



ES FOR COMMUNICATION

Substance Name: NICKEL DIHYDROXIDE (Update 2023)

EC Number: 235-008-5

CAS Number: 12054-48-7

Registration Number:

Date of Generation/Revision: 18/09/2023

Author: EBRC Consulting GmbH



Table of Contents

0. General provisions related to conditions of use and guidance to downstream users	4
0.1. Good occupational hygiene practice.....	4
0.2. General provisions related to personal protective equipment.....	4
0.3. Generic guidance to DU to evaluate whether he works inside the boundaries set by the ES	5
0.4. Man via the environment exposure and risk characterisation assessments.....	8
1. ES 1: Use at industrial sites; Intermediate use of nickel dihydroxide for the manufacture of nickel-containing inorganic pigments and compounds	9
1.1. Title section	9
1.2. Conditions of use affecting exposure.....	9
1.3. Exposure estimation and reference to its source	13
1.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES	15
2. ES 2: Use at industrial sites; Intermediate use of nickel dihydroxide for the manufacture of nickel hydroxycarbonate.....	16
2.1. Title section	16
2.2. Conditions of use affecting exposure.....	16
2.3. Exposure estimation and reference to its source	20
2.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES	22
3. ES 3: Formulation or re-packing; Use of nickel dihydroxide in the formulation of surface treatment products for anodised aluminium sheets	23
3.1. Title section	23
3.2. Conditions of use affecting exposure.....	23
3.3. Exposure estimation and reference to its source	26
3.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES	28
4. ES 4: Use at industrial sites; Use of nickel dihydroxide for surface treatment of anodised aluminium sheets	29
4.1. Title section	29
4.2. Conditions of use affecting exposure.....	29
4.3. Exposure estimation and reference to its source	33
4.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES	35
5. ES 5: Service life (worker at industrial site); Service life of anodised goods in industrial settings...	36
5.1. Title section	36
5.2. Conditions of use affecting exposure.....	36
5.3. Exposure estimation and reference to its source	37
5.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES	37
6. ES 6: Service life (professional worker); Service life of anodised goods in professional settings ...	38
6.1. Title section	38
6.2. Conditions of use affecting exposure.....	38
6.3. Exposure estimation and reference to its source	38
6.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES	39
7. ES 7: Service life (consumers); Service life of surface treated articles (anodic coating) used by consumers.....	40
7.1. Title section	40
7.2. Conditions of use affecting exposure.....	40
7.3. Exposure estimation and reference to its source	41
7.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES	41
8. ES 8: Use at industrial sites; Use of nickel dihydroxide for the production of batteries using nickel electrodes.....	42



8.1. Title section	42
8.2. Conditions of use affecting exposure.....	42
8.3. Exposure estimation and reference to its source	48
8.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES	50
9. ES 9: Service life (worker at industrial site); Service life of nickel-containing batteries in industrial settings.....	51
9.1. Title section	51
9.2. Conditions of use affecting exposure.....	51
9.3. Exposure estimation and reference to its source	52
9.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES	53
10. ES 10: Service life (professional worker); Service life of nickel-containing batteries in professional settings.....	54
10.1. Title section	54
10.2. Conditions of use affecting exposure.....	54
10.3. Exposure estimation and reference to its source	54
10.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES	55
11. ES 11: Service life (consumers); Service life of rechargeable Ni-MH batteries used by consumers	56
11.1. Title section	56
11.2. Conditions of use affecting exposure.....	56
11.3. Exposure estimation and reference to its source	56
11.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES	57



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. Such exclusion of exposure may be determined by:

- (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) applied exposure prevention measures (segregation of the emission source or separation of the worker from the emission source), and
- (iv) a very small amount of the handled/emitted material in relation to the room size (i.e., dilution factor) under consideration of the 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 is to be selected in consideration of local effects caused by the substance, 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)

Specific information on the required assigned protection factor (APF) is provided in the occupational contributing scenarios as relevant. Respiratory protective equipment (RPE) is to 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 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 and/or the exposure duration is not explicitly stated in the ES up to 100 % of the substance could be used and/or the duration of exposure is not restricted, respectively. Depending on the basis for the exposure assessment conducted for the contributing scenario (CS), the assessment needs to be done in multiple ways as described individually for environmental and occupational CS below.

0.3.1. Occupational contributing scenarios

For the assessment of occupational exposure, different health endpoints are relevant. In general, occupational exposure via the inhalation route and the dermal route are considered relevant. Exposure via these routes may result in systemic or local effects in humans and these may occur after acute (short-term) exposure or long-term exposure. Depending on the type of effect, either quantitative or qualitative exposure assessments are further addressed below as required.

0.3.1.1. Quantitative exposure assessment

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 the exposure assessment, different ways for checking compliance with the conditions of use described in the ES are to be followed as given below. In any case, it needs to be ensured that the final exposure estimate remains well below the respective DNEL. For systemic effects (if relevant), the sum of the RCRs for the dermal and for the inhalation route needs to be below 1.

0.3.1.1.1. Monitoring data used as basis for assessment

If the exposure assessment in the ES is based on inhalation monitoring data, the same approach can be used by DUs for checking compliance with the conditions of use described in the ES. 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 scenario. Respiratory protective equipment (RPE) may be taken into account by applying the assigned protection factor as given in EN 529:2005.

If the typical duration per shift is less than full shift, (i.e., 480 minutes) exposure estimates reflect the actual exposure duration by calculated time-weighted-averages (TWAs).

0.3.1.1.1.1. Specific considerations for efficiency values for RMMs prescribed in occupational contributing scenarios

If your monitored exposure levels are equal or below those reported for the ES after consideration of any PPE worn, the efficiency of the risk management measures (RMMs) implemented at your facility can be considered compliant with the ES.

0.3.1.1.1.2. 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 be kept at your company as in-house documentation.

0.3.1.1.2. 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. In case of a multiple PROC assessment, the PROC used for the exposure estimation is provided in brackets with the corresponding exposure estimate. The installation of the prescribed RMMs is mandatory and 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).



0.3.1.1.2.1. Specific considerations for efficiency values for RMMs prescribed in occupational contributing 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 contributing scenario after consideration of any PPE worn. Further information on efficiency values can be found in the glossary of MEASE (version 1.02.01).

0.3.1.1.2.2. 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 be kept at your company as in-house documentation.

0.3.1.2. Qualitative exposure assessment

Qualitative exposure assessments may be required due to the hazardous properties of a substance to which exposure has to be minimised by specific operational conditions (OCs) and risk management measures (RMMs) or due to the unlikelihood that exposure may occur in a specific situation.

In addition to the quantitative risk characterisation, demonstrating that prescribed OCs and RMMs effectively control exposure well below the respective DNELs, residual exposure concentrations may theoretically still cause local effects. In the applicable sections of the occupational contributing scenarios personal protective equipment (PPE) is therefore prescribed in situations in which such residual exposure concentrations cannot be excluded. The risk of local effects is therefore adequately controlled.

