with hood (conforming to EN13982-1 Type 5) and safety shoes (e.g. according to EN 20346).</p>		
2.3 Control of workers exposure for contributing exposure scenario 37.3		
Use of nickel metal in formulating surface treatment products		
Workers related free short title	Packaging	
Use descriptor covered	PROC 22: Potentially closed processing operations with minerals/metals at elevated temperature	
Processes, tasks, activities covered	The Ni-containing conductive resin (coating products and resin components of 2-K epoxy adhesives) are packed into containers	
Assessment Method	Estimation of dermal exposure using a Tier 1 model (MEASE)	
Product characteristic		
Nickel metal		
Amounts used		
Not relevant		
Frequency and duration of use/exposure		
Packaging is continuous is continuous for up to 4 hours over every shift		
Human factors not influenced by risk management		
Respiration volume under conditions of use	Light to medium level work is routinely undertaken ~10 m³/d	
Room size and ventilation rate	Not relevant	
Not relevant	240 cm²	
Body weight	70 kg	
Other given operational conditions affecting workers exposure		
None		
Technical conditions and measures at process level (source) to prevent release		
Packaging is automated where possible. The process needs to be ventilated where not fully enclosed in order to control inhalation exposure to Ni metal dust.		
Technical conditions and measures to control dispersion from source towards the worker		

LEV is required to extract the dust for processes that are not fully enclosed and are likely to give rise to Ni metal particulate and automation is required to prevent dermal exposure to the Ni-containing resin.	
Organisational measures to prevent /limit releases, dispersion and exposure	
Training to reinforce good practice and hygiene issues.	
Conditions and measures related to personal protection, hygiene and health evaluation	
<u>Inhalation</u> : Appropriate suitable RPE such as powered respirators with mask or hood (EN12941:1998, TM3 or 12492:1998, TH3), FFP3 respirator (EN 149:2001) or FFP2 respirator (EN 149:2001) is required to deal with the airborne nickel-containing dust levels at process steps that are not fully enclosed and are likely to give rise to Ni dust or fumes and for emergencies and non-routine tasks where exposure to nickel-containing dust is possible.	
<u>Dermal</u> : Suitable gloves (EN 374, protection level 6, PVC or equivalent), goggles and special safety clothing are required. Other protective equipment should be chosen based on activities being undertaken, potential for exposure to airborne nickel-containing dust and other relevant workplace hazards may include protective suit with hood (conforming to EN13982-1 Type 5) and safety shoes (e.g. according to EN 20346).	
2.3 Control of workers exposure for contributing exposure scenario 37.4	
Use of nickel metal in formulating surface treatment products	
Workers related free short title	Use of nickel in powder metallurgy
Use descriptor covered	PROC: 0 Cleaning and maintenance
Processes, tasks, activities covered	Cleaning and maintenance of plant and premises
Assessment Method	Estimation of exposure using a Tier 1 model (MEASE)
Product characteristic	
Ni metal	
Amounts used	
Not relevant	
Frequency and duration of use/exposure	
Duration of exposure during cleaning and maintenance is considered to average 1 hour per day for formulating Ni surface treatment products.	
Human factors not influenced by risk management	
Respiration volume under conditions of use	Light to medium level work is routinely undertaken ~10 m ³ /d
Room size and ventilation rate	Not relevant
Area of skin contact with the substance under conditions of use	960 cm ²
Body weight	70 kg
Other given operational conditions affecting workers exposure	
None	
Technical conditions and measures at process level (source) to prevent release	
None	
Technical conditions and measures to control dispersion from source towards the worker	
Local (where appropriate) and general exhaust ventilation. Vacuuming or suitable wet removal methods for cleaning settled dust etc. from plant and premises. Avoid inappropriate cleaning methods such as dry brushing.	
Organisational measures to prevent /limit releases, dispersion and exposure	
Training to reinforce good practice and hygiene issues	
Conditions and measures related to personal protection, hygiene and health evaluation	
Inhalation to mists and particulates and skin exposure to mists, liquids splashes and particulates shall be controlled by RPE and gloves when undertaking maintenance and cleaning work.	
<u>Inhalation</u> : Use of air-assisted filtering visor, masks or hood with P3 filter element for plant or premises heavily contaminated with nickel-containing dust or spills {APF ~20 based on use of powered respirator meeting EN12492 requirement or FFP3 (EN149) or equivalent suitable respirator}. RPE with a lower APF of 10 {air-assisted filtering visor, masks or hood with P2 filter element including powered respirators meeting the EN12492 TM1 or EN 12941 TH1 requirement or the FFP2 (EN149) or equivalent suitable respirator} may be used for cleaning and maintenance work where the plant or premises is less heavily contaminated with nickel-containing dust or spills.	
<u>Dermal</u> : Use of suitable chemical gloves (EN 374, protection level 6, PVC or equivalent), goggles and special safety clothing is required to control dermal exposure, Protective equipment should be chosen based on activities being undertaken, potential for exposure to airborne nickel-containing dust and other relevant workplace hazards and may include protective suit with hood (conforming to EN13982-1 Type 5) and safety shoes (e.g. according to EN 20346).	
3. Exposure and risk estimation	
Environment	
ERC 2, SpERC Formulation of nickel compounds	

