Nickel carbonate

Safety Data Sheet

according to Regulation (EC) No. 1907/2006 (REACH) with its amendment Regulation (EU) 2015/830

Revision date: 7/30/2015 Supersedes: 10/12/2011 Version: 1.1

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form	:	Substance
Substance name	:	Nickel carbonate
IUPAC name	:	trinickel monocarbonate tetrahydroxide
EC index no	:	028-010-00-0
EC no	:	235-715-9
CAS No	:	12607-70-4
REACH registration No	:	01-2119490826-25
Formula	:	CH4Ni3O7

1.2. Relevant identified uses of the substance or mixture and uses advised against

1.2.1. Relevant identified uses

Use of the substance/mixture : Metal surface treatment
See attachment

1.2.2. Uses advised against

No additional information available

1.3. Details of the supplier of the safety data sheet

A.M.P.E.R.E. INDUSTRIE
5/7 RUE DE BRETAGNE - P.A. DES BETHUNES
95310 SAINT-OUEN-L'AUMÔNE - FRANCE
T 33 (0)1 34 32 38 00 - F 33 (0)1 30 37 14 96
fds@ampere.com

1.4. Emergency telephone number

Emergency number : N° ORFILA: +33 (0)1 45 42 59 59

Country	Official advisory body	Address	Emergency number	Comment
United Kingdom	National Poisons Information Service		0344 892 0111	

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Acute toxicity (oral), Category 4	H302
Acute toxicity (inhal.), Category 2	H330
Skin corrosion/irritation, Category 2	H315
Sensitisation — Respiratory, Category 1	H334
Sensitisation — Skin, Category 1	H317
Germ cell mutagenicity, Category 2	H341
Carcinogenicity (inhalation) Category 1A	H350i
Reproductive toxicity, Category 1B	H360D
Specific target organ toxicity – Repeated exposure, Category 1	H372
Hazardous to the aquatic environment — Acute Hazard, Category 1	H400 (M=1)
Hazardous to the aquatic environment — Chronic Hazard, Category 1	H410 (M=1)

Full text of H statements : see section 16

Adverse physicochemical, human health and environmental effects

No additional information available

2.2. Label elements

Labelling according to Regulation (EC) No. 1272/2008 [CLP]

Hazard pictograms (CLP) :

GHS06 GHS08 GHS09

Signal word (CLP) : Danger

Hazard statements (CLP) : H302 - Harmful if swallowed
H315 - Causes skin irritation
H317 - May cause an allergic skin reaction
H330 - Fatal if inhaled
H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled
H341 - Suspected of causing genetic defects (Oral)
H350i - May cause cancer by inhalation
H360D - May damage the unborn child
H372 - Causes damage to organs (lungs) through prolonged or repeated exposure (Inhalation)
H410 - Very toxic to aquatic life with long lasting effects

Precautionary statements (CLP) : P201 - Obtain special instructions before use
P260 - Do not breathe dust, mist
P270 - Do not eat, drink or smoke when using this product
P284 - Breathing apparatus
P304+P340 - IF INHALED: remove victim to fresh air and keep at rest in a position comfortable for breathing
P308+P313 - IF exposed or concerned: Get medical advice/attention
P310 - Immediately call a POISON CENTER or doctor/physician
P362 - Take off contaminated clothing and wash before reuse
P403+P233 - Store in a well-ventilated place. Keep container tightly closed
P501 - Dispose of contents/container in accordance with local/regional/national/international regulations

Extra phrases : Restricted to professional users

2.3. Other hazards

No additional information available

SECTION 3: Composition/information on ingredients

3.1. Substance

Name : Nickel carbonate

CAS No : 12607-70-4

EC no : 235-715-9

EC index no : 028-010-00-0

Name	Product identifier	%	Classification according to Regulation (EC) No. 1272/2008 [CLP]
[carbonato(2-)]tetrahydroxytrinickel	(CAS No) 12607-70-4 (EC no) 235-715-9 (EC index no) 028-010-00-0	>= 99.9	Acute Tox. 4 (Oral), H302 Acute Tox. 2 (Inhalation:dust,mist), H330 Skin Irrit. 2, H315 Resp. Sens. 1, H334 Skin Sens. 1, H317 Muta. 2, H341 Carc. 1A, H350i Repr. 1B, H360D STOT RE 1, H372 Aquatic Acute 1, H400 (M=1) Aquatic Chronic 1, H410 (M=1)
nickel carbonate, basic nickel carbonate, carbonic acid, nickel (2+) salt	(CAS No) 3333-67-3 (EC no) 222-068-2 (EC index no) 028-010-00-0		Acute Tox. 4 (Oral), H302 Acute Tox. 4 (Inhalation), H332 Skin Irrit. 2, H315 Resp. Sens. 1, H334 Skin Sens. 1, H317 Muta. 2, H341 Carc. 1A, H350i Repr. 1B, H360D STOT RE 1, H372 Aquatic Acute 1, H400 Aquatic Chronic 1, H410

Full text of H-statements: see section 16

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures after inhalation : Move the affected person away from the contaminated area and into the fresh air. If breathing is irregular or has stopped, effect artificial respiration resuscitation. If breathing is difficult, give oxygen.

First-aid measures after skin contact : Remove immediately contaminated clothing. Wash with plenty of soap and water. Seek medical attention if irritation develops or persists.

First-aid measures after eye contact : Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get immediate medical advice/attention.

First-aid measures after ingestion : Immediately call a POISON CENTER or doctor/physician. Do NOT induce vomiting. Rinse mouth (only if the person is conscious). NEVER induce swallowing in an inconscious person.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries : No data available.

4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media : None known.

5.2. Special hazards arising from the substance or mixture

Fire hazard : Not flammable.

5.3. Advice for firefighters

Precautionary measures fire : Evacuate the danger area. Keep up-wind to avoid fumes. Inform the public about the hazard and give advice to keep upwind.

Firefighting instructions : Cool down the containers exposed to heat with a water spray.

Protection during firefighting : Personal protective equipment. Complete protective clothing. Self contained breathing apparatus.

Other information : Do not allow run-off from fire-fighting to enter drains or water courses. Dispose of fire debris and contaminated fire fighting water in accordance with official regulations.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Do not get in eyes, on skin, or on clothing.

6.1.1. For non-emergency personnel

Protective equipment : Wear suitable gloves. Wear eye/face protection.

Emergency procedures : Evacuate unnecessary personnel. Keep upwind. Inform the public about the hazard and give advice to keep upwind.

6.1.2. For emergency responders

Protective equipment : In case of important spillage : Tightly sealed goggles. PVC or other plastic material gloves. Breathing apparatus with filter P2. (In case of excessive dust production : P3).

Emergency procedures : Evacuate unnecessary personnel. Keep upwind. Inform the public about the hazard and give advice to keep upwind. Avoid dust formation. Collect all waste in suitable and labelled containers and dispose according to local legislation. Avoid discharge to the environment.

6.2. Environmental precautions

Avoid release to the environment.

6.3. Methods and material for containment and cleaning up

For containment : Avoid raising dust. Do not release into the environment. Avoid spilling. Collect residues and seal in labelled drums for disposal.

Methods for cleaning up : Avoid raising powdered materials into airborne dust. Shovel into suitable and closed container for disposal. Must not be disposed together with household garbage. Evacuate and limit access.

6.4. Reference to other sections

No additional information available

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Read label before use. Avoid breathing dust. Do not get in eyes, on skin, or on clothing. Avoid release to the environment. Handle in accordance with good industrial hygiene and safety procedures.

Hygiene measures : Wash hands and face before break and at end of works. Do not eat, drink or smoke when using this product. Handle in accordance with good industrial hygiene and safety procedures. Wash contaminated clothing before reuse. Separate working clothes from town clothes. Launder separately.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures : Provide local exhaust or general room ventilation.

Storage conditions : Store in a dry, cool and well-ventilated place.

Incompatible products : Oxidation agents. Acids.

7.3. Specific end use(s)

(see section(s) : 1.2).

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

[carbonato(2-)]tetrahydroxytrinickel (12607-70-4)	
DNEL/DMEL (Workers)	
Acute - systemic effects, inhalation	7.1 mg/m³
Acute - local effects, inhalation	0.47 mg/m³
Long-term - local effects, dermal	0.003 mg/cm²/day
Long-term - systemic effects, inhalation	0.05 mg/m³
Long-term - local effects, inhalation	0.05 mg/m³/day
PNEC (Water)	
PNEC aqua (freshwater)	0.0071 mg/l
PNEC aqua (marine water)	0.0084 mg/l
PNEC (Sediment)	
PNEC sediment (freshwater)	136 mg/kg dwt
PNEC sediment (marine water)	136 mg/kg dwt
PNEC (Soil)	
PNEC soil	29.9 mg/kg dwt
PNEC (STP)	
PNEC sewage treatment plant	0.33 mg/l

8.2. Exposure controls

Appropriate engineering controls : Provide local exhaust or general room ventilation. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

Materials for protective clothing:

Safety glasses. Gloves. Wear suitable protective clothing. Wear a self contained breathing apparatus

Hand protection:

PVC gloves. Rubbers

Eye protection:

Safety glasses

Skin and body protection:

Wear suitable protective clothing. Long sleeved protective clothing

Respiratory protection:

Where exposure through inhalation may occur from use, respiratory protection equipment is recommended. P2

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Solid

Appearance : Paste. Powder.

Colour : Green.

Odour : odourless.

Odour threshold	:	No data available
pH	:	8
Relative evaporation rate (butylacetate=1)	:	No data available
Melting point	:	Decomposes ~ 240°C
Freezing point	:	No data available
Boiling point	:	Decomposes ~ 240°C
Flash point	:	No data available
Auto-ignition temperature	:	> 400 °C
Decomposition temperature	:	No data available
Flammability (solid, gas)	:	Not flammable
Vapour pressure	:	Decomposes ~ 240°C (Decomposes without melting)
Relative vapour density at 20 °C	:	No data available
Relative density	:	3.08 g/cm3 (22.5 °C)
Solubility	:	Water: 0.0329 g/l (20 °C)
Log Pow	:	No data available
Viscosity, kinematic	:	No data available
Viscosity, dynamic	:	No data available
Explosive properties	:	No data available
Oxidising properties	:	No data available
Explosive limits	:	No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

No data available.

10.2. Chemical stability

The product is stable at normal handling and storage conditions.

10.3. Possibility of hazardous reactions

No polymerization.

10.4. Conditions to avoid

Heat. Open flame. Sparks. warm surfaces. Ignition sources. High temperature.

10.5. Incompatible materials

Oxidising agents. Acids.

10.6. Hazardous decomposition products

No additional information available

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Oral: Harmful if swallowed. Inhalation: Fatal if inhaled.

Additional information : Harmful if swallowed
Fatal if inhaled

nickel carbonate, basic nickel carbonate, carbonic acid, nickel (2+) salt (3333-67-3)	
LD50 oral rat	1044 mg/kg
LC50 inhalation rat (mg/l)	2.09 mg/l/4h

Skin corrosion/irritation	:	Causes skin irritation. pH: 8
Serious eye damage/irritation	:	Not classified pH: 8
Respiratory or skin sensitisation	:	May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause an allergic skin reaction.
Additional information	:	May cause allergy or asthma symptoms or breathing difficulties if inhaled May cause an allergic skin reaction
Germ cell mutagenicity	:	Suspected of causing genetic defects (Oral).
Carcinogenicity	:	May cause cancer by inhalation.
Reproductive toxicity	:	May damage the unborn child.

Specific target organ toxicity (single exposure)	:	Not classified
Specific target organ toxicity (repeated exposure)	:	Causes damage to organs (lungs) through prolonged or repeated exposure (Inhalation).
Aspiration hazard	:	Not classified

SECTION 12: Ecological information

12.1. Toxicity

[carbonato(2-)]tetrahydroxytrinickel (12607-70-4)	
LC50 fish 1	0.23 - 320 mg/l
NOEC (chronic)	0.04 - 1.55 mg/l Fish

12.2. Persistence and degradability

No additional information available

12.3. Bioaccumulative potential

No additional information available

12.4. Mobility in soil

No additional information available

12.5. Results of PBT and vPvB assessment

No additional information available

12.6. Other adverse effects

No additional information available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste treatment methods : Collect and dissolve with water. Add sodium carbonate, mix and neutralize with dilute acid (such as 6M, HCl). Absorb with soil and dispose of to an approved landfill site.

Waste disposal recommendations : Dispose in a safe manner in accordance with local/national regulations. Dispose of this material and its container to hazardous or special waste collection point.

SECTION 14: Transport information

In accordance with ADR / RID / IMDG / IATA / ADN

14.1. UN number

UN-No. (ADR)	:	3077
UN-No. (IMDG)	:	3077
UN-No. (IATA)	:	3077
UN-No. (ADN)	:	3077
UN-No. (RID)	:	3077

14.2. UN proper shipping name

Proper Shipping Name (ADR)	:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
Proper Shipping Name (IMDG)	:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
Proper Shipping Name (IATA)	:	Environmentally hazardous substance, solid, n.o.s.
Proper Shipping Name (ADN)	:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
Proper Shipping Name (RID)	:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
Transport document description (ADR)	:	UN 3077 ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Nickel carbonate), 9, III, (E)
Transport document description (IMDG)	:	UN 3077 ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S., 9, III, MARINE POLLUTANT/ENVIRONMENTALLY HAZARDOUS
Transport document description (IATA)	:	UN 3077 Environmentally hazardous substance, solid, n.o.s., 9, III, ENVIRONMENTALLY HAZARDOUS
Transport document description (ADN)	:	UN 3077 ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S., 9, III, ENVIRONMENTALLY HAZARDOUS
Transport document description (RID)	:	UN 3077 ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S., 9, III, ENVIRONMENTALLY HAZARDOUS

14.3. Transport hazard class(es)

ADR

Transport hazard class(es) (ADR) : 9

Danger labels (ADR) : 9

:

IMDG

Transport hazard class(es) (IMDG) : 9
Danger labels (IMDG) : 9

:

IATA

Transport hazard class(es) (IATA) : 9
Hazard labels (IATA) : 9

:

ADN

Transport hazard class(es) (ADN) : 9
Danger labels (ADN) : 9

:

RID

Transport hazard class(es) (RID) : 9
Danger labels (RID) : 9

:

14.4. Packing group

Packing group (ADR) : III
Packing group (IMDG) : III
Packing group (IATA) : III
Packing group (ADN) : III
Packing group (RID) : III

14.5. Environmental hazards

Dangerous for the environment : Yes
Marine pollutant : Yes
Other information : No supplementary information available

14.6. Special precautions for user

- Overland transport

Classification code (ADR)	:	M7
Special provisions (ADR)	:	274, 335, 601, 375
Limited quantities (ADR)	:	5kg
Excepted quantities (ADR)	:	E1
Packing instructions (ADR)	:	P002, IBC08, LP02, R001
Special packing provisions (ADR)	:	PP12, B3
Mixed packing provisions (ADR)	:	MP10
Portable tank and bulk container instructions (ADR)	:	T1, BK1, BK2
Portable tank and bulk container special provisions (ADR)	:	TP33
Tank code (ADR)	:	SGAV, LGBV
Vehicle for tank carriage	:	AT
Transport category (ADR)	:	3
Special provisions for carriage - Packages (ADR)	:	V13
Special provisions for carriage - Bulk (ADR)	:	VC1, VC2
Special provisions for carriage - Loading, unloading and handling (ADR)	:	CV13
Hazard identification number (Kemler No.)	:	90
Orange plates	:	90 3077
Tunnel restriction code (ADR)	:	E
EAC code	:	2Z

- Transport by sea

Special provisions (IMDG)	:	274, 335, 966, 967, 969
Limited quantities (IMDG)	:	5 kg
Excepted quantities (IMDG)	:	E1
Packing instructions (IMDG)	:	P002, LP02
Special packing provisions (IMDG)	:	PP12
IBC packing instructions (IMDG)	:	IBC08
IBC special provisions (IMDG)	:	B3
Tank instructions (IMDG)	:	T1, BK1, BK2, BK3
Tank special provisions (IMDG)	:	TP33
EmS-No. (Fire)	:	F-A
EmS-No. (Spillage)	:	S-F
Stowage category (IMDG)	:	A
Stowage and handling (IMDG)	:	SW23

- Air transport

PCA Excepted quantities (IATA)	:	E1
PCA Limited quantities (IATA)	:	Y956
PCA limited quantity max net quantity (IATA)	:	30kgG
PCA packing instructions (IATA)	:	956
PCA max net quantity (IATA)	:	400kg
CAO packing instructions (IATA)	:	956
CAO max net quantity (IATA)	:	400kg
Special provisions (IATA)	:	A97, A158, A179, A197
ERG code (IATA)	:	9L

