ES FOR COMMUNICATION

Substance Name: NICKEL OXIDE (Update 2021)
EC Number: 215-215-7
CAS Number: 1313-99-1
Registration Number:
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0. General provisions related to conditions of use and guidance to downstream users

All provisions given in this section apply to each exposure scenario (ES) contained in this document. They are to be supplemented or exchanged for more specific measures as indicated in the individual ES.

0.1. Good occupational hygiene practice

Good occupational hygiene practices are essential to ensure safe handling of the substance. Inhalation (e.g., dust should not be blown off with compressed air) and ingestion must be avoided (e.g., no eating and smoking in the workplace, regular cleaning with suitable cleaning devices). Contaminated clothing should not be taken home. Good general ventilation in the workplace must ensure an adequate supply of fresh air. Regular training in workplace hygiene practice and proper use of personal protective equipment (if relevant) is indispensable.

0.2. General provisions related to personal protective equipment for workers

Use of personal protective equipment (PPE) for each of the exposure routes listed below is required as described here unless exposure to the substance can be excluded for the respective route(s) of exposure. Exposure exclusions may be determined by, for example:

(i) the physical appearance of the substance in the specific type of application (e.g., wetting the substance can effectively prevent from the emission of dust),
(ii) the emission potential resulting from the nature of the process (e.g., splashes, emission of dust can be excluded in a closed process),
(iii) exposure prevention measures in place (segregation of the emission source or separation of the worker from the emission source), and
(iv) the amount of handled/emitted material during use in relation to the room size (i.e., dilution factor), taking into consideration prevailing air exchange rates during use.

If PPE needs to be used, further information is provided in the applicable exposure scenarios, in the subsections of this document and in Section 8 of the SDS.

0.2.1. Dermal route (skin protection)

Skin protective equipment should be selected in consideration of mechanical (acc. to EN 388, mechanical risks), cold or heat stress (acc. to EN 407, thermal risks) or any other physico-chemical hazards as relevant for the conducted tasks and working environment in addition to the effectiveness of the equipment to control exposure. Certified safety clothing including coveralls and safety shoes must be worn. The following requirements for gloves are to be met:

- Due to the classification of the substance, gloves and skin protective clothing must be worn for precautionary reasons unless dermal exposure can be excluded (please see above).
- If gloves are to be worn, either due to these general provisions or due to specific requirements set in the ES, they must comply with EN 374.
- Any prescribed gloves must be changed according to manufacturer’s information or when damaged, whatever is the earlier.

0.2.2. Inhalation route (respiratory protection)

Occasionally, specific information on the required assigned protection factor (APF) is provided in the occupational exposure scenarios. Respiratory protective equipment (RPE) should be selected based on the given APF according to EN 529 and should comply with national legislation. The following requirements for RPE are to be met in any case:

- Due to the classification of the substance, RPE must be worn for precautionary reasons unless inhalation exposure can be excluded (please see above).

- If RPE must be worn, either due to these general provisions or due to specific requirements set in the ES, an APF of 10 represents the required minimum level of protection.

If RPE is to be worn, the following should all be considered:

i) the additional physiological stress for the worker due to the increased breathing resistance,
ii) the mass of the RPE itself,
iii) the increased temperature by enclosing the head, and
iv) that the worker's capability of using tools and communicating are reduced whilst wearing RPE.

For the above-indicated reasons, the worker should therefore:

(i) be healthy (especially regarding medical problems that may affect the use of RPE), and
(ii) have facial characteristics that ensure no leakages between face and mask (e.g., leakage risk from facial hair or scar tissue).

The devices recommended in the ES which rely on a tight face seal will not provide the required protection unless they fit the contours of the face properly and securely. The employer and self-employed persons have legal responsibilities for the supply and maintenance of respiratory protective devices, and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device programme, including worker training.

0.2.3. Eye/face protection

Eye/face protective equipment is to be selected in consideration of local effects caused by the substance, mechanical, cold or heat stress or any other physico-chemical hazards as relevant for the conducted tasks and working environment in addition to the effectiveness of the equipment to control exposure. The following requirements for eye/face protective equipment are to be met:

- Avoid direct contact of the eyes with the substance.
- Suitable eye protection equipment (e.g., goggles or visors) must be worn.
- Face protection must be worn unless such protection is provided by any eye protection (e.g., face covering visor) and/or RPE used.

0.3. Generic guidance to DU to evaluate whether he works inside the boundaries set by the ES

For the exposure scenarios (ES) in this document, the Downstream User (DU) works within the boundaries set by the ES if the given operational conditions (OCs) and risk management measures (RMMs) as described in the ES are met. If the DU's conditions are not explicitly included in the generic conditions described in the ES, the DU must ensure that his specific OCs and implemented RMMs are compliant. If the concentration of the substance in mixture is not explicitly stated in the ES this does not represent a restriction (i.e., up to 100 % of the substance could be used). Depending on the basis for the exposure assessment conducted for the ES, the assessment needs to be done in multiple ways as described individually for environmental and occupational ES below.

0.3.1. Occupational exposure scenarios

The occupational exposure assessment may be either based on monitoring data (including analogous or published data) or based on exposure assessment models. Depending on which method has been used for exposure assessment, different ways for compliance checking are to be followed as given below.

0.3.1.1. Monitoring data used as basis for assessment

If the exposure assessment in the ES is based on monitoring data, the same approach can be used by DUs for compliance checking. Please note that 6 measurements per workplace are required for an exposure assessment as a minimum. Depending on the variability of the data sets (expressed as the geometric standard deviation) and the level of the resulting risk characterisation ratio, additional measurements may be required. Only measurements of personal exposure to the inhalable fraction of airborne dust (according to EN 481) should be used. The exposure data shall either be applicable to

the length of a specific task to be assessed or to a full-shift (i.e., sampled over a duration of at least 120 min) if the task to be assessed is conducted for a significant portion of the work shift. From the exposure data set, the maximum likelihood estimate of the upper 90 % confidence limit for the 75th percentile of the exposure distribution is to be used as a reasonable worst case estimate for comparison with the reported exposure level in the associated contributing ES. Respiratory protective equipment (RPE) may be taken into account by applying the assigned protection factor as given in EN 529:2005.

0.3.1.1.1. Specific considerations for efficiency values for Risk Management Measures (RMMs) prescribed in occupational exposure scenarios

If your monitored exposure levels are following those reported for the ES after consideration of any PPE worn, the efficiency of the RMMs implemented at your facility can be considered compliant with the ES.

0.3.1.1.2. Deviations from the conditions of use if monitoring data were used for exposure assessment

Any deviations from the given conditions of use mean you need to either:

(i) inform the supplier of the eSDS about these deviations and request the ES be reviewed to include the identified deviations or
(ii) prepare your own DU CSR (according to Article 37(4)), which must be notified to ECHA and also be kept at your company as in-house documentation.

0.3.1.2. Use of exposure models

If the exposure assessment in the ES is based on modelled data, the same model can be used to justify specific slight deviations from the generic conditions described in the ES.

All parameters needed to run the exposure estimation tools, i.e., either MEASE (version 1.02.01; available on www.ebrc.de/mease.html) or ART (version 1.5; available on https://www.advancedreachtool.com/), can be found in the CS. It is noted that the installation of the prescribed RMMs is mandatory and that only the modification of the personal protective equipment (PPE) used is allowed as a deviation. The only parameters which may therefore be modified in the exposure calculation are:

(i) concentration in mixture (only lower concentrations),
(ii) efficiency of the installed RMMs (only higher efficiencies), and
(iii) type of PPE to be used (only lower efficiencies).

In any case, it needs to be ensured that the final exposure estimate obtained by the tool remains well below the respective DNEL. For systemic effects, the sum of the RCR for the dermal and that of the inhalation route need to be below 1.

0.3.1.2.1. Specific considerations for efficiency values for RMMs prescribed in occupational exposure scenarios

Any efficiency values reported in the ES represent typical efficiencies for a given industry sector after evaluating conditions of use as made available to the consultants and are therefore considered to adequately approximate to actual efficiencies. If downstream users want to evaluate whether prescribed efficiencies are met, exposure monitoring could be conducted. In such a case, monitored exposure levels should be the same as or lower than those reported for the ES after consideration of any PPE worn. Further information on efficiency values can be found in the glossary of MEASE.

0.3.1.2.2. Deviations from the conditions of use if exposure models were used for exposure assessment

Further deviations from the given conditions of use, or if the DU assessment is to be based on monitoring data, require you either to:

(i) inform the supplier of the eSDS about these deviations and request the ES be reviewed to include the identified deviations or
(ii) prepare your own DU CSR (according to Article 37(4)) which must be notified to ECHA and also be kept at your company as in-house documentation.

0.3.2. Environmental exposure scenarios

0.3.2.1. Deviations from the conditions of use

This can be done by using the MetalEUSES scaling tool (free download: http://www.arche-consulting.be/tools/du-scaling-tool/) to estimate the associated exposure. Following parameters can be scaled: amount used at local site, number of emission days, discharge effluent rate, dilution factor (or flow rate of the river), presence/absence of municipal sewage treatment plant (STP), removal rate municipal STP, use of municipal sludge on agricultural soil, and release factors to air and water.

0.4. Man via the environment exposure and risk characterisation assessments

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 60 ng Ni/m^3 as annual average in PM_{10} 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 Generic ES is defined as the product of tonnage (T) and emission factor to air (EF) being lower than 74000 g Ni/year. The value of 74000 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 56.6 ng Ni/m^3. The value of 56.6 ng Ni/m^3 is derived from the difference between the DNEL of 60 ng Ni/m^3 and the EU regional background concentration ($C_{regional}$) of 3.4 ng Ni/m^3 (average of P90 annual concentration of Ni in PM_{10} for the years 2013, 2014 and 2015).

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 Ni/year)**	**C_{local} (ng/m^3)**	**$C_{regional}$ (ng/m^3)**	**PEC_{local} (ng/m^3)**	**RCR = PEC/DNEL (DNEL= 60 ng/m^3)**
All	T	EF	T × EF < 74000	<56.6	3.4*	<60	<1

*: EU average of country P90 annual Ni concentrations in PM_{10} (2013, 2014 and 2015)

If a site is not compliant with these conditions, meaning that the product of tonnage and emission factor is above 74000 g Ni/year, a tiered approach including site-specific modelling can be applied to demonstrate safe use.

1. ES 1: Formulation or re-packing; Formulation and repackaging of nickel oxide

1.1. Title section

Environment	
1: Formulation, milling and repackaging of nickel oxide	ERC 2
Worker	
2: Raw material handling	PROC 26, PROC 9
3: Closed mixing/milling process	PROC 24
4: Packaging	PROC 26, PROC 9
5: Wet cleaning	PROC 28
6: Cleaning/removal of dust	PROC 28

1.2. Conditions of use affecting exposure

1.2.1. Control of environmental exposure: Formulation, milling and repackaging of nickel oxide (ERC 2)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 11.11 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 500 tonnes/year
Emission days >= 45 days/year
Technical and organisational conditions and measures
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
The substance should not be released to water
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Assumed effluent discharge flow from site >= 0 m3/day

1.2.2. Control of worker exposure: Raw material handling (PROC 26, PROC 9)

Product (article) characteristics
Maximum emission potential covered in this CS: Medium.
Physical form of product: Solid, granulate
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Local exhaust ventilation
Semi-closed system
Conditions and measures related to personal protection, hygiene and health evaluation

Wear suitable gloves tested to EN374. For further specification, refer to section 8 of the SDS.
APF of RPE = 10 (90 % respiratory protection). For further specification, refer to section 8 of the SDS.

1.2.3. Control of worker exposure: Closed mixing/milling process (PROC 24)

Product (article) characteristics
Physical form of product: Solid, powder / dust
Technical and organisational conditions and measures
Automated task
Use in closed process

1.2.4. Control of worker exposure: Packaging (PROC 26, PROC 9)

Product (article) characteristics
Physical form of product: Solid, high dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Local exhaust ventilation
Semi-closed system
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374. For further specification, refer to section 8 of the SDS.
APF of RPE = 10 (90 % respiratory protection). For further specification, refer to section 8 of the SDS.

1.2.5. Control of worker exposure: Wet cleaning (PROC 28)

Product (article) characteristics
Maximum emission potential covered in this CS: Very low.
Physical form of product: Solution and other liquid materials, e.g. suspensions are also covered
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Cleaning machines such as power sweeper, no direct manual cleaning.
Covers use at ambient temperatures.
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 10 (90 % respiratory protection). For further specification, refer to section 8 of the SDS.

1.2.6. Control of worker exposure: Cleaning/removal of dust (PROC 28)

Product (article) characteristics
Physical form of product: Residual dust
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Cleaning is conducted using cleaning machines, in particular hovering is applied and the use of compressed air is omitted.

Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 20 (95 % respiratory protection). For further specification, refer to section 8 of the SDS.

1.3. Exposure estimation and reference to its source

1.3.1. Environmental release and exposure: Formulation, milling and repackaging of nickel oxide (ERC 2)

Release route	Release rate	Release estimation method
Water	0 kg/day	Estimated release factor
Air	1.4E-3 kg/day	Measured release rate
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Agricultural soil	16.2 mg/kg dw (EUSES 2.1.2)	0.542

1.3.2. Worker exposure: Raw material handling (PROC 26, PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.014 mg/m³ (Measured data)	0.28
Inhalation, local, long term	0.014 mg/m³ (Measured data)	0.28
Inhalation, local, acute	0.071 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm² (Measured data)	0.432

1.3.3. Worker exposure: Closed mixing/milling process (PROC 24)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, acute	0.017 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.076 µg/cm² (Measured data)	< 0.01

1.3.4. Worker exposure: Packaging (PROC 26, PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.014 mg/m³ (Measured data)	0.28
Inhalation, local, long term	0.014 mg/m³ (Measured data)	0.28
Inhalation, local, acute	0.071 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm² (Measured data)	0.432

1.3.5. Worker exposure: Wet cleaning (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, acute	0.026 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

1.3.6. Worker exposure: Cleaning/removal of dust (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.032 mg/m³ (Measured data)	0.64
Inhalation, local, long term	0.032 mg/m³ (Measured data)	0.64
Inhalation, local, acute	0.189 mg/m³ (Measured data)	0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

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

Guidance: Please refer to Section 0.3 of this “ES for Communication”.

2. ES 2: Formulation or re-packing; Use of nickel oxide for the formulation of nickel oxide-containing catalysts and catalyst precursors

2.1. Title section

Product category: Other (PC 0), Products such as ph-regulators, flocculants, precipitants, neutralization agents (PC 20), Laboratory Chemicals (PC 21)

Environment	
1: Use of nickel oxide for the formulation of nickel oxide-containing catalysts and catalyst precursors - Discharge to fresh water via municipal sewage treatment plant	ERC 3
2: Use of nickel oxide for the formulation of nickel oxide-containing catalysts and catalyst precursors - Direct discharge to fresh water	ERC 3
3: Use of nickel oxide for the formulation of nickel oxide-containing catalysts and catalyst precursors - Direct discharge to marine water	ERC 3
Worker	
4: Formulation of powdered catalysts or shaped catalysts from powdered raw materials	PROC 8b, PROC 14, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9
5: Formulation of shaped catalysts from shaped raw materials and regeneration of shaped catalysts	PROC 8b, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9

2.2. Conditions of use affecting exposure

2.2.1. Control of environmental exposure: Use of nickel oxide for the formulation of nickel oxide-containing catalysts and catalyst precursors - Discharge to fresh water via municipal sewage treatment plant (ERC 3)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 1.4 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 476 tonnes/year
Emission days >= 340 days/year
Technical and organisational conditions and measures
Direct emissions to air should be mitigated by application of one or more of the following RMMs: • HEPA filtration (ESCOM 9267234005), Fabric filters (ESCOM 9267234003) and Bag or Ceramic Filters (ESCOM 12355002122) • Wet Scrubbers (ESCOM 9267234016) • Dry or semi-dry Scrubbers (No available ESCOM phrase) • Metallic Grids (ESCOM 12355002122)
Direct emissions to water should be mitigated by application of one or more of the following RMMs: • Precipitation (ESCOM 12355002126) • Sedimentation (ESCOM 12355002126) • Filtration (ESCOM 12355002126) • Distillation (ESCOM 9267234037) • Ion Exchange (ESCOM 12355002126)
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.

Assumed domestic sewage treatment plant flow >= 2E3 m3/day
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Local freshwater dilution factor 50

2.2.2. Control of environmental exposure: Use of nickel oxide for the formulation of nickel oxide-containing catalysts and catalyst precursors - Direct discharge to fresh water (ERC 3)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 1.4 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 476 tonnes/year
Emission days >= 340 days/year
Technical and organisational conditions and measures
Direct emissions to air should be mitigated by application of one or more of the following RMMs: • HEPA filtration (ESCOM 9267234005), Fabric filters (ESCOM 9267234003) and Bag or Ceramic Filters (ESCOM 12355002122) • Wet Scrubbers (ESCOM 9267234016) • Dry or semi-dry Scrubbers (No available ESCOM phrase) • Metallic Grids (ESCOM 12355002122)
Direct emissions to water should be mitigated by application of one or more of the following RMMs: • Precipitation (ESCOM 12355002126) • Sedimentation (ESCOM 12355002126) • Filtration (ESCOM 12355002126) • Distillation (ESCOM 9267234037) • Ion Exchange (ESCOM 12355002126)
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Assumed effluent discharge flow from site >= 2E3 m3/day
Local freshwater dilution factor 100

2.2.3. Control of environmental exposure: Use of nickel oxide for the formulation of nickel oxide-containing catalysts and catalyst precursors - Direct discharge to marine water (ERC 3)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 1.4 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 476 tonnes/year
Emission days >= 340 days/year
Technical and organisational conditions and measures
Direct emissions to air should be mitigated by application of one or more of the following RMMs: • HEPA filtration (ESCOM 9267234005), Fabric filters (ESCOM 9267234003) and Bag or Ceramic Filters (ESCOM 12355002122) • Wet Scrubbers (ESCOM 9267234016) • Dry or semi-dry Scrubbers (No available ESCOM phrase) • Metallic Grids (ESCOM 12355002122)
Direct emissions to water should be mitigated by application of one or more of the following RMMs: • Precipitation (ESCOM 12355002126) • Sedimentation (ESCOM 12355002126) • Filtration (ESCOM 12355002126) • Distillation (ESCOM 9267234037) • Ion Exchange (ESCOM 12355002126)
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.

Other conditions affecting environmental exposure
No discharge to freshwater assumed
Assumed effluent discharge flow from site >= 2E3 m3/day
Local marine water dilution factor 100

2.2.4. Control of worker exposure: Formulation of powdered catalysts or shaped catalysts from powdered raw materials (PROC 8b, PROC 14, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9)

Product (article) characteristics
Physical form of product: Solid, powder / dust, shaped catalysts
Limit the substance content in the product to 95 %
Amount used (or contained in articles), frequency and duration of use/exposure
Frequency and duration of use/exposure: 8–11 hours/day (37.5 hours/week). 80-360 days/year. Cleaning finds place in accordance to fixed cleaning plans for each production unit/area on regular and frequent basis.
Amounts used: 100-5000 kg nickel oxide/shift.
Technical and organisational conditions and measures
Local exhaust ventilation
During cleaning use vacuum and/or (pressure) washing with water to remove dusts or powders.
Automation and complete enclosure of powder processing and transfer is required.
Containment of raw materials and product is required to prevent dermal contact.
Reduce dermal contact to a single event per day.
Ensure automation and containment of handling and filling operations as far as technically feasible.
Conditions and measures related to personal protection, hygiene and health evaluation
Use of protective suit conforming to EN13982-1 Type 5 is required during operations where dermal contact is possible. Other protective equipment should be chosen based on activities being undertaken, potential for exposure to airborne substance-containing dust and other relevant workplace hazards may include protective suit (with hood) and safety shoes (e.g. according to EN 20346).
Use of RPE (Particle filter with high efficiency for solid and liquid particles (e.g. EN 143 or 149, Type P3 or FFPE)) for cleaning and maintenance operations and where exposure to the substance dust or powder is possible. Air fed RPE may be used, if entry to the equipment used for production is required.
Wear chemically resistant gloves (tested to EN374) in combination with ‘basic’ employee training.

2.2.5. Control of worker exposure: Formulation of shaped catalysts from shaped raw materials and regeneration of shaped catalysts (PROC 8b, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9)

Product (article) characteristics
Physical form of product: Solid, shaped catalysts
Limit the substance content in the product to 35 %
Amount used (or contained in articles), frequency and duration of use/exposure
Frequency and duration of use/exposure: 8–11 hours/day (37.5 hours/week). 80-360 days/year. Cleaning finds place in accordance to fixed cleaning plans for each production unit/area on regular and frequent basis.

Amounts used: 100-5000 kg nickel oxide/shift.
Technical and organisational conditions and measures
Local exhaust ventilation
During cleaning use vacuum and/or (pressure) washing with water to remove dusts or powders.
Automation and complete enclosure of thermal processing and mechanised transfer operations are required.
Containment of raw materials and product is required to prevent dermal contact.
Reduce dermal contact to a single event per day.
For screening and filling of shaped catalyst into storage container a semi-automatic filling line is used, specially designed for the filling of catalysts.
Conditions and measures related to personal protection, hygiene and health evaluation
Use of protective suit conforming to EN13982-1 Type 5 is required during operations where dermal contact is possible. Other protective equipment should be chosen based on activities being undertaken, potential for exposure to airborne substance-containing dust and other relevant workplace hazards may include protective suit (with hood) and safety shoes (e.g. according to EN 20346).
Use of RPE (Particle filter with high efficiency for solid and liquid particles (e.g. EN 143 or 149, Type P3 or FFPE)) for cleaning and maintenance operations and where exposure to the substance dust or powder is possible. Air fed RPE may be used, if entry to the equipment used for production is required.
Wear chemically resistant gloves (tested to EN374) in combination with ‘basic’ employee training.

2.3. Exposure estimation and reference to its source

2.3.1. Environmental release and exposure: Use of nickel oxide for the formulation of nickel oxide-containing catalysts and catalyst precursors - Discharge to fresh water via municipal sewage treatment plant (ERC 3)

Release route	Release rate	Release estimation method
Water	0.56 kg/day	Estimated release factor
Air	0.252 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	5.31E-3 mg/L (EUSES 2.1.2)	0.748
Sediment (freshwater)	96.88 mg/kg dw (PEC sediment calculation method for metals)	0.889
Sewage Treatment Plant	0.168 mg/L (EUSES 2.1.2)	0.509
Agricultural soil	20.93 mg/kg dw (EUSES 2.1.2)	0.7

2.3.2. Environmental release and exposure: Use of nickel oxide for the formulation of nickel oxide-containing catalysts and catalyst precursors - Direct discharge to fresh water (ERC 3)

Release route	Release rate	Release estimation method
Water	0.56 kg/day	Estimated release factor
Air	0.252 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	4.91E-3 mg/L (EUSES 2.1.2)	0.691
Sediment (freshwater)	86.32 mg/kg dw (PEC sediment calculation method for metals)	0.792
Agricultural soil	16.22 mg/kg dw (EUSES 2.1.2)	0.543

2.3.3. Environmental release and exposure: Use of nickel oxide for the formulation of nickel oxide-containing catalysts and catalyst precursors - Direct discharge to marine water (ERC 3)

Release route	Release rate	Release estimation method
Water	0.56 kg/day	Estimated release factor
Air	0.252 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	2.31E-3 mg/L (EUSES 2.1.2)	0.268
Sediment (marine water)	68.92 mg/kg dw (PEC sediment calculation method for metals)	0.632
Agricultural soil	16.22 mg/kg dw (EUSES 2.1.2)	0.543

2.3.4. Worker exposure: Formulation of powdered catalysts or shaped catalysts from powdered raw materials (PROC 8b, PROC 14, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.035 mg/m³ (Measured data)	0.7
Inhalation, local, long term	0.035 mg/m³ (Measured data)	0.7
Inhalation, local, acute	0.105 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5E-4 mg/cm² (MEASE, PROC 8b)	0.042

2.3.5. Worker exposure: Formulation of shaped catalysts from shaped raw materials and regeneration of shaped catalysts (PROC 8b, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.026 mg/m³ (Measured data)	0.52
Inhalation, local, long term	0.026 mg/m³ (Measured data)	0.52
Inhalation, local, acute	0.078 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5E-4 mg/cm² (MEASE, PROC 8b)	0.042

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

Guidance: Please refer to Section 0.3 of this “ES for Communication”.

3. ES 3: Use at industrial sites; Use of nickel oxide-containing catalysts

3.1. Title section

Product category: Other (PC 0), Products such as ph-regulators, flocculants, precipitants, neutralization agents (PC 20), Laboratory Chemicals (PC 21)
Sector of use: Manufacture of bulk, large scale chemicals (including petroleum products) (SU 8), Manufacture of fine chemicals (SU 9)

Environment	
1: Use of nickel oxide-containing catalysts	ERC 4
2: Use of nickel oxide-containing catalysts	ERC 6b
Worker	
3: Industrial use of powdered catalysts	PROC 8b, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9
4: Industrial use of shaped catalysts	PROC 8b, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9

3.2. Conditions of use affecting exposure

3.2.1. Control of environmental exposure: Use of nickel oxide-containing catalysts (ERC 4)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 43 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 200 tonnes/year
Technical and organisational conditions and measures
The substance should not be released to air
The substance should not be released to water
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.

