



ES FOR COMMUNICATION

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0. General provisions related to conditions of use and guidance to downstream users

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

0.1. Good occupational hygiene practice

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

0.2. General provisions related to personal protective equipment for workers

Use of personal protective equipment (PPE) for each of the exposure routes listed below is required as described here unless exposure to the substance can be excluded for the respective route(s) of exposure. 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 sulphate for the manufacture of nickel metal

1.1. Title section

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

Environment	
1: Intermediate use of nickel sulphate for the manufacture of nickel metal - Direct discharge to fresh water	ERC 6a
Worker	
2: Raw material handling (solid materials)	PROC 26
3: Raw material handling (solutions)	PROC 8b
4: Chemical reduction (hydrogen reduction)	PROC 1
5: Chemical reaction (electrowinning process)	PROC 3, PROC 2
6: Wet cleaning	PROC 28
7: Cleaning/removal of dust	PROC 28

1.2. Conditions of use affecting exposure

1.2.1. Control of environmental exposure: Intermediate use of nickel sulphate for the manufacture of nickel metal - Direct discharge to fresh water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 190 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 $\leq 6.94E4$ tonnes/year
Emission days ≥ 365 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Receiving surface water flow $\geq 1.78E6$ m ³ /day
Assumed effluent discharge flow from site $\geq 2E3$ m ³ /day
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 892

1.2.2. Control of worker exposure: Raw material handling (solid materials) (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%.
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 chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.
If arsenic acid is relevant as impurity 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 arsenic acid 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

1.2.3. Control of worker exposure: Raw material handling (solutions) (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).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.
If arsenic acid is relevant as impurity 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 arsenic acid 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

1.2.4. Control of worker exposure: Chemical reduction (hydrogen reduction) (PROC 1)**Product (article) characteristics**

Physical form of product: Liquid

Additional physical form of product: Solution

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%.

Automated task

Use in closed process

Ensure that worker is in a separated (control) room with independent clean air supply.

Other conditions affecting workers exposure

Assumes process temperature up to 40 °C

Indoor use

1.2.5. Control of worker exposure: Chemical reaction (electrowinning process) (PROC 3, PROC 2)**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 specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.

Use in closed process

Use of styrophor beads to prevent evaporation of the electrolyte is required.

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

Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If



skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.
If arsenic acid is relevant as impurity 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 arsenic acid 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

1.2.6. 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 \geq 10). For further specification, refer to section 8 of the SDS.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.
If arsenic acid 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

1.2.7. 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 \geq 20). For further specification, refer to section 8 of the SDS.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.
If arsenic acid 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

1.3. Exposure estimation and reference to its source

1.3.1. Environmental release and exposure: Intermediate use of nickel sulphate for the manufacture of nickel metal - Direct discharge to fresh water (ERC 6a)

Release route	Release rate	Release estimation method
Water	5.377 kg/day	Estimated release factor
Air	5.586 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	5.06E-3 mg/L (EUSES 2.1.2)	0.83
Sediment (freshwater)	90.2 mg/kg dw (PEC sediment calculation method for metals)	0.828
Agricultural soil	16.87 mg/kg dw (EUSES 2.1.2)	0.429

1.3.2. Worker exposure: Raw material handling (solid materials) (PROC 26)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term For the substance	0.012 mg/m ³ (Measured data)	0.24
Inhalation, systemic, long term For impurity arsenic acid ($> 0 - \leq 3 \%$)	3.46E-04 mg/m ³ (Measured data)	0.086*
Inhalation, systemic, long term Combined for substance and impurity arsenic acid ($> 0 - \leq 3 \%$) (sum of RCRs)	-	0.317
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)	0.022



Route of exposure and type of effects	Exposure estimate	RCR
Dermal, local, long term	0.11 µg/cm ² (Measured data)	0.25
Dermal, systemic, long term For impurity arsenic acid (> 0 – ≤ 3 %)	9.43E-05 mg/kg bw/day (Measured data)	< 0.01**
Combined routes, systemic, long-term	-	0.318

*For inhalation, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.004 mg/m³.

**For dermal, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.085 mg/kg bw/day.

1.3.3. Worker exposure: Raw material handling (solutions) (PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term For the substance	0.012 mg/m ³ (Measured data)	0.24
Inhalation, systemic, long term For impurity arsenic acid (> 0 – ≤ 3 %)	3.50E-04 mg/m ³ (Measured data)	0.088*
Inhalation, systemic, long term Combined for substance and impurity arsenic acid (> 0 – ≤ 3 %) (sum of RCRs)	-	0.322
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)	0.029
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136
Dermal, systemic, long term For impurity arsenic acid (> 0 – ≤ 3 %)	5.14E-05 mg/kg bw/day (Measured data)	< 0.01**
Combined routes, systemic, long-term	-	0.322

*For inhalation, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.004 mg/m³.

**For dermal, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.085 mg/kg bw/day.

1.3.4. Worker exposure: Chemical reduction (hydrogen reduction) (PROC 1)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term For the substance	6E-3 mg/m ³ (Measured data)	0.12
Inhalation, systemic, long term For impurity arsenic acid (> 0 – ≤ 3 %)	1.75E-04 mg/m ³ (Measured data)	0.044*
Inhalation, systemic, long term Combined for substance and impurity arsenic acid (> 0 – ≤ 3 %) (sum of RCRs)	-	0.161
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
Inhalation, local, acute	0.017 mg/m ³ (Measured data)	0.011
Dermal, local, long term	0.076 µg/cm ² (Measured data)	0.173



Route of exposure and type of effects	Exposure estimate	RCR
Dermal, systemic, long term For impurity arsenic acid ($> 0 - \leq 3 \%$)	6.51E-05 mg/kg bw/day (Measured data)	$< 0.01^{**}$
Combined routes, systemic, long-term	-	0.161

*For inhalation, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.004 mg/m³.

**For dermal, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.085 mg/kg bw/day.

1.3.5. Worker exposure: Chemical reaction (electrowinning process) (PROC 3, PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term For the substance	0.012 mg/m ³ (Measured data)	0.24
Inhalation, systemic, long term For impurity arsenic acid ($> 0 - \leq 3 \%$)	3.50E-04 mg/m ³ (Measured data)	0.088*
Inhalation, systemic, long term Combined for substance and impurity arsenic acid ($> 0 - \leq 3 \%$) (sum of RCRs)	-	0.321
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)	0.029
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136
Dermal, systemic, long term For impurity arsenic acid ($> 0 - \leq 3 \%$)	5.14E-05 mg/kg bw/day (Measured data)	$< 0.01^{**}$
Combined routes, systemic, long-term	-	0.322

*For inhalation, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.004 mg/m³.

**For dermal, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.085 mg/kg bw/day.

1.3.6. Worker exposure: Wet cleaning (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term For the substance	6E-3 mg/m ³ (Measured data)	0.12
Inhalation, systemic, long term For impurity arsenic acid ($> 0 - \leq 3 \%$)	1.93E-04 mg/m ³ (Measured data)	0.048*
Inhalation, systemic, long term Combined for substance and impurity arsenic acid ($> 0 - \leq 3 \%$) (sum of RCRs)	-	0.177
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)	0.016
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136
Dermal, systemic, long term For impurity arsenic acid ($> 0 - \leq 3 \%$)	5.14E-05 mg/kg bw/day (Measured data)	$< 0.01^{**}$



Route of exposure and type of effects	Exposure estimate	RCR
Combined routes, systemic, long-term	-	0.177

*For inhalation, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.004 mg/m³.

**For dermal, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.085 mg/kg bw/day.

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

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term For the substance	0.032 mg/m ³ (Measured data)	0.64
Inhalation, systemic, long term For impurity arsenic acid (> 0 – ≤ 3 %)	9.45E-04 mg/m ³ (Measured data)	0.236*
Inhalation, systemic, long term Combined for substance and impurity arsenic acid (> 0 – ≤ 3 %) (sum of RCRs)	-	0.866
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)	0.118
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136
Dermal, systemic, long term For impurity arsenic acid (> 0 – ≤ 3 %)	5.14E-05 mg/kg bw/day (Measured data)	0.01**
Combined routes, systemic, long-term	-	0.867

*For inhalation, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.004 mg/m³.

**For dermal, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.085 mg/kg bw/day.

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 sulphate for the manufacture of nickel salts

2.1. Title section

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

Environment	
1: Intermediate use of nickel sulphate for the manufacture of nickel salts - Direct discharge to fresh water	ERC 6a
2: Intermediate use of nickel sulphate for the manufacture of nickel salts - Direct discharge to marine water	ERC 6a
Worker	
3: Raw material handling (solutions)	PROC 8b
4: Raw material handling (solid materials)	PROC 26
5: Reaction with other chemicals	PROC 2
6: Wet cleaning	PROC 28
7: Cleaning/removal of dust	PROC 28

2.2. Conditions of use affecting exposure

2.2.1. Control of environmental exposure: Intermediate use of nickel sulphate for the manufacture of nickel salts - Direct discharge to fresh water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 5.361 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 $\leq 1.93E3$ 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
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Receiving water dilution (fresh or marine) $\geq 1E3$
Receiving surface water flow $\geq 2E6$ m ³ /day
Assumed effluent discharge flow from site $\geq 2E3$ m ³ /day

2.2.2. Control of environmental exposure: Intermediate use of nickel sulphate for the manufacture of nickel salts - Direct discharge to marine water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 5.361 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 $\leq 1.93E3$ 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
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to freshwater assumed
Receiving water dilution (fresh or marine) ≥ 100
Assumed effluent discharge flow from site $\geq 2E3$ m ³ /day

2.2.3. Control of worker exposure: Raw material handling (solutions) (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).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