- Inland waterway transport

Classification code (ADN)	:	M7
Special provisions (ADN)	:	274, 335, 375, 601
Limited quantities (ADN)	:	5 kg

Excepted quantities (ADN)	:	E1
Carriage permitted (ADN)	:	T* B**
Equipment required (ADN)	:	PP, A
Number of blue cones/lights (ADN)	:	0

- Rail transport

Classification code (RID)	:	M7
Special provisions (RID)	:	274, 335, 375, 601
Limited quantities (RID)	:	5kg
Excepted quantities (RID)	:	E1
Packing instructions (RID)	:	P002, IBC08, LP02, R001
Special packing provisions (RID)	:	PP12, B3
Mixed packing provisions (RID)	:	MP10
Portable tank and bulk container instructions (RID)	:	T1, BK1, BK2
Portable tank and bulk container special provisions (RID)	:	TP33
Tank codes for RID tanks (RID)	:	SGAV, LGBV
Transport category (RID)	:	3
Special provisions for carriage – Packages (RID)	:	W13
Special provisions for carriage – Bulk (RID)	:	VC1, VC2
Special provisions for carriage - Loading, unloading and handling (RID)	:	CW13, CW31
Colis express (express parcels) (RID)	:	CE11
Hazard identification number (RID)	:	90

14.7. Transport in bulk according to Annex II of MARPOL and the IBC Code

Not applicable

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

15.1.1. EU-Regulations

The following restrictions are applicable according to Annex XVII of the REACH Regulation (EC) No 1907/2006:

28. Substances which appear in Part 3 of Annex VI to Regulation (EC) No 1272/2008 classified as Carcinogen category 1A or 1B (Table 3.1) or Carcinogen category 1 or 2 (Table 3.2) and listed as follows: Carcinogen category 1A (Table 3.1)/Carcinogen category 1 (Table 3.2) listed in Appendix 1 Carcinogen category 1B (Table 3.1)/Carcinogen category 2 (Table 3.2) listed in Appendix 2	Nickel carbonate - nickel carbonate, basic nickel carbonate, carbonic acid, nickel (2+) salt - [carbonato(2-)]tetrahydroxytrinickel
30. Substances which appear in Part 3 of Annex VI to Regulation (EC) No 1272/2008 classified as Toxic to Reproduction category 1A or 1B (Table 3.1) or Toxic to Reproduction category 1 or 2 (Table 3.2) and listed as follows: Reproductive toxicant category 1A adverse effects on sexual function and fertility or on development (Table 3.1) or Reproductive toxicant category 1 with R60 (May impair fertility) or R61 (May cause harm to the unborn child) (Table 3.2) listed in Appendix 5 Reproductive toxicant category 1B adverse effects on sexual function and fertility or on development (Table 3.1) or Reproductive toxicant category 2 with R60 (May impair fertility) or R61 (May cause harm to the unborn child) (Table 3.2) listed in Appendix 6	Nickel carbonate - nickel carbonate, basic nickel carbonate, carbonic acid, nickel (2+) salt - [carbonato(2-)]tetrahydroxytrinickel

Nickel carbonate is not on the REACH Candidate List

Nickel carbonate is not on the REACH Annex XIV List

15.1.2. National regulations

Germany

VwVwS Annex reference	:	Water hazard class (WGK) 3, severe hazard to waters (Classification according to VwVwS, Annex 3; ID No. 8319)
12th Ordinance Implementing the Federal Immission Control Act - 12.BImSchV	:	Is not subject of the 12. BImSchV (Hazardous Incident Ordinance)

15.2. Chemical safety assessment

No additional information available

SECTION 16: Other information

Full text of H- and EUH-statements:

Acute Tox. 2 (Inhalation)	Acute toxicity (inhal.), Category 2
Acute Tox. 2 (Inhalation:dust,mist)	Acute toxicity (inhalation:dust,mist) Category 2
Acute Tox. 4 (Inhalation)	Acute toxicity (inhal.), Category 4
Acute Tox. 4 (Oral)	Acute toxicity (oral), Category 4
Aquatic Acute 1	Hazardous to the aquatic environment — Acute Hazard, Category 1
Aquatic Chronic 1	Hazardous to the aquatic environment — Chronic Hazard, Category 1
Carc. 1A	Carcinogenicity (inhalation) Category 1A
Muta. 2	Germ cell mutagenicity, Category 2
Repr. 1B	Reproductive toxicity, Category 1B
Resp. Sens. 1	Sensitisation — Respiratory, Category 1
Skin Irrit. 2	Skin corrosion/irritation, Category 2
Skin Sens. 1	Sensitisation — Skin, Category 1
STOT RE 1	Specific target organ toxicity — Repeated exposure, Category 1
H302	Harmful if swallowed
H315	Causes skin irritation
H317	May cause an allergic skin reaction
H330	Fatal if inhaled
H332	Harmful if inhaled
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled
H341	Suspected of causing genetic defects
H350i	May cause cancer by inhalation
H360D	May damage the unborn child
H372	Causes damage to organs through prolonged or repeated exposure
H400	Very toxic to aquatic life
H410	Very toxic to aquatic life with long lasting effects

Acute Tox. 4 (Oral)	H302	
Acute Tox. 2 (Inhalation)	H330	
Skin Irrit. 2	H315	
Resp. Sens. 1	H334	
Skin Sens. 1	H317	
Muta. 2	H341	
Carc. 1A	H350i	
Repr. 1B	H360D	
STOT RE 1	H372	
Aquatic Acute 1	H400	
Aquatic Chronic 1	H410	

SDS EU (REACH Annex II)

DISCLAIMER

The information contained in this sheet comes from reliable sources. It has been drawn up based on our knowledge at the time of the most recent update, as indicated. This information is intended as an aid to the user and should not be considered as a guarantee.
Conditions or methods of handling, storage, use or disposal of the product are outside our control, and we may not be held responsible for any loss, damage or expenses incurred as a result of, or in connection with, the latter.
All substances or mixtures can present unknown dangers and must be used with caution. We cannot guarantee that all dangers have been set out in an exhaustive manner.
This sheet has been drawn up for, and must be used for, this product only. If the product is used as a component in another product, the information given with it may not be applicable.
This sheet does not under any circumstances exempt the user from complying with all laws, regulations and administrative requirements related to the product, health and safety, and the protection of human health and the environment.
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Annex to the Safety Data Sheet

Product exposure scenario(s)

ES Type	ES title
Worker	Manufacture of nickel hydroxycarbonate
Worker	Metal surface treatment: nickel electroplating, nickel electroforming, electroless nickel plating
Worker	Use of nickel hydroxycarbonate as an intermediate for the production of nickel oxide in catalyst or catalyst precursor manufacture
Worker	Use of nickel hydroxycarbonate for the production of nickel sulphamate
Worker	Use of nickel hydroxycarbonate for the production of nickel acetate
Worker	Use of nickel hydroxycarbonate in the production of nickel powder
Worker	Use of nickel hydroxycarbonate in the formulation of surface treatment products

1. Exposure scenario ES 1

Manufacture of nickel hydroxycarbonate

ES Ref.: ES 1 ES Type: Worker	

Use descriptors	PROC0, PROC2, PROC9 ERC1
Processes, tasks, activities covered	Raw material handling, chemical reaction (production of nickel hydroxycarbonate), washing, drying, packaging, shipping, storage, cleaning and maintenance. Industrial use
Assessment method	Estimation of dermal exposure based on Tier 1 model. Estimation of inhalation exposure based on measured data. Modeled dermal exposure data using MEASE.

2. Operational conditions and risk management measures

2.1.1 Contributing scenario controlling worker exposure (PROC2)

Precipitation, recovery (filtration) and washing of crude nickel hydroxycarbonate	
PROC2	Use in closed, continuous process with occasional controlled exposure

Product characteristics

Physical form of product	Ni supplied as purified nickel sulphate solution, purified nickel chloride solution or other Ni-containing solutions

Operational conditions

Amounts used	Not relevant	
Frequency and duration of use	8 hours/day	
Human factors not influenced by risk management	Respiration volume under conditions of use	not relevant
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	480 cm^2
	Body weight:	not relevant
Other given operational conditions affecting workers exposure	Enclosed precipitation of crude nickel hydroxylcarbonate, enclosed and automated transfer of crude nickel hydroxycarbonate from reaction vessel onto a belt filter for partially enclosed spray washing and enclosed and automated transfer (screw conveyor) of washed nickel hydroxycarbonate from belt filter to pulp preparation area. Filtering on the belt filter is automated with some manual interventions and some manual interventions and sampling of the nickel hydroxycarbonate. Maintain clean workplace to prevent accumulation of powders and dust on surfaces. Oral: Good workplace hygiene practice	

Risk management measures

Technical conditions and measures at process level (source) to prevent release	Inhalation: Automation and complete enclosure of nickel hydroxycarbonate during transfer operations are likely to give rise to insignificant exposure to inhalable Ni. Manual scraping of the crude nickel hudroxycarbonate on the belt filter and sampling is likely to give rise to some inhalation of Ni. Dermal: Gloves suitable for handing powders and other suitable protective clothing are required where direct contact with nickel hydroxcycarbonate could occur. Inhalation: Automation and complete enclosure of nickel hydroxycarbonate during transfer operations are likely to give rise to insignificant exposure to inhalable Ni. Manual scraping of the crude nickel hudroxycarbonate on the belt filter and sampling is likely to give rise to some inhalation of Ni. Dermal: Gloves suitable for handing powders and other suitable protective clothing are required where direct contact with nickel hydroxcycarbonate could occur.	
Technical conditions and measures to control dispersion from source towards the worker	LEV is required for processes not automated or enclosed involving nickel hydroxycarbonate or likely to give rise to Ni dust or mist	
Organisational measures to prevent /limit releases, dispersion and exposure	None	
Conditions and measures related to personal protection, hygiene and health evaluation	Inhalation: RPE (FFP3, APF 20) {approved with regard to EN 149 e.g. 3M 9332 half-mask disposable dust/mist/metal fume valved respirator} is required for unenclosed processes and for manual scraping of the crude nickel hydroxycarbonate on the belt filter and sampling. Dermal: Gloves suitable for handling liquids and other suitable protective clothing re required where direct contact with nickel hydroxycarbonate could occur	

2.1.2 Contributing scenario controlling worker exposure (PROC2)

Preparation and atomisation of 'pulped' nickel hydroxycarbonate	
PROC2	Use in closed, continuous process with occasional controlled exposure

Product characteristics		
Physical form of product	Moist nickel hydroxycarbonate	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	8 hours/day	
Human factors not influenced by risk management	Respiration volume under conditions of use	not relevant
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	480 cm^2
	Body weight:	not relevant
Other given operational conditions affecting workers exposure	Enclosed mixing of washed nickel hydroxycarbonate with water (in high speed stirrer) to form the 'pulp', enclosed and automated transfer of the 'pulp' to the atomiser and drier (fluidised bed) and onto storage. Maintain clean workplace to prevent accumulation of powders and dusts on surfaces. Oral: Good workplace hygiene practice	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	Inhalation: Automation and complete enclosure of operations likely to give rise to insignificant exposures to nickel hydroxycarbonate powder. Dermal: Automation of processes should be used where possible to eliminate dermal contact.	
Technical conditions and measures to control	LEV is required for processes not automated or enclosed involving nickel hydroxycarbonate or likely	

dispersion from source towards the worker	to give rise to Ni dust or mist	
Organisational measures to prevent /limit releases, dispersion and exposure	None	
Conditions and measures related to personal protection, hygiene and health evaluation	Inhalation: RPE (FFP3, APF 20) {approved with regard to EN 149e.g. 3M 9332 half-mask disposable dust/mist/metal fume valved respirator} is required for unenclosed processes and for manual scraping of the crude nickel hydroxycarbonate on the belt filter and sampling. Dermal: Gloves suitable for handling liquids and other suitable protective clothing re required where direct contact with nickel hydroxycarbonate could occur	

2.1.3 Contributing scenario controlling worker exposure (PROC9)

Packaging	
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

Product characteristics		
Physical form of product	Nickel hydroxycarbonate powder (median diameter ~25 µm) or granular (median diameter ~150 µm) form. Paste product containing nickel hydroxycarbonate.	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	8 hours/day	
Human factors not influenced by risk management	Respiration volume under conditions of use	not relevant
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	480 cm^2
	Body weight:	not relevant
Other given operational conditions affecting workers exposure	Mechanised packaging of nickel hydroxycarbonate powder or granules in 1 ton bags and driving of sealed and wrapped bags to the warehouse. Apply ambient temperature and humidity. Maintain clean workplace to prevent accumulation of powders and dusts on surfaces. Oral: Good workplace hygiene practice.	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	Inhalation: Manual packaging interventions, including securing the open bag in the unit, fitting the dust sock over the mouth of the nickel hydroxycarbonate delivery chute and uncoupling the filled bag from the unit, are likely to give rise to significant exposures to nickel hydroxycarbonate dust. An autosampler places a sample of the bagged product into a bottle secured in the unit for laboratory analysis. The manual emptying of contents of the bottle into a small box in a glove box is enclosed and is likely to give insignificant exposures to nickel hydroxycarbonate dust. Driving sealed bags of nickel hydroxycarbonate powder or granules from the packaging area to the warehouse is likely to give insignificant exposures to nickel hydroxycarbonate dust. Dermal: Automation of processes should be used where possible to eliminate dermal contact.	
Technical conditions and measures to control dispersion from source towards the worker	LEV is required for the bag packaging process.	
Organisational measures to prevent /limit releases, dispersion and exposure	None	
Conditions and measures related to personal protection, hygiene and health evaluation	Inhalation: RPE (FFP3, APF 20) {approved with regard to EN 149 e.g. 3M 9332 half-mask disposable dust/mist/metal fume valved respirator} is required for unenclosed processes and for manual scraping of the crude nickel hydroxycarbonate on the belt filter and sampling. Dermal: Gloves suitable for handling liquids and	

	other suitable protective clothing re required where direct contact with nickel hydroxycarbonate could occur	

2.1.4 Contributing scenario controlling worker exposure (PROC0)

Cleaning and maintenance	
PROC0	Other Process or activity

Product characteristics		
Physical form of product	Ni present as nickel-containing dust such as nickel hydroxycarbonate	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	8 hours/day	
Human factors not influenced by risk management	Respiration volume under conditions of use	A breathing volume of 10 m^3/d is assumed which is default for light work activity. A default value of 70 kg is assumed as body weight for workers.
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	960 cm^2
	Body weight:	not relevant
Other given operational conditions affecting workers exposure	Smaller areas of the plant are to be cleaned out daily or weekly by vacuuming. Larger areas of the plant are to be cleaned during annual summer shutdown , Maintain clean workplace to prevent accumulation of powders and dusts on surfaces. Oral: Good workplace hygiene practice	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	None	
Technical conditions and measures to control dispersion from source towards the worker	Use of water or vacuum fitted with a HEPA filter to remove dusts and powders during cleaning.	
Organisational measures to prevent /limit releases, dispersion and exposure	None	
Conditions and measures related to personal protection, hygiene and health evaluation	Inhalation: RPE (FFP3, APF 20) {approved with regard to EN 149e.g. 3M 9332 half-mask disposable dust/mist/metal fume valved respirator} is required for unenclosed processes and for manual scraping of the crude nickel hydroxycarbonate on the belt filter and sampling. Dermal: Gloves suitable for handling liquids and other suitable protective clothing re required where direct contact with nickel hydroxycarbonate could occur	

2.2 Contributing scenario controlling environmental exposure (ERC1)

ERC1	Manufacture of substances
Assessment method	Estimates based on monitoring local and regional concentrations are used for calculation of PEC

Product characteristics		
Physical form of product	Ni supplied as purified nickel sulphate solution, purified nickel chloride solution or other Ni-containing solutions, Moist nickel hydroxycarbonate, Nickel hydroxycarbonate powder (median diameter ~25 µm) or granular (median diameter ~150 µm) form. Paste product containing nickel hydroxycarbonate.	
Operational conditions		
Amounts used	Maximum daily use at site	147 T
	Maximum annual use at site	51113 t/yr (ES 1 & 2)
Frequency and duration of use	Pattern of release to the environment	348 days/yr per site
Environmental factors not influenced by risk management	Receiving surface water flow (m^3/day):	998000 (Effluent Site: 2000 m^3/d)
	Local freshwater dilution factor:	500 (ES 1)
	Local marine water dilution factor:	500 (ES 2)
Other given operational conditions affecting environmental exposure	None	
Risk management measures		

