

1. Title		Version 6, 2015
GES 14: Use of pre-reduced Ni-containing catalysts		
Life cycle	Use at industrial sites of Ni metal	
Free short title	Industrial use of powdered and shaped Ni-containing catalysts	
Systematic title based on use descriptor	<p>SU: SU 3 Industrial uses: uses of substances as such or in mixtures at industrial sites SU 8 Manufacture of bulk, large scale chemicals (including petroleum products) SU 9 Manufacture of fine chemicals</p> <p>PC: PC19 Intermediate PC20 Products such as pH-regulators, flocculants, precipitants, neutralizing agents PC 21 Laboratory chemicals PC 0: Other , UCN P15500- Catalysts</p> <p>ERC: ERC 4Industrial use of processing aids in processes and products, not becoming part of articles ERC 6a Industrial use resulting in manufacture of another substance (use of intermediates) ERC 6b Industrial use of reactive processing aids</p> <p>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 (synthesis or formulation) PROC 4 Use in batch and other process (synthesis) where opportunity for exposure arises PROC 8a Transfer of substance or mixture (charging/ discharging) from/to vessels/large containers at non-dedicated facilities PROC 8b Transfer of substance or mixture (charging/ discharging) from/to vessels/large containers at dedicated facilities</p>	
Processes, tasks, activities covered (environment)	Industrial use of powdered and shaped Ni-containing catalysts: Loading of reactor (transfer from big bags/drums/containers), use in closed reactor, unloading of reactor (transfer into drums /containers), cleaning and maintenance.	
Processes, tasks, activities covered (workers)	Contributing exposure scenario ES 14.1: Industrial use of powdered catalysts Contributing exposure scenario ES 14.2: Industrial use of shaped catalysts (extrudates, pellets, tablets, spheres, encapsulated powders)	
2. Operational conditions and risk management measures		
2.1 Control of environmental exposure		
Environmental related free short title	Industrial use of powdered and shaped Ni-containing catalysts	
Systematic title based on use descriptor (environment)	ERC 4Industrial use of processing aids in processes and products, not becoming part of articles ERC 6a Industrial use resulting in manufacture of another substance (use of intermediates) ERC 6b Industrial use of reactive processing aids	
Processes, tasks, activities covered (environment)	Industrial use of powdered and shaped Ni-containing catalysts: Loading of reactor (transfer from big bags/drums/containers), use in closed reactor, unloading of reactor (transfer into drums /containers), cleaning and maintenance.	
Environmental Assessment Method	Not relevant	
Product characteristics		
Powdered and shaped catalysts with Ni concentration ranging between 1 and 95 wt%.		