Compartment	Unit	PNEC	PEC _{Regional}	C _{local}	PEC	RCR	Methods for calculation of environmental concentrations
ES 1: Freshwater STP discharge							Measured values, Tier 3-RWC
Freshwater	µg Ni/L	7.1	2.9	0.47	3.37	0.47	
STP	mg Ni/L	0.33	-	-	0.007	0.02	
Sediment	mg Ni/kg	136	33.5	12.2	45.7	0.34	
Terrestrial	mg Ni/kg	29.9	16.2	0.20	16.40	0.55	
ES 2: Freshwater direct discharge							
Freshwater	µg Ni/L	7.1	2.9	3.10	6.00	0.85	
Sediment	mg Ni/kg	136	33.5	81.6	115.1	0.85	
Terrestrial	mg Ni/kg	29.9	16.2	< 0.01	16.20	0.54	
ES 3: Marine direct discharge							
Marine water	µg Ni/L	8.6	0.3	3.18	3.48	0.40	
Sediment	mg Ni/kg	136	16.1	83.6	99.7	0.73	
Terrestrial	mg Ni/kg	29.9	16.2	< 0.01	16.20	0.54	

Workers

ES 37.1 PROC 5, 8a: Powder mixing					
	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	0.00003	0.0008	90 th percentile exposure estimate modelled using MEASE for PROCS 5 & 8b {Ni content >25%, non-dispersive use, non-direct handling, incidental exposure, duration 4 hours, RPE, gloves}
Inhalation					
Acute local	mg Ni/m ³	4	1.17	0.3	3 x long-term exposure estimate
Long-term systemic and local	mg Ni/m ³	0.05	0.39 0.039	7.8 excluding RPE 0.78 By use of RPE (APF 10)	90 th percentile exposure estimate modelled using MEASE for PROCS 5 & 8b {Ni content >25%, non-dispersive use, non-direct handling, incidental exposure, duration 4 hours, RPE, gloves}
ES 37.2 PROC 1, 2, 3: Screening					
	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	mg	0.035	0.00003	0.0008	90 th percentile exposure estimate modelled

local	Ni/cm ² /day				using MEASE for PROC 2 {Ni content >25%, non-dispersive use, non-direct handling, intermittent exposure, duration 4 hours, gloves}
Inhalation					
Acute local	mg Ni/m ³	4	0.024	0.006	3 x long-term exposure estimate
Long-term systemic and local	mg Ni/m ³	0.05	0.008	0.16	90 th percentile exposure estimate modelled using MEASE for PROC 2 {Ni content >25%, non-dispersive use, non-direct handling, intermittent exposure, duration 4 hours, gloves}
ES 37.3 PROC 8a, 8b, 9: Packaging					
	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	0.00003	0.0008	90 th percentile exposure estimate modelled using MEASE for PROC 8b & 9 {Ni content >25%, non-dispersive use, non-direct handling intermittent exposure, duration 4 hours, gloves}
Inhalation					
Acute local	mg Ni/m ³	4	0.117	0.03	3 x long-term exposure estimate
Long-term systemic and local	mg Ni/m ³	0.05	0.039	0.78	90 th percentile exposure estimate modelled using MEASE for PROC 8b & 9 {Ni content >25%, non-dispersive use, non-direct handling intermittent exposure, duration 4 hours, gloves}
ES 37.4 PROC 0 & 5: Cleaning and maintenance of plant, solutions and premises					
	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	0.00001	0.0003	90 th percentile exposure estimate using MEASE for PROC 10 { non-dispersive use, non-direct handling incidental exposure, duration 1 hour, general ventilation, RPE, gloves}
Inhalation					
Acute local	mg Ni/m ³	4	1.71	0.43	3 x long-term inhalable modelled estimate
Long-term systemic and	mg Ni/m ³	0.05	0.57	11.4 (excluding	90 th percentile exposure estimate using MEASE for PROC 10 { non-dispersive use,

local			0.0285	RPE) 0.57 By use of RPE (APF 10) By use of RPE (APF = 20) 0.34	non-direct handling, incidental exposure, duration 1 hour, general ventilation, RPE, gloves}
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 evaluate whether a site 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 ³ (e.g., ≤10% of nickel mass in respirable fraction). Respirable fraction exposure levels should be kept below 0.01 mg Ni/m ³ .					
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 formulation of surface treatment products

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