



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 x 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 x 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: Formulation or re-packing; Formulation of nickel sulphide-containing catalysts

1.1. Title section

Product category: Other (PC 0), Laboratory Chemicals (PC 21)

Environment	
1: Formulation of nickel sulphide-containing catalysts - Discharge to fresh water via municipal sewage treatment plant	ERC 3
2: Formulation of nickel sulphide-containing catalysts - Direct discharge to fresh water	ERC 3
3: Formulation of nickel sulphide-containing catalysts - Direct discharge to marine water	ERC 3
Worker	
4: Loading of catalyst into reactor under inert atmosphere	PROC 1
5: Formulation (including impregnation and stabilisation) in closed systems	PROC 1, PROC 3, PROC 2
6: Packaging of catalysts in closed systems	PROC 1
7: Semi-automated packaging of stabilised/passivated catalysts	PROC 8b, PROC 9
8: Cleaning and maintenance at closed systems	PROC 28
9: Cleaning and maintenance at semi-closed systems	PROC 28

1.2. Conditions of use affecting exposure

1.2.1. Control of environmental exposure: Formulation of nickel sulphide-containing catalysts - Discharge to fresh water via municipal sewage treatment plant (ERC 3)

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



Local freshwater dilution factor 50

1.2.2. Control of environmental exposure: Formulation of nickel sulphide-containing catalysts - Direct discharge to fresh water (ERC 3)

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

1.2.3. Control of environmental exposure: Formulation of nickel sulphide-containing catalysts - Direct discharge to marine water (ERC 3)

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



1.2.4. Control of worker exposure: Loading of catalyst into reactor under inert atmosphere (PROC 1)

Product (article) characteristics
Physical form of product: Not relevant (closed process)
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
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.
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

1.2.5. Control of worker exposure: Formulation (including impregnation and stabilisation) in closed systems (PROC 1, PROC 3, PROC 2)

Product (article) characteristics
Physical form of product: Not relevant (closed process)
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
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.
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: Packaging of catalysts in closed systems (PROC 1)

Product (article) characteristics
Physical form of product: Not relevant (closed process)
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
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
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.
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: Semi-automated packaging of stabilised/passivated catalysts (PROC 8b, PROC 9)

Product (article) characteristics
Physical form of product: Solid, no or very low dustiness
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
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 specifically designed and maintained LEV (receiving hood type). Ensure effectiveness is at least 80%.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Semi-automated task
Semi-closed system
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 10 (APF \geq 10). For further specification, refer to section 8 of the SDS.
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.

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

1.2.8. Control of worker exposure: Cleaning and maintenance at closed systems (PROC 28)

Product (article) characteristics

Physical form of product: Solid, high dustiness

Covers concentrations up to 100 %

Additional physical form of product: Solutions / Suspensions

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).

During cleaning use vacuum and/or (pressure) washing with water to remove dusts or powders. No direct handling (use of long-distance tools).

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.

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

1.2.9. Control of worker exposure: Cleaning and maintenance at semi-closed systems (PROC 28)

Product (article) characteristics

Physical form of product: Solid, high dustiness

Covers concentrations up to 100 %

Additional physical form of product: Solutions / Suspensions

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).

During cleaning use vacuum and/or (pressure) washing with water to remove dusts or powders. No



direct handling (use of long-distance tools).
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.
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: Formulation of nickel sulphide-containing catalysts - Discharge to fresh water via municipal sewage treatment plant (ERC 3)

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

Protection target	Exposure estimate	RCR
Fresh water	5.31E-3 mg/L (EUSES 2.1.2)	0.87
Sediment (freshwater)	96.88 mg/kg dw (PEC sediment calculation method for metals)	0.889
Sewage Treatment Plant	0.168 mg/L (EUSES 2.1.2)	0.509
Agricultural soil	20.93 mg/kg dw (EUSES 2.1.2)	0.533

1.3.2. Environmental release and exposure: Formulation of nickel sulphide-containing catalysts - Direct discharge to fresh water (ERC 3)

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

Protection target	Exposure estimate	RCR
Fresh water	4.91E-3 mg/L (EUSES 2.1.2)	0.805
Sediment (freshwater)	86.32 mg/kg dw (PEC sediment calculation method for metals)	0.792
Agricultural soil	16.22 mg/kg dw (EUSES 2.1.2)	0.413

1.3.3. Environmental release and exposure: Formulation of nickel sulphide-containing catalysts - Direct discharge to marine water (ERC 3)