0.3.1.3. Specific considerations on the conditions of use

Standard phrases according to the ECom Standard Phrase Catalogue, version 5.2, were used as much as possible. In this regard, it should be noted that the generic standard phrase "Liquids" is also covering other liquid mixtures such as aqueous solutions, pastes, slurries, and suspensions. In some cases, in which standard phrases could not be used to meet the specific requirements of the exposure situation described in the ES, additional phrases were developed and included in the relevant contributing scenarios as required.

0.3.1.4. Reflection of additional RMMs due to impurities

Information about the reflection of additional RMMs due to impurities is given in the sub-sections below. Further information about the "Substance Identification Profiles" can be found on the Nickel Consortia website (<https://www.nickelconsortia.eu/nickel-consortia.html>).

0.3.1.4.1. Additional qualitative risk assessment

If qualitative risk assessments were required for local effects caused by impurities, RMMs such as personal protective equipment (PPE) were prescribed as required. If exposure to the impurity as nominated in the ES below can be excluded, because this impurity is not relevant for a company or certain process, then the RMMs included for this impurity do not have to be considered. In cases, in which multiple impurities of one "SIP" (substance identity profile) leading to different qualitative hazard classes for the same route of exposure and type of effect, the hazard class with the severest effect was considered in the additional risk assessment and appropriate RMMs were prescribed for precautionary reasons.



0.3.1.4.2. Additional quantitative risk assessment

Quantitative risk assessments were conducted, if one route of exposure and type of effect were currently not covered by the current risk assessment for the pure substance, or if the DNEL derived for an impurity was significantly lower than that derived for the pure substance. In both cases, the DNEL of the impurity has been used to describe the hazard of the impurity.

If the types of emission are the same for the pure substance and impurity, the exposure assessment was conducted by linear extrapolation from substance exposure levels to exposure levels of the impurity. For the exposure assessment, the upper concentration limit of the impurity was used for extrapolation.

If an additional risk assessment was required for the same route of exposure and type of effect, the RCRs from the pure substance and the impurity or multiple impurities were summed up.

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/m³ as annual average in PM₁₀ in order to demonstrate adequate control of risk (RCR<1) for Man via the Environment (MvE).

Hereto a Generic safe use Exposure Scenario for MvE was developed based on the EUSES model. The MvE 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/m³. The value of 56.6 ng Ni/m³ is derived from the difference between the DNEL of 60 ng Ni/m³ and the EU regional background concentration (C_{regional}) of 3.4 ng Ni/m³ (average of P90 annual concentration of Ni in PM₁₀ 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 PM10 (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: Use at industrial sites; Intermediate use of nickel dihydroxide for the manufacture of nickel-containing inorganic pigments and compounds

1.1. Title section

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

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

1.2. Conditions of use affecting exposure

1.2.1. Control of environmental exposure: Intermediate use of nickel dihydroxide for the manufacture of nickel-containing inorganic pigments and compounds - 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 $\geq 2E3$ m ³ /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 $\geq 1.8E4$ m ³ /day
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 10

1.2.2. Control of environmental exposure: Intermediate use of nickel dihydroxide for the manufacture of nickel-containing inorganic pigments and compounds - 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 $\geq 2.97E4$ m ³ /day
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 100
Assumed effluent discharge flow from site ≥ 225 m ³ /day

1.2.3. Control of environmental exposure: Intermediate use of nickel dihydroxide for the manufacture of nickel-containing inorganic pigments and compounds - 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 \geq 225 m ³ /day
--

Local marine water dilution factor 100
--

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

Product (article) characteristics
Physical form of product: Solid, high dustiness
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Frequency of task: Once per shift.
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Provide specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

1.2.5. Control of worker exposure: Closed mixing and transfer process (PROC 2, PROC 1)

Product (article) characteristics
Physical form of product: Solid, no or very low dustiness
Additional physical form of product: Damp solid
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Automated task
Use in closed process
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

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

Product (article) characteristics
Physical form of product: Solid, high dustiness
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure



Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Provide specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.
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.
Ensure segregation of worker from the source.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 40 °C

1.2.7. Control of worker exposure: Drying and calcining (PROC 22, PROC 3, PROC 4, PROC 9, PROC 2)

Product (article) characteristics
Physical form of product: Solid, low dustiness
Additional physical form of product: Damp solid
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Provide specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.
Semi-closed system
Elevated temperature
Other conditions affecting workers exposure
Indoor use

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

Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Solution
Covers concentrations up to 100 %
Maximum emission potential covered in this CS: Very low.
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.



Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Cleaning machines such as power sweeper, no direct manual cleaning.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 10 (APF >= 10). For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

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

Product (article) characteristics
Physical form of product: Solid, high dustiness
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
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
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 20 (APF >= 20). For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

1.3. Exposure estimation and reference to its source

1.3.1. Environmental release and exposure: Intermediate use of nickel dihydroxide for the manufacture of nickel-containing inorganic pigments and compounds - 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)	0.548
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)	0.417



1.3.2. Environmental release and exposure: Intermediate use of nickel dihydroxide for the manufacture of nickel-containing inorganic pigments and compounds - 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)	0.557
Sediment (freshwater)	46.5 mg/kg dw (PEC sediment calculation method for metals)	0.427
Agricultural soil	16.20 mg/kg dw (EUSES 2.1.2)	0.412

1.3.3. Environmental release and exposure: Intermediate use of nickel dihydroxide for the manufacture of nickel-containing inorganic pigments and compounds - 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)	0.1
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)	0.412

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

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.028 mg/m ³ (Measured data)	0.56
Inhalation, systemic, acute	0.111 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.028 mg/m ³ (Measured data)	0.56
Inhalation, local, acute	0.111 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	< 0.01

1.3.5. Worker exposure: Closed mixing and transfer process (PROC 2, PROC 1)

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



Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, acute	0.017 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.076 µg/cm ² (Measured data)	< 0.01

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

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.031 mg/m ³ (Measured data)	0.62
Inhalation, systemic, acute	0.093 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.031 mg/m ³ (Measured data)	0.62
Inhalation, local, acute	0.093 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	1 µg/cm ² (Measured data)	< 0.01

1.3.7. Worker exposure: Drying and calcining (PROC 22, PROC 3, PROC 4, PROC 9, PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	5E-3 mg/m ³ (Measured data)	0.1
Inhalation, systemic, acute	0.016 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	5E-3 mg/m ³ (Measured data)	0.1
Inhalation, local, acute	0.016 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	< 0.01

1.3.8. Worker exposure: Wet cleaning (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m ³ (Measured data)	0.12
Inhalation, systemic, acute	0.026 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	6E-3 mg/m ³ (Measured data)	0.12
Inhalation, local, acute	0.026 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	< 0.01

1.3.9. 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/m ³ (Measured data)	0.64
Inhalation, systemic, acute	0.189 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.032 mg/m ³ (Measured data)	0.64
Inhalation, local, acute	0.189 mg/m ³ (Measured data)	0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	< 0.01