2.2.4. Control of worker exposure: Raw material handling (solid materials) (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%.
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 chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

2.2.5. Control of worker exposure: Reaction with other chemicals (PROC 2)

Product (article) characteristics
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.
Closed process with occasional opening
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

2.2.6. 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 \geq 10). For further specification, refer to section 8 of the SDS.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

2.2.7. 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 \geq 20). For further specification, refer to section 8 of the SDS.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

2.3. Exposure estimation and reference to its source

2.3.1. Environmental release and exposure: Intermediate use of nickel sulphate for the manufacture of nickel salts - Direct discharge to fresh water (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.927 kg/day	Estimated release factor
Air	0.373 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	3.23E-3 mg/L (EUSES 2.1.2)	0.53
Sediment (freshwater)	42.2 mg/kg dw (PEC sediment calculation method for metals)	0.387
Agricultural soil	16.24 mg/kg dw (EUSES 2.1.2)	0.413

2.3.2. Environmental release and exposure: Intermediate use of nickel sulphate for the manufacture of nickel salts - Direct discharge to marine water (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.927 kg/day	Estimated release factor
Air	0.373 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Marine water	3.63E-3 mg/L (EUSES 2.1.2)	0.38
Sediment (marine water)	103.6 mg/kg dw (PEC sediment calculation method for metals)	0.95
Agricultural soil	16.24 mg/kg dw (EUSES 2.1.2)	0.413

2.3.3. Worker exposure: Raw material handling (solutions) (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)	0.029
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

2.3.4. Worker exposure: Raw material handling (solid materials) (PROC 26)



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)	0.022
Dermal, local, long term	0.11 µg/cm ² (Measured data)	0.25

2.3.5. Worker exposure: Reaction with other chemicals (PROC 2)

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)	0.037
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

2.3.6. 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)	0.016
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

2.3.7. 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)	0.118
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

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

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

3. ES 3: Use at industrial sites; Intermediate use of nickel sulphate for the manufacture of nickel-containing inorganic pigments

3.1. Title section

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

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

3.2. Conditions of use affecting exposure

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

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 0.459 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site ≤ 156 tonnes/year
Emission days ≥ 340 days/year
Technical and organisational conditions and measures
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow $\geq 2E3$ 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: Intermediate use of nickel sulphate for the manufacture of nickel-containing inorganic pigments - Direct discharge to fresh water (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 0.459 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site ≤ 156 tonnes/year
Emission days ≥ 340 days/year
Technical and organisational conditions and measures
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Receiving surface water flow $\geq 2.97E4$ 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

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

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 0.459 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site ≤ 156 tonnes/year
Emission days ≥ 340 days/year
Technical and organisational conditions and measures
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to freshwater assumed
Assumed effluent discharge flow from site ≥ 225 m ³ /day
Local marine water dilution factor 100

3.2.4. 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%.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. 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: Closed mixing and transfer process (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).
Automated task
Use in closed process
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

3.2.6. 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.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. 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: Drying and calcining (PROC 22, 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
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Indoor use

3.2.8. 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 \geq 10). For further specification, refer to section 8 of the SDS.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

3.2.9. 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 \geq 20). For further specification, refer to section 8 of the SDS.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. 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: Intermediate use of nickel sulphate for the manufacture of nickel-containing inorganic pigments - Discharge to fresh water via municipal sewage treatment plant (ERC 6a)

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

Protection target	Exposure estimate	RCR
Fresh water	3.34E-3 mg/L (EUSES 2.1.2)	0.548
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

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

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

Protection target	Exposure estimate	RCR
Fresh water	3.39E-3 mg/L (EUSES 2.1.2)	0.557
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

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

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

Protection target	Exposure estimate	RCR
Marine water	9.58E-4 mg/L (EUSES 2.1.2)	0.1
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

3.3.4. 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)	0.069
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

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

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	6E-3 mg/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
Inhalation, local, acute	0.017 mg/m ³ (Measured data)	0.011
Dermal, local, long term	0.076 µg/cm ² (Measured data)	0.173

3.3.6. 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)	0.058
Dermal, local, long term	0.11 µg/cm ² (Measured data)	0.25

3.3.7. Worker exposure: Drying and calcining (PROC 22, 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	0.06 µg/cm ² (Measured data)	0.136

3.3.8. 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)	0.016
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

3.3.9. 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)	0.118
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

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: Formulation or re-packing; Use of nickel sulphate in formulating and repackaging of surface treatment products

4.1. Title section

Product category: Metal surface treatment products (PC 14)

Environment	
1: Use of nickel sulphate in formulating and repackaging of surface treatment products - Discharge to fresh water via municipal sewage treatment plant	ERC 2
2: Use of nickel sulphate in formulating and repackaging of surface treatment products - Direct discharge to fresh water	ERC 2
3: Use of nickel sulphate in formulating and repackaging of surface treatment products - Direct discharge to marine water	ERC 2
Worker	
4: Raw material handling (fully contained)	PROC 1
5: Raw material handling (solutions)	PROC 8b, PROC 9
6: Mixing	PROC 3, PROC 5
7: Filling of solutions	PROC 8b, PROC 9
8: Laboratory testing	PROC 15
9: Wet cleaning	PROC 28
10: Cleaning/removal of dust	PROC 28

4.2. Conditions of use affecting exposure

4.2.1. Control of environmental exposure: Use of nickel sulphate in formulating and repackaging of surface treatment products - 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
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow $\geq 2E3$ 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



No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 10
Receiving surface water flow $\geq 1.8E4$ m ³ /day

4.2.2. Control of environmental exposure: Use of nickel sulphate in formulating and repackaging of surface treatment products - 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
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 200
Receiving surface water flow $\geq 4.98E3$ m ³ /day
Assumed effluent discharge flow from site ≥ 25 m ³ /day

4.2.3. Control of environmental exposure: Use of nickel sulphate in formulating and repackaging of surface treatment products - 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
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to freshwater assumed
Receiving water dilution (fresh or marine) ≥ 100
Assumed effluent discharge flow from site ≥ 25 m ³ /day

4.2.4. Control of worker exposure: Raw material handling (fully contained) (PROC 1)



Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Solution
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).
Use in closed process
Automated task
Conditions and measures related to personal protection, hygiene and health evaluation
If copper sulphate 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

4.2.5. Control of worker exposure: Raw material handling (solutions) (PROC 8b, PROC 9)

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).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

4.2.6. Control of worker exposure: Mixing (PROC 3, PROC 5)

Product (article) characteristics
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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 specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.
Automated task
Closed process with occasional opening
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

4.2.7. Control of worker exposure: Filling of solutions (PROC 8b, PROC 9)

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).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

4.2.8. Control of worker exposure: Laboratory testing (PROC 15)**Product (article) characteristics**

Physical form of product: Liquid

Additional physical form of product: Solution

Covers concentrations up to 100 %

Maximum emission potential: Very low.

Amount used (or contained in articles), frequency and duration of use/exposure

Covers use up to 8 h/day

Amount per use < 1 kg

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%.

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

Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.

If copper sulphate 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

4.2.9. 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.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

4.2.10. 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.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

4.3. Exposure estimation and reference to its source

4.3.1. Environmental release and exposure: Use of nickel sulphate in formulating and repackaging of surface treatment products - 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	9.3E-3 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor



Protection target	Exposure estimate	RCR
Fresh water	3.36E-3 mg/L (EUSES 2.1.2)	0.552
Sediment (freshwater)	45.7 mg/kg dw (PEC sediment calculation method for metals)	0.419
Sewage Treatment Plant	6.47E-3 mg/L (EUSES 2.1.2)	0.02
Agricultural soil	16.38 mg/kg dw (EUSES 2.1.2)	0.417

4.3.2. Environmental release and exposure: Use of nickel sulphate in formulating and repackaging of surface treatment products - 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

4.3.3. Environmental release and exposure: Use of nickel sulphate in formulating and repackaging of surface treatment products - 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)	99.7 mg/kg dw (PEC sediment calculation method for metals)	0.915
Agricultural soil	16.2 mg/kg dw (EUSES 2.1.2)	0.412

4.3.4. Worker exposure: Raw material handling (fully contained) (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
Inhalation, local, acute	0.017 mg/m ³ (Measured data)	0.011
Dermal, local, long term	0.076 µg/cm ² (Measured data)	0.173

4.3.5. Worker exposure: Raw material handling (solutions) (PROC

**8b, PROC 9)**

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)	0.029
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

4.3.6. Worker exposure: Mixing (PROC 3, PROC 5)

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)	0.037
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

4.3.7. Worker exposure: Filling of solutions (PROC 8b, PROC 9)

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)	0.029
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

4.3.8. Worker exposure: Laboratory testing (PROC 15)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	3E-3 mg/m ³ (Measured data)	0.06
Inhalation, systemic, acute	0.01 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	3E-3 mg/m ³ (Measured data)	0.06
Inhalation, local, acute	0.01 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

4.3.9. 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)	0.016
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

4.3.10. 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)	0.118
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

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

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



5. ES 5: Use at industrial sites; Use of nickel sulphate in surface treatment (nickel electroplating, nickel electroforming and nickel electroless technologies)