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

Protection target	Exposure estimate	RCR
Marine water	2.31E-3 mg/L (EUSES 2.1.2)	0.242
Sediment (marine water)	68.92 mg/kg dw (PEC sediment calculation method for metals)	0.632
Agricultural soil	16.22 mg/kg dw (EUSES 2.1.2)	0.413

1.3.4. Worker exposure: Loading of catalyst into reactor under inert atmosphere (PROC 1)

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	0.027 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	9E-3 mg/m ³ (Measured data)	0.18
Inhalation, local, acute	0.027 mg/m ³ (Measured data)	0.034
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.025

1.3.5. Worker exposure: Formulation (including impregnation and stabilisation) in closed systems (PROC 1, PROC 3, PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.013 mg/m ³ (Measured data)	0.26
Inhalation, systemic, acute	0.052 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.013 mg/m ³ (Measured data)	0.26
Inhalation, local, acute	0.052 mg/m ³ (Measured data)	0.065
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.025

1.3.6. Worker exposure: Packaging of catalysts in closed systems (PROC 1)

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	0.027 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	9E-3 mg/m ³ (Measured data)	0.18
Inhalation, local, acute	0.027 mg/m ³ (Measured data)	0.034
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.025

1.3.7. Worker exposure: Semi-automated packaging of stabilised/passivated catalysts (PROC 8b, PROC 9)

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



Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	0.014 mg/m ³ (Measured data)	0.28
Inhalation, local, acute	0.071 mg/m ³ (Measured data)	0.089
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.025

1.3.8. Worker exposure: Cleaning and maintenance at closed systems (PROC 28)

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	0.16 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.027 mg/m ³ (Measured data)	0.54
Inhalation, local, acute	0.16 mg/m ³ (Measured data)	0.2
Dermal, local, long term	0.06 µg/cm ² (Measured data)	0.025

1.3.9. Worker exposure: Cleaning and maintenance at semi-closed systems (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.018 mg/m ³ (Measured data)	0.36
Inhalation, systemic, acute	0.073 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.018 mg/m ³ (Measured data)	0.36
Inhalation, local, acute	0.073 mg/m ³ (Measured data)	0.091
Dermal, local, long term	0.11 µg/cm ² (Measured data)	0.046

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; Use of nickel sulphide-containing catalysts (as non-reactive processing aid)

2.1. Title section

Product category: Other (PC 0), Laboratory Chemicals (PC 21)

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

Environment	
1: Use of nickel sulphide-containing catalysts (as non-reactive processing aid)	ERC 4
Worker	
2: Enclosed transfer/loading of stabilised/passivated catalyst into reactor/vessel/device	PROC 3, PROC 9, PROC 8b
3: Semi-closed transfer/loading of stabilised/passivated catalyst into reactor/vessel/device	PROC 4, PROC 9, PROC 8b
4: Use of catalyst in closed systems	PROC 1, PROC 3, PROC 2
5: Screening of spent catalyst	PROC 4
6: Enclosed unloading/emptying of spent catalyst	PROC 3
7: Semi-closed unloading/emptying of spent catalyst	PROC 8b
8: Manual unloading/emptying of spent catalyst (incl. tasks inside reactors)	PROC 4, PROC 8b
9: Manual handling of (spent) catalysts in dust-reduced form	PROC 4, PROC 8b
10: Transfer of spent catalyst into containers	PROC 8b, PROC 9
11: Cleaning and maintenance at closed systems	PROC 28
12: Cleaning and maintenance at semi-closed systems	PROC 28

2.2. Conditions of use affecting exposure

2.2.1. Control of environmental exposure: Use of nickel sulphide-containing catalysts (as non-reactive processing aid) (ERC 4)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 6 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 <= 40 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.

2.2.2. Control of worker exposure: Enclosed transfer/loading of stabilised/passivated catalyst into reactor/vessel/device (PROC 3, PROC 9, PROC 8b)



Product (article) characteristics
Physical form of product: Not relevant (closed process)
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
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
Conditions and measures related to personal protection, hygiene and health evaluation
If pyrite (iron disulphide) 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

2.2.3. Control of worker exposure: Semi-closed transfer/loading of stabilised/passivated catalyst into reactor/vessel/device (PROC 4, PROC 9, PROC 8b)

Product (article) characteristics
Physical form of product: Shaped catalyst: encapsulated powders
Maximum emission potential covered in this CS: No foreseeable emission (Shaped catalyst, encapsulated powders).
Covers concentrations up to 20 %
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-automated task
Semi-closed system
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 20 (APF \geq 20). For further specification, refer to section 8 of the SDS.
If pyrite (iron disulphide) 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: Use of catalyst in closed systems (PROC 1, PROC 3, PROC 2)