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: Use at industrial sites; Intermediate use of nickel dihydroxide for the manufacture of nickel hydroxycarbonate

2.1. Title section

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

Environment	
1: Intermediate use of nickel dihydroxide for the manufacture of nickel hydroxycarbonate - Discharge to fresh water via municipal sewage treatment plant	ERC 6a
Worker	
2: Raw material handling	PROC 4
3: Purification of crude nickel dihydroxide	PROC 3, PROC 26, PROC 8b
4: Isolation of pure nickel dihydroxide	PROC 3, PROC 26, PROC 8b
5: Packaging of pure nickel dihydroxide	PROC 3, PROC 26, PROC 8b
6: Manufacture of nickel salts	PROC 3, PROC 26, PROC 8b
7: Wet cleaning	PROC 28
8: Cleaning/removal of dust	PROC 28

2.2. Conditions of use affecting exposure

2.2.1. Control of environmental exposure: Intermediate use of nickel dihydroxide for the manufacture of nickel hydroxycarbonate - 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 ≤ 0.278 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 ≤ 100 tonnes/year
Emission days ≥ 360 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
The substance should not be released to air
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow $\geq 2E3$ m ³ /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 $\geq 2E6$ m ³ /day
No discharge to marine water assumed



Receiving water dilution (fresh or marine) $\geq 1E3$

2.2.2. Control of worker exposure: Raw material handling (PROC 4)

Product (article) characteristics
Physical form of product: Solid, no or very low dustiness
Additional physical form of product: Damp powder
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Provide specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.
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.
Use in closed process
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

2.2.3. Control of worker exposure: Purification of crude nickel dihydroxide (PROC 3, PROC 26, PROC 8b)

Product (article) characteristics
Physical form of product: Solid, no or very low dustiness
Additional physical form of product: Damp powder
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Provide specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.
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.
Use in closed process
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

2.2.4. Control of worker exposure: Isolation of pure nickel dihydroxide (PROC 3, PROC 26, PROC 8b)



Product (article) characteristics
Physical form of product: Solid, no or very low dustiness
Additional physical form of product: Damp powder
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Provide specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.
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.
Use in closed process
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

2.2.5. Control of worker exposure: Packaging of pure nickel dihydroxide (PROC 3, PROC 26, PROC 8b)

Product (article) characteristics
Physical form of product: Solid, no or very low dustiness
Additional physical form of product: Damp powder
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Provide specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.
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.
Use in closed process
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

2.2.6. Control of worker exposure: Manufacture of nickel salts (PROC 3, PROC 26, PROC 8b)

Product (article) characteristics
Physical form of product: Solid, no or very low dustiness



Additional physical form of product: Damp powder
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Provide specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.
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.
Use in closed process
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

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

Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Solution
Covers concentrations up to 100 %
Maximum emission potential covered in this CS: Very low.
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Cleaning machines such as power sweeper, no direct manual cleaning.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 10 (APF >= 10). For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

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

Product (article) characteristics
Physical form of product: Solid, high dustiness
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day



Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
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
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 20 (APF >= 20). For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

2.3. Exposure estimation and reference to its source

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

Release route	Release rate	Release estimation method
Water	2.78E-4 kg/day	Estimated release factor
Air	0 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	2.9E-3 mg/L (EUSES 2.1.2)	0.475
Sediment (freshwater)	33.50 mg/kg dw (PEC sediment calculation method for metals)	0.307
Sewage Treatment Plant	8.34E-5 mg/L (EUSES 2.1.2)	< 0.01
Agricultural soil	16.20 mg/kg dw (EUSES 2.1.2)	0.412

2.3.2. Worker exposure: Raw material handling (PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.012 mg/m ³ (Measured data)	0.24
Inhalation, systemic, acute	0.035 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.012 mg/m ³ (Measured data)	0.24
Inhalation, local, acute	0.035 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	1 µg/cm ² (Measured data)	< 0.01

2.3.3. Worker exposure: Purification of crude nickel dihydroxide (PROC 3, PROC 26, PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.012 mg/m ³ (Measured data)	0.24
Inhalation, systemic, acute	0.035 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.012 mg/m ³ (Measured data)	0.24



Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, acute	0.035 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	1 µg/cm ² (Measured data)	< 0.01

2.3.4. Worker exposure: Isolation of pure nickel dihydroxide (PROC 3, PROC 26, PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.012 mg/m ³ (Measured data)	0.24
Inhalation, systemic, acute	0.035 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.012 mg/m ³ (Measured data)	0.24
Inhalation, local, acute	0.035 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	1 µg/cm ² (Measured data)	< 0.01

2.3.5. Worker exposure: Packaging of pure nickel dihydroxide (PROC 3, PROC 26, PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.012 mg/m ³ (Measured data)	0.24
Inhalation, systemic, acute	0.035 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.012 mg/m ³ (Measured data)	0.24
Inhalation, local, acute	0.035 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	1 µg/cm ² (Measured data)	< 0.01

2.3.6. Worker exposure: Manufacture of nickel salts (PROC 3, PROC 26, PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.012 mg/m ³ (Measured data)	0.24
Inhalation, systemic, acute	0.035 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.012 mg/m ³ (Measured data)	0.24
Inhalation, local, acute	0.035 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	1 µg/cm ² (Measured data)	< 0.01

2.3.7. Worker exposure: Wet cleaning (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m ³ (Measured data)	0.12
Inhalation, systemic, acute	0.026 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	6E-3 mg/m ³ (Measured data)	0.12
Inhalation, local, acute	0.026 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	< 0.01

2.3.8. 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/m ³ (Measured data)	0.64



Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, acute	0.189 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.032 mg/m ³ (Measured data)	0.64
Inhalation, local, acute	0.189 mg/m ³ (Measured data)	0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	< 0.01

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: Formulation or re-packing; Use of nickel dihydroxide in the formulation of surface treatment products for anodised aluminium sheets

3.1. Title section

Product category: Metal surface treatment products (PC 14)

Environment	
1: Use of nickel dihydroxide in the formulation of surface treatment products for anodised aluminium sheets - Discharge to fresh water via municipal sewage treatment plant	ERC 2
2: Use of nickel dihydroxide in the formulation of surface treatment products for anodised aluminium sheets - Direct discharge to fresh water	ERC 2
3: Use of nickel dihydroxide in the formulation of surface treatment products for anodised aluminium sheets - Direct discharge to marine water	ERC 2
Worker	
4: Powder handling during preparation of sealant formulations	PROC 26, PROC 5
5: Handling of solutions during preparation of sealant formulations	PROC 8b, PROC 5
6: Wet cleaning	PROC 28
7: Cleaning/removal of dust	PROC 28

3.2. Conditions of use affecting exposure

3.2.1. Control of environmental exposure: Use of nickel dihydroxide in the formulation of surface treatment products for anodised aluminium sheets - Discharge to fresh water via municipal sewage treatment plant (ERC 2)