5.1. 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 sulphate in surface treatment (nickel electroplating, nickel electroforming and nickel electroless technologies) - Discharge to fresh water via municipal sewage treatment plant	ERC 5
2: Use of nickel sulphate in surface treatment (nickel electroplating, nickel electroforming and nickel electroless technologies) - Direct discharge to fresh water	ERC 5
3: Use of nickel sulphate in surface treatment (nickel electroplating, nickel electroforming and nickel electroless technologies) - Direct discharge to marine water	ERC 5
Worker	
4: Handling of solid materials	PROC 26
5: Handling of solutions as raw material	PROC 8b, PROC 9
6: Mixing and blending	PROC 5, PROC 3, PROC 4
7: Nickel electroplating, nickel electroforming and electroless nickel plating	PROC 13
8: Testing of solution composition	PROC 15
9: Wet cleaning	PROC 28
10: Cleaning/removal of dust	PROC 28
Subsequent service life exposure scenario(s)	
ES 8: Service life (worker at industrial site); Service life of nickel-coated objects in industrial settings	
ES 9: Service life (professional worker); Service life of nickel-coated objects in professional settings	
ES 10: Service life (consumers); Service life of surface treated articles (anodic coating) used by consumers	

5.2. Conditions of use affecting exposure

5.2.1. Control of environmental exposure: Use of nickel sulphate in surface treatment (nickel electroplating, nickel electroforming and nickel electroless technologies) - 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
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow $\geq 2E3$ 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
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 10
Receiving surface water flow $\geq 1.8E4$ m ³ /day

5.2.2. Control of environmental exposure: Use of nickel sulphate in surface treatment (nickel electroplating, nickel electroforming and nickel electroless technologies) - Direct discharge to fresh water (ERC 5)

Amount used, frequency and duration of use (or from service life)
Daily amount per site $\leq 9E-3$ 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 ≤ 2.1 tonnes/year
Emission days ≥ 240 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 50
Receiving surface water flow $\geq 1.23E4$ m ³ /day
Assumed effluent discharge flow from site ≥ 250 m ³ /day

5.2.3. Control of environmental exposure: Use of nickel sulphate in surface treatment (nickel electroplating, nickel electroforming and nickel electroless technologies) - 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
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to freshwater assumed
Receiving water dilution (fresh or marine) ≥ 100
Assumed effluent discharge flow from site ≥ 250 m ³ /day

5.2.4. Control of worker exposure: Handling of solid materials (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 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 chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

5.2.5. Control of worker exposure: Handling of solutions as raw material (PROC 8b, PROC 9)

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 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
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

5.2.6. Control of worker exposure: Mixing and blending (PROC 5, PROC 3, PROC 4)

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 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
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

5.2.7. Control of worker exposure: Nickel electroplating, nickel electroforming and electroless nickel plating (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 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.
Conditions and measures related to personal protection, hygiene and health evaluation
If copper sulphate 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

5.2.8. Control of worker exposure: Testing of solution composition (PROC 15)

Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Solution
Covers concentrations up to 100 %
Maximum emission potential: Very low.
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8 h/day
Amount per use < 1 kg
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. 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%.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

5.2.9. 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 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.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

5.2.10. 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 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.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

5.3. Exposure estimation and reference to its source

5.3.1. Environmental release and exposure: Use of nickel sulphate in surface treatment (nickel electroplating, nickel electroforming and nickel electroless technologies) - 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

5.3.2. Environmental release and exposure: Use of nickel sulphate in surface treatment (nickel electroplating, nickel electroforming and nickel electroless technologies) - 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	4.85E-3 mg/L (EUSES 2.1.2)	0.795
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

5.3.3. Environmental release and exposure: Use of nickel sulphate in surface treatment (nickel electroplating, nickel electroforming and nickel electroless technologies) - 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	2.01E-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

5.3.4. Worker exposure: Handling of solid materials (PROC 26)

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



Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	0.012 mg/m ³ (Measured data)	0.24
Inhalation, local, acute	0.035 mg/m ³ (Measured data)	0.022
Dermal, local, long term	0.11 µg/cm ² (Measured data)	0.25

5.3.5. Worker exposure: Handling of solutions as raw material (PROC 8b, PROC 9)

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)	0.029
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

5.3.6. Worker exposure: Mixing and blending (PROC 5, PROC 3, 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	0.047 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)	0.029
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

5.3.7. Worker exposure: Nickel electroplating, nickel electroforming and electroless nickel plating (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)	0.173

5.3.8. Worker exposure: Testing of solution composition (PROC 15)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	3E-3 mg/m ³ (Measured data)	0.06
Inhalation, systemic, acute	0.01 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	3E-3 mg/m ³ (Measured data)	0.06
Inhalation, local, acute	0.01 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

5.3.9. 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)	0.016
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

5.3.10. 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)	0.118
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

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

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



6. ES 6: Use at industrial sites; Use of nickel sulphate for surface treatment of anodised aluminium sheets

6.1. 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 sulphate for surface treatment of anodised aluminium sheets - Discharge to fresh water via municipal sewage treatment plant	ERC 5
2: Use of nickel sulphate for surface treatment of anodised aluminium sheets - Direct discharge to fresh water	ERC 5
3: Use of nickel sulphate for surface treatment of anodised aluminium sheets - Direct discharge to marine water	ERC 5
Worker	
4: Handling of solid materials	PROC 26
5: Handling of solutions as raw material	PROC 8b, PROC 9
6: Anodizing (dipping)	PROC 13
7: Wet cleaning	PROC 28
8: Cleaning/removal of dust	PROC 28
Subsequent service life exposure scenario(s)	
ES 8: Service life (worker at industrial site); Service life of nickel-coated objects in industrial settings	
ES 9: Service life (professional worker); Service life of nickel-coated objects in professional settings	
ES 10: Service life (consumers); Service life of surface treated articles (anodic coating) used by consumers	

6.2. Conditions of use affecting exposure

6.2.1. Control of environmental exposure: Use of nickel sulphate 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
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.



Assumed domestic sewage treatment plant flow $\geq 2E3$ 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
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 10
Receiving surface water flow $\geq 1.8E4$ m ³ /day

6.2.2. Control of environmental exposure: Use of nickel sulphate 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 $\leq 9E-3$ 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 ≤ 2.1 tonnes/year
Emission days ≥ 240 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 50
Receiving surface water flow $\geq 1.23E4$ m ³ /day
Assumed effluent discharge flow from site ≥ 250 m ³ /day

6.2.3. Control of environmental exposure: Use of nickel sulphate 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
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to freshwater assumed



Receiving water dilution (fresh or marine) ≥ 100
Assumed effluent discharge flow from site ≥ 250 m ³ /day

6.2.4. Control of worker exposure: Handling of solid materials (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 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 chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

6.2.5. Control of worker exposure: Handling of solutions as raw material (PROC 8b, PROC 9)

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 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
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

6.2.6. 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 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

6.2.7. 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 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.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

6.2.8. 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 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.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
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: Use of nickel sulphate 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

6.3.2. Environmental release and exposure: Use of nickel sulphate 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	4.85E-3 mg/L (EUSES 2.1.2)	0.795
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



6.3.3. Environmental release and exposure: Use of nickel sulphate 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	2.01E-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

6.3.4. Worker exposure: Handling of solid materials (PROC 26)

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)	0.022
Dermal, local, long term	0.11 µg/cm ² (Measured data)	0.25

6.3.5. Worker exposure: Handling of solutions as raw material (PROC 8b, PROC 9)

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)	0.029
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

6.3.6. 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)	0.173

6.3.7. 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



Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	6E-3 mg/m ³ (Measured data)	0.12
Inhalation, local, acute	0.026 mg/m ³ (Measured data)	0.016
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

6.3.8. 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
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)	0.118
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

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

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



7. ES 7: Use at industrial sites; Use of nickel sulphate in selective plating in industrial settings

7.1. Title section

Product category: Metal surface treatment products (PC 14)

Sector of use: Manufacture of computer, electronic and optical products, electrical equipment (SU 16), General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment. (SU 17)

Environment	
1: Use of nickel sulphate in selective plating in industrial settings - Discharge to fresh water via municipal sewage treatment plant	ERC 5
Worker	
2: Handling of solid materials	PROC 26
3: Handling of solutions as raw material	PROC 8b, PROC 9
4: Mixing and blending	PROC 5, PROC 4
5: Manual selective plating by brushing	PROC 10, PROC 8a
6: Wet cleaning	PROC 28
7: Cleaning/removal of dust	PROC 28
Subsequent service life exposure scenario(s)	
ES 8: Service life (worker at industrial site); Service life of nickel-coated objects in industrial settings	
ES 9: Service life (professional worker); Service life of nickel-coated objects in professional settings	
ES 10: Service life (consumers); Service life of surface treated articles (anodic coating) used by consumers	

7.2. Conditions of use affecting exposure

7.2.1. Control of environmental exposure: Use of nickel sulphate in selective plating in industrial settings - 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 $\leq 1.86 \times 10^{-3}$ 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 ≤ 0.4 tonnes/year
Emission days ≥ 215 days/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow $\geq 2 \times 10^3$ 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**

No discharge to marine water assumed

Receiving water dilution (fresh or marine) ≥ 10 Receiving surface water flow $\geq 1.8E4$ m³/day**7.2.2. Control of worker exposure: Handling of solid materials (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 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 chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.

If copper sulphate 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

7.2.3. Control of worker exposure: Handling of solutions as raw material (PROC 8b, PROC 9)**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 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

Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.



If copper sulphate 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

7.2.4. Control of worker exposure: Mixing and blending (PROC 5, PROC 4)

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 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

Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.

If copper sulphate 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

7.2.5. Control of worker exposure: Manual selective plating by brushing (PROC 10, PROC 8a)

Product (article) characteristics

Physical form of product: Liquid

Additional physical form of product: Solution

Covers concentrations up to 10 %

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 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%.

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.

Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For



further specification, refer to section 8 of the SDS.
If copper sulphate 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

7.2.6. 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 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.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

7.2.7. 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 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.



Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.