Technical conditions and measures at process level (source) to prevent release	None	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	On-site wastewater treatment by chemical precipitation	Efficiency: 99%
	ES 1 Freshwater & ES 2 Marine water direct discharge. Release factor after on-site wastewater treatment (g/T):	28
	Removal of nickel from stack emissions by fabric or bag filters and wet scrubbers	
	ES 1 & ES 2: Release factor after on-site treatment (g/T):	35.2
Organisational measures to prevent/limit release from site	None	
Conditions and measures related to municipal sewage treatment plant	Municipal STP	No
	Discharge rate of Municipal STP	Not applicable
	Incineration of the sludge of the Municipal STP	Not applicable
Conditions and measures related to external treatment of waste for disposal	Hazardous wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the nickel content of the waste is elevated enough, internal or external recovery/recycling might be considered.	
	Fraction of daily/annual use (expected in waste):	0.05 % Nickel producers
		0.6 % DU: stainless steel and alloy steels
		0.5 % DU: nickel alloys, copper alloys, foundry, batteries, catalysts, chemicals, dyes and others
		3 % DU: Plating
	Appropriate waste codes:	01 03 07*, 02 01 10*, 06 03 13*, 06 03 15*, 06 04 05*, 06 05 02*, 10 08 04, 10 08 08*, 10 08 09, 10 08 15*, 10 08 16, 10 10 03, 10 10 05*, 10 10 07*, 10 10 09*, 10 10 10, 10 10 11*, 11 02 07*, 12 01 03*, 12 01 04, 15 01 04*, 15 01 10*, 16 01 04*, 16 01 06*, 16 01 08*, 16 06 02*, 16 06 05, 16 08 02*, 16 08 03*, 17 04 07*, 17 04 09*, 19 09 04*, 19 10 02*, 19 12 03*
	Suitable disposal:	Keep separate and dispose of either. Hazardous waste incineration operated according to Council Directive 2008/98/EC on waste, Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006. Hazardous landfill operated under Directive 1999/31/EC.
Conditions and measures related to external recovery of waste	Shredders pre-treating metal wastes should have a maximum release factors to air of 0.0015 after RMM and no releases to water and soil.	
	Qmax, local (shredding) = 26 kg Ni/day	(Note: This Qmax, local for shredders is based on the existing information at the moment of the update. It will be reviewed when new information is available from

		the BREF for shredding)

3. Exposure estimation and reference to its source

3.1. Health

Long-term - systemic effects						
DNEL	Inhalation.: 0.05 mg/m³ Dermal:					
Contributing scenario	inhalation exposure mg/m³	RCR	Dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method
PROC2	0.019	0.38			0.38	Inhalation.: Single static exposure measurement
PROC2	0.003	0.06			0.06	Inhalation.: Single static exposure measurement
PROC9	0.078	1.6			1.6	Inhalation.: {excluding RPE}; RCR 0.08 {with RPE, APF = 20} Single personal exposure measurement
PROC0	0.086	1.7			1.7	Inhalation.: {excluding RPE}; RCR 0.09 {with RPE, APF = 20} 90th percentile modelled exposure value with MEASE (PROC 10, no direct handling and with intermittent contact during non-dispersive use)

Acute - systemic effects						
DNEL	Inhalation.: 7.1 mg/m³ Dermal:					
Contributing scenario	inhalation exposure mg/m³	RCR	Dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method
PROC2	0.06	0.008			0.008	Inhalation.: 3 x Single static exposure measurement
PROC2	0.009	0.001			0.001	Inhalation.: 3 x Single static exposure measurement
PROC9	0.234	0.033			0.033	Inhalation.: 3 x Single personal exposure measurement
PROC0	0.258	0.04			0.04	Inhalation.: 3 x Modelled exposure value

Local - Inhalation.					
DNEL	Acute: 0.47 mg/m³ Long-term: 0.05 mg/m³/day				
Contributing scenario	Acute mg/m³	RCR	Long term mg/m³	RCR	Assessment method
PROC2	0.06	0.12	0.019	0.38	Acute: 3 x Single static exposure measurement Long term: Single static exposure measurement
PROC2	0.009	0.019	0.003	0.06	Acute: 3 x Single static exposure measurement Long term: Single static exposure measurement
PROC9	0.234	0.5	0.078	0.08	Acute: 3 x Single personal exposure measurement Long term: {excluding RPE}; RCR 0.08 {with RPE, APF = 20} Single personal exposure measurement
PROC0	0.258	0.55	0.086	1.7	Acute: 3 x Modelled exposure value Long term: {excluding RPE}; RCR 0.09 {with RPE, APF = 20} 90th percentile modelled exposure value with MEASE (PROC 10, no direct handling and with

					intermittent contact during non-dispersive use)

Local - Dermal					
DNEL	Acute: Long-term: 0.003 mg/cm²/day				
Contributing scenario	Acute mg/m³	RCR	Long term mg/m³	RCR	Assessment method
PROC2			0.0001	0.03	Long term: (≤1hr); Modelled exposure data using MEASE (PROC 2, contained transfer operations, direct handling during recovery of filter cake (m/m% Ni content >25%) with intermittent contact during non-dispersive use, gloves, 1 hour maximum duration of operation (sampling, filter cake spreading and inspection activities), then hands must be washed before continuing work.
PROC2			0.0005	0.17	Long term: Modelled exposure data using MEASE (PROC 2, automated with contained transfer operations, incidental contact during non-dispersive use, no gloves)
PROC9			0.0005	0.17	Long term: Modelled exposure data using MEASE (PROC9, semi-automated with contained transfer operations, direct handling during non-dispersive use (manual interventions on bagging unit), and gloves.
PROC0			0.00003	0.01	Long term: Modelled exposure data using MEASE (PROC 10, no direct handling and with intermittent contact during non-dispersive use, gloves)

3.2. Environment

environmental exposure	Unit	Exposure Estimation	PNEC	RCR	Assessment method
freshwater	mg/l	0.0029	0.0071	0.00082	Measured values, Tier 3-RWC
marine water	mg/l	0.0003	0.0084	0.00038	Measured values, Tier 3-RWC
freshwater sediment	mg/kg dwt	33.5	136	0.82	Measured values, Tier 3-RWC
Marine water sediment	mg/kg dwt	16.1	136	0.69	Measured values, Tier 3-RWC
Soil	mg/kg dwt	16.2	29.9	0.56	Measured values, Tier 3-RWC

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

4.1. Health

Guidance - Health	Scaling considering duration and frequency of use. Collect process monitoring data with an inhalable sampler. The simultaneous use of a respirable sampler is encouraged. Use aerosol particle size information, when available, to confirm the appropriate use of the inhalable DNEL of 0.05 mg Ni/m^3. Respirable fraction exposure levels should be kept below 0.01 mg Ni/m^3.

4.2. Environment

Guidance - Environment	Scaling tool: Metals EUSES IT tool (free download: http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool). Scaling of the release to air and water environment includes: Refining of the release factor to air and waste water and/or and the efficiency of the air filter and wastewater treatment facility. Scaling of the PNEC for aquatic environment and soil compartment by using a tiered approach for correction for bioavailability and background concentration (Clocal approach).

1. Exposure scenario ES 2

Metal surface treatment: nickel electroplating, nickel electroforming, electroless nickel plating

ES Ref.: ES 2 ES Type: Worker	

Use descriptors	SU3, SU17 PROC0, PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC9, PROC13, PROC15 PC14 ERC5
Processes, tasks, activities covered	Raw materials handling Preparation of Ni(C2H3O2)2 solution by diluting a concentrated Ni(C2H3O2)2 solution or dissolving Ni(C2H3O2)2.4H2O powder in water Addition of Ni(C2H3O2)2 and Ni(C2H3O2)2.4H2O to tank solution during Dipping items with surfaces to be cleaned, prepared and coated into solutions Tank rinsing and manual hosing down treated of coated items Attaching workpieces to jigs or loading them into barrels Removal of coated items from jigs or barrels Removal and treatment of spent solution and dirty rinse water from tanks Testing solution composition Cleaning and maintenance of plant and premises For: Ni phosphate conversion coatings as well as perhaps Nickel electroplating without topcoat, Nickel electroplating with chromium topcoat, Nickel electroplating with other topcoats such as gold, silver, brass, and organic compounds, Nickel electroforming, Electroless nickel plating e.g. nickel boron alloy and Nickel composite/alloy electroplating such as nickel plus silicon carbide Industrial use
Assessment method	Estimation of exposure based on measured data for an analogous substance. Estimation of long term inhalation exposure and dermal exposure based on Tier 1 model.

2. Operational conditions and risk management measures

2.1.1 Contributing scenario controlling worker exposure (PROC5, PROC8a, PROC8b, PROC13)

Nickel electroplating, nickel electroforming & electroless nickel plating	
PROC5	Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)
PROC8a	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non dedicated facilities
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
PROC13	Treatment of articles by dipping and pouring
PROC15	Use as a laboratory reagent

Product characteristics		
Physical form of product	Ni hydroxycarbonate solution	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	Plating process continuous over every shift	
Human factors not influenced by risk management	Respiration volume under conditions of use	Light to medium level work, 10 m^3/d
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	240 cm^2. 480 cm^2. 960 cm^2. depending on task
	Body weight:	70 kg
Other given operational conditions affecting workers exposure	Ni plating solutions are often used hot and this can cause mist emissions from the solution surface. Manual solution make-up and replenishment with Ni hydroxycarbonate solution can lead to solution splashes to the skin and generate spray in the atmosphere. Oral: Good workplace hygiene practice	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	Treatment solutions contain a fume suppressant and/or are covered with a layer of plastic balls (chroffles) floating on the solution surface to seal	

	heat and mist inside plating tank where this barrier will allow easy immersion and removal of items and access to other tank fitments. Treatment solutions not in use are sealed with tank covers. The Ni hydroxycarbonate solution is carefully added to the tank solution where the process is not automated, in order to avoid throwing the Ni hydroxycarbonate along the length of the tanks and creating liquid splashes and solution spray. Eductors rather than air are used to agitate tank solutions. Long handled tools should be used when sampling tank solutions to provide a safe working distance between the worker and the solutioin and hands should not be immersed in the tank solution.	
Technical conditions and measures to control dispersion from source towards the worker	LEV shall be used to extract the mist and particulate during the solution mixing, dipping and transferring operations which are not fully enclosed.	
Organisational measures to prevent /limit releases, dispersion and exposure	Training to reinforce good workplace hygiene practice and hygiene issues.	
Conditions and measures related to personal protection, hygiene and health evaluation	Inhalation: Use of air-assisted filtering visor, masks or hood with P3 filter element for plant or premises heavily contaminated with nickel-containing dust or spills {APF 20 or 40 based on use of powered respirator meeting EN12492 or EN12941 requirement or FFP3 (EN136) or equivalent suitable respirator}. RPE with a lower APF of 10 {air-assisted filtering visor, masks or hood with P2 filter element including powered respirators meeting the EN12492 TM1 or EN12941 TH1 requirement or the FFP2 (EN149) or equivalent suitable respirator} may be used for cleaning and maintenance work where the plant or premises is less heavily contaminated with nickel-containing dust or spills. It is important to note that the disposable mask FFP1 (with APF = 4) is not recommended for use with Ni-containing dust. Dermal: Use of suitable gloves (EN 374, protection level 6, PVC or equivalent) goggles and special safety clothing is required to control dermal exposure. Protective equipment should be chosen based on activities being undertaken, potential for exposure to airborne Ni Hydroxycarbonate and other relevant workplace hazards and may include protective suit with hood (conforming to EN13982-1 Type 5), safety shoes (e.g. according to EN 20346).	

2.1.2 Contributing scenario controlling worker exposure (PROC0)

Cleaning and maintenance	
PROC0	Other Process or activity

Product characteristics		
Physical form of product	Ni present as nickel-containing dust such as nickel hydroxycarbonate , Nickel hydroxycarbonate-containing dust, Ni hydroxycarbonate solution	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	Duration of exposure during cleaning and maintenance is considered to average 1 hour per day for surface finishing including tank emptying, refilling tank solutions and replenishing tank solutions. Frequency of additions depends on process and through-put rate of plated items down the line and ranges from once per shift to once every 2 or 3 weeks.	
Human factors not influenced by risk management	Respiration volume under conditions of use	Light to medium level work, 10 m^3/d
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	960 cm^2
	Body weight:	70 kg

Other given operational conditions affecting workers exposure	None	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	The Ni hydroxycarbonate powder is carefully added to the tank solution where the process is not automated, in order to avoid throwing the Ni hydroxycarbonate powder along the length of the tanks and creating liquid splashes and powder becoming airborne.	
Technical conditions and measures to control dispersion from source towards the worker	Local (where appropriate) and general exhaust ventilation. Vacuuming or suitable wet removal methods for cleaning settled dust etc. from plant and premises. Avoid inappropriate cleaning methods such as dry brushing.	
Organisational measures to prevent /limit releases, dispersion and exposure	Training to reinforce good workplace hygiene practice and hygiene issues.	
Conditions and measures related to personal protection, hygiene and health evaluation	Inhalation to mists and particulates and skin exposure to mists, liquids splashes and particulates shall be controlled by RPE and gloves when undertaking maintenance and cleaning work Inhalation: Use of air-assisted filtering visor, masks or hood with P3 filter element for plant or premises heavily contaminated with nickel-containing dust or spills {APF 20 or 40 based on use of powered respirator meeting EN12492 or EN12941 requirement or FFP3 (EN136) or equivalent suitable respirator}. RPE with a lower APF of 10 {air-assisted filtering visor, masks or hood with P2 filter element including powered respirators meeting the EN12492 TM1 or EN12941 TH1 requirement or the FFP2 (EN149) or equivalent suitable respirator} may be used for cleaning and maintenance work where the plant or premises is less heavily contaminated with nickel-containing dust or spills. It is important to note that the disposable mask FFP1 (with APF = 4) is not recommended for use with Ni-containing dust. Dermal: Use of suitable gloves (EN 374, protection level 6, PVC or equivalent) goggles and special safety clothing is required to control dermal exposure. Protective equipment should be chosen based on activities being undertaken, potential for exposure to airborne Ni Hydroxycarbonate and other relevant workplace hazards and may include protective suit with hood (conforming to EN13982-1 Type 5), safety shoes (e.g. according to EN 20346).	

2.2 Contributing scenario controlling environmental exposure (ERC5)

ERC5	Industrial use resulting in inclusion into or onto a matrix
Assessment method	Estimates based on monitoring local and regional concentrations are used for calculation of PEC

Product characteristics		
Physical form of product	Powder and liquid (solution of Ni hydroxycarbonate)	
Operational conditions		
Amounts used	Maximum daily use at site	ES 1: 0.036 tonnes/day (median 50th% emission days) ES 2: 0.017 tonnes/day (median 50th% emission days) ES 3: 0.036 tonnes/day (median 50th% emission days)
	Maximum annual use at site	ES 1: 8 tonnes Ni; Discharge to STP ES 2: 3.8 tonnes Ni; Direct discharge ES 3: 8 tonnes Ni; Marine discharge
Frequency and duration of use	Pattern of release to the environment	Water: 240 days per year per site (median 50th%) Air: 220 days per year per site (median 50th%)

Environmental factors not influenced by risk management	Receiving surface water flow (m³/day):	ES 1 discharge to STP: 1.8xE4 m^3/d (Effluent STP: 2000 m^3/d) ES 2: direct discharge: 1.2xE4 m^3/d (Effluent Site: 250 m^3/d)
	Local freshwater dilution factor:	ES 1: 10 (default) ES 2: 50
	Local marine water dilution factor:	ES 3: 100
Other given operational conditions affecting environmental exposure	None	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	None	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	On-site wastewater treatment in a physico-chemical treatment plant by chemical precipitation, sedimentation, filtration or a combination	Efficiency: 95 -> 99%
	Off-site waste water treatment plant, community sewer system	Efficiency: 40%. (for ES 1)
	ES 1 freshwater discharge to STP (g/T):	3779 (median)
	ES 2 freshwater direct discharge (g/T):	3779 (median)
	ES 3 marine direct discharge (g/T):	3779 (median)
	Treatment of stack air emission by wet scrubbers	Efficiency: 99%
	Release factor after on-site air treatment (g/T)	1133 (median). (ES 1, 2 & 3)
Organisational measures to prevent/limit release from site	None	
Conditions and measures related to municipal sewage treatment plant	Municipal STP	ES 1: Yes
	Discharge rate of Municipal STP	2000 m^3/d
	Incineration of the sludge of the Municipal STP	The sludge is applied to agricultural soil
Conditions and measures related to external treatment of waste for disposal	Hazardous wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the nickel content of the waste is elevated enough, internal or external recovery/recycling might be considered.	
	Fraction of daily/annual use (expected in waste):	0.05 % Nickel producers
		0.6 % DU: stainless steel and alloy steels
		0.5 % DU: nickel alloys, copper alloys, foundry, batteries, catalysts, chemicals, dyes and others
		3 % DU: Plating
	Appropriate waste codes:	01 03 07*, 02 01 10*, 06 03 13*, 06 03 15*, 06 04 05*, 06 05 02*, 10 08 04, 10 08 08*, 10 08 09, 10 08 15*, 10 08 16, 10 10 03, 10 10 05*, 10 10 07*, 10 10 09*, 10 10 10, 10 10 11*, 11 02 07*, 12 01 03*, 12 01 04, 15 01 04*, 15 01 10*, 16 01 04*, 16 01 06*, 16 01 08*, 16 06 02*, 16 06 05, 16 08 02*, 16 08 03*, 17 04 07*, 17 04 09*, 19 09 04*, 19 10 02*, 19 12 03*
	Suitable disposal:	Keep separate and dispose of either. Hazardous waste incineration operated according to Council