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 0.186 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 ≤ 41 tonnes/year
Emission days ≥ 220 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 $\geq 2E3$ m ³ /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 $\geq 1.8E4$ m ³ /day
No discharge to marine water assumed



Receiving water dilution (fresh or marine) ≥ 10
--

3.2.2. Control of environmental exposure: Use of nickel dihydroxide in the formulation of surface treatment products for anodised aluminium sheets - Direct discharge to fresh water (ERC 2)

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 0.096 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 ≤ 21 tonnes/year
Emission days ≥ 220 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 $\geq 4.98E3$ m ³ /day
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 200
Assumed effluent discharge flow from site ≥ 25 m ³ /day

3.2.3. Control of environmental exposure: Use of nickel dihydroxide in the formulation of surface treatment products for anodised aluminium sheets - Direct discharge to marine water (ERC 2)

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 0.096 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 ≤ 21 tonnes/year
Emission days ≥ 220 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
Receiving water dilution (fresh or marine) ≥ 100
Assumed effluent discharge flow from site ≥ 25 m ³ /day

3.2.4. Control of worker exposure: Powder handling during preparation of sealant formulations (PROC 26, PROC 5)

Product (article) characteristics
Physical form of product: Solid, high dustiness



Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Provide specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.
Semi-closed system
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 10 (APF >= 10). For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

3.2.5. Control of worker exposure: Handling of solutions during preparation of sealant formulations (PROC 8b, PROC 5)

Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Solution
Covers concentrations up to 100 %
Maximum emission potential covered in this CS: Very low.
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

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

Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Solution
Covers concentrations up to 100 %
Maximum emission potential covered in this CS: Very low.
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained



personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Cleaning machines such as power sweeper, no direct manual cleaning.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 10 (APF >= 10). For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

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

Product (article) characteristics
Physical form of product: Solid, high dustiness
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
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
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 20 (APF >= 20). For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

3.3. Exposure estimation and reference to its source

3.3.1. Environmental release and exposure: Use of nickel dihydroxide in the formulation of surface treatment products for anodised aluminium sheets - Discharge to fresh water via municipal sewage treatment plant (ERC 2)

Release route	Release rate	Release estimation method
Water	0.022 kg/day	Estimated release factor
Air	9.32E-3 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	3.37E-3 mg/L (EUSES 2.1.2)	0.552
Sediment (freshwater)	45.7 mg/kg dw (PEC sediment calculation method for metals)	0.419



Protection target	Exposure estimate	RCR
Sewage Treatment Plant	6.49E-3 mg/L (EUSES 2.1.2)	0.02
Agricultural soil	16.38 mg/kg dw (EUSES 2.1.2)	0.417

3.3.2. Environmental release and exposure: Use of nickel dihydroxide in the formulation of surface treatment products for anodised aluminium sheets - Direct discharge to fresh water (ERC 2)

Release route	Release rate	Release estimation method
Water	0.011 kg/day	Estimated release factor
Air	4.77E-3 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	4.49E-3 mg/L (EUSES 2.1.2)	0.736
Sediment (freshwater)	75.3 mg/kg dw (PEC sediment calculation method for metals)	0.691
Agricultural soil	16.2 mg/kg dw (EUSES 2.1.2)	0.412

3.3.3. Environmental release and exposure: Use of nickel dihydroxide in the formulation of surface treatment products for anodised aluminium sheets - Direct discharge to marine water (ERC 2)

Release route	Release rate	Release estimation method
Water	0.011 kg/day	Estimated release factor
Air	4.77E-3 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	3.48E-3 mg/L (EUSES 2.1.2)	0.364
Sediment (marine water)	99.65 mg/kg dw (PEC sediment calculation method for metals)	0.914
Agricultural soil	16.2 mg/kg dw (EUSES 2.1.2)	0.412

3.3.4. Worker exposure: Powder handling during preparation of sealant formulations (PROC 26, PROC 5)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.014 mg/m ³ (Measured data)	0.28
Inhalation, systemic, acute	0.071 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.014 mg/m ³ (Measured data)	0.28
Inhalation, local, acute	0.071 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	33.35 µg/cm ² (Measured data)	0.051

3.3.5. Worker exposure: Handling of solutions during preparation of sealant formulations (PROC 8b, PROC 5)



Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.012 mg/m ³ (Measured data)	0.24
Inhalation, systemic, acute	0.047 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.012 mg/m ³ (Measured data)	0.24
Inhalation, local, acute	0.047 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	< 0.01

3.3.6. Worker exposure: Wet cleaning (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m ³ (Measured data)	0.12
Inhalation, systemic, acute	0.026 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	6E-3 mg/m ³ (Measured data)	0.12
Inhalation, local, acute	0.026 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	< 0.01

3.3.7. 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/m ³ (Measured data)	0.64
Inhalation, systemic, acute	0.189 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.032 mg/m ³ (Measured data)	0.64
Inhalation, local, acute	0.189 mg/m ³ (Measured data)	0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	< 0.01

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; Use of nickel dihydroxide for surface treatment of anodised aluminium sheets

4.1. Title section

Product category: Metal surface treatment products (PC 14)

Sector of use: Manufacture of fabricated metal products, except machinery and equipment (SU 15),

General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment. (SU 17)

Environment	
1: Use of nickel dihydroxide for surface treatment of anodised aluminium sheets - Discharge to fresh water via municipal sewage treatment plant	ERC 5
2: Use of nickel dihydroxide for surface treatment of anodised aluminium sheets - Direct discharge to fresh water	ERC 5
3: Use of nickel dihydroxide for surface treatment of anodised aluminium sheets - Direct discharge to marine water	ERC 5
Worker	
4: Anodizing (dipping)	PROC 13
5: Handling of medium dusty materials for topping-up	PROC 26
6: Handling of solutions for topping-up	PROC 8b
7: Fabrication	PROC 24, PROC 21
8: Wet cleaning	PROC 28
9: Cleaning/removal of dust	PROC 28
Subsequent service life exposure scenario(s)	
ES 5: Service life (worker at industrial site); Service life of anodised goods in industrial settings	
ES 6: Service life (professional worker); Service life of anodised goods in professional settings	
ES 7: Service life (consumers); Service life of surface treated articles (anodic coating) used by consumers	

4.2. Conditions of use affecting exposure

4.2.1. Control of environmental exposure: Use of nickel dihydroxide for surface treatment of anodised aluminium sheets - 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 ≤ 0.033 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 ≤ 8 tonnes/year
Emission days ≥ 240 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 $\geq 2E3$ m ³ /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 $\geq 1.8E4$ m ³ /day
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 10

4.2.2. Control of environmental exposure: Use of nickel dihydroxide for surface treatment of anodised aluminium sheets - Direct discharge to fresh water (ERC 5)

Amount used, frequency and duration of use (or from service life)
Daily amount per site $\leq 8.96E-3$ 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 ≤ 2.15 tonnes/year
Emission days ≥ 240 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 $\geq 1.23E4$ m ³ /day
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 50
Assumed effluent discharge flow from site ≥ 250 m ³ /day