If copper sulphate 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

7.3. Exposure estimation and reference to its source

7.3.1. Environmental release and exposure: Use of nickel sulphate in selective plating in industrial settings - Discharge to fresh water via municipal sewage treatment plant (ERC 5)

Release route	Release rate	Release estimation method
Water	6.51E-5 kg/day	Estimated release factor
Air	1.12E-3 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)	0.476
Sediment (freshwater)	33.54 mg/kg dw (PEC sediment calculation method for metals)	0.308
Sewage Treatment Plant	1.95E-5 mg/L (EUSES 2.1.2)	< 0.01
Agricultural soil	16.20 mg/kg dw (EUSES 2.1.2)	0.412

7.3.2. Worker exposure: Handling of solid materials (PROC 26)

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)	0.022
Dermal, local, long term	0.11 µg/cm ² (Measured data)	0.25

7.3.3. Worker exposure: Handling of solutions as raw material (PROC 8b, PROC 9)

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)	0.029
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

7.3.4. Worker exposure: Mixing and blending (PROC 5, 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



Route of exposure and type of effects	Exposure estimate	RCR
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)	0.029
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

7.3.5. Worker exposure: Manual selective plating by brushing (PROC 10, PROC 8a)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.027 mg/m ³ (Measured data)	0.54
Inhalation, systemic, acute	0.106 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.027 mg/m ³ (Measured data)	0.54
Inhalation, local, acute	0.106 mg/m ³ (Measured data)	0.066
Dermal, local, long term	0.055 µg/cm ² (Measured data)	0.125

7.3.6. 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)	0.016
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

7.3.7. 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)	0.118
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

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: Service life (worker at industrial site); Service life of nickel-coated objects in industrial settings

8.1. Title section

Article category: Machinery, mechanical appliances, electrical/electronic articles (AC 2), Metal articles (AC 7), Plastic articles (AC 13)

Environment	
1: Service life of nickel-coated objects in industrial settings	ERC 12a
Worker	
2: Low energy handling of massive objects	PROC 21
Exposure scenario of the uses leading to the inclusion of the substance into the article	
ES 5: Use at industrial sites; Use of nickel sulphate in surface treatment (nickel electroplating, nickel electroforming and nickel electroless technologies)	
ES 6: Use at industrial sites; Use of nickel sulphate for surface treatment of anodised aluminium sheets	
ES 7: Use at industrial sites; Use of nickel sulphate in selective plating in industrial settings	

8.2. Conditions of use affecting exposure

8.2.1. Control of environmental exposure: Service life of nickel-coated objects in industrial settings (ERC 12a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 10 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 $\leq 1\text{E}3$ tonnes/year
Technical and organisational conditions and measures
The substance should not be released to air
The substance should not be released to water
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Assumed effluent discharge flow from site ≥ 0 m ³ /day

8.2.2. Control of worker exposure: Low energy handling of massive objects (PROC 21)

Product (article) characteristics
Physical form of product: Massive object
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 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
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If copper sulphate 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: Service life of nickel-coated objects in industrial settings (ERC 12a)

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

8.3.2. Worker exposure: Low energy handling of massive objects (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, 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	5.18 µg/cm ² (Measured data)	0.148

* It is noted that the substance has been completely transformed into nickel metal during production of the article. Thus, the associated RCRs were calculated by considering the DNELs of nickel metal:

- Inhalation, systemic effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, acute DNEL = 11.9 mg/m³
- Dermal, local effects, long term DNEL = 0.035 mg/cm²

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 (professional worker); Service life of nickel-coated objects in professional settings

9.1. Title section

Article category: Machinery, mechanical appliances, electrical/electronic articles (AC 2), Metal articles (AC 7), Plastic articles (AC 13)

Environment	
1: Service life of nickel-coated objects in professional settings	ERC 11a
Worker	
2: Low energy handling of massive objects	PROC 21
Exposure scenario of the uses leading to the inclusion of the substance into the article	
ES 5: Use at industrial sites; Use of nickel sulphate in surface treatment (nickel electroplating, nickel electroforming and nickel electroless technologies)	
ES 6: Use at industrial sites; Use of nickel sulphate for surface treatment of anodised aluminium sheets	
ES 7: Use at industrial sites; Use of nickel sulphate in selective plating in industrial settings	

9.2. Conditions of use affecting exposure

9.2.1. Control of environmental exposure: Service life of nickel-coated objects 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.

9.2.2. Control of worker exposure: Low energy handling of massive objects (PROC 21)

Product (article) characteristics
Physical form of product: Massive object
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
Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

9.3. Exposure estimation and reference to its source

9.3.1. Environmental release and exposure: Service life of nickel-coated objects in professional settings (ERC 11a)

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

9.3.2. Worker exposure: Low energy handling of massive objects (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, 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	5.18 µg/cm ² (Measured data)	0.148

* It is noted that the substance has been completely transformed into nickel metal during production of the article. Thus, the associated RCRs were calculated by considering the DNELs of nickel metal:

- Inhalation, systemic effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, acute DNEL = 11.9 mg/m³
- Dermal, local effects, long term DNEL = 0.035 mg/cm²

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

10.1. 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 5: Use at industrial sites; Use of nickel sulphate in surface treatment (nickel electroplating, nickel electroforming and nickel electroless technologies)	
ES 6: Use at industrial sites; Use of nickel sulphate for surface treatment of anodised aluminium sheets	
ES 7: Use at industrial sites; Use of nickel sulphate in selective plating in industrial settings	

10.2. Conditions of use affecting exposure

10.2.1. 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
The substance should not be released to air
The substance should not be released to water

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

Product (article) characteristics
Covers concentrations up to 25 %
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.

10.2.3. Control of consumer exposure: Manipulation of surface

**treated articles (e.g. drilling, sawing) by consumers (AC 7)**

Product (article) characteristics
Covers concentrations up to 25 %
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.

10.3. Exposure estimation and reference to its source**10.3.1. 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

10.3.2. 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, 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	8E-3 µg/kg bw/day (Quantitative assessment)	< 0.01
Combined, systemic, long term		< 0.01

* It is noted that the substance has been completely transformed into nickel metal during production of the article. Thus, the associated RCRs were calculated by considering the DNELs of nickel metal:

- Inhalation, systemic effects, long term DNEL = 60 ng/m³
- Inhalation, local effects, long term DNEL = 60 ng/m³
- Inhalation, local effects, acute DNEL = 0.8 mg/m³
- Dermal, local effects, long term DNEL = 0.035 mg/cm²
- Oral, systemic effects, long term DNEL = 0.013 mg/kg bw/day

10.3.3. 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, local, acute	0.66 mg/m ³ (MEASE)	0.825
Dermal, local, long term	30 µg/cm ² (MEASE)	0.857
Oral, systemic, long term	0 mg/kg bw/day (Qualitative assessment)	< 0.01



* It is noted that the substance has been completely transformed into nickel metal during production of the article. Thus, the associated RCRs were calculated by considering the DNELs of nickel metal:

- Inhalation, local effects, acute DNEL = 0.8 mg/m^3
- Dermal, local effects, long term DNEL = 0.035 mg/cm^2
- Oral, systemic effects, long term DNEL = $0.013 \text{ mg/kg bw/day}$

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

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



11. ES 11: Use at industrial sites; Use of nickel sulphate in the production of electroplated superabrasive tools

11.1. Title section

Product category: Metal surface treatment products (PC 14)

Sector of use: General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment. (SU 17)

Environment	
1: Use of nickel sulphate in the production of electroplated superabrasive tools - ERC 5	
Direct discharge to fresh water	
2: Use of nickel sulphate in the production of electroplated superabrasive tools - ERC 5	
only air	
Worker	
3: Electroplated bath monitoring	PROC 15
4: Diamond catching (fully automated)	PROC 13
5: Diamond catching	PROC 13
6: Growing of metal layer (under semi-closed conditions)	PROC 4
7: Growing of metal layer	PROC 13
8: Grinding (highly automated)	PROC 24
9: Grinding	PROC 24
10: Control room operations	PROC 2
11: Strip of metal used layer	PROC 13
12: Packaging	PROC 21
13: Wet cleaning	PROC 28
14: Cleaning/removal of dust	PROC 28
Subsequent service life exposure scenario(s)	
ES 12: Service life (worker at industrial site); Service life of superabrasive tools in industrial settings	
ES 13: Service life (professional worker); Service life of superabrasive tools in professional settings	
ES 14: Service life (consumers); Service life of superabrasive tools used by consumers	

11.2. Conditions of use affecting exposure

11.2.1. Control of environmental exposure: Use of nickel sulphate in the production of electroplated superabrasive tools - Direct discharge to fresh water (ERC 5)

Amount used, frequency and duration of use (or from service life)
Daily amount per site $\leq 1\text{E-}3$ 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 ≤ 0.2 tonnes/year
Emission days ≥ 200 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 $\geq 1.8E4$ m ³ /day
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 10
Assumed effluent discharge flow from site $\geq 2E3$ m ³ /day

11.2.2. Control of environmental exposure: Use of nickel sulphate in the production of electroplated superabrasive tools - only air (ERC 5)

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 0.05 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 ≥ 200 days/year
Technical and organisational conditions and measures
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
The substance should not be released to water
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.