Product (article) characteristics
Physical form of product: Not relevant (closed process)
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
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
Conditions and measures related to personal protection, hygiene and health evaluation
If pyrite (iron disulphide) 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: Screening of spent catalyst (PROC 4)

Product (article) characteristics
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
Physical form of product: Solid, high dustiness (shaped catalyst)
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.
Canopy hood with 50 % exposure reduction during supervision and occasional opening of the system
Mechanical ventilation giving at least 1 air change per hour during supervision and occasional opening of the system
Low level containment with 90 % exposure reduction during supervision
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 20 (APF \geq 20). For further specification, refer to section 8 of the SDS.
If pyrite (iron disulphide) 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
Process conducted indoors at large workrooms

2.2.6. Control of worker exposure: Enclosed unloading/emptying of

**spent catalyst (PROC 3)**

Product (article) characteristics
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
Physical form of product: Not relevant (closed process)
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
Conditions and measures related to personal protection, hygiene and health evaluation
If pyrite (iron disulphide) 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: Semi-closed unloading/emptying of spent catalyst (PROC 8b)

Product (article) characteristics
Physical form of product: Solid, no or very low dustiness
Maximum emission potential covered in this CS: No foreseeable emission (Shaped catalyst, encapsulated powders).
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
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-automated task
Semi-closed system
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 20 (APF \geq 20). For further specification, refer to section 8 of the SDS.
If pyrite (iron disulphide) 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



2.2.8. Control of worker exposure: Manual unloading/emptying of spent catalyst (incl. tasks inside reactors) (PROC 4, PROC 8b)

Product (article) characteristics
Physical form of product: Solid, no or very low dustiness
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
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).
Highly efficient extraction hose to be used. No direct handling (use of long-distance tools)
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 pyrite (iron disulphide) 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

2.2.9. Control of worker exposure: Manual handling of (spent) catalysts in dust-reduced form (PROC 4, PROC 8b)

Product (article) characteristics
Physical form of product: Solid, low dustiness
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
Amount used (or contained in articles), frequency and duration of use/exposure
Avoid carrying out activities involving exposure for more than 1 hour. Once per shift or up to 1-2 times per week.
Technical and organisational conditions and measures
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 regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Tools providing distance to exposure source to be used (e.g. paddles with long handle)
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 pyrite (iron disulphide) 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

2.2.10. Control of worker exposure: Transfer of spent catalyst into containers (PROC 8b, PROC 9)

Product (article) characteristics

Physical form of product: Solid, no or very low dustiness

Limit the substance content in the product to 20 % (Nickel concentration in catalyst)

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

Semi-automated task

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

Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 20 (APF \geq 20). For further specification, refer to section 8 of the SDS.

If pyrite (iron disulphide) 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

2.2.11. Control of worker exposure: Cleaning and maintenance at closed systems (PROC 28)

Product (article) characteristics

Physical form of product: Solid, high dustiness

Covers concentrations up to 100 %

Additional physical form of product: Solutions / Suspensions

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).

During cleaning use vacuum and/or (pressure) washing with water to remove dusts or powders. No direct handling (use of long-distance tools).

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



If pyrite (iron disulphide) 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

2.2.12. Control of worker exposure: Cleaning and maintenance at semi-closed systems (PROC 28)

Product (article) characteristics

Physical form of product: Solid, high dustiness

Covers concentrations up to 100 %

Additional physical form of product: Solutions / Suspensions

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).

During cleaning use vacuum and/or (pressure) washing with water to remove dusts or powders. No direct handling (use of long-distance tools).

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 pyrite (iron disulphide) 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: Use of nickel sulphide-containing catalysts (as non-reactive processing aid) (ERC 4)

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

2.3.2. Worker exposure: Enclosed transfer/loading of stabilised/passivated catalyst into reactor/vessel/device (PROC 3, PROC 9, PROC 8b)



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	0.027 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	9E-3 mg/m ³ (Measured data)	0.18
Inhalation, local, acute	0.027 mg/m ³ (Measured data)	0.034
Dermal, local, long term	0.076 µg/cm ² (Measured data)	0.032

2.3.3. Worker exposure: Semi-closed transfer/loading of stabilised/passivated catalyst into reactor/vessel/device (PROC 4, PROC 9, PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	7E-3 mg/m ³ (Measured data)	0.14
Inhalation, systemic, acute	0.036 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	7E-3 mg/m ³ (Measured data)	0.14
Inhalation, local, acute	0.036 mg/m ³ (Measured data)	0.045
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.317