4.2.3. Control of environmental exposure: Use of nickel dihydroxide for surface treatment of anodised aluminium sheets - Direct discharge to marine water (ERC 5)

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 0.016 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 ≤ 3.8 tonnes/year
Emission days ≥ 240 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
Receiving water dilution (fresh or marine) ≥ 100
Assumed effluent discharge flow from site ≥ 250 m ³ /day

4.2.4. Control of worker exposure: Anodizing (dipping) (PROC 13)

Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Solution
Covers concentrations up to 100 %
Maximum emission potential covered in this CS: Very low.
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Provide basic LEV such as canopy hood, movable capturing hood or other multipurpose LEV. Ensure effectiveness is at least 50%.
Automated task
Use of a surfactant/wetting/foaming agent is required.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

4.2.5. Control of worker exposure: Handling of medium dusty materials for topping-up (PROC 26)

Product (article) characteristics
Physical form of product: Solid, medium dustiness
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Provide specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.
Semi-closed system
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 10 (APF ≥ 10). For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use



4.2.6. Control of worker exposure: Handling of solutions for topping-up (PROC 8b)

Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Solution
Covers concentrations up to 100 %
Maximum emission potential covered in this CS: Very low.
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

4.2.7. Control of worker exposure: Fabrication (PROC 24, PROC 21)

Product (article) characteristics
Physical form of product: Massive object
Maximum emission potential covered in this CS: Low (abrasion based).
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

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

Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Solution
Covers concentrations up to 100 %
Maximum emission potential covered in this CS: Very low.
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.



Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Cleaning machines such as power sweeper, no direct manual cleaning.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 10 (APF >= 10). For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

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

Product (article) characteristics
Physical form of product: Solid, high dustiness
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
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
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 20 (APF >= 20). For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

4.3. Exposure estimation and reference to its source

4.3.1. Environmental release and exposure: Use of nickel dihydroxide for surface treatment of anodised aluminium sheets - Discharge to fresh water via municipal sewage treatment plant (ERC 5)

Release route	Release rate	Release estimation method
Water	0.126 kg/day	Estimated release factor
Air	0.038 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	5.61E-3 mg/L (EUSES 2.1.2)	0.919
Sediment (freshwater)	104.8 mg/kg dw (PEC sediment calculation method for metals)	0.961
Sewage Treatment Plant	0.038 mg/L (EUSES 2.1.2)	0.114
Agricultural soil	17.26 mg/kg dw (EUSES 2.1.2)	0.439



4.3.2. Environmental release and exposure: Use of nickel dihydroxide for surface treatment of anodised aluminium sheets - Direct discharge to fresh water (ERC 5)

Release route	Release rate	Release estimation method
Water	0.034 kg/day	Estimated release factor
Air	0.01 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	4.84E-3 mg/L (EUSES 2.1.2)	0.794
Sediment (freshwater)	84.6 mg/kg dw (PEC sediment calculation method for metals)	0.776
Agricultural soil	16.20 mg/kg dw (EUSES 2.1.2)	0.412

4.3.3. Environmental release and exposure: Use of nickel dihydroxide for surface treatment of anodised aluminium sheets - Direct discharge to marine water (ERC 5)

Release route	Release rate	Release estimation method
Water	0.06 kg/day	Estimated release factor
Air	0.018 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	2.02E-3 mg/L (EUSES 2.1.2)	0.211
Sediment (marine water)	61.2 mg/kg dw (PEC sediment calculation method for metals)	0.561
Agricultural soil	16.20 mg/kg dw (EUSES 2.1.2)	0.412

4.3.4. Worker exposure: Anodizing (dipping) (PROC 13)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	5E-3 mg/m ³ (Measured data)	0.1
Inhalation, systemic, acute	0.015 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	5E-3 mg/m ³ (Measured data)	0.1
Inhalation, local, acute	0.015 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.076 µg/cm ² (Measured data)	< 0.01

4.3.5. Worker exposure: Handling of medium dusty materials for topping-up (PROC 26)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.014 mg/m ³ (Measured data)	0.28
Inhalation, systemic, acute	0.071 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.014 mg/m ³ (Measured data)	0.28
Inhalation, local, acute	0.071 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	33.35 µg/cm ² (Measured data)	0.051



4.3.6. Worker exposure: Handling of solutions for topping-up (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.012 mg/m ³ (Measured data)	0.24
Inhalation, systemic, acute	0.047 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.012 mg/m ³ (Measured data)	0.24
Inhalation, local, acute	0.047 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	< 0.01

4.3.7. Worker exposure: Fabrication (PROC 24, PROC 21)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.019 mg/m ³ (Measured data)	0.38
Inhalation, systemic, acute	0.057 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.019 mg/m ³ (Measured data)	0.38
Inhalation, local, acute	0.057 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	33.35 µg/cm ² (Measured data)	0.051

4.3.8. Worker exposure: Wet cleaning (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m ³ (Measured data)	0.12
Inhalation, systemic, acute	0.026 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	6E-3 mg/m ³ (Measured data)	0.12
Inhalation, local, acute	0.026 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	< 0.01

4.3.9. 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/m ³ (Measured data)	0.64
Inhalation, systemic, acute	0.189 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.032 mg/m ³ (Measured data)	0.64
Inhalation, local, acute	0.189 mg/m ³ (Measured data)	0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	< 0.01

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: Service life (worker at industrial site); Service life of anodised goods in industrial settings

5.1. Title section

Article category: Metal articles (AC 7)

Environment	
1: Service life of anodised goods in industrial settings	ERC 12c
Worker	
2: Low energy handling/processing of articles	PROC 21
Exposure scenario of the uses leading to the inclusion of the substance into the article	
ES 4: Use at industrial sites; Use of nickel dihydroxide for surface treatment of anodised aluminium sheets	

5.2. Conditions of use affecting exposure

5.2.1. Control of environmental exposure: Service life of anodised goods in industrial settings (ERC 12c)

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 0.042 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 ≥ 240 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 biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow $\geq 2E3$ m ³ /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 $\geq 1.8E4$ m ³ /day

5.2.2. Control of worker exposure: Low energy handling/processing of articles (PROC 21)

Product (article) characteristics
Physical form of product: Massive object
Covers concentrations up to 100 %
Maximum emission potential covered in this CS: Low (abrasion based).
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.



Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Other conditions affecting workers exposure

Assumes process temperature up to 40 °C

Indoor use

5.3. Exposure estimation and reference to its source

5.3.1. Environmental release and exposure: Service life of anodised goods 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

5.3.2. Worker exposure: Low energy handling/processing of articles (PROC 21)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.019 mg/m ³ (Measured data)	0.38
Inhalation, systemic, acute	0.057 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.019 mg/m ³ (Measured data)	0.38
Inhalation, local, acute	0.057 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	33.35 µg/cm ² (Measured data)	0.051

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: Service life (professional worker); Service life of anodised goods in professional settings

6.1. Title section

Article category: Metal articles (AC 7)

Environment	
1: Service life of anodised goods in professional settings	ERC 11a
Worker	
2: Low energy handling/processing of articles	PROC 21
Exposure scenario of the uses leading to the inclusion of the substance into the article	
ES 4: Use at industrial sites; Use of nickel dihydroxide for surface treatment of anodised aluminium sheets	

6.2. Conditions of use affecting exposure

6.2.1. Control of environmental exposure: Service life of anodised goods 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.