11.2.3. Control of worker exposure: Electroplated bath monitoring (PROC 15)

Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Solution
Maximum emission potential: Very low.
Covers concentrations up to 100 %
Amount used (or contained in articles), frequency and duration of use/exposure
Amount per use < 1 L
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 daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Use of extraction hood with standard efficiency of an effectiveness 50-80% or closed containers are required.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If arsenic acid 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 arsenic acid is relevant as impurity use suitable eye protection. For further specification, refer to section 8 of the SDS.
If copper sulphate 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 60 °C
Indoor use

11.2.4. Control of worker exposure: Diamond catching (fully automated) (PROC 13)

Product (article) characteristics
Physical form of product: Liquid
Maximum emission potential covered in this CS: Very low.
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 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.
Conditions and measures related to personal protection, hygiene and health evaluation
If arsenic acid is relevant as impurity 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 arsenic acid 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 arsenic acid is relevant as impurity use suitable eye protection. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

11.2.5. Control of worker exposure: Diamond catching (PROC 13)

Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Massive object
Maximum emission potential covered in this CS: Very low.
Covers concentrations up to 25 %
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 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%.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If arsenic acid is relevant as impurity 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 arsenic acid is relevant as impurity use suitable eye protection. For further specification, refer to section 8 of the SDS.
If copper sulphate 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 90 °C
Indoor use

11.2.6. Control of worker exposure: Growing of metal layer (under semi-closed conditions) (PROC 4)

Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Solution
Additional physical form of product: Massive object
Maximum emission potential covered in this CS: Very low.
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 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 chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If arsenic acid is relevant as impurity 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 arsenic acid is relevant as impurity use suitable eye protection. For further specification, refer to section 8 of the SDS.
If copper sulphate 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 60 °C

Indoor use

11.2.7. Control of worker exposure: Growing of metal layer (PROC 13)

Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Solution
Additional physical form of product: Massive object
Maximum emission potential covered in this CS: Very low.
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 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
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If arsenic acid 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 arsenic acid is relevant as impurity use suitable eye protection. For further specification, refer to section 8 of the SDS.
If copper sulphate 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 90 °C
Indoor use

11.2.8. Control of worker exposure: Grinding (highly automated) (PROC 24)

Product (article) characteristics
Physical form of product: Massive object
Maximum emission potential covered in this CS: High (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 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 (fixed capturing hood type, on-tool extraction or enclosing hood type). Ensure effectiveness is at least 90%.
Only very limited manual intervention shall be required to run the process. Contact with the substance shall only be possible for a very limited duration of time.



Covers use at ambient temperatures.

Other conditions affecting workers exposure

Indoor use

11.2.9. Control of worker exposure: Grinding (PROC 24)**Product (article) characteristics**

Physical form of product: Massive object

Maximum emission potential: High (abrasion based).

Covers concentrations up to 1 %

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 daily cleaning of the equipment.

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

Manual intervention is repeatedly required although large parts of the process are machinery assisted.

Semi-closed system

Use of a wet suppression technique is required.

Covers use at ambient temperatures.

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.

Other conditions affecting workers exposure

Indoor use

11.2.10. Control of worker exposure: Control room operations (PROC 2)**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

Ensure that worker is in a separated (control) room with independent clean air supply.

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

Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision. Ensure daily cleaning of the equipment.

Other conditions affecting workers exposure

Indoor use

Assumes process temperature up to 40 °C

For supervision activities it is important to also respect the RMMs as prescribed in the contributing scenarios for the specific process that are supervised, as relevant.

11.2.11. Control of worker exposure: Strip of metal used layer (PROC 13)



Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Massive object
Additional physical form of product: Solution
Covers concentrations up to 25 %
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 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%.
Other conditions affecting workers exposure
Assumes process temperature up to 60 °C
Indoor use

11.2.12. Control of worker exposure: Packaging (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 daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Covers use at ambient temperatures.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Indoor use

11.2.13. 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 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.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If arsenic acid is relevant as impurity use suitable eye protection. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

11.2.14. 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 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.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If arsenic acid is relevant as impurity use suitable eye protection. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

11.3. Exposure estimation and reference to its source

11.3.1. Environmental release and exposure: Use of nickel sulphate in the production of electroplated superabrasive tools - Direct discharge to fresh water (ERC 5)



Release route	Release rate	Release estimation method
Water	5E-3 kg/day	Estimated release factor
Air	2E-3 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Fresh water	3.08E-3 mg/L (EUSES 2.1.2)	0.505
Sediment (freshwater)	38.2 mg/kg dw (PEC sediment calculation method for metals)	0.35
Agricultural soil	16.2 mg/kg dw (EUSES 2.1.2)	0.412

11.3.2. Environmental release and exposure: Use of nickel sulphate in the production of electroplated superabrasive tools - only air (ERC 5)

Release route	Release rate	Release estimation method
Water	0 kg/day	Estimated release factor
Air	0.1 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Agricultural soil	16.20 mg/kg dw (EUSES 2.1.2)	0.412

11.3.3. Worker exposure: Electroplated bath monitoring (PROC 15)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term For the substance	3E-3 mg/m ³ (Measured data)	0.068
Inhalation, systemic, long term For impurity arsenic acid (> 0 – ≤ 2 %)	6.80E-05 mg/m ³ (Measured data)	0.017*
Inhalation, systemic, long term Combined for substance and impurity (sum of RCRs)	-	0.085
Inhalation, systemic, acute	0.01 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	3E-3 mg/m ³ (Measured data)	0.06
Inhalation, local, acute	0.01 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term For the substance	0.06 µg/cm ² (Measured data)	0.136
Dermal, systemic, long term For impurity arsenic acid (> 0 – ≤ 2 %)	3.43E-05 mg/kg bw/day (Measured data)	< 0.01**
Combined routes, systemic, long-term	-	0.085

*For inhalation, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.004 mg/m³.

**For dermal, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.085 mg/kg bw/day.

11.3.4. Worker exposure: Diamond catching (fully automated) (PROC 13)



Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term For the substance	5E-3 mg/m ³ (Measured data)	0.103
Inhalation, systemic, long term For impurity arsenic acid (> 0 – ≤ 2 %)	1.03E-04 mg/m ³ (Measured data)	0.026*
Inhalation, systemic, long term Combined for substance and impurity (sum of RCRs)	-	0.129
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 For the substance	0.076 µg/cm ² (Measured data)	0.173
Dermal, systemic, long term For impurity arsenic acid (> 0 – ≤ 2 %)	4.34E-05 mg/kg bw/day (Measured data)	< 0.01**
Combined routes, systemic, long-term	-	0.129

*For inhalation, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.004 mg/m³.

**For dermal, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.085 mg/kg bw/day.

11.3.5. Worker exposure: Diamond catching (PROC 13)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term For the substance	1E-3 mg/m ³ (MEASE)	0.02
Inhalation, systemic, long term For impurity arsenic acid (> 0 – ≤ 2 %)	2E-5 mg/m ³ (MEASE)	< 0.01*
Inhalation, systemic, long term Combined for substance and impurity (sum of RCRs)	-	0.02
Inhalation, systemic, acute	2E-3 mg/m ³ (MEASE)	< 0.01
Inhalation, local, long term	1E-3 mg/m ³ (MEASE)	0.02
Inhalation, local, acute	2E-3 mg/m ³ (MEASE)	< 0.01
Dermal, local, long term For the substance	0.06 µg/cm ² (Measured data)	0.136
Dermal, systemic, long term For impurity arsenic acid (> 0 – ≤ 2 %)	3.43E-05 mg/kg bw/day (Measured data)	< 0.01**
Combined routes, systemic, long-term	-	0.02

*For inhalation, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.004 mg/m³.

**For dermal, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.085 mg/kg bw/day.

11.3.6. Worker exposure: Growing of metal layer (under semi-closed conditions) (PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term For the substance	8E-3 mg/m ³ (MEASE)	0.16



Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term For impurity arsenic acid ($> 0 - \leq 2\%$)	1.6E-4 mg/m ³ (MEASE)	0.04*
Inhalation, systemic, long term Combined for substance and impurity (sum of RCRs)	-	0.2
Inhalation, systemic, acute	0.016 mg/m ³ (MEASE)	< 0.01
Inhalation, local, long term	8E-3 mg/m ³ (MEASE)	0.16
Inhalation, local, acute	0.016 mg/m ³ (MEASE)	0.01
Dermal, local, long term For the substance	0.06 µg/cm ² (Measured data)	0.136
Dermal, systemic, long term For impurity arsenic acid ($> 0 - \leq 2\%$)	3.43E-05 mg/kg bw/day (Measured data)	< 0.01**
Combined routes, systemic, long-term	-	0.2

*For inhalation, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.004 mg/m³.

**For dermal, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.085 mg/kg bw/day.

11.3.7. Worker exposure: Growing of metal layer (PROC 13)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term For the substance	0.01 mg/m ³ (MEASE)	0.2
Inhalation, systemic, long term For impurity arsenic acid ($> 0 - \leq 2\%$)	2E-4 mg/m ³ (MEASE)	0.05*
Inhalation, systemic, long term Combined for substance and impurity (sum of RCRs)	-	0.25
Inhalation, systemic, acute	0.02 mg/m ³ (MEASE)	< 0.01
Inhalation, local, long term	0.01 mg/m ³ (MEASE)	0.2
Inhalation, local, acute	0.02 mg/m ³ (MEASE)	0.012
Dermal, local, long term For the substance	0.06 µg/cm ² (Measured data)	0.136
Dermal, systemic, long term For impurity arsenic acid ($> 0 - \leq 2\%$)	3.43E-05 mg/kg bw/day (Measured data)	< 0.01**
Combined routes, systemic, long-term	-	0.25

*For inhalation, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.004 mg/m³.