		Directive 2008/98/EC on waste, Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006. Hazardous landfill operated under Directive 1999/31/EC.
Conditions and measures related to external recovery of waste	Shredders pre-treating metal wastes should have a maximum release factors to air of 0.0015 after RMM and no releases to water and soil.	
	Qmax, local (shredding) = 26 kg Ni/day	(Note: This Qmax, local for shredders is based on the existing information at the moment of the update. It will be reviewed when new information is available from the BREF for shredding)

3. Exposure estimation and reference to its source

3.1. Health

Long-term - systemic effects						
DNEL	Inhalation.: 0.05 mg/m³ Dermal:					
Contributing scenario	inhalation exposure mg/m³	RCR	Dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method
PROC5, PROC8a, PROC8b, PROC13, PROC15	0.0083	0.17			0.17	Inhalation.: 75th percentile value from 20 personal exposure measurements
PROC0	0.57	11.4			11.4	Inhalation.: {excluding RPE}; 0.029, RCR 0.58 {by use of RPE, APF = 20} 90th percentile exposure estimate using MEASE for PROC 10 {Ni content > 25% of powder, incidental exposure, non-direct handling, duration 1 hour, general ventilation, RPE, gloves}

Acute - systemic effects						
DNEL	Inhalation.: 7.1 mg/m³ Dermal:					
Contributing scenario	inhalation exposure mg/m³	RCR	Dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method
PROC5, PROC8a, PROC8b, PROC13, PROC15	0.0249	0.004			0.004	Inhalation.: 3 x long-term exposure/inhalable modelled estimate
PROC0	1.71	0.241			0.241	Inhalation.: 3 x long-term exposure/inhalable modelled estimate

Local - Inhalation.					
DNEL	Acute: 0.47 mg/m³ Long-term: 0.05 mg/m³/day				
Contributing scenario	Acute mg/m³	RCR	Long term mg/m³	RCR	Assessment method
PROC5, PROC8a, PROC8b, PROC13, PROC15	0.0249	0.053	0.0083	0.17	Acute: 3 x long-term exposure/inhalable modelled estimate Long term: 75th percentile value from 20 personal exposure measurements
PROC0	1.71	3.64	0.57	11.4	Acute: {excluding RPE}; 0.171, RCR 0.36 {by use of RPE, APF 10}

					3 x long-term exposure/inhalable modelled estimate Long term: {excluding RPE}; 0.029, RCR 0.58 {by use of RPE, APF = 20} 90th percentile exposure estimate using MEASE for PROC 10 {Ni content > 25% of powder, incidental exposure, non-direct handling, duration 1 hour, general ventilation, RPE, gloves}

Local - Dermal					
DNEL	Acute: Long-term: 0.003 mg/cm²/day				
Contributing scenario	Acute mg/m³	RCR	Long term mg/m³	RCR	Assessment method
PROC5, PROC8a, PROC8b, PROC13, PROC15			0.00005	0.017	Long term: 90th percentile exposure estimate using MEASE for PROC 8 (Ni content >25% of solution, inclusion into matrix, incidental exposure, non-direct handling, duration 8 hrs, LEV, gloves)
PROC0			0.00001	0.003	Long term: 90th percentile exposure estimate using MEASE for PROC 10 {Ni content > 25% of powder, incidental exposure, non-direct handling, duration 1 hour, general ventilation, RPE, gloves}

3.2. Environment

environmental exposure	Unit	Exposure Estimation	PNEC	RCR	Assessment method
freshwater	mg/l	0.0029	0.0071	0.00079	Measured values, Tier 3-RWC
marine water	mg/l	0.0003	0.0064	0.00046	Measured values, Tier 3-RWC
freshwater sediment	mg/kg dwt	33.5	136	0.91	Measured values, Tier 3-RWC
Marine water sediment	mg/kg dwt	16.1	136	0.82	Measured values, Tier 3-RWC
Sewage treatment plant	mg/l	-	0.33	0.12	Measured values, Tier 3-RWC
Soil	mg/kg dwt	16.2	29.9	0.54	Measured values, Tier 3-RWC

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

4.1. Health

Guidance - Health	Scaling considering duration and frequency of use. Collect process monitoring data with an inhalable sampler. The simultaneous use of a respirable sampler is encouraged. Use aerosol particle size information, when available, to confirm the appropriate use of the inhalable DNEL of 0.05 mg Ni/m^3. Respirable fraction exposure levels should be kept below 0.01 mg Ni/m^3.

4.2. Environment

Guidance - Environment	Scaling tool: Metals EUSES IT tool (free download: http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool). Scaling of the release to air and water environment includes: Refining of the release factor to air and waste water and/or and the efficiency of the air filter and wastewater treatment facility. Scaling of the PNEC for aquatic environment and soil compartment by using a tiered approach for correction for bioavailability and background concentration (Clocal approach).

1. Exposure scenario ES 3

Use of nickel hydroxycarbonate as an intermediate for the production of nickel oxide in catalyst or catalyst precursor manufacture

ES Ref.: ES 3 ES Type: Worker	

Use descriptors	SU3, SU8, SU9 PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9, PROC14 PC19 ERC1, ERC3, ERC6a
Processes, tasks, activities covered	Raw material delivery and handling, catalyst manufacture: dissolving, precipitating, filtrating, drying, mixing, impregnation, calcination operations, cleaning and maintenance Industrial use
Assessment method	Estimation of inhalation exposure based on measured data. Estimation of dermal exposure based on Tier 1 model. Modeled dermal exposure data using MEASE.

2. Operational conditions and risk management measures

2.1.1 Contributing scenario controlling worker exposure (PROC1, PROC2, PROC3, PROC8b)

Production of wet catalysts precursors (extrudates, pellets, tablets, spheres, powders) from dissolved raw materials	
PROC1	Use in closed process, no likelihood of exposure
PROC2	Use in closed, continuous process with occasional controlled exposure
PROC3	Use in closed batch process (synthesis or formulation)
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities

Product characteristics

Physical form of product	Ni hydroxycarbonate or carbonate present in most steps in solution except for the dissolving procedure and bound in catalyst precursor i.e. wet intermediates for the production for NiO-containing catalysts

Operational conditions

Amounts used	Not relevant	
Frequency and duration of use	8-11 hours/day (37.5 hours/week),80-360 days/year	
Human factors not influenced by risk management	Respiration volume under conditions of use	not relevant
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	480 cm^2
	Body weight:	not relevant
Other given operational conditions affecting workers exposure	High level of workplace cleanliness and prevention of dust or powder accumulation on surfaces, including floors. Use of water or vacuum cleaner fitted with a HEPA filter to remove dusts and powders during cleaning. Oral: Good workplace hygiene practice	

Risk management measures

Technical conditions and measures at process level (source) to prevent release	Automation and complete enclosure of processing, transfer and handling operations where exposure to nickel hydroxycarbonate-containing powder, fume or dust could arise. Nickel hydroxycarbonate-containing powder, fume or dust is mainly in solution, or wet production processes, and therefore not likely to give rise to significant exposures to inhalable nickel hydroxycarbonate-containing powder, fume or dust. Exposure is intermittent for (Semi) automated processes operated from control room or separate control areas.Dust formation is unlikely for wet filter cake. Automation of processes should be used where possible to eliminate dermal contact.	
Technical conditions and measures to control dispersion from source towards the worker	LEV is required to avoid discharge of dust into workplace air. Extraction of gases from high temperature processes is required to avoid discharge into workplace air. Extraction of gases	

	from hot automated and enclosed processes shall be designed to remove gaseous side products (e.g. water vapour, carbon dioxide, oxides of nitrogen) and applied to discharge points and transfer systems to prevent work place exposure. During cleaning, vacuum or (pressure) washing with water shall be used to remove dusts or powders containing Ni compounds.	
Organisational measures to prevent /limit releases, dispersion and exposure	Regular training in work hygiene practices and proper use of PPE.	
Conditions and measures related to personal protection, hygiene and health evaluation	Use of RPE (Particle filter with high efficiency for solid and liquid particles (e.g. EN 143 or 149, Type P3 or FFPE)) is required for cleaning and maintenance operations and where exposure to Ni-containing dust or powder is possible. Air fed RPE may be used, if entry to the equipment used for production is required. Containment of raw materials and product is required to prevent dermal contact. Where dermal contact is possible use protective suit conforming to EN13982-1 Type 5 and suitable chemical resistant safety gloves (EN 374) capable of providing protection during prolonged, direct contact (Recommended: Protective index 6, corresponding> 480 minutes of permeation time according to EN 374): E.g. nitrile rubber (0.4 mm), chloroprene rubber (0.5 mm), butyl rubber (0.7 mm) or other gloves meeting the required performance specifications. Other protective equipment: Should be chosen based on activities being undertaken, potential for exposure to airborne Ni-containing powder and dust and other relevant workplace hazards may include protective suit (with hood), safety shoes (e.g. according to EN 20346)	

2.1.2 Contributing scenario controlling worker exposure (PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9, PROC14)

Use of nickel hydroxycarbonate-containing catalysts precursors for preparation of NiO-containing catalysts by calcination	
PROC1	Use in closed process, no likelihood of exposure
PROC2	Use in closed, continuous process with occasional controlled exposure
PROC3	Use in closed batch process (synthesis or formulation)
PROC4	Use in batch and other process (synthesis) where opportunity for exposure arises
PROC8a	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non dedicated facilities
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)
PROC14	Production of preparations or articles by tabletting, compression, extrusion, pelletisation

Product characteristics	
Physical form of product	Ni present as nickel hydroxycarbonate bound in catalyst carrier precursor i.e. wet intermediates for the production of NiO-containing catalysts

Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	8-11 hours/day (37.5 hours/week),80-360 days/year	
Human factors not influenced by risk management	Respiration volume under conditions of use	not relevant
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	480 cm^2
	Body weight:	not relevant
Other given operational conditions affecting workers exposure	High level of workplace cleanliness and prevention of dust or powder accumulation on surfaces, including floors. Use of water or vacuum cleaner fitted with a HEPA filter to remove dusts and powders during cleaning.,Oral: Good workplace hygiene practice	

Risk management measures		
Technical conditions and measures at process level (source) to prevent release	Automation and complete enclosure of processing, transfer and handling operations, as well as handling	

	mainly in solution are not likely to give rise to significant exposures to inhalable nickel hydroxycarbonate-containing powder, fume or dust. Exposure is intermittent for (Semi) automated processes operated from control room or separate control areas. Dust formation is unlikely for wet filter cake. Automation of processes should be used where possible to eliminate dermal contact.	
Technical conditions and measures to control dispersion from source towards the worker	LEV is required to avoid discharge of dust into workplace air. Extraction of gases from high temperature processes is required to avoid discharge into workplace air. Extraction of gases from hot automated and enclosed processes shall be designed to remove gaseous side products (e.g. water vapour, carbon dioxide, oxides of nitrogen) and applied to discharge points and transfer systems to prevent work place exposure. During cleaning, vacuum or (pressure) washing with water shall be used to remove dusts or powders containing Ni compounds.	
Organisational measures to prevent /limit releases, dispersion and exposure	Regular training in work hygiene practices and proper use of PPE.	
Conditions and measures related to personal protection, hygiene and health evaluation	Use of RPE (Particle filter with high efficiency for solid and liquid particles (e.g. EN 143 or 149, Type P3 or FFPE)) is required for cleaning and maintenance operations and where exposure to Ni-containing dust or powder is possible. Air fed RPE may be used, if entry to the equipment used for production is required. Containment of raw materials and product is required to prevent dermal contact. Where dermal contact is possible use protective suit conforming to EN13982-1 Type 5 and suitable chemical resistant safety gloves (EN 374) capable of providing protection during prolonged, direct contact (Recommended: Protective index 6, corresponding> 480 minutes of permeation time according to EN 374): E.g. nitrile rubber (0.4 mm), chloroprene rubber (0.5 mm), butyl rubber (0.7 mm) or other gloves meeting the required performance specifications. Other protective equipment: Should be chosen based on activities being undertaken, potential for exposure to airborne Ni-containing powder and dust and other relevant workplace hazards may include protective suit (with hood), safety shoes (e.g. according to EN 20346)	

2.2 Contributing scenario controlling environmental exposure (ERC1, ERC3, ERC6a)

ERC1	Manufacture of substances
ERC3	Formulation in materials
ERC6a	Industrial use resulting in manufacture of another substance (use of intermediates)
Assessment method	Estimates based on monitoring local and regional concentrations are used for calculation of PEC

Product characteristics

Physical form of product	Ni hydroxycarbonate or carbonate present in most steps in solution except for the dissolving procedure and bound in catalyst precursor:, Wet intermediates for the production of NiO-containing catalysts, Ni present as nickel hydroxycarbonate bound in catalyst carrier precursor

Operational conditions

Amounts used	Maximum daily use at site	1.8 t/d (90th% tonnage, 50th% emission days)
	Maximum annual use at site	476 t/y (90th%, 2007). (ES 1, 2 & 3)
Frequency and duration of use	Pattern of release to the environment	266 per site (50th%)
Environmental factors not influenced by risk management	Receiving surface water flow (m³/day):	ES 1 Discharge to STP: 98,000 m^3/d (Effluent STP/Site: 2000 m^3/d) ES 2 Direct discharge: 169,660 m^3/d (Effluent Site: 340 m^3/d)

	Local freshwater dilution factor:	ES 1 Discharge to STP: 50 ES 2 Direct discharge: 500
	Local marine water dilution factor:	ES 3: 100
Other given operational conditions affecting environmental exposure	None	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	Appropriate process control systems shall be implemented.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	On-site wastewater treatment by chemical precipitation, sedimentation, filtration, distillation or ion-exchange	Efficiency: 99%. (for ES 1)
	Off-site wastewater treatment plant, municipal STP	Efficiency: 40%. (for ES 1)
	ES 1 & ES 2: Release factor after on-site treatment (g/T):	460 (90P)
	ES 3 marine direct discharge, Release factor after on-site wastewater treatment (g/T):	40.5 (50P)
	Treatment of air emissions by air filters (fabric, bag, HEPA, ceramic) and/or wet scrubbers	
	Release factor after on-site air treatment (g/T)	220 (ES 1, 2 & 3)
Organisational measures to prevent/limit release from site	Regular operator training	
Conditions and measures related to municipal sewage treatment plant	Municipal STP	Yes for ES 1 Discharge to STP
	Discharge rate of Municipal STP	2000 m^3/d
	Incineration of the sludge of the Municipal STP	The sludge is applied to agricultural soil
Conditions and measures related to external treatment of waste for disposal	Hazardous wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the nickel content of the waste is elevated enough, internal or external recovery/recycling might be considered.	
	Fraction of daily/annual use (expected in waste):	0.05 % Nickel producers
		0.6 % DU: stainless steel and alloy steels
		0.5 % DU: nickel alloys, copper alloys, foundry, batteries, catalysts, chemicals, dyes and others
		3 % DU: Plating
	Appropriate waste codes:	01 03 07*, 02 01 10*, 06 03 13*, 06 03 15*, 06 04 05*, 06 05 02*, 10 08 04, 10 08 08*, 10 08 09, 10 08 15*, 10 08 16, 10 10 03, 10 10 05*, 10 10 07*, 10 10 09*, 10 10 10, 10 10 11*, 11 02 07*, 12 01 03*, 12 01 04, 15 01 04*, 15 01 10*, 16 01 04*, 16 01 06*, 16 01 08*, 16 06 02*, 16 06 05, 16 08 02*, 16 08 03*, 17 04 07*, 17 04 09*, 19 09 04*, 19 10 02*, 19 12 03*
	Suitable disposal:	Keep separate and dispose of either. Hazardous waste incineration operated according to Council Directive 2008/98/EC on waste, Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006.