2.3.4. Worker exposure: Use of catalyst in closed systems (PROC 1, PROC 3, PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.013 mg/m ³ (Measured data)	0.26
Inhalation, systemic, acute	0.052 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.013 mg/m ³ (Measured data)	0.26
Inhalation, local, acute	0.052 mg/m ³ (Measured data)	0.065
Dermal, local, long term	0.076 µg/cm ² (Measured data)	0.032

2.3.5. Worker exposure: Screening of spent catalyst (PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.029 mg/m ³ (ART)	0.58
Inhalation, systemic, acute	0.058 mg/m ³ (ART)	< 0.01
Inhalation, local, long term	0.029 mg/m ³ (ART)	0.58
Inhalation, local, acute	0.058 mg/m ³ (ART)	0.072
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.317

2.3.6. Worker exposure: Enclosed unloading/emptying of spent catalyst (PROC 3)

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	0.027 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	9E-3 mg/m ³ (Measured data)	0.18
Inhalation, local, acute	0.027 mg/m ³ (Measured data)	0.034
Dermal, local, long term	0.076 µg/cm ² (Measured data)	0.032

**2.3.7. Worker exposure: Semi-closed unloading/emptying of spent catalyst (PROC 8b)**

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	7E-3 mg/m ³ (Measured data)	0.14
Inhalation, systemic, acute	0.036 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	7E-3 mg/m ³ (Measured data)	0.14
Inhalation, local, acute	0.036 mg/m ³ (Measured data)	0.045
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.317

2.3.8. Worker exposure: Manual unloading/emptying of spent catalyst (incl. tasks inside reactors) (PROC 4, PROC 8b)

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	0.036 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	9E-3 mg/m ³ (Measured data)	0.18
Inhalation, local, acute	0.036 mg/m ³ (Measured data)	0.045
Dermal, local, long term	0.11 µg/cm ² (Measured data)	0.046

2.3.9. Worker exposure: Manual handling of (spent) catalysts in dust-reduced form (PROC 4, PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	3E-3 mg/m ³ (MEASE, PROC 4)	0.06
Inhalation, systemic, acute	6E-3 mg/m ³ (MEASE, PROC 4)	< 0.01
Inhalation, local, long term	3E-3 mg/m ³ (MEASE, PROC 4)	0.06
Inhalation, local, acute	6E-3 mg/m ³ (MEASE, PROC 4)	< 0.01
Dermal, local, long term	0.022 µg/cm ² (Measured data)	< 0.01

2.3.10. Worker exposure: Transfer of spent catalyst into containers (PROC 8b, PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	7E-3 mg/m ³ (Measured data)	0.14
Inhalation, systemic, acute	0.036 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	7E-3 mg/m ³ (Measured data)	0.14
Inhalation, local, acute	0.036 mg/m ³ (Measured data)	0.045
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.317

2.3.11. Worker exposure: Cleaning and maintenance at closed systems (PROC 28)

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	0.16 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.027 mg/m ³ (Measured data)	0.54



Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, acute	0.16 mg/m ³ (Measured data)	0.2
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.317

2.3.12. Worker exposure: Cleaning and maintenance at semi-closed systems (PROC 28)

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	0.036 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	9E-3 mg/m ³ (Measured data)	0.18
Inhalation, local, acute	0.036 mg/m ³ (Measured data)	0.045
Dermal, local, long term	0.11 µg/cm ² (Measured data)	0.046

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

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



3. ES 3: Use at industrial sites; Use of nickel sulphide-containing catalysts (as reactive processing aid)

3.1. Title section

Product category: Other (PC 0), Laboratory Chemicals (PC 21)

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

Environment	
1: Use of nickel sulphide-containing catalysts (as reactive processing aid)	ERC 6b
Worker	
2: Enclosed transfer/loading of stabilised/passivated catalyst into reactor/vessel/device	PROC 3, PROC 9, PROC 8b
3: Semi-closed transfer/loading of stabilised/passivated catalyst into reactor/vessel/device	PROC 4, PROC 9, PROC 8b
4: Use of catalyst in closed systems	PROC 1, PROC 3, PROC 2
5: Screening of spent catalyst	PROC 4
6: Enclosed unloading/emptying of spent catalyst	PROC 3
7: Semi-closed unloading/emptying of spent catalyst	PROC 8b
8: Manual unloading/emptying of spent catalyst (incl. tasks inside reactors)	PROC 4, PROC 8b
9: Manual handling of (spent) catalysts in dust-reduced form	PROC 4, PROC 8b
10: Transfer of spent catalyst into containers	PROC 8b, PROC 9
11: Cleaning and maintenance at closed systems	PROC 28
12: Cleaning and maintenance at semi-closed systems	PROC 28

3.2. Conditions of use affecting exposure

3.2.1. Control of environmental exposure: Use of nickel sulphide-containing catalysts (as reactive processing aid) (ERC 6b)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 6 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 <= 40 tonnes/year
Technical and organisational conditions and measures
The substance should not be released to air
The substance should not be released to water
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.