**For dermal, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.085 mg/kg bw/day.

11.3.8. Worker exposure: Grinding (highly automated) (PROC 24)

Route of exposure and type of effects	Exposure estimate	RCR*
Inhalation, systemic, long term	5E-3 mg/m ³ (Measured data)	0.1
Inhalation, local, long term	5E-3 mg/m ³ (Measured data)	0.1
Inhalation, local, acute	0.014 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.022

* It is noted that the substance has been completely transformed into nickel metal during production of



the article. Thus, the associated RCRs were calculated by considering the DNELs of nickel metal:

- Inhalation, systemic effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, acute DNEL = 11.9 mg/m³
- Dermal, local effects, long term DNEL = 0.035 mg/cm²

11.3.9. Worker exposure: Grinding (PROC 24)

Route of exposure and type of effects	Exposure estimate	RCR*
Inhalation, systemic, long term	0.014 mg/m ³ (MEASE)	0.28
Inhalation, local, long term	0.014 mg/m ³ (MEASE)	0.28
Inhalation, local, acute	0.028 mg/m ³ (MEASE)	< 0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.022

* It is noted that the substance has been completely transformed into nickel metal during production of the article. Thus, the associated RCRs were calculated by considering the DNELs of nickel metal:

- Inhalation, systemic effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, acute DNEL = 11.9 mg/m³
- Dermal, local effects, long term DNEL = 0.035 mg/cm²

11.3.10. Worker exposure: Control room operations (PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR*
Inhalation, systemic, long term	7E-3 mg/m ³ (Measured data)	0.14
Inhalation, local, long term	7E-3 mg/m ³ (Measured data)	0.14
Inhalation, local, acute	0.022 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.022

* It is noted that the substance has been completely transformed into nickel metal during production of the article. Thus, the associated RCRs were calculated by considering the DNELs of nickel metal:

- Inhalation, systemic effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, acute DNEL = 11.9 mg/m³
- Dermal, local effects, long term DNEL = 0.035 mg/cm²

11.3.11. Worker exposure: Strip of metal used layer (PROC 13)

Route of exposure and type of effects	Exposure estimate	RCR*
Inhalation, systemic, long term	1E-3 mg/m ³ (MEASE)	0.02
Inhalation, local, long term	1E-3 mg/m ³ (MEASE)	0.02
Inhalation, local, acute	2E-3 mg/m ³ (MEASE)	< 0.01
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.022

* It is noted that the substance has been completely transformed into nickel metal during production of the article. Thus, the associated RCRs were calculated by considering the DNELs of nickel metal:

- Inhalation, systemic effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, acute DNEL = 11.9 mg/m³
- Dermal, local effects, long term DNEL = 0.035 mg/cm²

11.3.12. Worker exposure: Packaging (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, local, long term	9E-3 mg/m ³ (Measured data)	0.18



Route of exposure and type of effects	Exposure estimate	RCR*
Inhalation, local, acute	0.037 mg/m ³ (Measured data)	< 0.01
Dermal, local, long term	5.18 µg/cm ² (Measured data)	0.148

* It is noted that the substance has been completely transformed into nickel metal during production of the article. Thus, the associated RCRs were calculated by considering the DNELs of nickel metal:

- Inhalation, systemic effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, acute DNEL = 11.9 mg/m³
- Dermal, local effects, long term DNEL = 0.035 mg/cm²

11.3.13. Worker exposure: Wet cleaning (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term For the substance	6E-3 mg/m ³ (Measured data)	0.129
Inhalation, systemic, long term For impurity arsenic acid (> 0 – ≤ 2 %)	1.29E-04 mg/m ³ (Measured data)	0.032*
Inhalation, systemic, long term Combined for substance and impurity (sum of RCRs)	-	0.161
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)	0.016
Dermal, local, long term For the substance	0.06 µg/cm ² (Measured data)	0.136
Dermal, systemic, long term For impurity arsenic acid (> 0 – ≤ 2 %)	3.43E-05 mg/kg bw/day (Measured data)	< 0.01**
Combined routes, systemic, long-term	-	0.161

*For inhalation, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.004 mg/m³.

**For dermal, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.085 mg/kg bw/day.

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

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term For the substance	0.032 mg/m ³ (Measured data)	0.64
Inhalation, systemic, long term For impurity arsenic acid (> 0 – ≤ 2 %)	6.30E-04 mg/m ³ (Measured data)	0.158*
Inhalation, systemic, long term Combined for substance and impurity (sum of RCRs)	-	0.788
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)	0.118
Dermal, local, long term For the substance	0.06 µg/cm ² (Measured data)	0.136
Dermal, systemic, long term For impurity arsenic acid (> 0 – ≤ 2 %)	3.43E-05 mg/kg bw/day (Measured data)	< 0.01**



Route of exposure and type of effects	Exposure estimate	RCR
Combined routes, systemic, long-term	-	0.788

*For inhalation, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.004 mg/m³.

**For dermal, systemic, long term, the RCR for the impurity assessment considers the DNEL for the impurity arsenic acid of 0.085 mg/kg bw/day.

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

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

12. ES 12: Service life (worker at industrial site); Service life of superabrasive tools in industrial settings

12.1. Title section

Article category: Other metal articles (AC 7g)

Environment	
1: Service life of superabrasive tools in industrial settings	ERC 12c
Worker	
2: Handling of superabrasive tools	PROC 24
Exposure scenario of the uses leading to the inclusion of the substance into the article	
ES 11: Use at industrial sites; Use of nickel sulphate in the production of electroplated superabrasive tools	

12.2. Conditions of use affecting exposure

12.2.1. Control of environmental exposure: Service life of superabrasive tools in industrial settings (ERC 12c)

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

12.2.2. Control of worker exposure: Handling of superabrasive tools (PROC 24)

Product (article) characteristics
Physical form of product: Bound in article
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 daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Covers use at ambient temperatures.
Other conditions affecting workers exposure
During grinding the process temperature might be higher, but far below the melting point of nickel.
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
FEPA has published safety instructions as best practice advice for the safe handling and use of abrasive tools. Downstream users are encouraged to follow the FEPA safety advice available via FEPA's website (https://fepa-abrasives.org/safety/).

12.3. Exposure estimation and reference to its source



12.3.1. Environmental release and exposure: Service life of superabrasive tools 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

12.3.2. Worker exposure: Handling of superabrasive tools (PROC 24)

Route of exposure and type of effects	Exposure estimate	RCR*
Inhalation, systemic, long term	0.1 ng/m ³ (Qualitative assessment)	< 0.01
Inhalation, local, long term	0.1 ng/m ³ (Qualitative assessment)	< 0.01
Inhalation, local, acute	0.1 ng/m ³ (Qualitative assessment)	< 0.01
Dermal, local, long term	0.1 ng/cm ² (Qualitative assessment)	< 0.01

* It is noted that the substance has been completely transformed into nickel metal during production of the article. Thus, the associated RCRs were calculated by considering the DNELs of nickel metal:

- Inhalation, systemic effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, acute DNEL = 11.9 mg/m³
- Dermal, local effects, long term DNEL = 0.035 mg/cm²

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

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



13. ES 13: Service life (professional worker); Service life of superabrasive tools in professional settings

13.1. Title section

Article category: Other metal articles (AC 7g)

Environment	
1: Service life of superabrasive tools in professional settings	ERC 11a
Worker	
2: Handling of superabrasive tools	PROC 24
Exposure scenario of the uses leading to the inclusion of the substance into the article	
ES 11: Use at industrial sites; Use of nickel sulphate in the production of electroplated superabrasive tools	

13.2. Conditions of use affecting exposure

13.2.1. Control of environmental exposure: Service life of superabrasive tools in professional settings (ERC 11a)

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

13.2.2. Control of worker exposure: Handling of superabrasive tools (PROC 24)

Product (article) characteristics
Physical form of product: Bound in article
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
Provide a basic standard of general ventilation (1 to 3 air changes per hour).
During grinding the process temperature might be higher, but far below the melting point of nickel.
Other conditions affecting workers exposure
Indoor use
Additional good practice advice. Obligations according to Article 37(4) of REACH do not apply
FEPA has published safety instructions as best practice advice for the safe handling and use of abrasive tools. Downstream users are encouraged to follow the FEPA safety advice available via FEPA's website (https://fepa-abrasives.org/safety/).

13.3. Exposure estimation and reference to its source

13.3.1. Environmental release and exposure: Service life of

**superabrasive tools in professional settings (ERC 11a)**

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

13.3.2. Worker exposure: Handling of superabrasive tools (PROC 24)

Route of exposure and type of effects	Exposure estimate	RCR*
Inhalation, systemic, long term	0.1 ng/m ³ (Qualitative assessment)	< 0.01
Inhalation, local, long term	0.1 ng/m ³ (Qualitative assessment)	< 0.01
Inhalation, local, acute	0.1 ng/m ³ (Qualitative assessment)	< 0.01
Dermal, local, long term	0.1 ng/cm ² (Qualitative assessment)	< 0.01

* It is noted that the substance has been completely transformed into nickel metal during production of the article. Thus, the associated RCRs were calculated by considering the DNELs of nickel metal:

- Inhalation, systemic effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, long term DNEL = 0.05 mg/m³
- Inhalation, local effects, acute DNEL = 11.9 mg/m³
- Dermal, local effects, long term DNEL = 0.035 mg/cm²

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

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



14. ES 14: Service life (consumers); Service life of superabrasive tools used by consumers

14.1. Title section

Article category: Other metal articles (AC 7g)

Environment	
1: Service life of superabrasive tools used by consumers	ERC 11a
Consumer	
2: Use of abrasive tools (superabrasives) by consumers	AC 7g
Exposure scenario of the uses leading to the inclusion of the substance into the article	
ES 11: Use at industrial sites; Use of nickel sulphate in the production of electroplated superabrasive tools	

14.2. Conditions of use affecting exposure

14.2.1. Control of environmental exposure: Service life of superabrasive tools 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
The substance should not be released to air
The substance should not be released to water

14.2.2. Control of consumer exposure: Use of abrasive tools (superabrasives) by consumers (AC 7g)

Product (article) characteristics
Physical form of used product: solid, bound in article
Covers concentrations up to 100 %
Oral exposure is considered to be not relevant.
Dermal exposure assumed to be negligible
Inhalation exposure is considered to be not relevant.
Information and behavioral advice for consumers
Do follow the manufacturers recommended advice/specification.

