SAFETY DATA SHEET

Based upon Regulation (EC) No 1907/2006, as amended by Regulation (EU) No 2020/878

indium, solid, in massive state

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

1.1. Product identifier

Product name : indium, solid, in massive state
Synonyms : indium
Registration number REACH : 01-2120756870-48-0011 (Nyrstar France SAS)
Product type REACH : Substance/mono-constituent
CAS number : 7440-74-6
EC number : 231-180-0
Molecular mass : 114.82 g/mol
Formula : In

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

1.2.1 Relevant identified uses

IU01: Manufacture of Indium
IU04: Uses at industrial sites: Use as an intermediate
IU05: Uses at industrial sites: Use of In-alloys for production of heat transfer fluids
IU07: Uses at industrial sites: Semiconductor and photovoltaic agent; Manufacture

1.2.2 Uses advised against

No uses advised against known

1.3. Details of the supplier of the safety data sheet

Supplier of the safety data sheet

Nyrstar France S.A.S. on behalf of Nyrstar Sales & Marketing A.G.
Rue Jean Jacques Rousseau
F-59950 Auby
☎ +32 14 44 96 80
🖷 +33 3 27 88 39 48
infoSDS@nyrstar.com

Manufacturer of the product

Nyrstar Sales & Marketing SA
1 Rue de Jargonnant
CH-1207 Geneva
infoSDS@nyrstar.com

1.4. Emergency telephone number

24h/24h (Telephone advice: English, French, German, Dutch) :
+32 14 58 45 45 (BIG)

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classified as dangerous according to the criteria of Regulation (EC) No 1272/2008

Class	Category	Hazard statements
STOT RE	category 1	H372: Causes damage to organs (lungs) through prolonged or repeated exposure if inhaled.
Aquatic Chronic	category 2	H411: Toxic to aquatic life with long lasting effects.

2.2. Label elements

This substance/mixture, although classified dangerous, does not require a label because of the form in which it is placed on the market (Regulation (EC) No 1272/2008 Annex I chapter 1.3.4)

2.3. Other hazards

The criteria of PBT and vPvB as listed in Annex XIII of Regulation (EC) No 1907/2006 do not apply to inorganic substances
Heated product causes burns

SECTION 3: Composition/information on ingredients

3.1. Substances

Name REACH Registration No	CAS No EC No	Conc. (C)	Classification according to CLP	Note	Remark	M-factors and ATE
indium 01-2120756870-48	7440-74-6 231-180-0	C>99 %	STOT RE 1; H372 Aquatic Chronic 2; H411	(1)(2)	Mono-constituent	

(1) For H- and EUH-statements in full: see section 16
(2) Substance with a Community workplace exposure limit

3.2. Mixtures

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

General:
Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with laboured breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain. Depending on the victim's condition: doctor/hospital.

After inhalation:
After inhalation of fume: Remove the victim into fresh air. Respiratory problems: consult a doctor/medical service.

After skin contact:
In case of burns: Wash immediately with lots of water (15 minutes)/shower. Remove clothing while washing. Do not tear off solidified product from the skin. Do not remove clothing if it sticks to the skin. Cover wounds with sterile bandage. Consult a doctor/medical service. If burned surface > 10%: take victim to hospital.

After eye contact:
In case of burns: Rinse immediately with plenty of water for 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Take victim to an ophthalmologist.

After ingestion:
Not applicable.

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

4.2.1 Acute symptoms

After inhalation:
AFTER INHALATION OF FUME: Feeling of weakness. Metal fume fever. Vomiting. Nausea.

After skin contact:
If molten: burns.

After eye contact:
If molten: burns.

After ingestion:
Not applicable.

4.2.2 Delayed symptoms
No effects known.

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

If applicable and available it will be listed below.

SECTION 5: Firefighting measures

5.1. Extinguishing media

5.1.1 Suitable extinguishing media:
Small fire: Dry sand, Quick-acting D powder extinguisher.

5.1.2 Unsuitable extinguishing media:
Small fire: Quick-acting CO2 extinguisher, Water, Foam, Quick-acting ABC powder extinguisher, Quick-acting BC powder extinguisher.
Major fire: Water, Foam.

5.2. Special hazards arising from the substance or mixture

On burning: formation of metal oxides. Reacts on exposure to temperature rise with many compounds e.g. (some) acids, (some) halogens and (some) metals. In molten state: violent to explosive reaction with water (moisture).

5.3. Advice for firefighters

5.3.1 Instructions:
In case of metal bath fire: add metal blocks. When cooling/extinguishing: no water in the substance.

5.3.2 Special protective equipment for fire-fighters:
Gloves (EN 374). Protective clothing (EN 14605 or EN 13034). Heat/fire exposure: self-contained breathing apparatus (EN 136 + EN 137).

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

No naked flames.