3.2.2. Control of environmental exposure: Use of nickel oxide-containing catalysts (ERC 6b)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 43 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 200 tonnes/year
Technical and organisational conditions and measures
The substance should not be released to air
The substance should not be released to water
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.

3.2.3. Control of worker exposure: Industrial use of powdered catalysts (PROC 8b, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9)

Product (article) characteristics
Physical form of product: Solid, powder / dust or suspension in an inert liquid (e.g. water, alcohols, hydrocarbons)
Limit the substance content in the product to 90 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Amounts used: 0.5-75 tonnes nickel/year (1-150 tonnes catalyst/year).
Technical and organisational conditions and measures
Use vacuum cleaner fitted with a HEPA filter to remove dusts and powders during cleaning.
During use nickel oxide-containing catalyst powder is required to be entirely contained within reaction vessels and associated pipework. The handling of powdered catalyst materials in open workspace is excluded.
Reduce dermal contact to a single event per day.
Charging and discharging of catalyst powder take place in 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.
Conditions and measures related to personal protection, hygiene and health evaluation
Use of protective suit conforming to EN13982-1 Type 5 is required during operations where dermal contact is possible. Other protective equipment should be chosen based on activities being undertaken, potential for exposure to airborne substance-containing dust and other relevant workplace hazards may include protective suit (with hood) and safety shoes (e.g. according to EN 20346).
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 nickel oxide-containing dust or powder is possible. Use of air fed RPE is required if entry to the reactor is required.
Wear chemically resistant gloves (tested to EN374) in combination with ‘basic’ employee training.

3.2.4. Control of worker exposure: Industrial use of shaped catalysts (PROC 8b, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9)

Product (article) characteristics
Limit the substance content in the product to 65 %
Physical form of product: Powder or shaped solid
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours (loading/unloading: carried out by specialist catalyst loading companies).
Amounts used: 1.5-200 tonnes nickel/year (5-600 tonnes catalyst/year).
Technical and organisational conditions and measures
Use vacuum cleaner fitted with a HEPA filter to remove dusts and powders during cleaning.
Closed or semi-closed, semi-automated loading (closed use in reactors, closed or semi-closed, semi-automated discharge).
Indoor and outdoor use is permitted.
Reduce dermal contact to a single event per day.
Conditions and measures related to personal protection, hygiene and health evaluation

Use of protective suit conforming to EN13982-1 Type 5 is required during operations where dermal contact is possible. Other protective equipment should be chosen based on activities being undertaken, potential for exposure to airborne substance-containing dust and other relevant workplace hazards may include protective suit (with hood) and safety shoes (e.g. according to EN 20346).
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 nickel oxide-containing dust or powder is possible; use of air fed RPE is required, if entry to the reactor is required.
Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.

3.3. Exposure estimation and reference to its source

3.3.1. Environmental release and exposure: Use of nickel oxide-containing catalysts (ERC 4)

Release route	Release rate	Release estimation method
Water	0 kg/day	Estimated release factor
Air	0 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

3.3.2. Environmental release and exposure: Use of nickel oxide-containing catalysts (ERC 6b)

Release route	Release rate	Release estimation method
Water	0 kg/day	Estimated release factor
Air	0 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

3.3.3. Worker exposure: Industrial use of powdered catalysts (PROC 8b, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.01 mg/m³ (Measured data)	0.2
Inhalation, local, long term	0.01 mg/m³ (Measured data)	0.2
Inhalation, local, acute	0.04 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5E-4 mg/cm² (MEASE, PROC 8b)	0.042

3.3.4. Worker exposure: Industrial use of shaped catalysts (PROC 8b, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.02 mg/m³ (Measured data)	0.4
Inhalation, local, long term	0.02 mg/m³ (Measured data)	0.4
Inhalation, local, acute	0.06 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5E-4 mg/cm² (MEASE, PROC 8b)	0.042

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

Guidance: Please refer to Section 0.3 of this “ES for Communication”.

4. ES 4: Use at industrial sites; Intermediate use of nickel oxide-containing catalyst precursors for the manufacture of other nickel substances in catalysts

4.1. Title section

Sector of use: Manufacture of bulk, large scale chemicals (including petroleum products) (SU 8), Manufacture of fine chemicals (SU 9)

Environment	
1: Intermediate use of nickel oxide-containing catalyst precursors for the manufacture of other nickel substances in catalysts - Discharge to fresh water via municipal sewage treatment plant	ERC 6a
2: Intermediate use of nickel oxide-containing catalyst precursors for the manufacture of other nickel substances in catalysts - Direct discharge to fresh water	ERC 6a
3: Intermediate use of nickel oxide-containing catalyst precursors for the manufacture of other nickel substances in catalysts - Direct discharge to marine water	ERC 6a
Worker	
4: Industrial use of powdered catalysts	PROC 8b, PROC 14, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9
5: Industrial use of shaped catalysts	PROC 8b, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9

4.2. Conditions of use affecting exposure

4.2.1. Control of environmental exposure: Intermediate use of nickel oxide-containing catalyst precursors for the manufacture of other nickel substances in catalysts - Discharge to fresh water via municipal sewage treatment plant (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 1.4 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 476 tonnes/year
Emission days >= 340 days/year
Technical and organisational conditions and measures
Direct emissions to air should be mitigated by application of one or more of the following RMMs: • HEPA filtration (ESCOM 9267234005), Fabric filters (ESCOM 9267234003) and Bag or Ceramic Filters (ESCOM 12355002122) • Wet Scrubbers (ESCOM 9267234016) • Dry or semi-dry Scrubbers (No available ESCOM phrase) • Metallic Grids (ESCOM 12355002122)
Direct emissions to water should be mitigated by application of one or more of the following RMMs: • Precipitation (ESCOM 12355002126) • Sedimentation (ESCOM 12355002126) • Filtration (ESCOM 12355002126) • Distillation (ESCOM 9267234037) • Ion Exchange (ESCOM 12355002126)
Conditions and measures related to biological sewage treatment plant

Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow >= 2E3 m3/day
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Local freshwater dilution factor 50

4.2.2. Control of environmental exposure: Intermediate use of nickel oxide-containing catalyst precursors for the manufacture of other nickel substances in catalysts - Direct discharge to fresh water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 1.4 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 476 tonnes/year
Emission days >= 340 days/year
Technical and organisational conditions and measures
Direct emissions to air should be mitigated by application of one or more of the following RMMs: • HEPA filtration (ESCOM 9267234005), Fabric filters (ESCOM 9267234003) and Bag or Ceramic Filters (ESCOM 12355002122) • Wet Scrubbers (ESCOM 9267234016) • Dry or semi-dry Scrubbers (No available ESCOM phrase) • Metallic Grids (ESCOM 12355002122)
Direct emissions to water should be mitigated by application of one or more of the following RMMs: • Precipitation (ESCOM 12355002126) • Sedimentation (ESCOM 12355002126) • Filtration (ESCOM 12355002126) • Distillation (ESCOM 9267234037) • Ion Exchange (ESCOM 12355002126)
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Assumed effluent discharge flow from site >= 2E3 m3/day
Local freshwater dilution factor 100

4.2.3. Control of environmental exposure: Intermediate use of nickel oxide-containing catalyst precursors for the manufacture of other nickel substances in catalysts - Direct discharge to marine water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 1.4 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 476 tonnes/year
Emission days >= 340 days/year
Technical and organisational conditions and measures
Direct emissions to air should be mitigated by application of one or more of the following RMMs: • HEPA filtration (ESCOM 9267234005), Fabric filters (ESCOM 9267234003) and Bag or Ceramic Filters (ESCOM 12355002122) • Wet Scrubbers (ESCOM 9267234016) • Dry or semi-dry Scrubbers (No available ESCOM phrase) • Metallic Grids (ESCOM 12355002122)
Direct emissions to water should be mitigated by application of one or more of the following RMMs: •

Precipitation (ESCOM 12355002126) • Sedimentation (ESCOM 12355002126) • Filtration (ESCOM 12355002126) • Distillation (ESCOM 9267234037) • Ion Exchange (ESCOM 12355002126)
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to freshwater assumed
Assumed effluent discharge flow from site >= 2E3 m3/day
Local marine water dilution factor 100

4.2.4. Control of worker exposure: Industrial use of powdered catalysts (PROC 8b, PROC 14, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9)

Product (article) characteristics
Physical form of product: Powder or shaped solid
Limit the substance content in the product to 90 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Amounts used: 220-1700 kg nickel oxide/shift.
Technical and organisational conditions and measures
Ensure semi-closed transfers, reduction, stabilisation and sulphiding are closed processes.
Local exhaust ventilation
Use vacuum cleaner fitted with a HEPA filter to remove dusts and powders during cleaning.
Reduce dermal contact to a single event per day.
Containment of raw materials and product is required to prevent dermal contact.
Automated task
Conditions and measures related to personal protection, hygiene and health evaluation
Use of protective suit conforming to EN13982-1 Type 5 is required during operations where dermal contact is possible. Other protective equipment should be chosen based on activities being undertaken, potential for exposure to airborne substance-containing dust and other relevant workplace hazards may include protective suit (with hood) and safety shoes (e.g. according to EN 20346).
Use of RPE (Particle filter with high efficiency for solid and liquid particles (e.g. EN 143 or 149, Type P3 or FFPE)) for cleaning and maintenance operations and where exposure to the substance dust or powder is possible. Air fed RPE may be used, if entry to the equipment used for production is required.
Wear chemically resistant gloves (tested to EN374) in combination with ‘basic’ employee training.

4.2.5. Control of worker exposure: Industrial use of shaped catalysts (PROC 8b, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9)

Product (article) characteristics
Physical form of product: Solid, shaped catalysts
Limit the substance content in the product to 90 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours (loading and unloading: carried out by specialist catalyst loading companies).
Amounts used: 220-1700 kg nickel oxide/shift.

Technical and organisational conditions and measures
Local exhaust ventilation
Use vacuum cleaner fitted with a HEPA filter to remove dusts and powders during cleaning.
Closed or semi-closed, semi-automated loading (closed use in reactors, closed or semi-closed, semi-automated discharge).
Reduce dermal contact to a single event per day.
Semi-automated task
Conditions and measures related to personal protection, hygiene and health evaluation
Use of protective suit conforming to EN13982-1 Type 5 is required during operations where dermal contact is possible. Other protective equipment should be chosen based on activities being undertaken, potential for exposure to airborne substance-containing dust and other relevant workplace hazards may include protective suit (with hood) and safety shoes (e.g. according to EN 20346).
Use of RPE (Particle filter with high efficiency for solid and liquid particles (e.g. EN 143 or 149, Type P3 or FFPE)) for cleaning and maintenance operations and where exposure to the substance dust or powder is possible. Air fed RPE may be used, if entry to the equipment used for production is required.
Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.

4.3. Exposure estimation and reference to its source

4.3.1. Environmental release and exposure: Intermediate use of nickel oxide-containing catalyst precursors for the manufacture of other nickel substances in catalysts - Discharge to fresh water via municipal sewage treatment plant (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.56 kg/day	Estimated release factor
Air	0.252 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	5.31E-3 mg/L (EUSES 2.1.2)	0.748
Sediment (freshwater)	96.88 mg/kg dw (PEC sediment calculation method for metals)	0.889
Sewage Treatment Plant	0.168 mg/L (EUSES 2.1.2)	0.509
Agricultural soil	20.93 mg/kg dw (EUSES 2.1.2)	0.7

4.3.2. Environmental release and exposure: Intermediate use of nickel oxide-containing catalyst precursors for the manufacture of other nickel substances in catalysts - Direct discharge to fresh water (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.56 kg/day	Estimated release factor
Air	0.252 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	4.91E-3 mg/L (EUSES 2.1.2)	0.691

Protection target	Exposure estimate	RCR
Sediment (freshwater)	86.32 mg/kg dw (PEC sediment calculation method for metals)	0.792
Agricultural soil	16.22 mg/kg dw (EUSES 2.1.2)	0.543

4.3.3. Environmental release and exposure: Intermediate use of nickel oxide-containing catalyst precursors for the manufacture of other nickel substances in catalysts - Direct discharge to marine water (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.56 kg/day	Estimated release factor
Air	0.252 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	2.31E-3 mg/L (EUSES 2.1.2)	0.268
Sediment (marine water)	68.92 mg/kg dw (PEC sediment calculation method for metals)	0.632
Agricultural soil	16.22 mg/kg dw (EUSES 2.1.2)	0.543

4.3.4. Worker exposure: Industrial use of powdered catalysts (PROC 8b, PROC 14, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.045 mg/m³ (Measured data)	0.9
Inhalation, local, long term	0.045 mg/m³ (Measured data)	0.9
Inhalation, local, acute	0.18 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5E-4 mg/cm² (MEASE, PROC 8b)	0.042

4.3.5. Worker exposure: Industrial use of shaped catalysts (PROC 8b, PROC 4, PROC 2, PROC 8a, PROC 3, PROC 1, PROC 28, PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.026 mg/m³ (Measured data)	0.52
Inhalation, local, long term	0.026 mg/m³ (Measured data)	0.52
Inhalation, local, acute	0.078 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5E-4 mg/cm² (MEASE, PROC 8b)	0.042

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

Guidance: Please refer to Section 0.3 of this “ES for Communication”.