6.2.2. Control of worker exposure: Low energy handling/processing of articles (PROC 21)

Product (article) characteristics
Physical form of product: Massive object
Covers concentrations up to 100 %
Maximum emission potential covered in this CS: Low (abrasion based).
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

6.3. Exposure estimation and reference to its source

6.3.1. Environmental release and exposure: Service life of anodised goods in professional settings (ERC 11a)

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

6.3.2. Worker exposure: Low energy handling/processing of articles (PROC 21)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.019 mg/m ³ (Measured data)	0.38
Inhalation, systemic, acute	0.057 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.019 mg/m ³ (Measured data)	0.38
Inhalation, local, acute	0.057 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	33.35 µg/cm ² (Measured data)	0.051

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: Service life (consumers); Service life of surface treated articles (anodic coating) used by consumers

7.1. Title section

Article category: Metal articles (AC 7)

Environment	
1: Service life of surface treated articles (anodic coating) used by consumers	ERC 11a
Consumer	
2: Handling of surface treated articles	AC 7
3: Manipulation of surface treated articles (e.g. drilling, sawing) by consumers	AC 7
Exposure scenario of the uses leading to the inclusion of the substance into the article	
ES 4: Use at industrial sites; Use of nickel dihydroxide for surface treatment of anodised aluminium sheets	

7.2. Conditions of use affecting exposure

7.2.1. Control of environmental exposure: Service life of surface treated articles (anodic coating) used by consumers (ERC 11a)

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
Municipal sewage treatment plant is assumed.
The substance should not be released to air
The substance should not be released to water

7.2.2. Control of consumer exposure: Handling of surface treated articles (AC 7)

Product (article) characteristics
Covers concentrations up to 4 % based on Nickel.
Physical form of product: Solid, non dusty form
Inhalation exposure is considered to be not relevant.
Ensure your object complies with the requirements of the EU Nickel Directive (Directive 94/27/EC and 2004/96/EC, replaced by the Regulation (EC) No. 1907/2006 (REACH), item 27 of Annex XVII).
Amount used (or contained in articles), frequency and duration of use/exposure
Duration of contact = 24 hr
Information and behavioral advice for consumers
Covers child use.
Other conditions affecting consumers exposure
Assumes that potential dermal contact is limited to inside hands / one hand / palm of hands.

7.2.3. Control of consumer exposure: Manipulation of surface treated articles (e.g. drilling, sawing) by consumers (AC 7)

Product (article) characteristics
Covers concentrations up to 5 %



Physical form of product: Solid, low dusty form
Oral exposure is considered to be not relevant.
Amount used (or contained in articles), frequency and duration of use/exposure
Exposure duration = 0.25 h/event
Covers infrequent uses, up to 2 weeks per year
Covers use up to 1 events per day
Information and behavioral advice for consumers
Covers adult use.
Covers indoor use

7.3. Exposure estimation and reference to its source

7.3.1. Environmental release and exposure: Service life of surface treated articles (anodic coating) used by consumers (ERC 11a)

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

7.3.2. Consumer exposure: Handling of surface treated articles (AC 7)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0 mg/m ³ (Qualitative assessment)	< 0.01
Inhalation, systemic, acute	0 mg/m ³ (Qualitative assessment)	< 0.01
Inhalation, local, long term	0 mg/m ³ (Qualitative assessment)	< 0.01
Inhalation, local, acute	0 mg/m ³ (Qualitative assessment)	< 0.01
Dermal, local, long term	0.07 µg/cm ² (Quantitative assessment)	< 0.01
Oral, systemic, long term	0.085 µg/kg bw/day (Quantitative assessment)	< 0.01
Combined, systemic, long term		< 0.01

7.3.3. Consumer exposure: Manipulation of surface treated articles (e.g. drilling, sawing) by consumers (AC 7)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, acute	0.22 mg/m ³ (MEASE)	< 0.01
Inhalation, local, acute	0.22 mg/m ³ (MEASE)	0.122
Dermal, local, long term	10 µg/cm ² (MEASE)	0.015
Oral, systemic, long term	0 mg/kg bw/day (Qualitative assessment)	< 0.01

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; Use of nickel dihydroxide for the production of batteries using nickel electrodes

8.1. Title section

Product category: Other (PC 0)

Sector of use: Manufacture of computer, electronic and optical products, electrical equipment (SU 16)

Environment	
1: Use of nickel dihydroxide for the production of batteries using nickel electrodes - Discharge to fresh water via municipal sewage treatment plant	ERC 5
2: Use of nickel dihydroxide for the production of batteries using nickel electrodes - Direct discharge to fresh water	ERC 5
3: Use of nickel dihydroxide for the production of batteries using nickel electrodes - Direct discharge to marine water	ERC 5
Worker	
4: Handling of paste	PROC 9, PROC 4, PROC 8b
5: Powder handling	PROC 26
6: Powder pressing	PROC 14
7: Further processing of electrodes as battery assembly and battery disassembly	PROC 21, PROC 4
8: Unwinding of impregnated coils	PROC 21
9: Wet cleaning	PROC 28
10: Cleaning/removal of dust	PROC 28
Subsequent service life exposure scenario(s)	
ES 9: Service life (worker at industrial site); Service life of nickel-containing batteries in industrial settings	
ES 10: Service life (professional worker); Service life of nickel-containing batteries in professional settings	
ES 11: Service life (consumers); Service life of rechargeable Ni-MH batteries used by consumers	

8.2. Conditions of use affecting exposure

8.2.1. Control of environmental exposure: Use of nickel dihydroxide for the production of batteries using nickel electrodes - 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 <= 2.884 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 <= 796 tonnes/year
Emission days >= 276 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 $\geq 2E3$ m ³ /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 $\geq 1.8E4$ m ³ /day
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 10

8.2.2. Control of environmental exposure: Use of nickel dihydroxide for the production of batteries using nickel electrodes - Direct discharge to fresh water (ERC 5)

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 2.884 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 ≤ 796 tonnes/year
Emission days ≥ 276 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 $\geq 5.23E4$ m ³ /day
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 100
Assumed effluent discharge flow from site ≥ 528 m ³ /day

8.2.3. Control of environmental exposure: Use of nickel dihydroxide for the production of batteries using nickel electrodes - Direct discharge to marine water (ERC 5)

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 2.884 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 ≤ 796 tonnes/year
Emission days ≥ 276 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
Receiving water dilution (fresh or marine) ≥ 100
Assumed effluent discharge flow from site ≥ 528 m ³ /day