		Hazardous landfill operated under Directive 1999/31/EC.
Conditions and measures related to external recovery of waste	Shredders pre-treating metal wastes should have a maximum release factors to air of 0.0015 after RMM and no releases to water and soil.	
	Qmax, local (shredding) = 26 kg Ni/day	(Note: This Qmax, local for shredders is based on the existing information at the moment of the update. It will be reviewed when new information is available from the BREF for shredding)

3. Exposure estimation and reference to its source

3.1. Health

Long-term - systemic effects						
DNEL	Inhalation.: 0.05 mg/m³ Dermal:					
Contributing scenario	inhalation exposure mg/m³	RCR	Dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method
PROC1, PROC2, PROC3, PROC8b	0.033	0.7			0.7	Inhalation.: Calculated 75th percentile for manufacturing processes relevant to use of nickel hydroxycarbonate in Ni-containing catalyst production
PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9, PROC14	0.033	0.7			0.7	Inhalation.: Calculated 75th percentile for manufacturing processes relevant to use of nickel hydroxycarbonate in Ni-containing catalyst production

Acute - systemic effects						
DNEL	Inhalation.: 7.1 mg/m³ Dermal:					
Contributing scenario	inhalation exposure mg/m³	RCR	Dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method
PROC1, PROC2, PROC3, PROC8b	0.099	0.014			0.014	Inhalation.: 3 x 75th percentile for manufacturing processes relevant to use of nickel hydroxycarbonate in Ni-containing catalyst production
PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9, PROC14	0.099	0.014			0.014	Inhalation.: 3 x 75th percentile for manufacturing processes relevant to use of nickel hydroxycarbonate in Ni-containing catalyst production

Local - Inhalation.					
DNEL	Acute: 0.47 mg/m³ Long-term: 0.05 mg/m³/day				
Contributing scenario	Acute mg/m³	RCR	Long term mg/m³	RCR	Assessment method
PROC1, PROC2, PROC3, PROC8b	0.099	0.21	0.033	0.7	Acute: 3 x 75th percentile for manufacturing processes relevant to use of nickel hydroxycarbonate in Ni-containing catalyst production Long term: Calculated 75th percentile for manufacturing processes relevant to use of nickel hydroxycarbonate in Ni-containing catalyst production
PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9, PROC14	0.099	0.21	0.033	0.7	Acute: 3 x 75th percentile for manufacturing processes relevant to use of nickel hydroxycarbonate in Ni-containing catalyst production Long term: Calculated 75th percentile for manufacturing processes relevant to use of

					nickel hydroxycarbonate in Ni-containing catalyst production

Local - Dermal					
DNEL	Acute: Long-term: 0.003 mg/cm²/day				
Contributing scenario	Acute mg/m³	RCR	Long term mg/m³	RCR	Assessment method
PROC1, PROC2, PROC3, PROC8b			0.0005	0.17	Long term: Modelled 90th percentile for dermal exposure by MEASE {PROC 8b, automated with no direct handling of powder (>25%w/w Ni) and no incidental contact, inclusion into matrix or non dispersive use, no gloves}
PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9, PROC14			0.0003	0.1	Long term: Modelled 90th percentile for dermal exposure by MEASE {PROC 8b, automated with contained transfer operations, no direct handling or contact (raw material), non dispersive use, no gloves}

3.2. Environment

environmental exposure	Unit	Exposure Estimation	PNEC	RCR	Assessment method
freshwater	mg/l	0.0029	0.0071	0.0009	Measured values, Tier 3-RWC
marine water	mg/l	0.0003	0.0084	0.00021	Measured values, Tier 3-RWC
freshwater sediment	mg/kg dwt	33.5	136	0.92	Measured values, Tier 3-RWC
Marine water sediment	mg/kg dwt	16.1	136	0.41	Measured values, Tier 3-RWC
Sewage treatment plant	mg/l	-	0.33	0.75	Measured values, Tier 3-RWC
Soil	mg/kg dwt	16.2	29.9	0.54	Measured values, Tier 3-RWC.

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

4.1. Health

Guidance - Health	Scaling considering duration and frequency of use. Collect process monitoring data with an inhalable sampler. The simultaneous use of a respirable sampler is encouraged. Use aerosol particle size information, when available, to confirm the appropriate use of the inhalable DNEL of 0.05 mg Ni/m^3. Respirable fraction exposure levels should be kept below 0.01 mg Ni/m^3.

4.2. Environment

Guidance - Environment	Scaling tool: Metals EUSES IT tool (free download: http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool). Scaling of the release to air and water environment includes: Refining of the release factor to air and waste water and/or and the efficiency of the air filter and wastewater treatment facility. Scaling of the PNEC for aquatic environment and soil compartment by using a tiered approach for correction for bioavailability and background concentration (Clocal approach).

1. Exposure scenario ES 4

Use of nickel hydroxycarbonate for the production of nickel sulphamate

ES Ref.: ES 4 ES Type: Worker	

Use descriptors	SU3, SU8, SU9 PROC3, PROC8b, PROC9, PROC0 PC19 ERC6a
Processes, tasks, activities covered	Raw material handling, batch processing and further processing Industrial use
Assessment method	Estimation of inhalation exposure based on measured data. Estimation of dermal exposure based on Tier 1 model. Modeled dermal exposure data using MEASE.

2. Operational conditions and risk management measures

2.1.1 Contributing scenario controlling worker exposure (PROC3, PROC8b)

Raw material handling and batch processing	
PROC3	Use in closed batch process (synthesis or formulation)
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities

Product characteristics		
Physical form of product	Ni supplied as nickel hydroxycarbonate (slurry)	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	8 hours/day	
Human factors not influenced by risk management	Respiration volume under conditions of use	not relevant
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	480 cm^2
	Body weight:	not relevant
Other given operational conditions affecting workers exposure	The reaction between nickel hydroxycarbonate (slurry) and sulphamic acid takes place in a closed batch process vessel provided with an extraction unit. After reaction is completed, the solution is filtered with a chamber filter press provided with an extraction unit. Oral: Good workplace hygiene practice	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	Reaction vessel shall be closed. Automation of processes should be used where possible to avoid dermal contact.	
Technical conditions and measures to control dispersion from source towards the worker	LEV is required at the cover plate of the vessel and the chamber filter press.	
Organisational measures to prevent /limit releases, dispersion and exposure	None	
Conditions and measures related to personal protection, hygiene and health evaluation	RPE for dust/mists (FFP3D, APF20) {approved with regard to EN 149:2001} is required. Gloves suitable for handling liquids e.g. butyl rubber chemical protective gloves and other suitable protective clothing are required where direct contact with nickel-containing solutions could occur.	

2.1.2 Contributing scenario controlling worker exposure (PROC9)

Dispersing of nickel sulphamate into containers for dispatch	
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

Product characteristics		
Physical form of product	Ni present as nickel sulphamate solution	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	8 hours/day	

Human factors not influenced by risk management	Respiration volume under conditions of use	not relevant
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	480 cm^2
	Body weight:	not relevant
Other given operational conditions affecting workers exposure	After filtering, the nickel sulphamate solutions are dispensed via a metering unit from an IBC to varying sized canisters using a semi-closed dispensing system with vapour extraction. Oral: Good workplace hygiene practice	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	None	
Technical conditions and measures to control dispersion from source towards the worker	Headspace vapours displaced during filling of canisters shall be controlled by an extraction system integrated within the dispensing gun.	
Organisational measures to prevent /limit releases, dispersion and exposure	None	
Conditions and measures related to personal protection, hygiene and health evaluation	RPE for dust/mists (FFP3D, APF20) {approved with regard to EN 149:2001} is required. Gloves suitable for handling liquids e.g. butyl rubber chemical protective gloves and other suitable protective clothing are required where direct contact with nickel-containing solutions could occur.	

2.1.3 Contributing scenario controlling worker exposure (PROC9)

Cleaning and maintenance	
PROC0	Other process or activity

Product characteristics		
Physical form of product	Ni present as nickel sulphamate solution, Ni supplied as nickel hydroxycarbonate (slurry)	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	8 hours/day Maximum 4 hour duration of operation	
Human factors not influenced by risk management	Respiration volume under conditions of use	not relevant
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	480 cm^2
	Body weight:	not relevant
Other given operational conditions affecting workers exposure	Cleaning and maintenance work of plant and premises can include scheduled regular and intermittent/occasional tasks of long and short duration which lead to exposure to Ni-containing solutions/liquids.	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	None	
Technical conditions and measures to control dispersion from source towards the worker	None	
Organisational measures to prevent /limit releases, dispersion and exposure	Use pressure washing with water to remove Ni-containing solutions/liquids during cleaning	
Conditions and measures related to personal protection, hygiene and health evaluation	RPE for dust/mists (FFP3D, APF20) {approved with regard to EN 149:2001} is required. Gloves suitable for handling liquids e.g. butyl rubber chemical protective gloves and other suitable protective clothing are required where direct contact with nickel-containing solutions could occur.	

2.2 Contributing scenario controlling environmental exposure (ERC6a)

ERC6a	Industrial use resulting in manufacture of another substance (use of intermediates)
Assessment method	Estimate based on monitoring local and regional concentration and used for calculating of PEC

Product characteristics	
Physical form of product	Ni supplied as nickel hydroxycarbonate (slurry), Ni present as nickel sulphamate

	solution	
Operational conditions		
Amounts used	Maximum daily use at site	3.3
	Maximum annual use at site	732.9 t/yr (ES 1, 2 & 3)
Frequency and duration of use	Pattern of release to the environment	220 days/yr per site
Environmental factors not influenced by risk management	Receiving surface water flow (m³/day):	ES1 discharge to STP: 18,000 m^3/d. (Effluent STP: 2000 m^3/d). ES2 direct discharge: 18,000 m^3/d. (Effluent site: 2000 m^3/d)
	Local freshwater dilution factor:	ES 1. Discharge to STP: 10. ES 2 Direct discharge: 10
	Local marine water dilution factor:	ES 3: 100
Other given operational conditions affecting environmental exposure	None	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	None	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	On-site wastewater treatment by chemical precipitation, sedimentation, flitration, ion-exchange or a combination of methods. Off-site wastewater treatment plant, municipal STP	Efficiency: 40%. (for ES 1)
	Release factor after on-site wastewater treatment (g/T):	1.1 (ES 1, 2 & 3)
	Treatment of air emission by use of wet scrubbers.	
	Release factor after on-site air treatment (g/T)	9.7 (ES 1, 2 & 3)
Organisational measures to prevent/limit release from site	None	
Conditions and measures related to municipal sewage treatment plant	Municipal STP	Yes for ES 1 Discharge to STP
	Discharge rate of Municipal STP	2000 m^3/d
	Incineration of the sludge of the Municipal STP	The sludge is applied to agricultural soil
Conditions and measures related to external treatment of waste for disposal	Hazardous wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the nickel content of the waste is elevated enough, internal or external recovery/recycling might be considered.	
	Fraction of daily/annual use (expected in waste):	0.05 % Nickel producers
		0.6 % DU: stainless steel and alloy steels
		0.5 % DU: nickel alloys, copper alloys, foundry, batteries, catalysts, chemicals, dyes and others
		3 % DU: Plating
	Appropriate waste codes:	01 03 07*, 02 01 10*, 06 03 13*, 06 03 15*, 06 04 05*, 06 05 02*, 10 08 04, 10 08 08*, 10 08 09, 10 08 15*, 10 08 16, 10 10 03, 10 10 05*, 10 10 07*, 10 10 09*, 10 10 10, 10 10 11*, 11 02 07*, 12 01 03*, 12 01 04, 15 01 04*, 15 01 10*, 16 01 04*, 16 01 06*, 16 01 08*, 16 06 02*, 16 06 05, 16 08 02*, 16 08 03*, 17 04 07*, 17 04 09*, 19 09 04*, 19 10 02*, 19 12 03*
	Suitable disposal:	Keep separate and dispose of either.

		Hazardous waste incineration operated according to Council Directive 2008/98/EC on waste, Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006. Hazardous landfill operated under Directive 1999/31/EC.
Conditions and measures related to external recovery of waste	Shredders pre-treating metal wastes should have a maximum release factors to air of 0.0015 after RMM and no releases to water and soil.	
	Qmax, local (shredding) = 26 kg Ni/day	(Note: This Qmax, local for shredders is based on the existing information at the moment of the update. It will be reviewed when new information is available from the BREF for shredding)

3. Exposure estimation and reference to its source

3.1. Health

Long-term - systemic effects						
DNEL	Inhalation.: 0.05 mg/m³ Dermal:					
Contributing scenario	inhalation exposure mg/m³	RCR	Dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method
PROC3, PROC8b	0.0075	0.15			0.15	Inhalation.: Highest of two (N=2) static measurements taken during production.,Data presumed to be representative of raw material handling and batch processing only
PROC0	0.004	0.08			0.08	Inhalation.: 90th percentile from MEASE modelling (PROC10, no direct handling of aqueous solution with m/m Ni content below 25% and with intermittent contact during non-dispersive use, gloves, 4 hour maximum duration of operation)

Acute - systemic effects						
DNEL	Inhalation.: 7.1 mg/m³ Dermal:					
Contributing scenario	inhalation exposure mg/m³	RCR	Dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method
PROC3, PROC8b	0.023	0.003			0.003	Inhalation.: 3 x Long-term exposure estimate derived from highest of two (N=2) static measurements taken during production.
PROC0	0.012	0.002			0.002	Inhalation.: 3 x long-term exposure/inhalable modelled estimate

Local - Inhalation.					
DNEL	Acute: 0.47 mg/m³ Long-term: 0.05 mg/m³/day				
Contributing scenario	Acute mg/m³	RCR	Long term mg/m³	RCR	Assessment method
PROC3, PROC8b	0.023	0.05	0.0075	0.15	Acute: 3 x Long-term exposure estimate derived from highest of two (N=2) static measurements taken during production. Long term: Highest of two (N=2) static

					measurements taken during production. Data presumed to be representative of raw material handling and batch processing only
PROC0	0.012	0.03	0.004	0.08	Acute: 3 x long-term exposure/inhalable modelled estimate Long term: 90th percentile from MEASE modelling (PROC10, no direct handling of aqueous solution with m/m Ni content below 25% and with intermittent contact during non-dispersive use, gloves, 4 hour maximum duration of operation)

Local - Dermal					
DNEL	Acute: Long-term: 0.003 mg/cm²/day				
Contributing scenario	Acute mg/m³	RCR	Long term mg/m³	RCR	Assessment method
PROC3, PROC8b			0.00003	0.01	Long term: Modelled 90th percentile for dermal exposure to Ni (PROC8b&3, automated with contained transfer operations, intermittent contact during non-dispersive use (occasional manual interventions), gloves)
PROC0			0.000018	0.006	Long term: 90th percentile from MEASE modelling (PROC10, no direct handling of aqueous solution with m/m Ni content below 25% and with incidental contact during non-dispersive use, gloves, 4 hour maximum duration of operation)

3.2. Environment

environmental exposure	Unit	Exposure Estimation	PNEC	RCR	Assessment method
freshwater	mg/l	0.0029	0.0071	0.00043	Measured values, Tier 3-RWC
marine water	mg/l	0.0003	0.0084	0.00004	Measured values, Tier 3-RWC
freshwater sediment	mg/kg dwt	33.5	136	0.27	Measured values, Tier 3-RWC
Marine water sediment	mg/kg dwt	16.1	136	0.12	Measured values, Tier 3-RWC
Sewage treatment plant	mg/l	-	0.33	0.003	Measured values, Tier 3-RWC
Soil	mg/kg dwt	16.2	29.9	0.54	Measured values, Tier 3-RWC

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

4.1. Health

Guidance - Health	Scaling considering duration and frequency of use. Collect process monitoring data with an inhalable sampler. The simultaneous use of a respirable sampler is encouraged. Use aerosol particle size information, when available, to confirm the appropriate use of the inhalable DNEL of 0.05 mg Ni/m^3. Respirable fraction exposure levels should be kept below 0.01 mg Ni/m^3.

4.2. Environment

Guidance - Environment	Scaling tool: Metals EUSES IT tool (free download: http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool). Scaling of the release to air and water environment includes: Refining of the release factor to air and waste water and/or and the efficiency of the air filter and wastewater treatment facility. Scaling of the PNEC for aquatic environment and soil compartment by using a tiered approach for correction for bioavailability and background concentration (Clocal approach).

1. Exposure scenario ES 5

Use of nickel hydroxycarbonate for the production of nickel acetate

ES Ref.: ES 5 ES Type: Worker	

Use descriptors	SU3, SU8, SU9 PROC0, PROC3, PROC8b, PROC9 PC19 ERC6a
Processes, tasks, activities covered	Raw material handling, batch processing and further processing Packaging, shipping and storage Industrial use
Assessment method	Estimation of inhalation exposure based on measured data. Estimation of dermal exposure based on Tier 1 model. Modeled dermal exposure data using MEASE.