5. ES 5: Use at industrial sites; Intermediate use of nickel oxide for the manufacture of nickel-containing powders

5.1. Title section

Sector of use: Manufacture of fine chemicals (SU 9)

Environment	
1: Intermediate use of nickel oxide for the manufacture of nickel-containing powders - Direct discharge to fresh water	ERC 6a
2: Intermediate use of nickel oxide for the manufacture of nickel-containing powders - Direct discharge to marine water	ERC 6a
Worker	
3: Raw material handling	PROC 26
4: Smelting	PROC 22
5: Wet cleaning	PROC 28
6: Cleaning/removal of dust	PROC 28

5.2. Conditions of use affecting exposure

5.2.1. Control of environmental exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing powders - Direct discharge to fresh water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 9.837 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 2.06E3 tonnes/year
Emission days >= 209 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Receiving water dilution (fresh or marine) >= 250
Receiving surface water flow >= 9.96E3 m3/day
Assumed effluent discharge flow from site >= 40 m3/day

5.2.2. Control of environmental exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing powders - Direct discharge to marine water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 5.014 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)

Annual amount per site <= 1.05E3 tonnes/year
Emission days >= 209 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to freshwater assumed
Receiving water dilution (fresh or marine) >= 100
Assumed effluent discharge flow from site >= 40 m3/day

5.2.3. Control of worker exposure: Raw material handling (PROC 26)

Product (article) characteristics
Physical form of product: Solid, high dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Local exhaust ventilation
Semi-closed system
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374. For further specification, refer to section 8 of the SDS.
APF of RPE = 10 (90 % respiratory protection). For further specification, refer to section 8 of the SDS.

5.2.4. Control of worker exposure: Smelting (PROC 22)

Product (article) characteristics
Maximum emission potential covered in this CS: Medium (temperature based).
Physical form of product: Molten
Technical and organisational conditions and measures
Local exhaust ventilation
Semi-closed system
Covers use at temperatures above melting point.

5.2.5. Control of worker exposure: Wet cleaning (PROC 28)

Product (article) characteristics
Maximum emission potential covered in this CS: Very low.
Physical form of product: Solution and other liquid materials, e.g. suspensions are also covered
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Cleaning machines such as power sweeper, no direct manual cleaning.
Covers use at ambient temperatures.

Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 10 (90 % respiratory protection). For further specification, refer to section 8 of the SDS.

5.2.6. Control of worker exposure: Cleaning/removal of dust (PROC 28)

Product (article) characteristics
Physical form of product: Residual dust
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Cleaning is conducted using cleaning machines, in particular hovering is applied and the use of compressed air is omitted.
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 20 (95 % respiratory protection). For further specification, refer to section 8 of the SDS.

5.3. Exposure estimation and reference to its source

5.3.1. Environmental release and exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing powders - Direct discharge to fresh water (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.032 kg/day	Estimated release factor
Air	2.843 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	5.21E-3 mg/L (EUSES 2.1.2)	0.734
Sediment (freshwater)	94.4 mg/kg dw (PEC sediment calculation method for metals)	0.866
Agricultural soil	16.39 mg/kg dw (EUSES 2.1.2)	0.548

5.3.2. Environmental release and exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing powders - Direct discharge to marine water (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.016 kg/day	Estimated release factor
Air	1.449 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	3.25E-3 mg/L (EUSES 2.1.2)	0.378
Sediment (marine water)	93.66 mg/kg dw (PEC sediment calculation method for metals)	0.859
Agricultural soil	16.30 mg/kg dw (EUSES 2.1.2)	0.545

5.3.3. Worker exposure: Raw material handling (PROC 26)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.014 mg/m³ (Measured data)	0.28
Inhalation, local, long term	0.014 mg/m³ (Measured data)	0.28
Inhalation, local, acute	0.071 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm² (Measured data)	0.432

5.3.4. Worker exposure: Smelting (PROC 22)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.021 mg/m³ (Measured data)	0.42
Inhalation, local, long term	0.021 mg/m³ (Measured data)	0.42
Inhalation, local, acute	0.085 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

5.3.5. Worker exposure: Wet cleaning (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, acute	0.026 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

5.3.6. Worker exposure: Cleaning/removal of dust (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.032 mg/m³ (Measured data)	0.64
Inhalation, local, long term	0.032 mg/m³ (Measured data)	0.64
Inhalation, local, acute	0.189 mg/m³ (Measured data)	0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

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

Guidance: Please refer to Section 0.3 of this “ES for Communication”.

6. ES 6: Use at industrial sites; Intermediate use of nickel oxide for the manufacture of nickel-containing frits

6.1. Title section

Sector of use: Manufacture of fine chemicals (SU 9)

Environment	
1: Intermediate use of nickel oxide for the manufacture of nickel-containing frits - Discharge to fresh water via municipal sewage treatment plant	ERC 6a
2: Intermediate use of nickel oxide for the manufacture of nickel-containing frits - Direct discharge to fresh water	ERC 6a
3: Intermediate use of nickel oxide for the manufacture of nickel-containing frits - Direct discharge to marine water	ERC 6a
Worker	
4: Raw material handling	PROC 26
5: Kilning	PROC 22
6: Wet cleaning	PROC 28
7: Cleaning/removal of dust	PROC 28

6.2. Conditions of use affecting exposure

6.2.1. Control of environmental exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing frits - Discharge to fresh water via municipal sewage treatment plant (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.212 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 72 tonnes/year
Emission days >= 340 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow >= 2E3 m3/day
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Receiving water dilution (fresh or marine) >= 10
Receiving surface water flow >= 1.8E4 m3/day

6.2.2. Control of environmental exposure: Intermediate use of

nickel oxide for the manufacture of nickel-containing frits - Direct discharge to fresh water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.212 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 72 tonnes/year
Emission days >= 340 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Receiving water dilution (fresh or marine) >= 250
Receiving surface water flow >= 2.49E4 m3/day
Assumed effluent discharge flow from site >= 100 m3/day

6.2.3. Control of environmental exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing frits - Direct discharge to marine water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.038 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 13 tonnes/year
Emission days >= 340 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to freshwater assumed
Receiving water dilution (fresh or marine) >= 100
Assumed effluent discharge flow from site >= 100 m3/day

6.2.4. Control of worker exposure: Raw material handling (PROC 26)

Product (article) characteristics
Physical form of product: Solid, high dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Frequency of task: Once per shift.

Technical and organisational conditions and measures
Local exhaust ventilation

6.2.5. Control of worker exposure: Kilning (PROC 22)

Product (article) characteristics
Maximum emission potential covered in this CS: Low (temperature based).
Physical form of product: Solid
Technical and organisational conditions and measures
Assumes process temperature up to 1.25E3 °C
Semi-closed system
Use of an integrated local exhaust ventilation is required.

6.2.6. Control of worker exposure: Wet cleaning (PROC 28)

Product (article) characteristics
Maximum emission potential covered in this CS: Very low.
Physical form of product: Solution and other liquid materials, e.g. suspensions are also covered
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Cleaning machines such as power sweeper, no direct manual cleaning.
Covers use at ambient temperatures.
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 10 (90 % respiratory protection). For further specification, refer to section 8 of the SDS.

6.2.7. Control of worker exposure: Cleaning/removal of dust (PROC 28)

Product (article) characteristics
Physical form of product: Residual dust
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Cleaning is conducted using cleaning machines, in particular hovering is applied and the use of compressed air is omitted.
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 20 (95 % respiratory protection). For further specification, refer to section 8 of the SDS.

6.3. Exposure estimation and reference to its source

6.3.1. Environmental release and exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing frits - Discharge to fresh water via municipal sewage treatment plant (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.085 kg/day	Estimated release factor
Air	6.35E-3 kg/day	Estimated release factor

Release route	Release rate	Release estimation method
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	4.72E-3 mg/L (EUSES 2.1.2)	0.665
Sediment (freshwater)	81.4 mg/kg dw (PEC sediment calculation method for metals)	0.747
Sewage Treatment Plant	0.025 mg/L (EUSES 2.1.2)	0.077
Agricultural soil	16.91 mg/kg dw (EUSES 2.1.2)	0.566

6.3.2. Environmental release and exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing frits - Direct discharge to fresh water (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.085 kg/day	Estimated release factor
Air	6.35E-3 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	5.33E-3 mg/L (EUSES 2.1.2)	0.751
Sediment (freshwater)	97.4 mg/kg dw (PEC sediment calculation method for metals)	0.894
Agricultural soil	16.20 mg/kg dw (EUSES 2.1.2)	0.542

6.3.3. Environmental release and exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing frits - Direct discharge to marine water (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.015 kg/day	Estimated release factor
Air	1.15E-3 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	1.4E-3 mg/L (EUSES 2.1.2)	0.162
Sediment (marine water)	45 mg/kg dw (PEC sediment calculation method for metals)	0.413
Agricultural soil	16.2 mg/kg dw (EUSES 2.1.2)	0.542

6.3.4. Worker exposure: Raw material handling (PROC 26)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.028 mg/m³ (Measured data)	0.56
Inhalation, local, long term	0.028 mg/m³ (Measured data)	0.56
Inhalation, local, acute	0.111 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

6.3.5. Worker exposure: Kilning (PROC 22)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	5E-3 mg/m³ (Measured data)	0.1
Inhalation, local, long term	5E-3 mg/m³ (Measured data)	0.1
Inhalation, local, acute	0.016 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

6.3.6. Worker exposure: Wet cleaning (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, acute	0.026 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

6.3.7. Worker exposure: Cleaning/removal of dust (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.032 mg/m³ (Measured data)	0.64
Inhalation, local, long term	0.032 mg/m³ (Measured data)	0.64
Inhalation, local, acute	0.189 mg/m³ (Measured data)	0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

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

Guidance: Please refer to Section 0.3 of this “ES for Communication”.

7. ES 7: Use at industrial sites; Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments

7.1. Title section

Sector of use: Manufacture of fine chemicals (SU 9)

Environment	
1: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Discharge to fresh water via municipal sewage treatment plant	ERC 6a
2: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Direct discharge to fresh water	ERC 6a
3: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Direct discharge to marine water	ERC 6a
Worker	
4: Raw material handling	PROC 26
5: Closed mixing and transfer process	PROC 2
6: Automated transfer process	PROC 8b
7: Drying and calcining	PROC 22, PROC 4, PROC 2, PROC 9
8: Wet cleaning	PROC 28
9: Cleaning/removal of dust	PROC 28

7.2. Conditions of use affecting exposure

7.2.1. Control of environmental exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Discharge to fresh water via municipal sewage treatment plant (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.459 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 156 tonnes/year
Emission days >= 340 days/year
Technical and organisational conditions and measures
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow >= 2E3 m3/day
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure

Receiving surface water flow >= 1.8E4 m3/day
No discharge to marine water assumed
Receiving water dilution (fresh or marine) >= 10

7.2.2. Control of environmental exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Direct discharge to fresh water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.459 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 156 tonnes/year
Emission days >= 340 days/year
Technical and organisational conditions and measures
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Receiving surface water flow >= 2.97E4 m3/day
No discharge to marine water assumed
Receiving water dilution (fresh or marine) >= 100
Assumed effluent discharge flow from site >= 225 m3/day

7.2.3. Control of environmental exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Direct discharge to marine water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.459 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 156 tonnes/year
Emission days >= 340 days/year
Technical and organisational conditions and measures
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to freshwater assumed
Assumed effluent discharge flow from site >= 225 m3/day
Local marine water dilution factor 100

7.2.4. Control of worker exposure: Raw material handling (PROC 26)

Product (article) characteristics
Physical form of product: Solid, high dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Frequency of task: Once per shift.
Technical and organisational conditions and measures
Local exhaust ventilation

7.2.5. Control of worker exposure: Closed mixing and transfer process (PROC 2)

Product (article) characteristics
Physical form of product: Damp solid
Technical and organisational conditions and measures
Automated task
Use in closed process

7.2.6. Control of worker exposure: Automated transfer process (PROC 8b)

Product (article) characteristics
Physical form of product: Solid, high dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Ensure segregation of worker from the source.
Use of an integrated local exhaust ventilation is required.
Very limited manual intervention is required to run the process. Contact with the substance shall only be possible for a very limited duration of time.