3.2.2. Control of worker exposure: Enclosed transfer/loading of stabilised/passivated catalyst into reactor/vessel/device (PROC 3, PROC 9, PROC 8b)

Product (article) characteristics



Physical form of product: Not relevant (closed process)
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
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
Conditions and measures related to personal protection, hygiene and health evaluation
If pyrite (iron disulphide) 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

3.2.3. Control of worker exposure: Semi-closed transfer/loading of stabilised/passivated catalyst into reactor/vessel/device (PROC 4, PROC 9, PROC 8b)

Product (article) characteristics
Physical form of product: Shaped catalyst: encapsulated powders
Maximum emission potential covered in this CS: No foreseeable emission (Shaped catalyst, encapsulated powders).
Covers concentrations up to 20 %
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-automated task
Semi-closed system
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 20 (APF \geq 20). For further specification, refer to section 8 of the SDS.
If pyrite (iron disulphide) 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

3.2.4. Control of worker exposure: Use of catalyst in closed

**systems (PROC 1, PROC 3, PROC 2)**

Product (article) characteristics
Physical form of product: Not relevant (closed process)
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
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 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 regular inspection, cleaning and maintenance of equipment and machines. Clear spills immediately. Ensure daily cleaning of the equipment.
Automated task
Use in closed process
Conditions and measures related to personal protection, hygiene and health evaluation
If pyrite (iron disulphide) 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

3.2.5. Control of worker exposure: Screening of spent catalyst (PROC 4)

Product (article) characteristics
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
Physical form of product: Solid, high dustiness (shaped catalyst)
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.
Canopy hood with 50 % exposure reduction during supervision and occasional opening of the system
Mechanical ventilation giving at least 1 air change per hour during supervision and occasional opening of the system
Low level containment with 90 % exposure reduction during supervision
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 20 (APF \geq 20). For further specification, refer to section 8 of the SDS.
If pyrite (iron disulphide) 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
Process conducted indoors at large workrooms

3.2.6. Control of worker exposure: Enclosed unloading/emptying of spent catalyst (PROC 3)



Product (article) characteristics
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
Physical form of product: Not relevant (closed process)
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
Conditions and measures related to personal protection, hygiene and health evaluation
If pyrite (iron disulphide) 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

3.2.7. Control of worker exposure: Semi-closed unloading/emptying of spent catalyst (PROC 8b)

Product (article) characteristics
Physical form of product: Solid, no or very low dustiness
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
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
Semi-automated task
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 20 (APF \geq 20). For further specification, refer to section 8 of the SDS.
If pyrite (iron disulphide) 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

3.2.8. Control of worker exposure: Manual unloading/emptying of spent catalyst (incl. tasks inside reactors) (PROC 4, PROC 8b)



Product (article) characteristics
Physical form of product: Solid, no or very low dustiness
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
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).
Highly efficient extraction hose to be used. No direct handling (use of long-distance tools)
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 pyrite (iron disulphide) 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

3.2.9. Control of worker exposure: Manual handling of (spent) catalysts in dust-reduced form (PROC 4, PROC 8b)

Product (article) characteristics
Physical form of product: Solid, low dustiness
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
Amount used (or contained in articles), frequency and duration of use/exposure
Avoid carrying out activities involving exposure for more than 1 hour. Once per shift or up to 1-2 times per week.
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).
Tools providing distance to exposure source to be used (e.g. paddles with long handle)
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 pyrite (iron disulphide) 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

3.2.10. Control of worker exposure: Transfer of spent catalyst into containers (PROC 8b, PROC 9)

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

Maximum emission potential covered in this CS: No foreseeable emission (Shaped catalyst, encapsulated powders).

Limit the substance content in the product to 20 % (Nickel concentration in catalyst)

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

Semi-automated task

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

Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 20 (APF \geq 20). For further specification, refer to section 8 of the SDS.

If pyrite (iron disulphide) 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

3.2.11. Control of worker exposure: Cleaning and maintenance at closed systems (PROC 28)

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

Covers concentrations up to 100 %

Additional physical form of product: Solutions / Suspensions
--

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).