14.3. Exposure estimation and reference to its source

14.3.1. Environmental release and exposure: Service life of superabrasive tools 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

14.3.2. Consumer exposure: Use of abrasive tools (superabrasives) by consumers (AC 7g)



Route of exposure and type of effects	Exposure estimate	RCR*
Inhalation, systemic, long term	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

* It is noted that the substance has been completely transformed into nickel metal during production of the article. Thus, the associated RCRs were calculated by considering the DNELs of nickel metal:

- Inhalation, systemic effects, long term DNEL = 60 ng/m³
- Inhalation, local effects, long term DNEL = 60 ng/m³
- Inhalation, local effects, acute DNEL = 0.8 mg/m³
- Dermal, local effects, long term DNEL = 0.035 mg/cm²
- Oral, systemic effects, long term DNEL = 0.013 mg/kg bw/day

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

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



15. ES 15: Use at industrial sites; Intermediate use of nickel sulphate for the manufacture of nickel dihydroxide in the battery sector

15.1. Title section

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

Environment	
1: Intermediate use of nickel sulphate for the manufacture of nickel dihydroxide in the battery sector - Discharge to fresh water via municipal sewage treatment plant	ERC 6a
2: Intermediate use of nickel sulphate for the manufacture of nickel dihydroxide in the battery sector - Direct discharge to fresh water	ERC 6a
3: Intermediate use of nickel sulphate for the manufacture of nickel dihydroxide in the battery sector - Direct discharge to marine water	ERC 6a
Worker	
4: Raw material handling (solid materials)	PROC 26
5: Handling of solutions as raw material	PROC 8b, PROC 9
6: Reaction	PROC 3
7: Wet cleaning	PROC 28
8: Cleaning/removal of dust	PROC 28

15.2. Conditions of use affecting exposure

15.2.1. Control of environmental exposure: Intermediate use of nickel sulphate for the manufacture of nickel dihydroxide in the battery sector - 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 ≤ 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
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow $\geq 2E3$ 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
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 10



Receiving surface water flow $\geq 1.8E4$ m ³ /day

15.2.2. Control of environmental exposure: Intermediate use of nickel sulphate for the manufacture of nickel dihydroxide in the battery sector - Direct discharge to fresh water (ERC 6a)

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
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 100
Receiving surface water flow $\geq 5.23E4$ m ³ /day
Assumed effluent discharge flow from site ≥ 528 m ³ /day

15.2.3. Control of environmental exposure: Intermediate use of nickel sulphate for the manufacture of nickel dihydroxide in the battery sector - Direct discharge to marine water (ERC 6a)

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
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to freshwater assumed
Receiving water dilution (fresh or marine) ≥ 100
Assumed effluent discharge flow from site ≥ 528 m ³ /day

15.2.4. Control of worker exposure: Raw material handling (solid materials) (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 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 chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

15.2.5. Control of worker exposure: Handling of solutions as raw material (PROC 8b, PROC 9)

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 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
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

15.2.6. Control of worker exposure: Reaction (PROC 3)

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 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
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

15.2.7. 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 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.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

15.2.8. 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 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.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

15.3. Exposure estimation and reference to its source

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

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

15.3.2. Environmental release and exposure: Intermediate use of nickel sulphate for the manufacture of nickel dihydroxide in the battery sector - Direct discharge to fresh water (ERC 6a)

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	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	16.20 mg/kg dw (EUSES 2.1.2)	0.412

15.3.3. Environmental release and exposure: Intermediate use of nickel sulphate for the manufacture of nickel dihydroxide in the

**battery sector - Direct discharge to marine water (ERC 6a)**

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
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
Agricultural soil	16.20 mg/kg dw (EUSES 2.1.2)	0.412

15.3.4. Worker exposure: Raw material handling (solid materials) (PROC 26)

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)	0.022
Dermal, local, long term	0.11 µg/cm ² (Measured data)	0.25

15.3.5. Worker exposure: Handling of solutions as raw material (PROC 8b, PROC 9)

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)	0.029
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

15.3.6. Worker exposure: Reaction (PROC 3)

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)	0.037
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

15.3.7. 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



Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, acute	0.026 mg/m ³ (Measured data)	0.016
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

15.3.8. 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
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)	0.118
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

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

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



16. ES 16: Use at industrial sites; Use of nickel sulphate for the production of plated electrodes in the battery sector

16.1. 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 sulphate for the production of plated electrodes in the battery sector - Discharge to fresh water via municipal sewage treatment plant	ERC 5
2: Use of nickel sulphate for the production of plated electrodes in the battery sector - Direct discharge to fresh water	ERC 5
3: Use of nickel sulphate for the production of plated electrodes in the battery sector - Direct discharge to marine water	ERC 5
Worker	
4: Raw material handling (solid materials)	PROC 26
5: Handling of solutions as raw material	PROC 8b, PROC 9
6: Nickel electroplating	PROC 4
7: Wet cleaning	PROC 28
8: Cleaning/removal of dust	PROC 28
Subsequent service life exposure scenario(s)	
ES 17: Service life (worker at industrial site); Service life of nickel-containing batteries in industrial settings	
ES 18: Service life (professional worker); Service life of nickel-containing batteries in professional settings	

16.2. Conditions of use affecting exposure

16.2.1. Control of environmental exposure: Use of nickel sulphate for the production of plated electrodes in the battery sector - 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
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow $\geq 2E3$ 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
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 10
Receiving surface water flow $\geq 1.8E4$ m ³ /day

16.2.2. Control of environmental exposure: Use of nickel sulphate for the production of plated electrodes in the battery sector - 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
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Receiving water dilution (fresh or marine) ≥ 100
Receiving surface water flow $\geq 5.23E4$ m ³ /day
Assumed effluent discharge flow from site ≥ 528 m ³ /day

16.2.3. Control of environmental exposure: Use of nickel sulphate for the production of plated electrodes in the battery sector - 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
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to freshwater assumed
Receiving water dilution (fresh or marine) ≥ 100
Assumed effluent discharge flow from site ≥ 528 m ³ /day



16.2.4. Control of worker exposure: Raw material handling (solid materials) (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 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
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.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

16.2.5. Control of worker exposure: Handling of solutions as raw material (PROC 8b, PROC 9)

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 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
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

**16.2.6. Control of worker exposure: Nickel electroplating (PROC 4)**

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 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.
Conditions and measures related to personal protection, hygiene and health evaluation
If copper sulphate 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

16.2.7. 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 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.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If copper sulphate 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



16.2.8. 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 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.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
If copper sulphate 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

16.3. Exposure estimation and reference to its source

16.3.1. Environmental release and exposure: Use of nickel sulphate for the production of plated electrodes in the battery sector - 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

16.3.2. Environmental release and exposure: Use of nickel sulphate for the production of plated electrodes in the battery sector - Direct discharge to fresh water (ERC 5)

Release route	Release rate	Release estimation method
Water	0.123 kg/day	Estimated release factor



Release route	Release rate	Release estimation method
Air	0.073 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	16.20 mg/kg dw (EUSES 2.1.2)	0.412

16.3.3. Environmental release and exposure: Use of nickel sulphate for the production of plated electrodes in the battery sector - Direct discharge to marine water (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
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
Agricultural soil	16.20 mg/kg dw (EUSES 2.1.2)	0.412

16.3.4. Worker exposure: Raw material handling (solid materials) (PROC 26)

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)	0.022
Dermal, local, long term	0.11 µg/cm ² (Measured data)	0.25

16.3.5. Worker exposure: Handling of solutions as raw material (PROC 8b, PROC 9)

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)	0.029
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

16.3.6. Worker exposure: Nickel electroplating (PROC 4)



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)	0.173

16.3.7. 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)	0.016
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

16.3.8. 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
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)	0.118
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

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

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

17. ES 17: Service life (worker at industrial site); Service life of nickel-containing batteries in industrial settings

17.1. Title section

Article category: Machinery, mechanical appliances, electrical/electronic articles (AC 2), Electrical batteries and accumulators (AC 3)

Environment	
1: Service life of nickel-containing batteries in industrial settings	ERC 12c
Worker	
2: Handling of batteries containing the substance with no foreseeable release	PROC 21
Exposure scenario of the uses leading to the inclusion of the substance into the article	
ES 16: Use at industrial sites; Use of nickel sulphate for the production of plated electrodes in the battery sector	

17.2. Conditions of use affecting exposure

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

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

17.2.2. Control of worker exposure: Handling of batteries containing the substance with no foreseeable release (PROC 21)

Product (article) characteristics
Physical form of product: Massive object
Maximum emission potential covered in this CS: No foreseeable emission (included in closed container).
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 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

17.3. Exposure estimation and reference to its source

17.3.1. 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

17.3.2. Worker exposure: Handling of batteries containing the substance with no foreseeable release (PROC 21)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.1 ng/m ³ (Qualitative Assessment)	< 0.01
Inhalation, systemic, acute	0.1 ng/m ³ (Qualitative Assessment)	< 0.01
Inhalation, local, long term	0.1 ng/m ³ (Qualitative Assessment)	< 0.01
Inhalation, local, acute	0.1 ng/m ³ (Qualitative Assessment)	< 0.01
Dermal, local, long term	0.1 ng/cm ² (Qualitative Assessment)	< 0.01

17.4. 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”.



18. ES 18: Service life (professional worker); Service life of nickel-containing batteries in professional settings

18.1. Title section

Article category: Machinery, mechanical appliances, electrical/electronic articles (AC 2), Electrical batteries and accumulators (AC 3)

Environment	
1: Service life of nickel-containing batteries in professional settings	ERC 11a
Worker	
2: Handling of batteries containing the substance with no foreseeable release	PROC 21
Exposure scenario of the uses leading to the inclusion of the substance into the article	
ES 16: Use at industrial sites; Use of nickel sulphate for the production of plated electrodes in the battery sector	

18.2. Conditions of use affecting exposure

18.2.1. 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.