7.2.7. Control of worker exposure: Drying and calcining (PROC 22, PROC 4, PROC 2, PROC 9)

Product (article) characteristics
Maximum emission potential covered in this CS: Low.
Physical form of product: Damp solid
Technical and organisational conditions and measures
Local exhaust ventilation
Elevated temperature
Semi-closed system

7.2.8. Control of worker exposure: Wet cleaning (PROC 28)

Product (article) characteristics
Maximum emission potential covered in this CS: Very low.
Physical form of product: Solution and other liquid materials, e.g. suspensions are also covered
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Cleaning machines such as power sweeper, no direct manual cleaning.
Covers use at ambient temperatures.

Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 10 (90 % respiratory protection). For further specification, refer to section 8 of the SDS.

7.2.9. Control of worker exposure: Cleaning/removal of dust (PROC 28)

Product (article) characteristics
Physical form of product: Residual dust
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Cleaning is conducted using cleaning machines, in particular hovering is applied and the use of compressed air is omitted.
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 20 (95 % respiratory protection). For further specification, refer to section 8 of the SDS.

7.3. Exposure estimation and reference to its source

7.3.1. Environmental release and exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Discharge to fresh water via municipal sewage treatment plant (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.021 kg/day	Estimated release factor
Air	0.021 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	3.34E-3 mg/L (EUSES 2.1.2)	0.471
Sediment (freshwater)	45.2 mg/kg dw (PEC sediment calculation method for metals)	0.415
Sewage Treatment Plant	6.2E-3 mg/L (EUSES 2.1.2)	0.019
Agricultural soil	16.37 mg/kg dw (EUSES 2.1.2)	0.548

7.3.2. Environmental release and exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Direct discharge to fresh water (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.021 kg/day	Estimated release factor
Air	0.021 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	3.39E-3 mg/L (EUSES 2.1.2)	0.478
Sediment (freshwater)	46.5 mg/kg dw (PEC sediment calculation method for metals)	0.427

Protection target	Exposure estimate	RCR
Agricultural soil	16.20 mg/kg dw (EUSES 2.1.2)	0.542

7.3.3. Environmental release and exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing inorganic pigments - Direct discharge to marine water (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.021 kg/day	Estimated release factor
Air	0.021 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	9.58E-4 mg/L (EUSES 2.1.2)	0.111
Sediment (marine water)	33.2 mg/kg dw (PEC sediment calculation method for metals)	0.305
Agricultural soil	16.20 mg/kg dw (EUSES 2.1.2)	0.542

7.3.4. Worker exposure: Raw material handling (PROC 26)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.028 mg/m³ (Measured data)	0.56
Inhalation, local, long term	0.028 mg/m³ (Measured data)	0.56
Inhalation, local, acute	0.111 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

7.3.5. Worker exposure: Closed mixing and transfer process (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, acute	0.017 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.076 µg/cm² (Measured data)	< 0.01

7.3.6. Worker exposure: Automated transfer process (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.031 mg/m³ (Measured data)	0.62
Inhalation, local, long term	0.031 mg/m³ (Measured data)	0.62
Inhalation, local, acute	0.093 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	1 µg/cm² (Measured data)	0.083

7.3.7. Worker exposure: Drying and calcining (PROC 22, PROC 4, PROC 2, PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	5E-3 mg/m³ (Measured data)	0.1
Inhalation, local, long term	5E-3 mg/m³ (Measured data)	0.1

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, acute	0.016 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

7.3.8. Worker exposure: Wet cleaning (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, acute	0.026 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

7.3.9. Worker exposure: Cleaning/removal of dust (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.032 mg/m³ (Measured data)	0.64
Inhalation, local, long term	0.032 mg/m³ (Measured data)	0.64
Inhalation, local, acute	0.189 mg/m³ (Measured data)	0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

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

Guidance: Please refer to Section 0.3 of this “ES for Communication”.

8. ES 8: Use at industrial sites; Intermediate use of nickel oxide for the manufacture of nickel-containing glass

8.1. Title section

Sector of use: Manufacture of other non-metallic mineral products, e.g. plasters, cement (SU 13)

Environment	
1: Intermediate use of nickel oxide for the manufacture of nickel-containing glass - Discharge to fresh water via municipal sewage treatment plant	ERC 6a
2: Intermediate use of nickel oxide for the manufacture of nickel-containing glass - Direct discharge to fresh water	ERC 6a
3: Intermediate use of nickel oxide for the manufacture of nickel-containing glass - Direct discharge to marine water	ERC 6a
4: Intermediate use of nickel oxide for the manufacture of nickel-containing glass - No water	ERC 6a
Worker	
5: Raw material handling	PROC 26
6: Formulation and mixing	PROC 3
7: Melting	PROC 22
8: Wet cleaning	PROC 28
9: Cleaning/removal of dust	PROC 28

8.2. Conditions of use affecting exposure

8.2.1. Control of environmental exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing glass - Discharge to fresh water via municipal sewage treatment plant (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.041 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 15 tonnes/year
Emission days >= 365 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow >= 2E3 m3/day
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Receiving water dilution (fresh or marine) >= 10

Receiving surface water flow >= 1.8E4 m3/day

8.2.2. Control of environmental exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing glass - Direct discharge to fresh water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.041 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 15 tonnes/year
Emission days >= 365 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Receiving water dilution (fresh or marine) >= 10
Receiving surface water flow >= 1.8E4 m3/day
Assumed effluent discharge flow from site >= 2E3 m3/day

8.2.3. Control of environmental exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing glass - Direct discharge to marine water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.041 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 15 tonnes/year
Emission days >= 365 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to freshwater assumed
Receiving water dilution (fresh or marine) >= 100
Assumed effluent discharge flow from site >= 2E3 m3/day

8.2.4. Control of environmental exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing glass - No water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.164 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 60 tonnes/year
Emission days >= 365 days/year
Technical and organisational conditions and measures
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
The substance should not be released to water
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.

8.2.5. Control of worker exposure: Raw material handling (PROC 26)

Product (article) characteristics
Physical form of product: Solid, high dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Frequency of task: Once per shift.
Technical and organisational conditions and measures
Local exhaust ventilation

8.2.6. Control of worker exposure: Formulation and mixing (PROC 3)

Product (article) characteristics
Physical form of product: Solid, powder / dust
Technical and organisational conditions and measures
Use in closed process

8.2.7. Control of worker exposure: Melting (PROC 22)

Product (article) characteristics
Maximum emission potential covered in this CS: Medium (temperature based).
Physical form of product: Molten
Technical and organisational conditions and measures
Local exhaust ventilation
Assumes process temperature up to 1.6E3 °C
Automated task
Use in closed process

8.2.8. Control of worker exposure: Wet cleaning (PROC 28)

Product (article) characteristics
Maximum emission potential covered in this CS: Very low.
Physical form of product: Solution and other liquid materials, e.g. suspensions are also covered
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Cleaning machines such as power sweeper, no direct manual cleaning.

Covers use at ambient temperatures.
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 10 (90 % respiratory protection). For further specification, refer to section 8 of the SDS.

8.2.9. Control of worker exposure: Cleaning/removal of dust (PROC 28)

Product (article) characteristics
Physical form of product: Residual dust
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Cleaning is conducted using cleaning machines, in particular hovering is applied and the use of compressed air is omitted.
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 20 (95 % respiratory protection). For further specification, refer to section 8 of the SDS.

8.3. Exposure estimation and reference to its source

8.3.1. Environmental release and exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing glass - Discharge to fresh water via municipal sewage treatment plant (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.041 kg/day	Estimated release factor
Air	0.058 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	3.78E-3 mg/L (EUSES 2.1.2)	0.533
Sediment (freshwater)	56.8 mg/kg dw (PEC sediment calculation method for metals)	0.521
Sewage Treatment Plant	0.012 mg/L (EUSES 2.1.2)	0.037
Agricultural soil	16.55 mg/kg dw (EUSES 2.1.2)	0.554

8.3.2. Environmental release and exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing glass - Direct discharge to fresh water (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.041 kg/day	Estimated release factor
Air	0.058 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	4.37E-3 mg/L (EUSES 2.1.2)	0.616
Sediment (freshwater)	72.3 mg/kg dw (PEC sediment calculation	0.663

Protection target	Exposure estimate	RCR
	method for metals)	
Agricultural soil	16.20 mg/kg dw (EUSES 2.1.2)	0.542

8.3.3. Environmental release and exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing glass - Direct discharge to marine water (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.041 kg/day	Estimated release factor
Air	0.058 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	4.47E-4 mg/L (EUSES 2.1.2)	0.052
Sediment (marine water)	20 mg/kg dw (PEC sediment calculation method for metals)	0.183
Agricultural soil	16.20 mg/kg dw (EUSES 2.1.2)	0.542

8.3.4. Environmental release and exposure: Intermediate use of nickel oxide for the manufacture of nickel-containing glass - No water (ERC 6a)

Release route	Release rate	Release estimation method
Water	0 kg/day	Estimated release factor
Air	0.23 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Agricultural soil	16.22 mg/kg dw (EUSES 2.1.2)	0.543

8.3.5. Worker exposure: Raw material handling (PROC 26)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.028 mg/m³ (Measured data)	0.56
Inhalation, local, long term	0.028 mg/m³ (Measured data)	0.56
Inhalation, local, acute	0.111 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

8.3.6. Worker exposure: Formulation and mixing (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, acute	0.017 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.076 µg/cm² (Measured data)	< 0.01

8.3.7. Worker exposure: Melting (PROC 22)

Route of exposure and type of effects	Exposure estimate	RCR

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.021 mg/m³ (Measured data)	0.42
Inhalation, local, long term	0.021 mg/m³ (Measured data)	0.42
Inhalation, local, acute	0.085 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

8.3.8. Worker exposure: Wet cleaning (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, acute	0.026 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

8.3.9. Worker exposure: Cleaning/removal of dust (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.032 mg/m³ (Measured data)	0.64
Inhalation, local, long term	0.032 mg/m³ (Measured data)	0.64
Inhalation, local, acute	0.189 mg/m³ (Measured data)	0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

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

Guidance: Please refer to Section 0.3 of this “ES for Communication”.

9. ES 9: Use at industrial sites; Intermediate use of nickel oxide sinter in the production of stainless, special steels and special alloys

9.1. Title section

Product category: Base metals and alloys (PC 7)
Sector of use: Manufacture of basic metals, including alloys (SU 14)

Environment	
1: Intermediate use of nickel oxide sinter in the production of stainless, special steels and special alloys - Direct discharge to fresh water D10	ERC 6a
2: Intermediate use of nickel oxide sinter in the production of stainless, special steels and special alloys - Direct discharge to fresh water D100	ERC 6a
3: Intermediate use of nickel oxide sinter in the production of stainless, special steels and special alloys - Direct discharge to fresh water D1000	ERC 6a
4: Intermediate use of nickel oxide sinter in the production of stainless, special steels and special alloys - Direct discharge to marine water	ERC 6a
Worker	
5: Raw material handling	PROC 26
6: Smelting	PROC 22
7: Maintenance in contaminated areas	PROC 28
8: Wet cleaning	PROC 28
9: Cleaning/removal of dust	PROC 28

9.2. Conditions of use affecting exposure

9.2.1. Control of environmental exposure: Intermediate use of nickel oxide sinter in the production of stainless, special steels and special alloys - Direct discharge to fresh water D10 (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 4.164 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 1.52E3 tonnes/year
Emission days >= 365 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Receiving water dilution (fresh or marine) >= 10
Receiving surface water flow >= 1.8E4 m3/day
Assumed effluent discharge flow from site >= 2E3 m3/day

9.2.2. Control of environmental exposure: Intermediate use of

nickel oxide sinter in the production of stainless, special steels and special alloys - Direct discharge to fresh water D100 (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 38.35 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 1.4E4 tonnes/year
Emission days >= 365 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Receiving water dilution (fresh or marine) >= 100
Receiving surface water flow >= 1.98E5 m3/day
Assumed effluent discharge flow from site >= 2E3 m3/day

9.2.3. Control of environmental exposure: Intermediate use of nickel oxide sinter in the production of stainless, special steels and special alloys - Direct discharge to fresh water D1000 (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 151.5 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 5.53E4 tonnes/year
Emission days >= 365 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Receiving water dilution (fresh or marine) >= 1E3
Receiving surface water flow >= 2E6 m3/day
Assumed effluent discharge flow from site >= 2E3 m3/day

9.2.4. Control of environmental exposure: Intermediate use of nickel oxide sinter in the production of stainless, special steels and special alloys - Direct discharge to marine water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 111.0 tonnes/day (All the amounts and concentrations are expressed as Ni

as this is the driver for the environmental risk assessment.)
Annual amount per site <= 4.05E4 tonnes/year
Emission days >= 365 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to freshwater assumed
Receiving water dilution (fresh or marine) >= 100
Assumed effluent discharge flow from site >= 2E3 m3/day

9.2.5. Control of worker exposure: Raw material handling (PROC 26)

Product (article) characteristics
Physical form of product: Solid, high dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Local exhaust ventilation
Semi-closed system
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374. For further specification, refer to section 8 of the SDS.
APF of RPE = 10 (90 % respiratory protection). For further specification, refer to section 8 of the SDS.