During cleaning use vacuum and/or (pressure) washing with water to remove dusts or powders. No direct handling (use of long-distance tools).
--

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

If pyrite (iron disulphide) 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

3.2.12. Control of worker exposure: Cleaning and maintenance at semi-closed systems (PROC 28)

Product (article) characteristics
Physical form of product: Solid, high dustiness
Covers concentrations up to 100 %
Additional physical form of product: Solutions / Suspensions
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).
During cleaning use vacuum and/or (pressure) washing with water to remove dusts or powders. No direct handling (use of long-distance tools).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 20 (APF >= 20). For further specification, refer to section 8 of the SDS.
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 pyrite (iron disulphide) 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

3.3. Exposure estimation and reference to its source

3.3.1. Environmental release and exposure: Use of nickel sulphide-containing catalysts (as reactive processing aid) (ERC 6b)

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

3.3.2. Worker exposure: Enclosed transfer/loading of stabilised/passivated catalyst into reactor/vessel/device (PROC 3, PROC 9, PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR



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	0.027 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	9E-3 mg/m ³ (Measured data)	0.18
Inhalation, local, acute	0.027 mg/m ³ (Measured data)	0.034
Dermal, local, long term	0.076 µg/cm ² (Measured data)	0.032

3.3.3. Worker exposure: Semi-closed transfer/loading of stabilised/passivated catalyst into reactor/vessel/device (PROC 4, PROC 9, PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	7E-3 mg/m ³ (Measured data)	0.14
Inhalation, systemic, acute	0.036 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	7E-3 mg/m ³ (Measured data)	0.14
Inhalation, local, acute	0.036 mg/m ³ (Measured data)	0.045
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.317

3.3.4. Worker exposure: Use of catalyst in closed systems (PROC 1, PROC 3, PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.013 mg/m ³ (Measured data)	0.26
Inhalation, systemic, acute	0.052 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.013 mg/m ³ (Measured data)	0.26
Inhalation, local, acute	0.052 mg/m ³ (Measured data)	0.065
Dermal, local, long term	0.076 µg/cm ² (Measured data)	0.032

3.3.5. Worker exposure: Screening of spent catalyst (PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.029 mg/m ³ (ART)	0.58
Inhalation, systemic, acute	0.058 mg/m ³ (ART)	< 0.01
Inhalation, local, long term	0.029 mg/m ³ (ART)	0.58
Inhalation, local, acute	0.058 mg/m ³ (ART)	0.072
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.317

3.3.6. Worker exposure: Enclosed unloading/emptying of spent catalyst (PROC 3)

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	0.027 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	9E-3 mg/m ³ (Measured data)	0.18
Inhalation, local, acute	0.027 mg/m ³ (Measured data)	0.034
Dermal, local, long term	0.076 µg/cm ² (Measured data)	0.032

**3.3.7. Worker exposure: Semi-closed unloading/emptying of spent catalyst (PROC 8b)**

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	7E-3 mg/m ³ (Measured data)	0.14
Inhalation, systemic, acute	0.036 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	7E-3 mg/m ³ (Measured data)	0.14
Inhalation, local, acute	0.036 mg/m ³ (Measured data)	0.045
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.317

3.3.8. Worker exposure: Manual unloading/emptying of spent catalyst (incl. tasks inside reactors) (PROC 4, PROC 8b)

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	0.036 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	9E-3 mg/m ³ (Measured data)	0.18
Inhalation, local, acute	0.036 mg/m ³ (Measured data)	0.045
Dermal, local, long term	0.11 µg/cm ² (Measured data)	0.046

3.3.9. Worker exposure: Manual handling of (spent) catalysts in dust-reduced form (PROC 4, PROC 8b)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	3E-3 mg/m ³ (MEASE, PROC 4)	0.06
Inhalation, systemic, acute	6E-3 mg/m ³ (MEASE, PROC 4)	< 0.01
Inhalation, local, long term	3E-3 mg/m ³ (MEASE, PROC 4)	0.06
Inhalation, local, acute	6E-3 mg/m ³ (MEASE, PROC 4)	< 0.01
Dermal, local, long term	0.022 µg/cm ² (Measured data)	< 0.01

3.3.10. Worker exposure: Transfer of spent catalyst into containers (PROC 8b, PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	7E-3 mg/m ³ (Measured data)	0.14
Inhalation, systemic, acute	0.036 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	7E-3 mg/m ³ (Measured data)	0.14
Inhalation, local, acute	0.036 mg/m ³ (Measured data)	0.045
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.317

3.3.11. Worker exposure: Cleaning and maintenance at closed systems (PROC 28)

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	0.16 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.027 mg/m ³ (Measured data)	0.54



Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, acute	0.16 mg/m ³ (Measured data)	0.2
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.317