18.2.2. Control of worker exposure: Handling of batteries containing the substance with no foreseeable release (PROC 21)

Product (article) characteristics
Physical form of product: Massive object
Maximum emission potential covered in this CS: No foreseeable emission (included in closed container).
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
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

18.3. Exposure estimation and reference to its source

18.3.1. 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
Air	0 kg/day	Estimated release factor
Soil	0 kg/day	Estimated release factor

18.3.2. Worker exposure: Handling of batteries containing the substance with no foreseeable release (PROC 21)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.1 ng/m ³ (Qualitative Assessment)	< 0.01
Inhalation, systemic, acute	0.1 ng/m ³ (Qualitative Assessment)	< 0.01
Inhalation, local, long term	0.1 ng/m ³ (Qualitative Assessment)	< 0.01
Inhalation, local, acute	0.1 ng/m ³ (Qualitative Assessment)	< 0.01
Dermal, local, long term	0.1 ng/cm ² (Qualitative Assessment)	< 0.01

18.4. 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”.



19. ES 19: Formulation or re-packing; Use of nickel sulphate in the formulation of micronutrient additives for biogas production

19.1. Title section

Product category: Other (PC 0)

Environment		
1: Use of nickel sulphate in the formulation of micronutrient additives for biogas production - No emissions to water	ERC 2	
Worker		
2: Nickel sulphate reception (solutions)	PROC 4	
3: Nickel sulphate reception (solid)	PROC 26	
4: Preparing the additive in solution	PROC 3	
5: Preparing the additive as solid	PROC 3	
6: Filling of solutions	PROC 9	
7: Filling of biodegradable bags	PROC 9	
8: Palletising	PROC 21	
9: Wet cleaning	PROC 28	
10: Cleaning/removal of dust	PROC 28	

19.2. Conditions of use affecting exposure

19.2.1. Control of environmental exposure: Use of nickel sulphate in the formulation of micronutrient additives for biogas production - No emissions to water (ERC 2)

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 0.025 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site ≤ 10 tonnes/year
Technical and organisational conditions and measures
The substance should not be released to water
The substance should not be released to air
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.

19.2.2. Control of worker exposure: Nickel sulphate reception (solutions) (PROC 4)

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 daily cleaning of the equipment.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
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.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

19.2.3. Control of worker exposure: Nickel sulphate reception (solid) (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 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 chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

19.2.4. Control of worker exposure: Preparing the additive in solution (PROC 3)

Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Solution
Covers concentrations up to 100 %
Maximum emission potential: 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 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
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

19.2.5. Control of worker exposure: Preparing the additive as solid (PROC 3)

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 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
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

19.2.6. Control of worker exposure: Filling of solutions (PROC 9)

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 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
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

19.2.7. Control of worker exposure: Filling of biodegradable bags (PROC 9)

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 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 chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

19.2.8. Control of worker exposure: Palletising (PROC 21)

Product (article) characteristics
Physical form of product: Massive object (biodegradable bags)
Maximum emission potential covered in this CS: Low (abrasion based).
Covers concentrations up to 1 %
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 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

19.2.9. 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 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.

Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.

Other conditions affecting workers exposure

Assumes process temperature up to 40 °C

Indoor use

19.2.10. 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 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.

Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.

Other conditions affecting workers exposure

Assumes process temperature up to 40 °C

Indoor use



19.3. Exposure estimation and reference to its source

19.3.1. Environmental release and exposure: Use of nickel sulphate in the formulation of micronutrient additives for biogas production - No emissions to water (ERC 2)

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

19.3.2. Worker exposure: Nickel sulphate reception (solutions) (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	0.047 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)	0.029
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

19.3.3. Worker exposure: Nickel sulphate reception (solid) (PROC 26)

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)	0.022
Dermal, local, long term	0.11 µg/cm ² (Measured data)	0.25

19.3.4. Worker exposure: Preparing the additive in solution (PROC 3)

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)	0.037
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

19.3.5. Worker exposure: Preparing the additive as solid (PROC 3)

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



Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, acute	0.06 mg/m ³ (Measured data)	0.037
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

19.3.6. Worker exposure: Filling of solutions (PROC 9)

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)	0.029
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

19.3.7. Worker exposure: Filling of biodegradable bags (PROC 9)

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)	0.022
Dermal, local, long term	0.11 µg/cm ² (Measured data)	0.25

19.3.8. Worker exposure: Palletising (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)	0.023
Dermal, local, long term	0.076 µg/cm ² (Measured data)	0.173

19.3.9. 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)	0.016
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

19.3.10. 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)	0.118



Route of exposure and type of effects	Exposure estimate	RCR
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

19.4. 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”.



20. ES 20: Use at industrial sites; Use of nickel sulphate and nickel sulphate-derived micronutrients in biogas production

20.1. Title section

Product category: Other (PC 0)

Sector of use: Agriculture, forestry, fishery (SU 1)

Environment	
1: Use of nickel sulphate and nickel sulphate-derived micronutrients in biogas production	ERC 4
Worker	
2: Handling of solutions (reception and charging/discharging the bioreactor)	PROC 8b
3: Handling of biodegradable bags (reception and charging/discharging the bioreactor)	PROC 21
4: Wet cleaning	PROC 28
5: Cleaning/removal of dust	PROC 28

20.2. Conditions of use affecting exposure

20.2.1. Control of environmental exposure: Use of nickel sulphate and nickel sulphate-derived micronutrients in biogas production (ERC 4)

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 0.025 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 ≤ 9 tonnes/year
Technical and organisational conditions and measures
The substance should not be released to water
The substance should not be released to air
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.

20.2.2. Control of worker exposure: Handling of solutions (reception and charging/discharging the bioreactor) (PROC 8b)

Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Solution
Covers concentrations up to 20 %
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 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



Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.

Other conditions affecting workers exposure

Assumes process temperature up to 40 °C

Indoor use

20.2.3. Control of worker exposure: Handling of biodegradable bags (reception and charging/discharging the bioreactor) (PROC 21)**Product (article) characteristics**

Physical form of product: Massive object (biodegradable bags)

Maximum emission potential covered in this CS: Very low.

Covers concentrations up to 1 %

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 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

20.2.4. 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 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.

Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.

Other conditions affecting workers exposure

Assumes process temperature up to 40 °C

Indoor use

20.2.5. 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 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.
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C
Indoor use

20.3. Exposure estimation and reference to its source

20.3.1. Environmental release and exposure: Use of nickel sulphate and nickel sulphate-derived micronutrients in biogas production (ERC 4)

Release route	Release rate	Release estimation method
Water	0 kg/day	Estimated release factor
Air	0 kg/day	Estimated release factor
Soil	25 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Agricultural soil	16.2 mg/kg dw (EUSES 2.1.2)	0.412

20.3.2. Worker exposure: Handling of solutions (reception and charging/discharging the bioreactor) (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)	0.029
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

20.3.3. Worker exposure: Handling of biodegradable bags (reception and charging/discharging the bioreactor) (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)	0.023
Dermal, local, long term	0.076 µg/cm ² (Measured data)	0.173

20.3.4. 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)	0.016
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

20.3.5. 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)	0.118
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

20.4. 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”.



21. ES 21: Widespread use by professional workers; Use of nickel sulphate and nickel sulphate-derived micronutrients in compostable bags in biogas production

21.1. Title section

Product category: Other (PC 0)

Sector of use: Agriculture, forestry, fishery (SU 1)

Environment	
1: Use of nickel sulphate and nickel sulphate-derived micronutrients in compostable bags in biogas production	ERC 8b
Worker	
2: Handling of solutions (reception and charging/discharging the bioreactor)	PROC 8b
3: Handling of biodegradable bags (reception and charging/discharging the bioreactor)	PROC 21

21.2. Conditions of use affecting exposure

21.2.1. Control of environmental exposure: Use of nickel sulphate and nickel sulphate-derived micronutrients in compostable bags in biogas production (ERC 8b)

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.

21.2.2. Control of worker exposure: Handling of solutions (reception and charging/discharging the bioreactor) (PROC 8b)

Product (article) characteristics
Physical form of product: Liquid
Additional physical form of product: Solution
Covers concentrations up to 20 %
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
Provide a basic standard of general ventilation (1 to 3 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with specific activity training. For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Assumes process temperature up to 40 °C



Indoor use

21.2.3. Control of worker exposure: Handling of biodegradable bags (reception and charging/discharging the bioreactor) (PROC 21)

Product (article) characteristics
Physical form of product: Massive object (biodegradable bags)
Maximum emission potential covered in this CS: Very low.
Covers concentrations up to 1 %
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

21.3. Exposure estimation and reference to its source**21.3.1. Environmental release and exposure: Use of nickel sulphate and nickel sulphate-derived micronutrients in compostable bags in biogas production (ERC 8b)**

Release route	Release rate	Release estimation method
Water	0 kg/day	Estimated release factor
Air	0 kg/day	Estimated release factor
Soil	0.55 kg/day	Estimated release factor

Protection target	Exposure estimate	RCR
Agricultural soil	16.2 mg/kg dw (EUSES 2.1.2)	0.412

21.3.2. Worker exposure: Handling of solutions (reception and charging/discharging the bioreactor) (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)	0.029
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.136

21.3.3. Worker exposure: Handling of biodegradable bags (reception and charging/discharging the bioreactor) (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)	0.023



Route of exposure and type of effects	Exposure estimate	RCR
Dermal, local, long term	0.076 µg/cm ² (Measured data)	0.173

21.4. 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”.