9.2.6. Control of worker exposure: Smelting (PROC 22)

Product (article) characteristics
Maximum emission potential covered in this CS: Medium (temperature based).
Physical form of product: Molten
Technical and organisational conditions and measures
Local exhaust ventilation
Semi-closed system
Covers use at temperatures above melting point.

9.2.7. Control of worker exposure: Maintenance in contaminated areas (PROC 28)

Product (article) characteristics
Physical form of product: Residual dust
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours (potentially lasting for an entire shift or even longer if critical equipment needs to be repaired).
Technical and organisational conditions and measures

Machinery to be maintained is to be turned off during work.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374. For further specification, refer to section 8 of the SDS.
APF of RPE = 10 (90 % respiratory protection). For further specification, refer to section 8 of the SDS.

9.2.8. Control of worker exposure: Wet cleaning (PROC 28)

Product (article) characteristics
Maximum emission potential covered in this CS: Very low.
Physical form of product: Solution and other liquid materials, e.g. suspensions are also covered
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Cleaning machines such as power sweeper, no direct manual cleaning.
Covers use at ambient temperatures.
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 10 (90 % respiratory protection). For further specification, refer to section 8 of the SDS.

9.2.9. Control of worker exposure: Cleaning/removal of dust (PROC 28)

Product (article) characteristics
Physical form of product: Residual dust
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Cleaning is conducted using cleaning machines, in particular hovering is applied and the use of compressed air is omitted.
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 20 (95 % respiratory protection). For further specification, refer to section 8 of the SDS.

9.3. Exposure estimation and reference to its source

9.3.1. Environmental release and exposure: Intermediate use of nickel oxide sinter in the production of stainless, special steels and special alloys - Direct discharge to fresh water D10 (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.057 kg/day	Estimated release factor
Air	0.57 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	4.96E-3 mg/L (EUSES 2.1.2)	0.699
Sediment (freshwater)	87.7 mg/kg dw (PEC sediment calculation method for metals)	0.805
Agricultural soil	16.26 mg/kg dw (EUSES 2.1.2)	0.544

9.3.2. Environmental release and exposure: Intermediate use of nickel oxide sinter in the production of stainless, special steels and special alloys - Direct discharge to fresh water D100 (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.529 kg/day	Estimated release factor
Air	5.247 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	4.8E-3 mg/L (EUSES 2.1.2)	0.676
Sediment (freshwater)	83.4 mg/kg dw (PEC sediment calculation method for metals)	0.765
Agricultural soil	16.83 mg/kg dw (EUSES 2.1.2)	0.563

9.3.3. Environmental release and exposure: Intermediate use of nickel oxide sinter in the production of stainless, special steels and special alloys - Direct discharge to fresh water D1000 (ERC 6a)

Release route	Release rate	Release estimation method
Water	2.091 kg/day	Estimated release factor
Air	20.72 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	3.65E-3 mg/L (EUSES 2.1.2)	0.514
Sediment (freshwater)	53.2 mg/kg dw (PEC sediment calculation method for metals)	0.488
Agricultural soil	18.71 mg/kg dw (EUSES 2.1.2)	0.626

9.3.4. Environmental release and exposure: Intermediate use of nickel oxide sinter in the production of stainless, special steels and special alloys - Direct discharge to marine water (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.805 kg/day	Estimated release factor
Air	15.18 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	3.19E-3 mg/L (EUSES 2.1.2)	0.37
Sediment (marine water)	92 mg/kg dw (PEC sediment calculation method for metals)	0.844
Agricultural soil	18.04 mg/kg dw (EUSES 2.1.2)	0.604

9.3.5. Worker exposure: Raw material handling (PROC 26)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.014 mg/m³ (Measured data)	0.28
Inhalation, local, long term	0.014 mg/m³ (Measured data)	0.28

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, acute	0.071 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm² (Measured data)	0.432

9.3.6. Worker exposure: Smelting (PROC 22)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.021 mg/m³ (Measured data)	0.42
Inhalation, local, long term	0.021 mg/m³ (Measured data)	0.42
Inhalation, local, acute	0.085 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

9.3.7. Worker exposure: Maintenance in contaminated areas (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	4.5E-3 mg/m³ (Measured data)	0.09
Inhalation, local, long term	4.5E-3 mg/m³ (Measured data)	0.09
Inhalation, local, acute	0.023 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm² (Measured data)	0.432

9.3.8. Worker exposure: Wet cleaning (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, acute	0.026 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

9.3.9. Worker exposure: Cleaning/removal of dust (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.032 mg/m³ (Measured data)	0.64
Inhalation, local, long term	0.032 mg/m³ (Measured data)	0.64
Inhalation, local, acute	0.189 mg/m³ (Measured data)	0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

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

Guidance: Please refer to Section 0.3 of this “ES for Communication”.

10. ES 10: Use at industrial sites; Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics

10.1. Title section

Product category: Metal surface treatment products (PC 14)
Sector of use: Manufacture of computer, electronic and optical products, electrical equipment (SU 16)

Environment	
1: Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics - Direct discharge to fresh water	ERC 5
2: Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics - Direct discharge to marine water	ERC 5
Worker	
3: Raw material handling	PROC 26, PROC 1
4: Preparation of slurry	PROC 5, PROC 4
5: Calcination	PROC 3, PROC 4
6: Sintering	PROC 22
7: Sawing/cutting of sintered objects	PROC 24
8: Assembly and packaging	PROC 21
9: Wet cleaning	PROC 28
10: Cleaning/removal of dust	PROC 28
Subsequent service life exposure scenario(s)	
ES 12: Service life (worker at industrial site); Service life of nickel-containing electronics/ferrite cores in industrial settings	
ES 13: Service life (professional worker); Service life of nickel-containing electronics/ferrite cores in professional settings	

10.2. Conditions of use affecting exposure

10.2.1. Control of environmental exposure: Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics - Direct discharge to fresh water (ERC 5)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 9.5E-4 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 0.29 tonnes/year
Emission days >= 304 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed

Receiving water dilution (fresh or marine) >= 50
Receiving surface water flow >= 3.09E3 m3/day
Assumed effluent discharge flow from site >= 63 m3/day

10.2.2. Control of environmental exposure: Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics - Direct discharge to marine water (ERC 5)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 9.5E-4 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 0.29 tonnes/year
Emission days >= 304 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to freshwater assumed
Receiving water dilution (fresh or marine) >= 100
Assumed effluent discharge flow from site >= 63 m3/day

10.2.3. Control of worker exposure: Raw material handling (PROC 26, PROC 1)

Product (article) characteristics
Physical form of product: Solid, high dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Amount per use < 1 kg
Technical and organisational conditions and measures
Semi-closed system

10.2.4. Control of worker exposure: Preparation of slurry (PROC 5, PROC 4)

Product (article) characteristics
Maximum emission potential covered in this CS: Very low.
Physical form of product: Solution and other liquid materials, e.g. suspensions are also covered
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Covers use at ambient temperatures.

10.2.5. Control of worker exposure: Calcination (PROC 3, PROC 4)

Product (article) characteristics
Maximum emission potential covered in this CS: Low.

Physical form of product: Damp solid
Technical and organisational conditions and measures
Local exhaust ventilation
Elevated temperature
Use in closed process

10.2.6. Control of worker exposure: Sintering (PROC 22)

Product (article) characteristics
Maximum emission potential covered in this CS: Low (temperature based).
Physical form of product: Solid (Various physical forms are possible: powders, pressed powders, pasted powders etc.)
Technical and organisational conditions and measures
Use of an integrated local exhaust ventilation is required.
Very limited manual intervention is required to run the process. Contact with the substance shall only be possible for a very limited duration of time.
Closed process with occasional opening
Manufacturing and processing of minerals and/or metals at substantially elevated temperature. High temperature processes slightly below melting point / degradation temperature.

10.2.7. Control of worker exposure: Sawing/cutting of sintered objects (PROC 24)

Product (article) characteristics
Maximum emission potential covered in this CS: Medium (abrasion based).
Physical form of product: Massive object
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Local exhaust ventilation
Ensure segregation of worker from the source.
Very limited manual intervention is required to run the process. Contact with the substance shall only be possible for a very limited duration of time.

10.2.8. Control of worker exposure: Assembly and packaging (PROC 21)

Product (article) characteristics
Maximum emission potential covered in this CS: Low (abrasion based).
Physical form of product: Massive object
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374. For further specification, refer to section 8 of the SDS.

10.2.9. Control of worker exposure: Wet cleaning (PROC 28)

Product (article) characteristics
Maximum emission potential covered in this CS: Very low.
Physical form of product: Solution and other liquid materials, e.g. suspensions are also covered
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures

Cleaning machines such as power sweeper, no direct manual cleaning.
Covers use at ambient temperatures.
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 10 (90 % respiratory protection). For further specification, refer to section 8 of the SDS.

10.2.10. Control of worker exposure: Cleaning/removal of dust (PROC 28)

Product (article) characteristics
Physical form of product: Residual dust
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Cleaning is conducted using cleaning machines, in particular hovering is applied and the use of compressed air is omitted.
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 20 (95 % respiratory protection). For further specification, refer to section 8 of the SDS.

10.3. Exposure estimation and reference to its source

10.3.1. Environmental release and exposure: Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics - Direct discharge to fresh water (ERC 5)

Release route	Release rate	Release estimation method
Water	3.14E-3 kg/day	Estimated release factor
Air	9.5E-5 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	3.61E-3 mg/L (EUSES 2.1.2)	0.509
Sediment (freshwater)	52.4 mg/kg dw (PEC sediment calculation method for metals)	0.481
Agricultural soil	16.2 mg/kg dw (EUSES 2.1.2)	0.542

10.3.2. Environmental release and exposure: Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics - Direct discharge to marine water (ERC 5)

Release route	Release rate	Release estimation method
Water	3.14E-3 kg/day	Estimated release factor
Air	9.5E-5 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	6.57E-4 mg/L (EUSES 2.1.2)	0.076
Sediment (marine water)	25.5 mg/kg dw (PEC sediment calculation method for metals)	0.234

Protection target	Exposure estimate	RCR
Agricultural soil	16.2 mg/kg dw (EUSES 2.1.2)	0.542

10.3.3. Worker exposure: Raw material handling (PROC 26, PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.04 mg/m³ (Measured data)	0.8
Inhalation, local, long term	0.04 mg/m³ (Measured data)	0.8
Inhalation, local, acute	0.12 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	3.73 µg/cm² (Measured data)	0.311

10.3.4. Worker exposure: Preparation of slurry (PROC 5, PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.012 mg/m³ (Measured data)	0.24
Inhalation, local, long term	0.012 mg/m³ (Measured data)	0.24
Inhalation, local, acute	0.047 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

10.3.5. Worker exposure: Calcination (PROC 3, PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	5E-3 mg/m³ (Measured data)	0.1
Inhalation, local, long term	5E-3 mg/m³ (Measured data)	0.1
Inhalation, local, acute	0.016 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

10.3.6. Worker exposure: Sintering (PROC 22)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.015 mg/m³ (Measured data)	0.3
Inhalation, local, long term	0.015 mg/m³ (Measured data)	0.3
Inhalation, local, acute	0.044 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

10.3.7. Worker exposure: Sawing/cutting of sintered objects (PROC 24)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	4E-3 mg/m³ (Measured data)	0.08
Inhalation, local, long term	4E-3 mg/m³ (Measured data)	0.08
Inhalation, local, acute	0.012 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

10.3.8. Worker exposure: Assembly and packaging (PROC 21)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	9E-3 mg/m³ (Measured data)	0.18

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	9E-3 mg/m³ (Measured data)	0.18
Inhalation, local, acute	0.037 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm² (Measured data)	0.432

10.3.9. Worker exposure: Wet cleaning (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, acute	0.026 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

10.3.10. Worker exposure: Cleaning/removal of dust (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.032 mg/m³ (Measured data)	0.64
Inhalation, local, long term	0.032 mg/m³ (Measured data)	0.64
Inhalation, local, acute	0.189 mg/m³ (Measured data)	0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

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

Guidance: Please refer to Section 0.3 of this “ES for Communication”.