3.3.12. Worker exposure: Cleaning and maintenance at semi-closed systems (PROC 28)

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	0.036 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	9E-3 mg/m ³ (Measured data)	0.18
Inhalation, local, acute	0.036 mg/m ³ (Measured data)	0.045
Dermal, local, long term	0.11 µg/cm ² (Measured data)	0.046

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

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



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

4.1. Title section

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

Environment	
1: Intermediate use of nickel sulphide-containing catalysts for the manufacture of other nickel substances - Discharge to fresh water via municipal sewage treatment plant	ERC 6a
2: Intermediate use of nickel sulphide-containing catalysts for the manufacture of other nickel substances - Direct discharge to fresh water	ERC 6a
3: Intermediate use of nickel sulphide-containing catalysts for the manufacture of other nickel substances - Direct discharge to marine water	ERC 6a
Worker	
4: Enclosed transfer/loading of stabilised/passivated catalyst into reactor/vessel/device	PROC 3, PROC 9, PROC 8b
5: Semi-closed transfer/loading of stabilised/passivated catalyst into reactor/vessel/device	PROC 8b, PROC 9
6: Use of catalyst in closed systems	PROC 1, PROC 3, PROC 2
7: Cleaning and maintenance at closed systems	PROC 28
8: Cleaning and maintenance at semi-closed systems	PROC 28

4.2. Conditions of use affecting exposure

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

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 1.4 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site <= 476 tonnes/year
Emission days >= 340 days/year
Technical and organisational conditions and measures
Direct emissions to air should be mitigated by application of one or more of the following RMMs: • HEPA filtration (ESCOM 9267234005), Fabric filters (ESCOM 9267234003) and Bag or Ceramic Filters (ESCOM 12355002122) • Wet Scrubbers (ESCOM 9267234016) • Dry or semi-dry Scrubbers (No available ESCOM phrase) • Metallic Grids (ESCOM 12355002122)
Direct emissions to water should be mitigated by application of one or more of the following RMMs: • Precipitation (ESCOM 12355002126) • Sedimentation (ESCOM 12355002126) • Filtration (ESCOM 12355002126) • Distillation (ESCOM 9267234037) • Ion Exchange (ESCOM 12355002126)
Use Absorbant if leak of substance (liquid phase)
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow >= 2E3 m3/day



Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Local freshwater dilution factor 50

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

Amount used, frequency and duration of use (or from service life)
Daily amount per site ≤ 1.4 tonnes/day (All the amounts and concentrations are expressed as Ni as this is the driver for the environmental risk assessment.)
Annual amount per site ≤ 476 tonnes/year
Emission days ≥ 340 days/year
Technical and organisational conditions and measures
Direct emissions to air should be mitigated by application of one or more of the following RMMs: • HEPA filtration (ESCOM 9267234005), Fabric filters (ESCOM 9267234003) and Bag or Ceramic Filters (ESCOM 12355002122) • Wet Scrubbers (ESCOM 9267234016) • Dry or semi-dry Scrubbers (No available ESCOM phrase) • Metallic Grids (ESCOM 12355002122)
Direct emissions to water should be mitigated by application of one or more of the following RMMs: • Precipitation (ESCOM 12355002126) • Sedimentation (ESCOM 12355002126) • Filtration (ESCOM 12355002126) • Distillation (ESCOM 9267234037) • Ion Exchange (ESCOM 12355002126)
Use Absorbant if leak of substance (liquid phase)
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to marine water assumed
Assumed effluent discharge flow from site $\geq 2E3$ m ³ /day
Local freshwater dilution factor 100

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

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



Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
No discharge to freshwater assumed
Assumed effluent discharge flow from site $\geq 2E3$ m ³ /day
Local marine water dilution factor 100

4.2.4. Control of worker exposure: Enclosed transfer/loading of stabilised/passivated catalyst into reactor/vessel/device (PROC 3, PROC 9, PROC 8b)

Product (article) characteristics
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
Physical form of product: Not relevant (closed process)
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
Conditions and measures related to personal protection, hygiene and health evaluation
If cobalt sulphide is relevant as impurity wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 10 (APF ≥ 10). For further specification, refer to section 8 of the SDS.
If cobalt sulphide 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 pyrite (iron disulphide) 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: Semi-closed transfer/loading of stabilised/passivated catalyst into reactor/vessel/device (PROC 8b, PROC 9)

Product (article) characteristics
Physical form of product: Solid, low dustiness
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
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
Semi-automated task
Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator which provides an assigned protection factor (APF) according to EN 529 of at least of 10 (APF \geq 10). For further specification, refer to section 8 of the SDS.
If cobalt sulphide 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 pyrite (iron disulphide) 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: Use of catalyst in closed systems (PROC 1, PROC 3, PROC 2)