2. Operational conditions and risk management measures

2.1.1 Contributing scenario controlling worker exposure (PROC3, PROC8b)

Raw material handling and batch processing	
PROC3	Use in closed batch process (synthesis or formulation)
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities

Product characteristics

Physical form of product	Ni supplied as nickel hydroxycarbonate (slurry), Nickel present in nickel acetate solution

Operational conditions

Amounts used	Not relevant	
Frequency and duration of use	8 hours/day	
Human factors not influenced by risk management	Respiration volume under conditions of use	not relevant
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	480 cm^2
	Body weight:	not relevant
Other given operational conditions affecting workers exposure	The nickel hydroxycarbonate slurry is added to acetic acid in the reaction vessel. At the endpoint the nickel acetate is pumped into a storage tank before filtering with a chamber filter press. The reaction takes place in a closed batch process vessel provided with an extraction unit. After reaction is completed, the solution is filtered with a chamber filter press provided with an extraction unit. Oral: Good workplace hygiene practice	

Risk management measures

Technical conditions and measures at process level (source) to prevent release	Reaction vessel shall be closed. Automation of processes should be used where possible to avoid dermal contact.	
Technical conditions and measures to control dispersion from source towards the worker	LEV is required at the cover plate of the vessel and the chamber filter press.	
Organisational measures to prevent /limit releases, dispersion and exposure	None	
Conditions and measures related to personal protection, hygiene and health evaluation	RPE for dust/mists (FFP3D, APF20) {approved with regard to EN 149:2001} is required. Gloves suitable for handling liquids e.g. butyl rubber chemical protective gloves and other suitable protective clothing are required where direct contact with nickel-containing solutions could occur.	

2.1.2 Contributing scenario controlling worker exposure (PROC9)

Packaging nickel acetate crystals into containers for dispatch	
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

Product characteristics

Physical form of product	Ni present in nickel acetate solution and as nickel acetate crystals

Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	8 hours/day Dermal exposure duration shall be less than 1.25 hours	
Human factors not influenced by risk management	Respiration volume under conditions of use	not relevant
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	not relevant
	Body weight:	not relevant
Other given operational conditions affecting workers exposure	After filtering, the nickel acetate solution is cooled using a Turboflow dryer which is emptied to a centrifuge to produce nickel acetate crystals which are dispensed into bags using a suction apparatus equipped with extraction.	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	Drier and centrifuge shall be closed by design. Automation of processes should be used where possible to avoid dermal contact.	
Technical conditions and measures to control dispersion from source towards the worker	Dispensing apparatus shall be equipped with LEV	
Organisational measures to prevent /limit releases, dispersion and exposure	None	
Conditions and measures related to personal protection, hygiene and health evaluation	RPE for dust/mists (FFP3D, APF20) {approved with regard to EN 149:2001} is required. Gloves suitable for handling liquids and other suitable protective clothing are required where direct contact with nickel-containing solutions and dusts could occur.	

2.1.3 Contributing scenario controlling worker exposure (PROC0)

Cleaning and maintenance	
PROC0	Other Process or activity

Product characteristics		
Physical form of product	Ni present in process as nickel acetate solution and dusts and as nickel hydroxycarbonate slurry	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	8 hours/day Maximum 4 hour duration of operation	
Human factors not influenced by risk management	Respiration volume under conditions of use	not relevant
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	960 cm^2
	Body weight:	not relevant
Other given operational conditions affecting workers exposure	Cleaning and maintenance work of plant and premises can include scheduled regular and intermittent/occasional tasks of long and short duration which may lead to high exposure to dust and mists.	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	None	
Technical conditions and measures to control dispersion from source towards the worker	None	
Organisational measures to prevent /limit releases, dispersion and exposure	Use vacuum and pressure washing with water to remove Ni-containing powder and dust during cleaning. Use pressure washing with water to remove Ni-containing solutions/slurries during cleaning.	
Conditions and measures related to personal protection, hygiene and health evaluation	RPE for dust/mists (FFP3D, APF20) {approved with regard to EN 149:2001} is required. Gloves used suitable for handling liquids are required where direct contact with nickel hydroxycarbonate and nickel acetate could occur.	

2.2 Contributing scenario controlling environmental exposure (ERC6a)

ERC6a	Industrial use resulting in manufacture of another substance (use of intermediates)
Assessment method	Estimate based on monitoring local and regional concentration and used for calculating of PEC

Product characteristics		
Physical form of product	Ni supplied as nickel hydroxycarbonate (slurry), Nickel present in nickel acetate solution	
Operational conditions		
Amounts used	Maximum daily use at site	3.3
	Maximum annual use at site	732.9 t/yr (ES 1, 2 & 3)
Frequency and duration of use	Pattern of release to the environment	220 days/yr per site
Environmental factors not influenced by risk management	Receiving surface water flow (m^3/day):	ES1 discharge to STP: 18,000 m^3/d. (Effluent STP: 2000 m^3/d). ES2 direct discharge: 18,000 m^3/d. (Effluent site: 2000 m^3/d)
	Local freshwater dilution factor:	ES 1: Discharge to STP: 10. ES 2 Direct discharge: 10
	Local marine water dilution factor:	ES 3: 100
Other given operational conditions affecting environmental exposure	None	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	None	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	On-site wastewater treatment by chemical precipitation, sedimentation, filtration, ion-exchange or a combination of methods. Off-site wastewater treatment plant, municipal STP	Efficiency: 40%. (for ES 1)
	Release factor after on-site wastewater treatment (g/T):	1.1 (ES 1, 2 & 3)
	Treatment of air emission by use of wet scrubbers.	
	Release factor after on-site air treatment (g/T)	9.7 (ES 1, 2 & 3)
Organisational measures to prevent/limit release from site	None	
Conditions and measures related to municipal sewage treatment plant	Municipal STP	Yes for ES 1 Discharge to STP
	Discharge rate of Municipal STP	2000 m^3/d
	Incineration of the sludge of the Municipal STP	The sludge is applied to agricultural soil
Conditions and measures related to external treatment of waste for disposal	Hazardous wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the nickel content of the waste is elevated enough, internal or external recovery/recycling might be considered.	
	Fraction of daily/annual use (expected in waste):	0.05 % Nickel producers
		0.6 % DU: stainless steel and alloy steels
		0.5 % DU: nickel alloys, copper alloys, foundry, batteries, catalysts, chemicals, dyes and others
		3 % DU: Plating
	Appropriate waste codes:	01 03 07*, 02 01 10*, 06 03 13*, 06 03 15*, 06 04 05*, 06 05 02*, 10 08 04, 10 08 08*, 10 08 09, 10 08 15*, 10 08 16, 10 10 03, 10 10 05*, 10 10 07*, 10 10 09*, 10 10 10, 10 10 11*, 11 02 07*, 12 01 03*, 12 01 04, 15 01 04*, 15 01

		10*, 16 01 04*, 16 01 06*, 16 01 08*, 16 06 02*, 16 06 05, 16 08 02*, 16 08 03*, 17 04 07*, 17 04 09*, 19 09 04*, 19 10 02*, 19 12 03*
	Suitable disposal:	Keep separate and dispose of either. Hazardous waste incineration operated according to Council Directive 2008/98/EC on waste, Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006. Hazardous landfill operated under Directive 1999/31/EC.
Conditions and measures related to external recovery of waste	Shredders pre-treating metal wastes should have a maximum release factors to air of 0.0015 after RMM and no releases to water and soil.	
	Qmax, local (shredding) = 26 kg Ni/day	(Note: This Qmax, local for shredders is based on the existing information at the moment of the update. It will be reviewed when new information is available from the BREF for shredding)

3. Exposure estimation and reference to its source

3.1. Health

Long-term - systemic effects						
DNEL	Inhalation.: 0.05 mg/m³ Dermal:					
Contributing scenario	inhalation exposure mg/m³	RCR	Dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method
PROC3, PROC8b	0.0075	0.15			0.15	Inhalation.: Highest of two (N=2) static measurements taken during production. Data presumed to be representative of raw material handling and batch processing only
PROC0	0.004	0.08			0.08	Inhalation.: 90th percentile from MEASE modelling (PROC10, no direct handling of aqueous solution with m/m Ni content below 25% and with intermittent contact during non-dispersive use, gloves, 4 hour maximum duration of operation)

Acute - systemic effects						
DNEL	Inhalation.: 7.1 mg/m³ Dermal:					
Contributing scenario	inhalation exposure mg/m³	RCR	Dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method
PROC3, PROC8b	0.023	0.003			0.003	Inhalation.: 3 x Long-term exposure estimate derived from highest of two (N=2) static measurements taken during production.
PROC0	0.012	0.002			0.002	Inhalation.: 3 x long-term exposure/inhalable modelled estimate

Local - Inhalation.	
DNEL	Acute: 0.47 mg/m³

	Long-term: 0.05 mg/m³/day				
Contributing scenario	Acute mg/m³	RCR	Long term mg/m³	RCR	Assessment method
PROC3, PROC8b	0.023	0.049	0.0075	0.15	Acute: 3 x Long-term exposure estimate derived from highest of two (N=2) static measurements taken during production. Long term: Highest of two (N=2) static measurements taken during production. Data presumed to be representative of raw material handling and batch processing only
PROC0	0.012	0.03	0.004	0.08	Acute: 3 x long-term exposure/inhalable modelled estimate Long term: 90th percentile from MEASE modelling (PROC10, no direct handling of aqueous solution with m/m Ni content below 25% and with intermittent contact during non-dispersive use, gloves, 4 hour maximum duration of operation)

Local - Dermal					
DNEL	Acute: Long-term: 0.003 mg/cm²/day				
Contributing scenario	Acute mg/m³	RCR	Long term mg/m³	RCR	Assessment method
PROC3, PROC8b			0.00003	0.01	Long term: Modelled 90th percentile for dermal exposure to Ni (PROC8b&3, automated with contained transfer operations, intermittent contact during non-dispersive use (occasional manual interventions), gloves)
PROC0			0.000018	0.006	Long term: 90th percentile from MEASE modelling (PROC10, no direct handling of aqueous solution with m/m Ni content below 25% and with incidental contact during non-dispersive use, gloves, 4 hour maximum duration of operation)

3.2. Environment

environmental exposure	Unit	Exposure Estimation	PNEC	RCR	Assessment method
freshwater	mg/l	0.0029	0.0071	0.00043	Measured values, Tier 3-RWC
marine water	mg/l	0.0003	0.0084	0.00004	Measured values, Tier 3-RWC
freshwater sediment	mg/kg dwt	33.5	136	0.27	Measured values, Tier 3-RWC
Marine water sediment	mg/kg dwt	16.1	136	0.12	Measured values, Tier 3-RWC
Sewage treatment plant	mg/l		0.33	0.003	Measured values, Tier 3-RWC
Soil	mg/kg dwt	16.2	29.9	0.54	Measured values, Tier 3-RWC

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

4.1. Health

Guidance - Health	Scaling considering duration and frequency of use. Collect process monitoring data with an inhalable sampler. The simultaneous use of a respirable sampler is encouraged. Use aerosol particle size information, when available, to confirm the appropriate use of the inhalable DNEL of 0.05 mg Ni/m^3. Respirable fraction exposure levels should be kept below 0.01 mg Ni/m^3.

4.2. Environment

Guidance - Environment	Scaling tool: Metals EUSES IT tool (free download: http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool). Scaling of the release to air and water environment includes: Refining of the release factor to air and waste water and/or and the efficiency of the air filter and wastewater treatment facility. Scaling of the PNEC for aquatic environment and soil compartment by using a tiered approach for correction for bioavailability and background concentration (Clocal approach).

1. Exposure scenario ES 6

Use of nickel hydroxycarbonate in the production of nickel powder

ES Ref.: ES 6 ES Type: Worker	

Use descriptors	SU3, SU8, SU10 PROC0, PROC1, PROC2, PROC8b, PROC9, PROC22, PROC24 PC19 ERC1
Processes, tasks, activities covered	Use of nickel hydroxycarbonate in the production of nickel powder Industrial use
Assessment method	Estimation of inhalation exposure based on measured data. Estimation of dermal exposure based on Tier 1 model. Modeled dermal exposure data using MEASE.

2. Operational conditions and risk management measures

2.1.1 Contributing scenario controlling worker exposure (PROC1, PROC2, PROC8b, PROC9)

Raw material handling		
PROC1	Use in closed process, no likelihood of exposure	
PROC2	Use in closed, continuous process with occasional controlled exposure	
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities	
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	
Product characteristics		
Concentration of substance in product	> 40 %	
	Nickel hydroxycarbonate; Others < 0.1%; Particle size (d50) ~40µm	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	All production workers generally work 8 hours per shift. There are three shifts per day. Duration of drums transfer operations is 10 minutes per container and 10 minutes per hour for small containers.	
Human factors not influenced by risk management	Respiration volume under conditions of use	not relevant
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	480 cm^2
	Body weight:	not relevant
Other given operational conditions affecting workers exposure	Good personal hygiene practices. Nickel hydroxycarbonate is received in enclosed drums and there is no direct contact with the product except during interventions for checking and sampling operations.	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	Use of entirely enclosed drums. Drum emptying line is semi-automated. The transfer process is fully automated. Interventions are limited to checking and supervision operations.	
Technical conditions and measures to control dispersion from source towards the worker	None	
Organisational measures to prevent /limit releases, dispersion and exposure	Good personal hygiene practices are provided for new starts and annually for permanent and contractual employees.	
Conditions and measures related to personal protection, hygiene and health evaluation	Use of personal protective equipment, gloves is required	

2.1.2 Contributing scenario controlling worker exposure (PROC1, PROC8b, PROC9, PROC22)

Hydrogen reduction of nickel hydroxycarbonate in enclosed kiln	
PROC1	Use in closed process, no likelihood of exposure
PROC2	Use in closed, continuous process with occasional controlled exposure
PROC22	Potentially closed processing operations with minerals/metals at elevated temperature Industrial setting

Product characteristics		
Concentration of substance in product	> 40 %	
	Nickel hydroxycarbonate; Others < 0.1%; Particle size (d50) ~40µm, Ni powder: Ni = 100%, Ficher size < 2.5 µm	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	1 small container of 5 kg is filled every 15 minutes. Sampling 1: granular analysis (exit of the kiln), twice per 8 hr shift = 10min/8hours; Sampling 2 : full analysis (after homogenization), twice per 8 hr shift = 8min/8hours	
Human factors not influenced by risk management	Respiration volume under conditions of use	not relevant
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	1980 cm^2 (PROC19)
	Body weight:	not relevant
Other given operational conditions affecting workers exposure	The process is fully automated and supervised from a control room. Routine operations are conducted by the operators from control rooms. Therefore, worker exposure is most likely to occur during inspection rounds and residue discharge and packing. Exposure and biological monitoring of operators is regularly performed Good personal hygiene practices.	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	The reduction process of nickel hydroxycarbonate in the production of nickel powder shall be fully enclosed to ensure containment of dust emission, hydrogen and nitrogen or other gaseous and volatile materials inside the production unit.	
Technical conditions and measures to control dispersion from source towards the worker	LEV is required to prevent dust emission at stages where dust is generated	
Organisational measures to prevent /limit releases, dispersion and exposure	None	
Conditions and measures related to personal protection, hygiene and health evaluation	Dermal exposure shall be controlled by use of gloves and long sleeve overalls. During sampling and other interventions gloves (e.g. chemical resistant gloves) are required. Exposure during emergency or non-routine production situations (such as leakage through a breach in the integrity of the kiln) shall be controlled by use of Self Contained Breathing Apparatus (SCBA) when entering kilns and other confined spaces. Use of full- or half-face disposable mask with P3 filter is required for other activities. During transfer and handling operations, powder packaging, collection of residues from the reduction Kiln and for other dusty jobs, workers shall wear P3 half mask disposable respirators.	