11. ES 11: Use at industrial sites; Use of nickel oxide powder for the production of nickel zinc ferrite cores

11.1. Title section

Product category: Metal surface treatment products (PC 14)
Sector of use: Manufacture of computer, electronic and optical products, electrical equipment (SU 16)

Environment	
1: Use of nickel oxide powder for the production of nickel zinc ferrite cores - Discharge to fresh water via municipal sewage treatment plant	ERC 5
2: Use of nickel oxide powder for the production of nickel zinc ferrite cores - Direct discharge to fresh water	ERC 5
3: Use of nickel oxide powder for the production of nickel zinc ferrite cores - Direct discharge to marine water	ERC 5
Worker	
4: Raw material handling	PROC 26
5: Milling	PROC 2
6: Spray drying	PROC 4
7: Calcination	PROC 22
8: Sintering	PROC 22
9: Handling of nickel zinc solids	PROC 21
10: Wet cleaning	PROC 28
11: Cleaning/removal of dust	PROC 28
Subsequent service life exposure scenario(s)	
ES 12: Service life (worker at industrial site); Service life of nickel-containing electronics/ferrite cores in industrial settings	
ES 13: Service life (professional worker); Service life of nickel-containing electronics/ferrite cores in professional settings	

11.2. Conditions of use affecting exposure

11.2.1. Control of environmental exposure: Use of nickel oxide powder for the production of nickel zinc ferrite cores - Discharge to fresh water via municipal sewage treatment plant (ERC 5)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 1.5 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 337.5 tonnes/year
Emission days >= 225 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow >= 2E3 m3/day
Conditions and measures related to external treatment of waste (including article waste)

Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Receiving water dilution (fresh or marine) >= 10
Receiving surface water flow >= 1.8E4 m3/day

11.2.2. Control of environmental exposure: Use of nickel oxide powder for the production of nickel zinc ferrite cores - Direct discharge to fresh water (ERC 5)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 1.5 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 337.5 tonnes/year
Emission days >= 225 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Receiving water dilution (fresh or marine) >= 10
Receiving surface water flow >= 1.8E4 m3/day
Assumed effluent discharge flow from site >= 2E3 m3/day

11.2.3. Control of environmental exposure: Use of nickel oxide powder for the production of nickel zinc ferrite cores - Direct discharge to marine water (ERC 5)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 1.5 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 337.5 tonnes/year
Emission days >= 225 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to freshwater assumed
Receiving water dilution (fresh or marine) >= 100
Assumed effluent discharge flow from site >= 2E3 m3/day

11.2.4. Control of worker exposure: Raw material handling (PROC 26)

Product (article) characteristics
Physical form of product: Solid, medium dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Local exhaust ventilation
Semi-closed system
Automated task
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374. For further specification, refer to section 8 of the SDS.
APF of RPE = 10 (90 % respiratory protection). For further specification, refer to section 8 of the SDS.

11.2.5. Control of worker exposure: Milling (PROC 2)

Product (article) characteristics
Physical form of product: Solid, low dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Local exhaust ventilation
Semi-closed system
Very limited manual intervention is required to run the process. Contact with the substance shall only be possible for a very limited duration of time.

11.2.6. Control of worker exposure: Spray drying (PROC 4)

Product (article) characteristics
Maximum emission potential covered in this CS: Low.
Physical form of product: Damp solid
Technical and organisational conditions and measures
Local exhaust ventilation
Elevated temperature
Semi-closed system

11.2.7. Control of worker exposure: Calcination (PROC 22)

Product (article) characteristics
Maximum emission potential covered in this CS: Low.
Physical form of product: Damp solid
Technical and organisational conditions and measures
Local exhaust ventilation
Elevated temperature
Semi-closed system

11.2.8. Control of worker exposure: Sintering (PROC 22)

Product (article) characteristics

Maximum emission potential covered in this CS: Low (temperature based).
Physical form of product: Solid (Various physical forms are possible: powders, pressed powders, pasted powders etc.)
Technical and organisational conditions and measures
Use of an integrated local exhaust ventilation is required.
Very limited manual intervention is required to run the process. Contact with the substance shall only be possible for a very limited duration of time.
Closed process with occasional opening
Manufacturing and processing of minerals and/or metals at substantially elevated temperature. High temperature processes slightly below melting point / degradation temperature.

11.2.9. Control of worker exposure: Handling of nickel zinc solids (PROC 21)

Product (article) characteristics
Maximum emission potential covered in this CS: Low (abrasion based).
Physical form of product: Massive object
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374. For further specification, refer to section 8 of the SDS.

11.2.10. Control of worker exposure: Wet cleaning (PROC 28)

Product (article) characteristics
Maximum emission potential covered in this CS: Very low.
Physical form of product: Solution and other liquid materials, e.g. suspensions are also covered
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Cleaning machines such as power sweeper, no direct manual cleaning.
Covers use at ambient temperatures.
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 10 (90 % respiratory protection). For further specification, refer to section 8 of the SDS.

11.2.11. Control of worker exposure: Cleaning/removal of dust (PROC 28)

Product (article) characteristics
Physical form of product: Residual dust
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Cleaning is conducted using cleaning machines, in particular hovering is applied and the use of compressed air is omitted.
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 20 (95 % respiratory protection). For further specification, refer to section 8 of the SDS.

11.3. Exposure estimation and reference to its source

11.3.1. Environmental release and exposure: Use of nickel oxide

powder for the production of nickel zinc ferrite cores - Discharge to fresh water via municipal sewage treatment plant (ERC 5)

Release route	Release rate	Release estimation method
Water	0.075 kg/day	Estimated release factor
Air	0.075 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	4.51E-3 mg/L (EUSES 2.1.2)	0.636
Sediment (freshwater)	75.9 mg/kg dw (PEC sediment calculation method for metals)	0.696
Sewage Treatment Plant	0.023 mg/L (EUSES 2.1.2)	0.068
Agricultural soil	16.83 mg/kg dw (EUSES 2.1.2)	0.563

11.3.2. Environmental release and exposure: Use of nickel oxide powder for the production of nickel zinc ferrite cores - Direct discharge to fresh water (ERC 5)

Release route	Release rate	Release estimation method
Water	0.075 kg/day	Estimated release factor
Air	0.075 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	5.59E-3 mg/L (EUSES 2.1.2)	0.787
Sediment (freshwater)	104.2 mg/kg dw (PEC sediment calculation method for metals)	0.956
Agricultural soil	16.20 mg/kg dw (EUSES 2.1.2)	0.542

11.3.3. Environmental release and exposure: Use of nickel oxide powder for the production of nickel zinc ferrite cores - Direct discharge to marine water (ERC 5)

Release route	Release rate	Release estimation method
Water	0.075 kg/day	Estimated release factor
Air	0.075 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	5.69E-4 mg/L (EUSES 2.1.2)	0.066
Sediment (marine water)	23.2 mg/kg dw (PEC sediment calculation method for metals)	0.213
Agricultural soil	16.20 mg/kg dw (EUSES 2.1.2)	0.542

11.3.4. Worker exposure: Raw material handling (PROC 26)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.014 mg/m³ (Measured data)	0.28
Inhalation, local, long term	0.014 mg/m³ (Measured data)	0.28

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, acute	0.071 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm² (Measured data)	0.432

11.3.5. Worker exposure: Milling (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.012 mg/m³ (Measured data)	0.24
Inhalation, local, long term	0.012 mg/m³ (Measured data)	0.24
Inhalation, local, acute	0.035 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	1 µg/cm² (Measured data)	0.083

11.3.6. Worker exposure: Spray drying (PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	5E-3 mg/m³ (Measured data)	0.1
Inhalation, local, long term	5E-3 mg/m³ (Measured data)	0.1
Inhalation, local, acute	0.016 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

11.3.7. Worker exposure: Calcination (PROC 22)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	5E-3 mg/m³ (Measured data)	0.1
Inhalation, local, long term	5E-3 mg/m³ (Measured data)	0.1
Inhalation, local, acute	0.016 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

11.3.8. Worker exposure: Sintering (PROC 22)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.015 mg/m³ (Measured data)	0.3
Inhalation, local, long term	0.015 mg/m³ (Measured data)	0.3
Inhalation, local, acute	0.044 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

11.3.9. Worker exposure: Handling of nickel zinc solids (PROC 21)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	9E-3 mg/m³ (Measured data)	0.18
Inhalation, local, long term	9E-3 mg/m³ (Measured data)	0.18
Inhalation, local, acute	0.037 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm² (Measured data)	0.432

11.3.10. Worker exposure: Wet cleaning (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m³ (Measured data)	0.12

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, acute	0.026 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

11.3.11. Worker exposure: Cleaning/removal of dust (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.032 mg/m³ (Measured data)	0.64
Inhalation, local, long term	0.032 mg/m³ (Measured data)	0.64
Inhalation, local, acute	0.189 mg/m³ (Measured data)	0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

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

Guidance: Please refer to Section 0.3 of this “ES for Communication”.

12. ES 12: Service life (worker at industrial site); Service life of nickel-containing electronics/ferrite cores in industrial settings

12.1. Title section

Article category: Machinery, mechanical appliances, electrical/electronic articles (AC 2)

Environment	
1: Service life of nickel-containing electronics/ferrite cores in industrial settings	ERC 12c
Worker	
2: Handling of nickel-containing electronics/ferrite cores	PROC 21
Exposure scenario of the uses leading to the inclusion of the substance into the article	
ES 10: Use at industrial sites; Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics	
ES 11: Use at industrial sites; Use of nickel oxide powder for the production of nickel zinc ferrite cores	

12.2. Conditions of use affecting exposure

12.2.1. Control of environmental exposure: Service life of nickel-containing electronics/ferrite cores in industrial settings (ERC 12c)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 16.87 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 337.5 tonnes/year
Technical and organisational conditions and measures
The substance should not be released to air
The substance should not be released to water
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.

12.2.2. Control of worker exposure: Handling of nickel-containing electronics/ferrite cores (PROC 21)

Product (article) characteristics
Maximum emission potential covered in this CS: Low (abrasion based).
Physical form of product: Massive object
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374. For further specification, refer to section 8 of the SDS.

12.3. Exposure estimation and reference to its source

12.3.1. Environmental release and exposure: Service life of nickel-containing electronics/ferrite cores in industrial settings (ERC 12c)

Release route	Release rate	Release estimation method
Water	0 kg/day	Estimated release factor

Release route	Release rate	Release estimation method
Air	0 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

12.3.2. Worker exposure: Handling of nickel-containing electronics/ferrite cores (PROC 21)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	9E-3 mg/m³ (Measured data)	0.18
Inhalation, local, long term	9E-3 mg/m³ (Measured data)	0.18
Inhalation, local, acute	0.037 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm² (Measured data)	0.432

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

Guidance: Please refer to Section 0.3 of this “ES for Communication”.

13. ES 13: Service life (professional worker); Service life of nickel-containing electronics/ferrite cores in professional settings

13.1. Title section

Article category: Machinery, mechanical appliances, electrical/electronic articles (AC 2)

Environment	
1: Service life of nickel-containing electronics/ferrite cores in professional settings	ERC 11a
Worker	
2: Handling of nickel-containing electronics/ferrite cores	PROC 21
Exposure scenario of the uses leading to the inclusion of the substance into the article	
ES 10: Use at industrial sites; Use of nickel oxide for the production of nickel-containing electronics and thermally functioning ceramics	
ES 11: Use at industrial sites; Use of nickel oxide powder for the production of nickel zinc ferrite cores	

13.2. Conditions of use affecting exposure

13.2.1. Control of environmental exposure: Service life of nickel-containing electronics/ferrite cores in professional settings (ERC 11a)

Technical and organisational conditions and measures
The substance should not be released to air
The substance should not be released to water
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.

13.2.2. Control of worker exposure: Handling of nickel-containing electronics/ferrite cores (PROC 21)

Product (article) characteristics
Maximum emission potential covered in this CS: Low (abrasion based).
Physical form of product: Massive object
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374. For further specification, refer to section 8 of the SDS.