Product (article) characteristics
Limit the substance content in the product to 20 % (Nickel concentration in catalyst)
Physical form of product: Not relevant (closed process)
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 cobalt sulphide 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 cobalt sulphide 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 pyrite (iron disulphide) 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: Cleaning and maintenance at closed systems (PROC 28)

Product (article) characteristics
Physical form of product: Solid, high dustiness
Covers concentrations up to 100 %
Additional physical form of product: Solutions / Suspensions



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).
During cleaning use vacuum and/or (pressure) washing with water to remove dusts or powders. No direct handling (use of long-distance tools).
Conditions and measures related to personal protection, hygiene and health evaluation
If cobalt sulphide 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 cobalt sulphide 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 pyrite (iron disulphide) 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: Cleaning and maintenance at semi-closed systems (PROC 28)

Product (article) characteristics
Physical form of product: Solid, high dustiness
Covers concentrations up to 100 %
Additional physical form of product: Solutions / Suspensions
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).
During cleaning use vacuum and/or (pressure) washing with water to remove dusts or powders. No direct handling (use of long-distance tools).
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 pyrite (iron disulphide) 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: Intermediate use of nickel sulphide-containing catalysts for the manufacture of other nickel substances - Discharge to fresh water via municipal sewage treatment plant (ERC 6a)

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

Protection target	Exposure estimate	RCR
Fresh water	5.31E-3 mg/L (EUSES 2.1.2)	0.87
Sediment (freshwater)	96.88 mg/kg dw (PEC sediment calculation method for metals)	0.889
Sewage Treatment Plant	0.168 mg/L (EUSES 2.1.2)	0.509
Agricultural soil	20.93 mg/kg dw (EUSES 2.1.2)	0.533

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

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

Protection target	Exposure estimate	RCR
Fresh water	4.91E-3 mg/L (EUSES 2.1.2)	0.805
Sediment (freshwater)	86.32 mg/kg dw (PEC sediment calculation method for metals)	0.792
Agricultural soil	16.22 mg/kg dw (EUSES 2.1.2)	0.413

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

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

Protection target	Exposure estimate	RCR
Marine water	2.31E-3 mg/L (EUSES 2.1.2)	0.242
Sediment (marine water)	68.92 mg/kg dw (PEC sediment calculation method for metals)	0.632
Agricultural soil	16.22 mg/kg dw (EUSES 2.1.2)	0.413

4.3.4. Worker exposure: Enclosed transfer/loading of

**stabilised/passivated catalyst into reactor/vessel/device (PROC 3, PROC 9, PROC 8b)**

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	0.027 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	9E-3 mg/m ³ (Measured data)	0.18
Inhalation, local, acute	0.027 mg/m ³ (Measured data)	0.034
Dermal, local, long term	0.076 µg/cm ² (Measured data)	0.032

4.3.5. Worker exposure: Semi-closed transfer/loading of stabilised/passivated catalyst into reactor/vessel/device (PROC 8b, PROC 9)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.014 mg/m ³ (Measured data)	0.28
Inhalation, systemic, acute	0.071 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.014 mg/m ³ (Measured data)	0.28
Inhalation, local, acute	0.071 mg/m ³ (Measured data)	0.089
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.317

4.3.6. Worker exposure: Use of catalyst in closed systems (PROC 1, PROC 3, PROC 2)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.013 mg/m ³ (Measured data)	0.26
Inhalation, systemic, acute	0.052 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.013 mg/m ³ (Measured data)	0.26
Inhalation, local, acute	0.052 mg/m ³ (Measured data)	0.065
Dermal, local, long term	0.076 µg/cm ² (Measured data)	0.032

4.3.7. Worker exposure: Cleaning and maintenance at closed systems (PROC 28)

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	0.16 mg/m ³ (Measured data)	< 0.01
Inhalation, local, long term	0.027 mg/m ³ (Measured data)	0.54
Inhalation, local, acute	0.16 mg/m ³ (Measured data)	0.2
Dermal, local, long term	0.76 µg/cm ² (Measured data)	0.317

4.3.8. Worker exposure: Cleaning and maintenance at semi-closed systems (PROC 28)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, systemic, long term	0.018 mg/m ³ (Measured data)	0.36
Inhalation, systemic, acute	0.073 mg/m ³ (Measured data)	< 0.01



Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	0.018 mg/m ³ (Measured data)	0.36
Inhalation, local, acute	0.073 mg/m ³ (Measured data)	0.091
Dermal, local, long term	0.11 µg/cm ² (Measured data)	0.046

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”.