8.2.4. Control of worker exposure: Handling of paste (PROC 9, PROC 4, PROC 8b)

Product (article) characteristics
Physical form of product: Pastes
Covers concentrations up to 100 %
Maximum emission potential covered in this CS: Low.
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Provide specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.
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
Conditions and measures related to personal protection, hygiene and health evaluation
If cobalt dihydroxide is relevant as impurity wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 10 (APF ≥ 10). For further specification, refer to section 8 of the SDS.
If cobalt dihydroxide is relevant as impurity wear suitable gloves tested to EN374 unless gloves according to EN 388 or EN 407 are required. For further specification, refer to section 8 of the SDS.
If cobalt dihydroxide is relevant as impurity use suitable eye protection. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

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

Product (article) characteristics
Physical form of product: Solid, high dustiness
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Provide specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at



least 80%.
Semi-closed system
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 10 (APF \geq 10). For further specification, refer to section 8 of the SDS.
If cobalt dihydroxide is relevant as impurity wear suitable gloves tested to EN374 unless gloves according to EN 388 or EN 407 are required. For further specification, refer to section 8 of the SDS.
If cobalt dihydroxide is relevant as impurity use suitable eye protection. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

8.2.6. Control of worker exposure: Powder pressing (PROC 14)

Product (article) characteristics
Physical form of product: Solid, high dustiness
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Provide specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.
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.
Semi-closed system
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 10 (APF \geq 10). For further specification, refer to section 8 of the SDS.
If cobalt dihydroxide is relevant as impurity wear suitable gloves tested to EN374 unless gloves according to EN 388 or EN 407 are required. For further specification, refer to section 8 of the SDS.
If cobalt dihydroxide is relevant as impurity use suitable eye protection. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

8.2.7. Control of worker exposure: Further processing of electrodes as battery assembly and battery disassembly (PROC 21, PROC 4)

Product (article) characteristics
Physical form of product: Massive object
Covers concentrations up to 100 %
Maximum emission potential covered in this CS: Low (abrasion based).
Amount used (or contained in articles), frequency and duration of use/exposure



Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
If cobalt dihydroxide is relevant as impurity wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 10 (APF >= 10). For further specification, refer to section 8 of the SDS.
If cobalt dihydroxide is relevant as impurity wear suitable gloves tested to EN374 unless gloves according to EN 388 or EN 407 are required. For further specification, refer to section 8 of the SDS.
If cobalt dihydroxide is relevant as impurity use suitable eye protection. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

8.2.8. Control of worker exposure: Unwinding of impregnated coils (PROC 21)

Product (article) characteristics
Physical form of product: Massive object
Covers concentrations up to 100 %
Maximum emission potential covered in this CS: Low (abrasion based).
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Provide specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.
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.
Semi-closed system
Conditions and measures related to personal protection, hygiene and health evaluation
If cobalt dihydroxide is relevant as impurity wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 10 (APF >= 10). For further specification, refer to section 8 of the SDS.
If cobalt dihydroxide is relevant as impurity wear suitable gloves tested to EN374 unless gloves according to EN 388 or EN 407 are required. For further specification, refer to section 8 of the SDS.
If cobalt dihydroxide is relevant as impurity use suitable eye protection. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use



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

Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Solution
Covers concentrations up to 100 %
Maximum emission potential covered in this CS: Very low.
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Cleaning machines such as power sweeper, no direct manual cleaning.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 10 (APF \geq 10). For further specification, refer to section 8 of the SDS.
If cobalt dihydroxide is relevant as impurity wear suitable gloves tested to EN374 unless gloves according to EN 388 or EN 407 are required. For further specification, refer to section 8 of the SDS.
If cobalt dihydroxide is relevant as impurity use suitable eye protection. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

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

Product (article) characteristics
Physical form of product: Solid, high dustiness
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
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
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 20 (APF \geq 20). For further specification, refer to section 8 of the SDS.
If cobalt dihydroxide is relevant as impurity wear suitable gloves tested to EN374 unless gloves according to EN 388 or EN 407 are required. For further specification, refer to section 8 of the SDS.
If cobalt dihydroxide is relevant as impurity use suitable eye protection. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure



Assumes process temperature up to 40 °C

Indoor use

8.3. Exposure estimation and reference to its source

8.3.1. Environmental release and exposure: Use of nickel dihydroxide for the production of batteries using nickel electrodes - Discharge to fresh water via municipal sewage treatment plant (ERC 5)

Release route	Release rate	Release estimation method
Water	0.123 kg/day	Estimated release factor
Air	0.073 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	5.55E-3 mg/L (EUSES 2.1.2)	0.91
Sediment (freshwater)	103.2 mg/kg dw (PEC sediment calculation method for metals)	0.947
Sewage Treatment Plant	0.037 mg/L (EUSES 2.1.2)	0.112
Agricultural soil	17.24 mg/kg dw (EUSES 2.1.2)	0.439

8.3.2. Environmental release and exposure: Use of nickel dihydroxide for the production of batteries using nickel electrodes - Direct discharge to fresh water (ERC 5)

Release route	Release rate	Release estimation method
Water	0.123 kg/day	Estimated release factor
Air	7.326 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	4.57E-3 mg/L (EUSES 2.1.2)	0.75
Sediment (freshwater)	77.5 mg/kg dw (PEC sediment calculation method for metals)	0.711
Agricultural soil	16.87 mg/kg dw (EUSES 2.1.2)	0.429

8.3.3. Environmental release and exposure: Use of nickel dihydroxide for the production of batteries using nickel electrodes - Direct discharge to marine water (ERC 5)

Release route	Release rate	Release estimation method
Water	0.123 kg/day	Estimated release factor
Air	7.326 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	1.97E-3 mg/L (EUSES 2.1.2)	0.207
Sediment (marine water)	60.1 mg/kg dw (PEC sediment calculation method for metals)	0.551



Protection target	Exposure estimate	RCR
Agricultural soil	16.87 mg/kg dw (EUSES 2.1.2)	0.429

8.3.4. Worker exposure: Handling of paste (PROC 9, PROC 4, PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.02 mg/m ³ (Measured data)	0.4
Inhalation, systemic, acute	0.06 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.02 mg/m ³ (Measured data)	0.4
Inhalation, local, acute	0.06 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	< 0.01

8.3.5. Worker exposure: Powder handling (PROC 26)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.014 mg/m ³ (Measured data)	0.28
Inhalation, systemic, acute	0.071 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.014 mg/m ³ (Measured data)	0.28
Inhalation, local, acute	0.071 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	33.35 µg/cm ² (Measured data)	0.051

8.3.6. Worker exposure: Powder pressing (PROC 14)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	7E-3 mg/m ³ (Measured data)	0.14
Inhalation, systemic, acute	0.02 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	7E-3 mg/m ³ (Measured data)	0.14
Inhalation, local, acute	0.02 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	3.73 µg/cm ² (Measured data)	< 0.01