13.3. Exposure estimation and reference to its source

13.3.1. Environmental release and exposure: Service life of nickel-containing electronics/ferrite cores in professional settings (ERC 11a)

Release route	Release rate	Release estimation method
Water	0 kg/day	Estimated release factor
Air	0 kg/day	Estimated release factor

Release route	Release rate	Release estimation method
Soil	0 kg/day	Estimated release factor

13.3.2. Worker exposure: Handling of nickel-containing electronics/ferrite cores (PROC 21)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	9E-3 mg/m³ (Measured data)	0.18
Inhalation, local, long term	9E-3 mg/m³ (Measured data)	0.18
Inhalation, local, acute	0.037 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm² (Measured data)	0.432

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

Guidance: Please refer to Section 0.3 of this “ES for Communication”.

14. ES 14: Use at industrial sites; Use of nickel oxide for the production of nickel oxide-containing automotive catalysts

14.1. Title section

Product category: Other (PC 0)
Sector of use: General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment. (SU 17)

Environment	
1: Use of nickel oxide for the production of nickel oxide-containing automotive catalysts	ERC 5
Worker	
2: Handling/transfer of raw material from locked store to glove box	PROC 26
3: Handling of dusty raw material in glove box	PROC 3
4: Formulation into washcoat	PROC 4, PROC 5
5: Dosing of slurry	PROC 8b, PROC 9
6: Coating of catalytic monoliths/filters	PROC 13
7: Handling of coated parts	PROC 21
8: Drying and calcination	PROC 3
9: Equipment cleaning (wet)	PROC 28
10: Equipment cleaning (at closed systems)	PROC 28
Subsequent service life exposure scenario(s)	
ES 15: Service life (worker at industrial site); Production of vehicle exhaust systems in industrial settings	
ES 16: Service life (professional worker); Service life of vehicle exhaust system in professional settings	

14.2. Conditions of use affecting exposure

14.2.1. Control of environmental exposure: Use of nickel oxide for the production of nickel oxide-containing automotive catalysts (ERC 5)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.038 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 10 tonnes/year
Emission days >= 260 days/year
Technical and organisational conditions and measures
The substance should not be released to air
The substance should not be released to water
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.

14.2.2. Control of worker exposure: Handling/transfer of raw material from locked store to glove box (PROC 26)

Product (article) characteristics

Physical form of product: Solid, high dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Exposure duration <= 240 min
Technical and organisational conditions and measures
Local exhaust ventilation
Semi-closed system
Conditions and measures related to personal protection, hygiene and health evaluation
In cases where direct contact with the substance cannot be avoided, a protective suit conforming to EN 13982 should be worn. For further specification, refer to section 8 of the SDS.
Wear suitable gloves tested to EN374. For further specification, refer to section 8 of the SDS.
APF of RPE = 10 (90 % respiratory protection). For further specification, refer to section 8 of the SDS.

14.2.3. Control of worker exposure: Handling of dusty raw material in glove box (PROC 3)

Product (article) characteristics
Physical form of product: Solid, high dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Frequency of task: Once per shift.
Technical and organisational conditions and measures
Use of an integrated local exhaust ventilation is required.
Handle in a glove box.
Conditions and measures related to personal protection, hygiene and health evaluation
In cases where direct contact with the substance cannot be avoided, a protective suit conforming to EN 13982 should be worn. For further specification, refer to section 8 of the SDS.
Wear suitable gloves tested to EN374. For further specification, refer to section 8 of the SDS.
APF of RPE = 40 (97.5 % respiratory protection). For further specification, refer to section 8 of the SDS.

14.2.4. Control of worker exposure: Formulation into washcoat (PROC 4, PROC 5)

Product (article) characteristics
Maximum emission potential covered in this CS: Very low.
Physical form of product: Solution, suspension or slurry
Amount used (or contained in articles), frequency and duration of use/exposure
Exposure duration <= 240 min
Technical and organisational conditions and measures
Enclosed automated mixer or mixing in glove box.
Covers use at ambient temperatures.

14.2.5. Control of worker exposure: Dosing of slurry (PROC 8b, PROC 9)

Product (article) characteristics
Maximum emission potential covered in this CS: Very low.
Physical form of product: Solution, suspension or slurry
Amount used (or contained in articles), frequency and duration of use/exposure

Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Use in closed process
Covers use at ambient temperatures.
Very limited manual intervention is required to run the process. Contact with the substance shall only be possible for a very limited duration of time.

14.2.6. Control of worker exposure: Coating of catalytic monoliths/filters (PROC 13)

Product (article) characteristics
Maximum emission potential covered in this CS: Very low.
Physical form of product: Solution, suspension or slurry
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Use in closed process
Covers use at ambient temperatures.
Very limited manual intervention is required to run the process. Contact with the substance shall only be possible for a very limited duration of time.

14.2.7. Control of worker exposure: Handling of coated parts (PROC 21)

Product (article) characteristics
Maximum emission potential covered in this CS: Very low.
Physical form of product: Massive object (Monolith/filter)
Technical and organisational conditions and measures
Ensure automation of the process as far as technically feasible. Gloves are not required when fully automated process.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374. For further specification, refer to section 8 of the SDS.

14.2.8. Control of worker exposure: Drying and calcination (PROC 3)

Product (article) characteristics
Maximum emission potential covered in this CS: Low.
Physical form of product: Massive object (Monolith/filter)
Technical and organisational conditions and measures
Local exhaust ventilation
Use in closed process
Manufacturing and processing of minerals and/or metals at substantially elevated temperature (800 °C).

14.2.9. Control of worker exposure: Equipment cleaning (wet) (PROC 28)

Product (article) characteristics
Maximum emission potential covered in this CS: Very low.
Physical form of product: Solution and other liquid materials, e.g. suspensions are also covered

Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
Automated task
Automated cleaning machines used, no manual cleaning.
Covers use at ambient temperatures.
Conditions and measures related to personal protection, hygiene and health evaluation
APF of RPE = 10 (90 % respiratory protection). For further specification, refer to section 8 of the SDS.

14.2.10. Control of worker exposure: Equipment cleaning (at closed systems) (PROC 28)

Product (article) characteristics
Physical form of product: Solutions / Suspensions, residual dust
Amount used (or contained in articles), frequency and duration of use/exposure
Covers daily exposures up to 8 hours
Technical and organisational conditions and measures
During cleaning use vacuum and/or (pressure) washing with water to remove dusts or powders. No direct handling (use of long-distance tools).

14.3. Exposure estimation and reference to its source

14.3.1. Environmental release and exposure: Use of nickel oxide for the production of nickel oxide-containing automotive catalysts (ERC 5)

Release route	Release rate	Release estimation method
Water	0 kg/day	Estimated release factor
Air	0 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

14.3.2. Worker exposure: Handling/transfer of raw material from locked store to glove box (PROC 26)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	7E-3 mg/m³ (Measured data)	0.14
Inhalation, local, long term	7E-3 mg/m³ (Measured data)	0.14
Inhalation, local, acute	0.071 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm² (Measured data)	0.432

14.3.3. Worker exposure: Handling of dusty raw material in glove box (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	7E-4 mg/m³ (Measured data)	0.014
Inhalation, local, long term	7E-4 mg/m³ (Measured data)	0.014
Inhalation, local, acute	2.8E-3 mg/m³ (Measured data)	< 0.01

Route of exposure and type of effects	Exposure estimate	RCR
Dermal, local, long term	0.06 µg/cm² (Measured data)	< 0.01

14.3.4. Worker exposure: Formulation into washcoat (PROC 4, PROC 5)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, acute	0.047 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

14.3.5. Worker exposure: Dosing of slurry (PROC 8b, PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.012 mg/m³ (Measured data)	0.24
Inhalation, local, long term	0.012 mg/m³ (Measured data)	0.24
Inhalation, local, acute	0.047 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

14.3.6. Worker exposure: Coating of catalytic monoliths/filters (PROC 13)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.012 mg/m³ (Measured data)	0.24
Inhalation, local, long term	0.012 mg/m³ (Measured data)	0.24
Inhalation, local, acute	0.047 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

14.3.7. Worker exposure: Handling of coated parts (PROC 21)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	9E-3 mg/m³ (Measured data)	0.18
Inhalation, local, long term	9E-3 mg/m³ (Measured data)	0.18
Inhalation, local, acute	0.037 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm² (Measured data)	0.432

14.3.8. Worker exposure: Drying and calcination (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	5E-3 mg/m³ (Measured data)	0.1
Inhalation, local, long term	5E-3 mg/m³ (Measured data)	0.1
Inhalation, local, acute	0.016 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

14.3.9. Worker exposure: Equipment cleaning (wet) (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, long term	6E-3 mg/m³ (Measured data)	0.12
Inhalation, local, acute	0.026 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

14.3.10. Worker exposure: Equipment cleaning (at closed systems) (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.027 mg/m³ (Measured data)	0.54
Inhalation, local, long term	0.027 mg/m³ (Measured data)	0.54
Inhalation, local, acute	0.16 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm² (Measured data)	0.063

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

Guidance: Please refer to Section 0.3 of this “ES for Communication”.

15. ES 15: Service life (worker at industrial site); Production of vehicle exhaust systems in industrial settings

15.1. Title section

Article category: Vehicles covered by End of Life Vehicles (ELV) directive (AC 1a)

Environment	
1: Production of vehicle exhaust systems in industrial settings	ERC 12c
Worker	
2: Handling/Packaging of finished article (catalyst brick/monolith) and assembly into vehicle exhaust system with no release	PROC 21
Exposure scenario of the uses leading to the inclusion of the substance into the article	
ES 14: Use at industrial sites; Use of nickel oxide for the production of nickel oxide-containing automotive catalysts	

15.2. Conditions of use affecting exposure

15.2.1. Control of environmental exposure: Production of vehicle exhaust systems in industrial settings (ERC 12c)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.038 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 10 tonnes/year
Technical and organisational conditions and measures
The substance should not be released to air
The substance should not be released to water
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.

15.2.2. Control of worker exposure: Handling/Packaging of finished article (catalyst brick/monolith) and assembly into vehicle exhaust system with no release (PROC 21)

Product (article) characteristics
Maximum emission potential covered in this CS: Very low.
Physical form of product: Massive object (Monolith/filter)
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374. For further specification, refer to section 8 of the SDS.

15.3. Exposure estimation and reference to its source

15.3.1. Environmental release and exposure: Production of vehicle exhaust systems in industrial settings (ERC 12c)

Release route	Release rate	Release estimation method
Water	0 kg/day	Estimated release factor
Air	0 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

15.3.2. Worker exposure: Handling/Packaging of finished article (catalyst brick/monolith) and assembly into vehicle exhaust system with no release (PROC 21)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	9E-3 mg/m³ (Measured data)	0.18
Inhalation, local, long term	9E-3 mg/m³ (Measured data)	0.18
Inhalation, local, acute	0.037 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm² (Measured data)	0.432

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

Guidance: Please refer to Section 0.3 of this “ES for Communication”.

16. ES 16: Service life (professional worker); Service life of vehicle exhaust system in professional settings

16.1. Title section

Article category: Vehicles covered by End of Life Vehicles (ELV) directive (AC 1a)

Environment	
1: Service life of vehicle exhaust system in professional settings	ERC 10a
Worker	
2: Assembly into/repair of vehicle exhaust system with no release	PROC 21
Exposure scenario of the uses leading to the inclusion of the substance into the article	
ES 14: Use at industrial sites; Use of nickel oxide for the production of nickel oxide-containing automotive catalysts	

16.2. Conditions of use affecting exposure

16.2.1. Control of environmental exposure: Service life of vehicle exhaust system in professional settings (ERC 10a)

Technical and organisational conditions and measures
The substance should not be released to air
The substance should not be released to water
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.

16.2.2. Control of worker exposure: Assembly into/repair of vehicle exhaust system with no release (PROC 21)

Product (article) characteristics
Maximum emission potential covered in this CS: Very low.
Physical form of product: Massive object (Monolith/filter)
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374. For further specification, refer to section 8 of the SDS.

16.3. Exposure estimation and reference to its source

16.3.1. Environmental release and exposure: Service life of vehicle exhaust system in professional settings (ERC 10a)

Release route	Release rate	Release estimation method
Water	0 kg/day	Estimated release factor
Air	0 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

16.3.2. Worker exposure: Assembly into/repair of vehicle exhaust system with no release (PROC 21)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	9E-3 mg/m³ (Measured data)	0.18
Inhalation, local, long term	9E-3 mg/m³ (Measured data)	0.18
Inhalation, local, acute	0.037 mg/m³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm² (Measured data)	0.432

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

Guidance: Please refer to Section 0.3 of this “ES for Communication”.