2.1.3 Contributing scenario controlling worker exposure (PROC8b, PROC9, PROC24)

Crushing/homogenization of nickel powder, packaging and storage	
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)
PROC24	High (mechanical) energy work-up of substances bound in materials and/or articles

Product characteristics		
Concentration of substance in product	100 %	
	Ni powder: Ni = 100%, Ficher size < 2.5 µm	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	Once every three days	
Human factors not influenced by risk management	Respiration volume under conditions of use	not relevant
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	not relevant

	Body weight:	not relevant
Other given operational conditions affecting workers exposure	Good personal hygiene practices. Exposure and biological monitoring of operators are regularly performed. Weight limit for storage of Ni powder is respected. Regular inspection and routine maintenance are made.	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	Homogenization hoppers shall be enclosed. Ni powder from enclosed homogenization hoppers shall be moved via fenced transfer systems to drum packaging lines, fitted with dust extraction systems at the filling point.	
Technical conditions and measures to control dispersion from source towards the worker	LEV shall be used for controlling dust and gas emission from reactor. LEV shall be installed at points on transfer line and drumming line where emission may occur including at the end of the process for packaging product. Fixed capturing shall be directed at the source of emission. The design shall enable that the work can be performed in the capture zone of the ventilation system and the capture shall be indicated at the workplace	
Organisational measures to prevent /limit releases, dispersion and exposure	Investigation of the relationship between observed nickel aerosol in workplace and urinary nickel and blood nickel of workers	
Conditions and measures related to personal protection, hygiene and health evaluation	Good practices and hygiene issues are reinforced. Exposure and biological monitoring of operators is regularly performed. All workers wear gloves and respiratory protective equipment during their interventions. Process control: regular inspection and routine maintenance are made. Ventilation control: Local exhaust ventilation (LEV) is use for controlling dust and gas emission from reactor. Investigation of the relationship between observed nickel aerosol in workplace and urinary nickel and blood nickel	

2.1.4 Contributing scenario controlling worker exposure (PROC0)

Cleaning and maintenance operations	
PROC0	Other Process or activity

Product characteristics		
Concentration of substance in product	> 40 %	
	Nickel hydroxycarbonate; Others < 0.1%; Particle size (d50) ~40µm, Ni powder: Ni = 100%, Ficher size < 2.5 µm	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	Routine cleaning of crushing/homogenization unit, spills and maintenance incidences: once every 3 days or as they occur (duration approximately 1-4 hrs). Scheduled cleaning and maintenance: frequency and duration approximately 4- 8 hrs every 6 months to 1 year.	
Human factors not influenced by risk management	Respiration volume under conditions of use	Light to medium level work, 10 m^3/d
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	960 cm^2
	Body weight:	70 kg
Other given operational conditions affecting workers exposure	None	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	None	
Technical conditions and measures to control dispersion from source towards the worker	None	
Organisational measures to prevent /limit releases, dispersion and exposure	Only trained workers handle the substance during cleaning and maintenance work, handling procedures are available	

Conditions and measures related to personal protection, hygiene and health evaluation	Dermal exposure shall be controlled by use of individual protection equipment such as gloves, long sleeve overalls and goggles. Use of P3 mask and disposable respirators are required to control inhalation of dust.	

2.2 Contributing scenario controlling environmental exposure (ERC6a)

ERC6a	Industrial use resulting in manufacture of another substance (use of intermediates)
Assessment method	Estimates of environmental concentrations are based on the Metal SPERC for manufacturing and recycling of massive metal and metal powder

Product characteristics		
Concentration of substance in product	> 40 %	
	Nickel hydroxycarbonate; Others < 0.1%; Particle size (d50) ~40µm	
Operational conditions		
Amounts used	Maximum daily site tonnage (kg/day):	0.53 T
	Maximum annual site tonnage (tons/year):	80 (ES 1, 2 & 3)
Frequency and duration of use	Pattern of release to the environment	150 days/yr per site
Environmental factors not influenced by risk management	Receiving surface water flow (m^3/day):	ES1 discharge to STP: 18,000 m^3/d. (Effluent site: 2000 m^3/d) ES2 direct discharge: 18,000 m^3/d. (Effluent STP: 2000 m^3/d).
	Local freshwater dilution factor:	ES 1: Discharge to STP: 10. ES 2 Direct discharge: 10
	Local marine water dilution factor:	ES 3: 100
Other given operational conditions affecting environmental exposure	None	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	None	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	On-site wastewater treatment by chemical precipitation, sedimentation, flitration, ion-exchange or a combination of methods	Efficiency: 90-99.98%
	Off-site wastewater treatment plant, municipal STP	Efficiency: 40%. (for ES 1)
	Release factor after on-site treatment based on SPERCs data for "Manufacture and recycling of massive metal and metal powder" are used (Eurometaux, 2012)	100 g Ni/T. (ES 1, 2 & 3)
	Treatment of air emission by use of fabric or bag filters, ceramic filters, wet scrubbers, dry or semi-dry scrubbers or electrostatic precipitation	Efficiency: 90-99.98%
	Release factor after on-site treatment based on SPERCs data for "Manufacture and recycling of massive metal and metal powder" are used (Eurometaux, 2012)	300 g Ni/T. (ES 1, 2 & 3)
Organisational measures to prevent/limit release from site	None	
Conditions and measures related to municipal sewage treatment plant	Municipal STP	Yes for ES 1 Discharge to STP
	Discharge rate of Municipal STP	2000 m^3/d
	Incineration of the sludge of the Municipal STP	The sludge is applied to agricultural soil
Conditions and measures related to external treatment of waste for disposal	Hazardous wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the nickel content of the waste is elevated enough, internal or external recovery/recycling might be considered.	
	Fraction of daily/annual use (expected in waste):	0.05 % Nickel producers
		0.6 % DU: stainless steel and alloy steels
		0.5 % DU: nickel alloys, copper alloys, foundry, batteries,

		catalysts, chemicals, dyes and others
		3 % DU: Plating
	Appropriate waste codes:	01 03 07*, 02 01 10*, 06 03 13*, 06 03 15*, 06 04 05*, 06 05 02*, 10 08 04, 10 08 08*, 10 08 09, 10 08 15*, 10 08 16, 10 10 03, 10 10 05*, 10 10 07*, 10 10 09*, 10 10 10, 10 10 11*, 11 02 07*, 12 01 03*, 12 01 04, 15 01 04*, 15 01 10*, 16 01 04*, 16 01 06*, 16 01 08*, 16 06 02*, 16 06 05, 16 08 02*, 16 08 03*, 17 04 07*, 17 04 09*, 19 09 04*, 19 10 02*, 19 12 03*
	Suitable disposal:	Keep separate and dispose of either. Hazardous waste incineration operated according to Council Directive 2008/98/EC on waste, Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006. Hazardous landfill operated under Directive 1999/31/EC.
Conditions and measures related to external recovery of waste	Shredders pre-treating metal wastes should have a maximum release factors to air of 0.0015 after RMM and no releases to water and soil.	
	Qmax, local (shredding) = 26 kg Ni/day	(Note: This Qmax, local for shredders is based on the existing information at the moment of the update. It will be reviewed when new information is available from the BREF for shredding)

3. Exposure estimation and reference to its source

3.1. Health

Long-term - systemic effects						
DNEL	Inhalation.: 0.05 mg/m³ Dermal:					
Contributing scenario	inhalation exposure mg/m³	RCR	Dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method
PROC1, PROC2, PROC8b, PROC9	< 0.015	< 0.3			< 0.3	Inhalation.: Static measurement at a work area. The measured Ni concentration was less than detection limit for the sample collected over 325 minutes.
PROC1, PROC2, PROC22	< 0.015	< 0.3			< 0.3	Inhalation.: Static measurement at a work area. The measured Ni concentration was less than detection limit for the sample collected over 325 minutes.
PROC0	0.021	0.42			0.42	Inhalation.: RCR 0.02 {with RPE, APF = 40} Maximum of 6 inhalable static measurements during cleaning and maintenance operations at one site. Exposure includes use of mask with P3 filter.

Acute - systemic effects

DNEL	Inhalation.: 7.1 mg/m³ Dermal:					
Contributing scenario	inhalation exposure mg/m³	RCR	Dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method
PROC1, PROC2, PROC8b, PROC9	< 0.15	< 0.02			< 0.02	Inhalation.: 10 x detection limit since measured long term exposure estimate was less than detection limit
PROC1, PROC2, PROC22	< 0.15	< 0.02			< 0.02	Inhalation.: 10 x detection limit since measured long term exposure estimate was less than detection limit
PROC0	0.21	0.03			0.03	Inhalation.: RCR 0.001 {with RPE, APF = 40} 10 x long-term exposure estimate based on a single static measurement; A factor of 10 is used because the cleaning and maintenance operations may involve presence of powders, which may result in substantial short-term variability of exposure concentrations.

Local - Inhalation.					
DNEL	Acute: 0.47 mg/m³ Long-term: 0.05 mg/m³/day				
Contributing scenario	Acute mg/m³	RCR	Long term mg/m³	RCR	Assessment method
PROC1, PROC2, PROC8b, PROC9	< 0.15	< 0.32	< 0.015	< 0.3	Acute: 10 x detection limit since measured long term exposure estimate was less than detection limit Long term: Static measurement at a work area. The measured Ni concentration was less than detection limit for the sample collected over 325 minutes.
PROC1, PROC2, PROC22	< 0.15	< 0.32	< 0.015	< 0.3	Acute: 10 x detection limit since measured long term exposure estimate was less than detection limit Long term: Static measurement at a work area. The measured Ni concentration was less than detection limit for the sample collected over 325 minutes.
PROC0	0.21	0.45	0.021	0.42	Acute: RCR 0.011 {with RPE, APF = 40} 10 x long-term exposure estimate based on a single static measurement; A factor of 10 is used because the cleaning and maintenance operations may involve presence of powders, which may result in substantial short-term variability of exposure concentrations. Long term: RCR 0.02 {with RPE, APF = 40} Maximum of 6 inhalable static measurements during cleaning and maintenance operations at one site. Exposure includes use of mask with P3 filter.

Local - Dermal					
DNEL	Acute: Long-term: 0.003 mg/cm²/day				
Contributing scenario	Acute mg/m³	RCR	Long term mg/m³	RCR	Assessment method
PROC1, PROC2, PROC22			0.00005	0.017	Long term: Exposure calculated using MEASE, a Tier 1 model for PROC 9.The process is assumed to be carried out in a closed system without breaches, with non-direct handling. It is assumed that workers wear gloves and only

					incidental exposure occurs.
PROC1, PROC2, PROC22			0.00005	0.017	Long term: Exposure calculated using MEASE, a Tier 1 model for PROC 22.The process is assumed to be carried out in a closed system without breaches, with non-direct handling. It is assumed that workers wear gloves and only incidental exposure occurs.
PROC0			0.00005	0.017	Long term: Exposure calculated using MEASE, a Tier 1 model for PROC 10. sThe process is assumed to be carried out in a closed system without breaches, with non-direct handling. It is assumed that workers wear gloves and only incidental exposure occurs.

3.2. Environment

environmental exposure	Unit	Exposure Estimation	PNEC	RCR	Assessment method
freshwater	mg/l	0.0029	0.0071	0.00068	Metal SPERC for manufacturing and recycling of massive metal and metal powder is used for estimation of environmental concentrations
marine water	mg/l	0.0003	0.0084	0.00006	
freshwater sediment	mg/kg dwt	33.5	136	0.62	
Marine water sediment	mg/kg dwt	16.1	136	0.16	
Sewage treatment plant	mg/l		0.33	0.05	
Soil	mg/kg dwt	16.2	29.9	0.54	

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

4.1. Health

Guidance - Health	Scaling considering duration and frequency of use. Collect process monitoring data with an inhalable sampler. The simultaneous use of a respirable sampler is encouraged. Use aerosol particle size information, when available, to confirm the appropriate use of the inhalable DNEL of 0.05 mg Ni/m^3. Respirable fraction exposure levels should be kept below 0.01 mg Ni/m^3.

4.2. Environment

Guidance - Environment	Scaling tool: Metals EUSES IT tool (free download: http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool). Scaling of the release to air and water environment includes: Refining of the release factor to air and waste water and/or and the efficiency of the air filter and wastewater treatment facility. Scaling of the PNEC for aquatic environment and soil compartment by using a tiered approach for correction for bioavailability and background concentration (Clocal approach).

1. Exposure scenario ES 11

Use of nickel hydroxycarbonate in the formulation of surface treatment products

ES Ref.: ES 11 ES Type: Worker	

Use descriptors	SU3, SU9 PROC0, PROC1, PROC3, PROC5, PROC8b, PROC9, PROC15, PROC26 PC14 ERC2
Processes, tasks, activities covered	Raw material handling Raw material mixing Packaging (Ni-containing phosphate conversion coatings and perhaps plating solutions) Cleaning and maintenance Laboratory testing Industrial use
Assessment method	Estimation of dermal and inhalation exposure using a Tier 1 model (MEASE)

2. Operational conditions and risk management measures

2.1.1 Contributing scenario controlling worker exposure (PROC1, PROC8b, PROC9)

Raw material handling	
PROC1	Use in closed process, no likelihood of exposure
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

Product characteristics		
Physical form of product	Nickel hydroxycarbonate-containing solution or slurry	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	Task is of short duration and low frequency e.g. the duration of raw material handling is 2 minutes and frequency of 6 times a year	
Human factors not influenced by risk management	Respiration volume under conditions of use	Light to medium level work, 10 m^3/d
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	240 cm^2
	Body weight:	70 kg
Other given operational conditions affecting workers exposure	Oral: Good workplace hygiene practice	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	Transferring nickel hydroxycarbonate solution from tankers into bulk storage should be enclosed e.g. pipelines and automated	
Technical conditions and measures to control dispersion from source towards the worker	LEV is required to extract mists and aerosols from processes that are not fully enclosed and are likely to give rise to Ni-containing aerosols	
Organisational measures to prevent /limit releases, dispersion and exposure	Training to reinforce good workplace hygiene practice and hygiene issues.	
Conditions and measures related to personal protection, hygiene and health evaluation	Inhalation: Air-assisted filtering visor, masks or hood with P3 filter element (Assigned Protection Factor ~20 based on use of powered respirator meeting EN12492 requirement or FFP3 (EN149) or equivalent suitable respirator) is required for emergencies and non-routine tasks where exposure to nickel carboxycarbonate containing mist or dust is possible e.g. spills or leaks from breaches in transfer systems. It is important to note that the disposable maks FFP1 (with APF = 4) is not recommended for use with Ni-containing aerosols. Dermal: Suitable gloves (EN 374, protection level 6, PVC or equivalent), and goggles. Other protective equipment e.g. special safety clothing should be chosen based on activities being undertaken, potential for exposure to airborne nickel-containing	

	aerosols and other relevant workplace hazards may include protective suit with hood (conforming to EN13982-1 Type 5) and safety shoes (e.g. according to EN 20346)	

2.1.2 Contributing scenario controlling worker exposure (PROC3, PROC5, PROC8b, PROC26)

Raw material mixing	
PROC1	Use in closed process, no likelihood of exposure
PROC3	Use in closed batch process (synthesis or formulation)
PROC5	Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
PROC26	Handling of solid inorganic substances at ambient temperature

Product characteristics		
Physical form of product	Nickel hydroxycarbonate-containing solution or slurry	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	Task is of short duration and low frequency e.g. the duration of raw material handling is 2 minutes and frequency of 6 times a year	
Human factors not influenced by risk management	Respiration volume under conditions of use	Light to medium level work, 10 m^3/d
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	240 cm^2 - 480 cm^2
	Body weight:	70 kg
Other given operational conditions affecting workers exposure	Oral: Good workplace hygiene practice	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	Mixing is automated and enclosed where possible and needs to be ventilated where not fully enclosed in order to control inhalation exposure to Ni-containing mists and aerosols.	
Technical conditions and measures to control dispersion from source towards the worker	LEV is required to extract mists and aerosols from processes that are not fully enclosed and are likely to give rise to Ni-containing aerosols. e.g. during the act of charging.	
Organisational measures to prevent /limit releases, dispersion and exposure	Training to reinforce good workplace hygiene practice and hygiene issues.	
Conditions and measures related to personal protection, hygiene and health evaluation	Inhalation: Air-assisted filtering visor, masks or hood with P3 filter element (Assigned Protection Factor ~20 based on use of powered respirator meeting EN12492 requirement or FFP3 (EN149) or equivalent suitable respirator) is required for emergencies and non-routine tasks where exposure to Ni-containing mist or aerosol is possible or for operations that are not fully enclosed and are likely to give rise to Ni-containing mists or aerosol and where there is contamination with Ni-containing solutions and dusts. It is important to note that the disposable mask FFP1 (with APF = 4) is not recommended for use with Ni-containing aerosols. Dermal: Suitable gloves (EN 374, protection level 6, PVC or equivalent), and goggles. Other protective equipment e.g. special safety clothing should be chosen based on activities being undertaken, potential for exposure to airborne nickel-containing aerosols and other relevant workplace hazards may include protective suit with hood (conforming to EN13982-1 Type 5) and safety shoes (e.g. according to EN 20346)	

2.1.3 Contributing scenario controlling worker exposure (PROC8b, PROC9)

Packaging	
PROC8b	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
PROC9	Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

Product characteristics

Physical form of product	Nickel hydroxycarbonate-based solution	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	Task is of short duration and low frequency e.g. the duration of raw material handling is 2 minutes and frequency of 6 times a year	
Human factors not influenced by risk management	Respiration volume under conditions of use	Light to medium level work, 10 m^3/d
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	480 cm^2
	Body weight:	70 kg
Other given operational conditions affecting workers exposure	Oral: Good workplace hygiene practice	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	Packaging is automated and enclosed where possible. The process needs to be ventilated where not fully enclosed in order to control inhalation exposure to Ni-containing mists and aerosols.	
Technical conditions and measures to control dispersion from source towards the worker	LEV is required to extract any aerosols for processes that are not fully enclosed and are likely to give rise to Ni-containing mists and automation is require to prevent dermal exposure to Ni-containing aerosols.	
Organisational measures to prevent /limit releases, dispersion and exposure	Training to reinforce good workplace hygiene practice and hygiene issues.	
Conditions and measures related to personal protection, hygiene and health evaluation	Inhalation: Air-assisted filtering visor, masks or hood with P3 filter element (Assigned Protection Factor ~20 based on use of powered respirator meeting EN12492 requirement or FFP3 (EN149) or equivalent suitable respirator) is required for emergencies and non-routine tasks where exposure to Ni-containing mist or aerosol is possible or for operations that are not fully enclosed and are likely to give rise to Ni-containing mists or aerosol and where there is contamination with Ni-containing solutions and dusts. It is important to note that the disposable mask FFP1 (with APF = 4) is not recommended for use with Ni-containing aerosols. Dermal: Suitable gloves (EN 374, protection level 6, PVC or equivalent), and goggles. Other protective equipment e.g. special safety clothing should be chosen based on activities being undertaken, potential for exposure to airborne nickel-containing aerosols and other relevant workplace hazards may include protective suit with hood (conforming to EN13982-1 Type 5) and safety shoes (e.g. according to EN 20346)	