8.3.7. Worker exposure: Further processing of electrodes as battery assembly and battery disassembly (PROC 21, PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	9E-3 mg/m ³ (Measured data)	0.18
Inhalation, systemic, acute	0.037 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	9E-3 mg/m ³ (Measured data)	0.18
Inhalation, local, acute	0.037 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	33.35 µg/cm ² (Measured data)	0.051

8.3.8. Worker exposure: Unwinding of impregnated coils (PROC 21)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.04 mg/m ³ (Measured data)	0.8
Inhalation, systemic, acute	0.12 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.04 mg/m ³ (Measured data)	0.8



Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, acute	0.12 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	3.73 µg/cm ² (Measured data)	< 0.01

8.3.9. Worker exposure: Wet cleaning (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/m ³ (Measured data)	0.12
Inhalation, systemic, acute	0.026 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	6E-3 mg/m ³ (Measured data)	0.12
Inhalation, local, acute	0.026 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	< 0.01

8.3.10. 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/m ³ (Measured data)	0.64
Inhalation, systemic, acute	0.189 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.032 mg/m ³ (Measured data)	0.64
Inhalation, local, acute	0.189 mg/m ³ (Measured data)	0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	< 0.01

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: Service life (worker at industrial site); Service life of nickel-containing batteries in industrial settings

9.1. Title section

Article category: Electrical batteries and accumulators (AC 3)

Environment	
1: Service life of nickel-containing batteries in industrial settings	ERC 12c
Worker	
2: Welding	PROC 25
3: Handling of batteries	PROC 21
Exposure scenario of the uses leading to the inclusion of the substance into the article	
ES 8: Use at industrial sites; Use of nickel dihydroxide for the production of batteries using nickel electrodes	

9.2. Conditions of use affecting exposure

9.2.1. Control of environmental exposure: Service life of nickel-containing batteries in industrial settings (ERC 12c)

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 0.042 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 ≥ 240 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 biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow $\geq 2E3$ m ³ /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 $\geq 1.8E4$ m ³ /day

9.2.2. Control of worker exposure: Welding (PROC 25)

Product (article) characteristics
Physical form of product: Massive object
Covers concentrations up to 100 %
Maximum emission potential covered in this CS: High (temperature based).
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of



equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
High temperature
Conditions and measures related to personal protection, hygiene and health evaluation
Dermal contact with the substance has to be excluded.
If cobalt dihydroxide is relevant as impurity wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 10 (APF >= 10). For further specification, refer to section 8 of the SDS.
If cobalt dihydroxide is relevant as impurity use suitable eye protection. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Indoor use

9.2.3. Control of worker exposure: Handling of batteries (PROC 21)

Product (article) characteristics
Physical form of product: Massive object
Covers concentrations up to 100 %
Maximum emission potential: No foreseeable emission (included in closed container).
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

9.3. Exposure estimation and reference to its source

9.3.1. Environmental release and exposure: Service life of nickel-containing batteries 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

9.3.2. Worker exposure: Welding (PROC 25)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.015 mg/m ³ (Measured data)	0.3
Inhalation, systemic, acute	0.044 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.015 mg/m ³ (Measured data)	0.3
Inhalation, local, acute	0.044 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	< 0.01

**9.3.3. Worker exposure: Handling of batteries (PROC 21)**

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	9E-3 mg/m ³ (Measured data)	0.18
Inhalation, systemic, acute	0.037 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	9E-3 mg/m ³ (Measured data)	0.18
Inhalation, local, acute	0.037 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	33.35 µg/cm ² (Measured data)	0.051

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: Service life (professional worker); Service life of nickel-containing batteries in professional settings

10.1. Title section

Article category: Electrical batteries and accumulators (AC 3)

Environment	
1: Service life of nickel-containing batteries in professional settings	ERC 11a
Worker	
2: Handling of batteries	PROC 21
Exposure scenario of the uses leading to the inclusion of the substance into the article	
ES 8: Use at industrial sites; Use of nickel dihydroxide for the production of batteries using nickel electrodes	

10.2. Conditions of use affecting exposure

10.2.1. Control of environmental exposure: Service life of nickel-containing batteries 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.

10.2.2. Control of worker exposure: Handling of batteries (PROC 21)

Product (article) characteristics
Physical form of product: Massive object
Covers concentrations up to 100 %
Maximum emission potential: No foreseeable emission (included in closed container).
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Technical and organisational conditions and measures
Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

10.3. Exposure estimation and reference to its source

10.3.1. Environmental release and exposure: Service life of nickel-containing batteries in professional settings (ERC 11a)

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

10.3.2. Worker exposure: Handling of batteries (PROC 21)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	9E-3 mg/m ³ (Measured data)	0.18
Inhalation, systemic, acute	0.037 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	9E-3 mg/m ³ (Measured data)	0.18
Inhalation, local, acute	0.037 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	33.35 µg/cm ² (Measured data)	0.051

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: Service life (consumers); Service life of rechargeable Ni-MH batteries used by consumers

11.1. Title section

Article category: Electrical batteries and accumulators (AC 3)

Environment	
1: Service life of rechargeable Ni-MH batteries used by consumers	ERC 11a
Consumer	
2: Replacement of rechargeable Ni-MH batteries into an electronic device or reloading of Ni-MH batteries	AC 3
Exposure scenario of the uses leading to the inclusion of the substance into the article	
ES 8: Use at industrial sites; Use of nickel dihydroxide for the production of batteries using nickel electrodes	

11.2. Conditions of use affecting exposure

11.2.1. Control of environmental exposure: Service life of rechargeable Ni-MH batteries used by consumers (ERC 11a)

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
Municipal sewage treatment plant is assumed.
The substance should not be released to air
The substance should not be released to water

11.2.2. Control of consumer exposure: Replacement of rechargeable Ni-MH batteries into an electronic device or reloading of Ni-MH batteries (AC 3)

Product (article) characteristics
Assumes no dermal contact
Inhalation exposure is considered to be not relevant.
Oral exposure is considered to be not relevant.
Physical form covered in this ES: included in closed container.
Information and behavioral advice for consumers
Do not open the battery.

11.3. Exposure estimation and reference to its source

11.3.1. Environmental release and exposure: Service life of rechargeable Ni-MH batteries used by consumers (ERC 11a)

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



11.3.2. Consumer exposure: Replacement of rechargeable Ni-MH batteries into an electronic device or reloading of Ni-MH batteries (AC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0 mg/m ³ (Qualitative assessment)	< 0.01
Inhalation, systemic, acute	0 mg/m ³ (Qualitative assessment)	< 0.01
Inhalation, local, long term	0 mg/m ³ (Qualitative assessment)	< 0.01
Inhalation, local, acute	0 mg/m ³ (Qualitative assessment)	< 0.01
Dermal, local, long term	0 mg/cm ² (Qualitative assessment)	< 0.01
Oral, systemic, long term	0 mg/kg bw/day (Qualitative assessment)	< 0.01
Combined, systemic, long term		< 0.01

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”.