Amounts used	
Maximum daily use at a site	43 tonnes (expressed as Ni) based on loading/unloading of 300 tonnes catalyst with a Ni content of 40% during one week, twice a year
Maximum annual use at a site	Powdered catalyst: 0.5 - 75 tonnes Ni/year (1 - 150 tonnes catalyst/year) Shaped catalyst : 1.5 - 200 tonnes Ni/year (5 - 600 tonnes catalyst/year)
Frequency and duration of use	
Pattern of release to the environment	No appreciable release to the environment
Environment factors not influenced by risk management	
Receiving surface water flow rate	Not relevant
Dilution capacity, freshwater	Not relevant
Dilution capacity, marine	Not relevant
Other given operational conditions affecting environmental exposure	
None	
Technical conditions and measures at process level (source) to prevent release	
Ni-containing catalyst is practically entirely contained within reaction vessels and associated pipework. Transfer of catalyst between reactor and containers during loading and unloading are enclosed and may occur outdoors. Delivery of catalyst frequently occurs in big bags, drums or flow bins; big bags are equipped with dumping spouts that can be connected to a loading tube. Transfer also refers to tank cars or railroad cars, <i>i.e.</i> big containers that can be tightly connected to the reactor.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Transfer of catalyst to reactor: semi-automated: catalyst transferred into hoppers and connected to loading tubes, or enclosed transfer from container to reactor. Production equipment is not ventilated. The catalyst is installed in a reactor that is completely closed with no ventilation. Water should not be used except in a closed cycle/system.	
Organizational measures to prevent/limit release from site	
Regular operator training.	
Conditions and measures related to municipal sewage treatment plant	
Municipal Sewage Treatment Plant (STP)	Not relevant
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:	
10 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 for contributing exposure scenario ES 14.1	
Industrial use of powdered catalysts	
Workers related free short title	Use of pre-reduced Ni-containing powdered catalysts
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 (synthesis or formulation) PROC 4 Use in batch and other process (synthesis) where opportunity for exposure arises PROC 8a Transfer of substance or mixture (charging/ discharging) from/to vessels/large containers at non-dedicated facilities PROC 8b Transfer of substance or mixture (charging/ discharging) from/to vessels/large containers at dedicated facilities
Processes, tasks, activities covered	Charging and discharging of catalyst powder including piped transfer of catalyst from supply tank and return of spent catalyst to tank.
Assessment Method	Estimation of exposure based on measured data Estimation of dermal exposure based on Tier 1 model.
Product characteristic	
Ni-containing powder with nickel concentration 1 – 95 %.	
As dry powder or as suspension in an inert liquid (e.g. water, alcohols, hydrocarbons).	
Amounts used	
0.5 - 75 tonnes Ni/year (1 - 150 tonnes catalyst/year)	
Frequency and duration of use/exposure	
8 – 11 hours/shift (37.5 hours/week)	
Loading and unloading operations for plant operators shall be no more than 5% of shifts.	
Special loading companies have up to full shift exposures. The exposure assessment is based on full shift data.	
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 ² (based on MEASE model. Considered a conservative estimate for this scenario)
Body weight	Not relevant
Other given operational conditions affecting workers exposure	
High level of workplace cleanliness and prevention of dust or powder accumulation on surfaces, including floors. Use of water or vacuum cleaner fitted with a HEPA filter to remove dusts and powders during cleaning.	
Oral: Good workplace hygiene practice	
The ES 14.1 excludes the handling of powdered catalyst materials in open workspace.	
Technical conditions and measures at process level (source) to prevent release	
Charging and discharging of catalyst powder takes place in a semi automated methods whereby the catalyst is transferred into hoppers and lifted up to the top of the reactor and transferred from the hopper to the reactor by manual assistance/control or enclosed transfer from container to reactor.	
During use Ni-containing catalyst powder is required to be entirely contained within reaction vessels and associated pipework.	
Technical conditions and measures to control dispersion from source towards the worker	
None	
Organisational measures to prevent /limit releases, dispersion and exposure	
Regular training in work hygiene practices and proper use of PPE.	
Conditions and measures related to personal protection, hygiene and health evaluation	

Inhalation: Use of RPE (Particle filter with high efficiency for solid and liquid particles (e.g. EN 143 or 149, Type P3 or FFPE)) is required during loading and unloading of reactor and for cleaning and maintenance operations and where exposure to Ni containing dust or powder is possible. Use of air fed RPE is required if entry to the reactor is required

Dermal: Use of protective suit conforming to EN13982-1 Type 5 and suitable chemical resistant safety gloves (EN 374) capable of providing protection during prolonged, direct contact (Recommended: Protective index 6, corresponding > 480 minutes of permeation time according to EN 374); E.g. nitrile rubber (0.4 mm), chloroprene rubber (0.5 mm), butyl rubber (0.7 mm) or other gloves meeting the required performance specifications is required during loading and unloading of reactor, during cleaning and maintenance and during any other operations where dermal contact is possible.

Other protective equipment: Should be chosen based on activities being undertaken, potential for exposure to airborne Ni and other relevant workplace hazards may include protective suit (with hood), safety shoes (e.g. according to EN 20346)

2.3 Control of workers exposure for contributing exposure scenario ES 14.2

Industrial use of shaped catalysts (extrudates, pellets, tablets, spheres, encapsulated powders)

Workers related free short title	Use of pre-reduced Ni-containing shaped catalysts
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 (synthesis or formulation) PROC 4 Use in batch and other process (synthesis) where opportunity for exposure arises PROC 8a Transfer of substance or mixture (charging/ discharging) from/to vessels/large containers at non-dedicated facilities PROC 8b Transfer of substance or mixture (charging/ discharging) from/to vessels/large containers at dedicated facilities
Processes, tasks, activities covered	Loading of reactor (transfer from big bags/drums/containers), use in closed reactor, unloading of reactor (transfer into drums /containers), cleaning and maintenance.
Assessment Method	Estimation of exposure based on measured data. Estimation of dermal exposure based on Tier 1 model.

Product characteristic

Ni-containing shaped catalyst. Nickel concentration 1 – 65 wt%.

Amounts used

1.5 - 200 tonnes Ni/year (5 - 600 tonnes catalyst/year)

Frequency and duration of use/exposure

Loading/unloading frequency: During 1 week once every 6 months or less frequently.