2.1.4 Contributing scenario controlling worker exposure (PROC0)

Cleaning and maintenance	
PROC0	Other Process or activity

Product characteristics		
Physical form of product	Nickel hydroxycarbonate-containing solution or slurry, Nickel hydroxycarbonate-containing dust	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	Duration of exposure is considered to average between 60 and 240 minutes and is carried out around 6 times a year.	
Human factors not influenced by risk management	Respiration volume under conditions of use	Light to medium level work, 10 m^3/d
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	960 cm^2
	Body weight:	70 kg

Other given operational conditions affecting workers exposure	Oral: Good workplace hygiene practice	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	None	
Technical conditions and measures to control dispersion from source towards the worker	Local (where appropriate) and general exhaust ventilation. Vacuuming or suitable wet removal methods for cleaning settled dust etc. from plant and premises. Avoid inappropriate cleaning methods such as dry brushing.	
Organisational measures to prevent /limit releases, dispersion and exposure	Training to reinforce good workplace hygiene practice and hygiene issues.	
Conditions and measures related to personal protection, hygiene and health evaluation	Inhalation to mists and particulates and skin exposure to mists, liquids splashes and particulates shall be controlled by RPE and gloves when undertaking maintenance and cleaning work. Inhalation: Use of air-assisted filtering visor, masks or hood with P3 filter element for plant or premises heavily contaminated with nickel-containing dust or spills {APF 20 or 40 based on use of powered respirator meeting EN12492 or EN12941 requirement or FFP3 (EN136) or equivalent suitable respirator}. RPE with a lower APF of 10 {air-assisted filtering visor, masks or hood with P2 filter element including powered respirators meeting the EN12492 TM1 or EN12941 TH1 requirement or the FFP2 (EN149) or equivalent suitable respirator} may be used for cleaning and maintenance work where the plant or premises is less heavily contaminated with nickel-containing dust or spills. It is important to note that the disposable mask FFP1 (with APF = 4) is not recommended for use with Ni-containing dust. Dermal: Suitable gloves (EN 374, protection level 6, PVC or equivalent), and goggles. Other protective equipment e.g. special safety clothing should be chosen based on activities being undertaken, potential for exposure to airborne nickel-containing aerosols and other relevant workplace hazards may include protective suit with hood (conforming to EN13982-1 Type 5) and safety shoes (e.g. according to EN 20346)	

2.1.5 Contributing scenario controlling worker exposure (PROC15)

Laboratory testing	
PROC15	Use as laboratory reagent

Product characteristics		
Physical form of product	Nickel hydroxycarbonate-containing solution or slurry	
Operational conditions		
Amounts used	Not relevant	
Frequency and duration of use	Duration of exposure is considered to average between 60 and 240 minutes and is carried out around 6 times a year.	
Human factors not influenced by risk management	Respiration volume under conditions of use	Light to medium level work, 10 m^3/d
	Room size and ventilation rate	not relevant
	Area of skin contact with the substance under condition of use	240 cm^2
	Body weight:	70 kg
Other given operational conditions affecting workers exposure	Oral: Good workplace hygiene practice	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	None	
Technical conditions and measures to control dispersion from source towards the worker	Handle in a fume cupboard.	

Organisational measures to prevent /limit releases, dispersion and exposure	Training to reinforce good workplace hygiene practice and hygiene issues.	
Conditions and measures related to personal protection, hygiene and health evaluation	Inhalation: Air-assisted filtering visor, masks or hood with P3 filter element (Assigned Protection Factor ~20 based on use of powered respirator meeting EN12492 requirement or FFP3 (EN149) or equivalent suitable respirator) is required for emergencies and non-routine tasks where exposure to Ni-containing mist or aerosol is possible or for operations that are not fully enclosed and are likely to give rise to Ni-containing mists or aerosol and where there is contamination with Ni-containing solutions and dusts. It is important to note that the disposable mask FFP1 (with APF = 4) is not recommended for use with Ni-containing aerosols. Dermal: Suitable gloves (EN 374, protection level 6. PVC or equivalent), and goggles. Other protective equipment e.g. special safety clothing should be chosen based on activities being undertaken, potential for exposure to airborne nickel-containing aerosols and other relevant workplace hazards may include protective suit with hood (conforming to EN13982-1 Type 5) and safety shoes (e.g. according to EN 20346)	

2.2 Contributing scenario controlling environmental exposure (ERC2)

Use of nickel metal in formulating surface treatment products	
ERC2	Formulation of preparations

Product characteristics		
Physical form of product	Powder and liquid (solution of Ni hydroxycarbonate)	
Operational conditions		
Amounts used	Maximum daily use at site	0.17 T ES 1 & ES 2: Maximum
		0.88 T (ES 3). Minimum
	Maximum annual use at site	41 t/yr ES 1 & ES 2: (75P)
		21 t/yr (ES 3). (50P)
Frequency and duration of use	Pattern of release to the environment	240 days per site
Environmental factors not influenced by risk management	Receiving surface water flow (m³/day):	ES1 discharge to STP: 18,000 m^3/d. (Effluent STP: 2000 m^3/d). ES 2 Direct discharge: 4975 m^3/d (Effluent Site: 25 m3/d)
	Local freshwater dilution factor:	ES 1: Discharge to STP: 10. ES 2 direct discharge: 200
	Local marine water dilution factor:	ES 3: 100
Other given operational conditions affecting environmental exposure	None	
Risk management measures		
Technical conditions and measures at process level (source) to prevent release	None	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	On-site wastewater treatment by chemical precipitation, sedimentation, flitration, ion-exchange or a combination of methods. Off-site wastewater treatment plant, municipal STP	Efficiency: 40%
	ES 1 & ES 2: Release factor after on-site wastewater treatment (g/T):	116
	ES 3 marine direct discharge, Release factor after on-site wastewater treatment (g/T):	116
	Treatment in exhaust system (fabric or bag filters, electrostatic precipitation, ceramic filters, wet, dry or semi-dry scrubbers)	Efficiency: 99%
	Release factor after on-site air treatment (g/T)	50 (ES 1, 2 & 3). SPERC
Organisational measures to prevent/limit release from site	None	
Conditions and measures related to municipal sewage	Municipal STP	Yes.

treatment plant	Discharge rate of Municipal STP	2000 m^3/d
	Incineration of the sludge of the Municipal STP	The sludge is applied to agricultural soil
Conditions and measures related to external treatment of waste for disposal	Hazardous wastes from onsite risk management measures and solid or liquid wastes from production, use and cleaning processes should be disposed of separately to hazardous waste incineration plants or hazardous waste landfills as hazardous waste. Releases to the floor, water and soil are to be prevented. If the nickel content of the waste is elevated enough, internal or external recovery/recycling might be considered.	
	Fraction of daily/annual use (expected in waste):	0.05 % Nickel producers
		0.6 % DU: stainless steel and alloy steels
		0.5 % DU: nickel alloys, copper alloys, foundry, batteries, catalysts, chemicals, dyes and others
		3 % DU: Plating
	Appropriate waste codes:	01 03 07*, 02 01 10*, 06 03 13*, 06 03 15*, 06 04 05*, 06 05 02*, 10 08 04, 10 08 08*, 10 08 09, 10 08 15*, 10 08 16, 10 10 03, 10 10 05*, 10 10 07*, 10 10 09*, 10 10 10, 10 10 11*, 11 02 07*, 12 01 03*, 12 01 04, 15 01 04*, 15 01 10*, 16 01 04*, 16 01 06*, 16 01 08*, 16 06 02*, 16 06 05, 16 08 02*, 16 08 03*, 17 04 07*, 17 04 09*, 19 09 04*, 19 10 02*, 19 12 03*
	Suitable disposal:	Keep separate and dispose of either. Hazardous waste incineration operated according to Council Directive 2008/98/EC on waste, Directive 2000/76/EC on the incineration of waste and the Reference Document on the Best Available Techniques for Waste Incineration of August 2006. Hazardous landfill operated under Directive 1999/31/EC.
Conditions and measures related to external recovery of waste	Shredders pre-treating metal wastes should have a maximum release factors to air of 0.0015 after RMM and no releases to water and soil.	
	Qmax, local (shredding) = 26 kg Ni/day	(Note: This Qmax, local for shredders is based on the existing information at the moment of the update. It will be reviewed when new information is available from the BREF for shredding)

3. Exposure estimation and reference to its source

3.1. Health

Long-term - systemic effects						
DNEL	Inhalation.: 0.05 mg/m³ Dermal:					
Contributing scenario	inhalation exposure mg/m³	RCR	Dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method

PROC1, PROC8b, PROC9	0.001	0.02			0.02	Inhalation.: 90th percentile exposure estimate modelled using MEASE for PROCS 1, 8b & 9 {Ni content >25%, closed system without breaches, non-direct handling, incidental exposure, enclosed, duration <15 minutes, gloves}
PROC1, PROC3, PROC5, PROC8b, PROC26	0.001	0.02			0.02	Inhalation.: 90th percentile exposure estimate modelled using MEASE for PROC1, 3, 5 & 8b {Ni content 5-25%, non-dispersive use, non-direct handling, incidental exposure, enclosed, duration <15 minutes, gloves}
PROC8b, PROC9	0.001	0.02			0.02	Inhalation.: 90th percentile exposure estimate modelled using MEASE for PROCS 8b & 9 {Ni content 5-25%, non-dispersive use, non-direct handling, incidental exposure, general ventilation, duration <15 minutes, gloves}
PROC0	1.03	20.5			20.5	Inhalation.: {excluding RPE}; 0.026, RCR 0.52 {by use of RPE, APF = 40} 90th percentile exposure estimate using MEASE for PROC 10 {Ni content >25%, non-dispersive use, non-direct handling incidental exposure, general ventilation, duration 60-240 minutes, general ventilation, gloves}
PROC15	0.001	0.02			0.02	Inhalation.: 90th percentile exposure estimate modelled using MEASE for PROCS 15 {Ni content >25%, non-dispersive use, non-direct handling, incidental exposure, LEV, 60-240 minutres, gloves}

Acute - systemic effects						
DNEL	Inhalation.: 7.1 mg/m³ Dermal:					
Contributing scenario	inhalation exposure mg/m³	RCR	Dermal exposure mg/kg bodyweight/day	RCR	Sum RCR	Assessment method
PROC1, PROC8b, PROC9	0.003	0.00042			0.000	Inhalation.: 3 x long-term exposure/inhalable modelled estimate
PROC1, PROC3, PROC5, PROC8b, PROC26	0.003	0.00042			0.000	Inhalation.: 3 x long-term exposure/inhalable modelled estimate
PROC8b, PROC9	0.003	0.00042			0.000	Inhalation.: 3 x long-term exposure/inhalable modelled estimate
PROC0	3.078	0.43			0.43	Inhalation.: 3 x long-term exposure/inhalable modelled estimate
PROC15	0.003	0.00042			0.000	Inhalation.: 3 x long-term exposure/inhalable modelled estimate

Local - Inhalation.					
DNEL	Acute: 0.47 mg/m³ Long-term: 0.05 mg/m³/day				
Contributing scenario	Acute mg/m³	RCR	Long term mg/m³	RCR	Assessment method
PROC1, PROC8b, PROC9	0.003	0.0063	0.001	0.02	Acute: 3 x long-term exposure/inhalable modelled estimate

					Long term: 90th percentile exposure estimate modelled using MEASE for PROCS 1, 8b & 9 {Ni content >25%, closed system without breaches, non-direct handling, incidental exposure, enclosed, duration <15 minutes, gloves}
PROC1, PROC3, PROC5, PROC8b, PROC26	0.003	0.0063	0.001	0.02	Acute: 3 x long-term exposure/inhalable modelled estimate Long term: 90th percentile exposure estimate modelled using MEASE for PROC1, 3, 5 & 8b {Ni content 5-25%, non-dispersive use, non-direct handling, incidental exposure, enclosed, duration <15 minutes, gloves}
PROC8b, PROC9	0.003	0.0063	0.001	0.02	Acute: 3 x long-term exposure/inhalable modelled estimate Long term: 90th percentile exposure estimate modelled using MEASE for PROCS 8b & 9 {Ni content 5-25%, non-dispersive use, non-direct handling, incidental exposure, general ventilation, duration <15 minutes, gloves}
PROC0	3.078	6.6	1.03	20.5	Acute: {excluding RPE}; 0.308, RCR 0.66 {by use of RPE, APF 10} 3 x long-term exposure/inhalable modelled estimate Long term: {excluding RPE}; 0.026, RCR 0.52 {by use of RPE, APF 40} 90th percentile exposure estimate using MEASE for PROC 10 {Ni content >25%, non-dispersive use, non-direct handling incidental exposure, general ventilation, duration 60-240 minutes, general ventilation, gloves}
PROC15	0.003	0.0063	0.001	0.02	Acute: 3 x long-term exposure/inhalable modelled estimate Long term: 90th percentile exposure estimate modelled using MEASE for PROCS 15 {Ni content >25%, non-dispersive use, non-direct handling, incidental exposure, LEV, 60-240 minutres, gloves}

Local - Dermal					
DNEL	Acute: Long-term: 0.003 mg/cm²/day				
Contributing scenario	Acute mg/m³	RCR	Long term mg/m³	RCR	Assessment method
PROC1, PROC8b, PROC9			0.000005	0.0017	Long term: 90th percentile exposure estimate modelled using MEASE for PROCS 1, 8b & 9 {Ni content >25%, closed system without breaches, non-direct handling, incidental exposure, enclosed, duration <15 minutes, gloves}
PROC1, PROC3, PROC5, PROC8b, PROC26			0.000003	0.001	Long term: 90th percentile exposure estimate modelled using MEASE for PROC1, 3, 5 & 8b {Ni content 5-25%, non-dispersive use, non-direct handling, incidental exposure, enclosed, duration <15 minutes, gloves}
PROC8b, PROC9			0.000003	0.001	Long term: 90th percentile exposure estimate modelled using MEASE for PROCS 8b & 9 {Ni content 5-25%, non-dispersive use, non-direct handling, incidental exposure, general ventilation, duration <15 minutes, gloves}
PROC0			0.000003	0.01	Long term: 90th percentile exposure estimate using MEASE for PROC 10 {Ni content >25%, non-dispersive use, non-direct handling incidental exposure, general ventilation, duration 60-240 minutes, general ventilation, gloves}
PROC15			0.000003	0.01	Long term: 90th percentile exposure estimate modelled using MEASE for PROCS 15 {Ni

					content >25%, non-dispersive use, non-direct handling, incidental exposure, LEV, 60-240 minutres, gloves}

3.2. Environment

environmental exposure	Unit	Exposure Estimation	PNEC	RCR	Assessment method
freshwater	mg/l	0.0029	0.0071	0.85	Measured values, Tier 3-RWC
marine water	mg/l	0.0003	0.0084	0.4	Measured values, Tier 3-RWC
freshwater sediment	mg/kg dwt	33.5	136	0.85	Measured values, Tier 3-RWC
Marine water sediment	mg/kg dwt	16.1	136	0.73	Measured values, Tier 3-RWC
Sewage treatment plant	mg/l		0.33	0.02	Measured values, Tier 3-RWC
Soil	mg/kg dwt	16.2	29.9	0.54	Measured values, Tier 3-RWC

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

4.1. Health

Guidance - Health	Scaling considering duration and frequency of use. Collect process monitoring data with an inhalable sampler. The simultaneous use of a respirable sampler is encouraged. Use aerosol particle size information, when available, to confirm the appropriate use of the inhalable DNEL of 0.05 mg Ni/m^3. Respirable fraction exposure levels should be kept below 0.01 mg Ni/m^3.

4.2. Environment

Guidance - Environment	Scaling tool: Metals EUSES IT tool (free download: http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool). Scaling of the release to air and water environment includes: Refining of the release factor to air and waste water and/or and the efficiency of the air filter and wastewater treatment facility. Scaling of the PNEC for aquatic environment and soil compartment by using a tiered approach for correction for bioavailability and background concentration (Clocal approach).