Cleaning frequency: From twice a year to once in 8 years.

8 – 11 hours/shift (37.5 hours/week)

Loading and unloading operations for plant operators shall be no more than 5% of shifts.

Special loading companies have up to full shift exposures. The exposure assessment is based on full shift data.

For encapsulated powders loading/unloading may occur 10-20 times per day.

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 ² (based on MEASE model. Considered a conservative estimate for this scenario)
Body weight	Not relevant

Other given operational conditions affecting workers exposure

Batch loading and unloading.

Cleaning is normally undertaken by vacuuming fitted with a HEPA filter with control measures in place to prevent the release of dust into workplace air.

Oral: Good workplace hygiene practice

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

Loading: Enclosed transfer systems are used to prevent the release of dust into workplace air or semi-automated operations are used for outdoor transfer.

Use: A closed reactor is required.

Unloading: Enclosed transfer from reactor to container or operation may occur outdoors.

For encapsulated powders charging and discharging of catalyst droplets is entirely enclosed, including piped transfer of catalyst from supply tank and return of spent catalyst embedded in organic matrix to tank.

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

None

Organisational measures to prevent /limit releases, dispersion and exposure

Regular operator training.

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

Inhalation: Use of RPE (Particle filter with high efficiency for solid and liquid particles (e.g. EN 143 or 149, Type P3 or FFPE)) is required during loading and unloading of reactor and for cleaning and maintenance operations where exposure to Ni containing dust or powder is possible; use of air fed RPE is required, if entry to the reactor is required

Dermal: Use of protective suit conforming to EN13982-1 Type 5 and suitable chemical resistant safety gloves (EN 374) capable of providing protection during prolonged, direct contact (Recommended: Protective index 6, corresponding > 480 minutes of permeation time according to EN 374); E.g. nitrile rubber (0.4 mm), chloroprene rubber (0.5 mm), butyl rubber (0.7 mm) or other gloves meeting the required performance specifications is required during loading and unloading of reactor, during cleaning and maintenance and during any other operations where dermal contact is possible.

Other protective equipment: Should be chosen based on activities being undertaken, potential for exposure to airborne Ni and other relevant workplace hazards may include protective suit (with hood), safety shoes (e.g. according to EN 20346)

3. Exposure and risk estimation

Environment

ERC 4 , 6A and 6B Industrial use of powdered and shaped Ni-containing catalysts							
Compartment	Unit	PNEC	PEC _{Regional}	C _{local}	PEC	RCR	Methods for calculation of environmental concentrations
Freshwater	µg Ni/l	3.55	2.9	-	-	-	No emissions to water
Marine	µg Ni/l	8.6	0.3	-	-	-	No emissions to water
Terrestrial	mg Ni/kg	29.9	16.2	-	-	-	No emissions to air
STP	mg Ni/kg	0.33	-	-	-	-	No emissions to water

Workers

ES 14.1 Industrial use of powdered catalysts					
	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	0.07	0.0005	0.007	90 th percentile from MEASE modelling (PROC 8b, automated, contained transfer operations, gloves) for handling raw material and product.
Inhalation					
Acute local	mg Ni /m ³	4	0.04	0.01	4 x 75 th percentile for filling operations in nickel metal and NiO powdered

					catalyst production. Assumes processes are enclosed and effective LEV is in place. A factor of 4 was used to account for presumed higher acute exposure to powders.
Long-term systemic and local	mg Ni /m ³	0.05	0.01	0.2	Calculated 75 th percentile for filling operations (full shift) in nickel metal and NiO powdered catalyst production. Assumes processes are enclosed and effective LEV is in place.
ES 14.2					
Industrial use of shaped catalysts (extrudates, pellets, tablets, spheres, encapsulated powders)					
	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	0.07	0.0005	0.007	90 th percentile from MEASE modelling (PROC 8b, automated, contained transfer operations, gloves) for handling raw material and product.
Inhalation					
Acute local	mg Ni /m ³	4	0.06	0.015	3 x calculated 75 th percentile for filling operations in nickel metal and NiO shaped catalyst production.; assumes processes are enclosed and effective LEV is in place
Long-term systemic and local	mg Ni /m ³	0.05	0.02	0.4	Calculated 75 th percentile for filling operations (full shift) in nickel metal and NiO shaped catalyst production. Assumes processes are enclosed and effective LEV is in place

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 ³ . 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 use of pre-reduced ni-containing catalysts

Not relevant (no environmental emissions)