6.1.1 Protective equipment for non-emergency personnel
See section 8.2

6.1.2 Protective equipment for emergency responders
Gloves (EN 374). Protective clothing (EN 14605 or EN 13034).

Suitable protective clothing
See section 8.2

6.2. Environmental precautions

Prevent soil and water pollution. Prevent spreading in sewers.

6.3. Methods and material for containment and cleaning up

If melted: allow liquid to solidify before taking it up. Pick-up the material. Take collected spill to manufacturer/competent authority. Wash clothing and equipment after handling.

6.4. Reference to other sections

See section 13.

SECTION 7: Handling and storage

The information in this section is a general description. If applicable and available, exposure scenarios are attached in annex. Always use the relevant exposure scenarios that correspond to your identified use.

7.1. Precautions for safe handling

Avoid raising dust. Observe very strict hygiene - avoid contact. On (re)melting down: dry and preheat installation before use. Add only dry material to the metal bath. Do not discharge the waste into the drain.

7.2. Conditions for safe storage, including any incompatibilities

7.2.1 Safe storage requirements:

Store in a dry area. Keep container in a well-ventilated place. Store at room temperature. Meet the legal requirements. Quantity limits: Not applicable. Not applicable.

7.2.2 Keep away from:

Heat sources, (strong) acids, oxidizing agents, halogens.

7.2.3 Suitable packaging material:

No data available

7.2.4 Non suitable packaging material:

No data available

7.3. Specific end use(s)

If applicable and available, exposure scenarios are attached in annex. See information supplied by the manufacturer.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

8.1.1 Occupational exposure

a) Occupational exposure limit values

If limit values are applicable and available these will be listed below.

Belgium

Indium et composés (en In)	Time-weighted average exposure limit 8 h	0.1 mg/m³

Germany

Indium	Time-weighted average exposure limit 8 h (TRGS 900)	0.0001 mg/m³

Austria

Indium und seine Verbindungen	Tagesmittelwert (MAK)	0.1 mg/m³
	Kurzzeitwert 15(Miw) 4x (MAK)	0.2 mg/m³

UK

Indium	Time-weighted average exposure limit 8 h (Workplace exposure limit (EH40/2005))	0.1 mg/m³
	Short time value (Workplace exposure limit (EH40/2005))	0.3 mg/m³

USA (TLV-ACGIH)

Indium and compounds, as In	Time-weighted average exposure limit 8 h (TLV - Adopted Value)	0.1 mg/m³

b) National biological limit values

If limit values are applicable and available these will be listed below.

USA (BEI-ACGIH)

Indium and indium inorganic compounds, including Indium tin oxide and Indium oxide (Indium)	Serum or plasma: not critical	1 µg/L	

8.1.2 Sampling methods

Product name	Test	Number
Indium (In)	NIOSH	7306
Indium	OSHA	ID 121

8.1.3 Applicable limit values when using the substance or mixture as intended

If limit values are applicable and available these will be listed below.

8.1.4 Threshold values

DNEL/DMEL - Workers

indium, solid, in massive state

Effect level (DNEL/DMEL)	Type	Value	Remark
DNEL	Long-term local effects inhalation	6.3 µg/m³	
	Long-term systemic effects dermal	0.12 mg/kg bw/day	

PNEC

indium, solid, in massive state

Compartments	Value	Remark
Fresh water	40.6 µg/l	
Marine water	40.6 µg/l	
STP	51.6 mg/l	
Fresh water sediment	5051 mg/kg sediment dw	
Marine water sediment	5051 mg/kg sediment dw	
Soil	7.3 mg/kg soil dw	

8.1.5 Control banding

If applicable and available it will be listed below.

8.2. Exposure controls

The information in this section is a general description. If applicable and available, exposure scenarios are attached in annex. Always use the relevant exposure scenarios that correspond to your identified use.

8.2.1 Appropriate engineering controls

Avoid raising dust. On (re)melting down: measure the concentration in the air regularly. Carry operations in the open/under local exhaust/ventilation or with respiratory protection.

8.2.2 Individual protection measures, such as personal protective equipment

Observe very strict hygiene - avoid contact. Do not eat, drink or smoke during work.

a) Respiratory protection:

Dust production: dust mask with filter type P3. High dust production: self-contained breathing apparatus (EN 136 + EN 137).

b) Hand protection:

Gloves, On heating: heat insulating gloves (EN 407).

Materials	Remark
leather	Good resistance

c) Eye protection:

Safety glasses (EN 166). In case of dust production: protective goggles (EN 166).

d) Skin protection:

Protective clothing (EN 14605 or EN 13034). On (re)melting down: heatproof clothing (EN 11612). Protective clothing against molten metal splash (EN 9185). Protective clothing for workers exposed to heat (EN 11612). Safety shoes type S3.

8.2.3 Environmental exposure controls:

See sections 6.2, 6.3 and 13

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical form	Solid
	Metal
	Physical state depending on the production process
Odour	Odourless
Odour threshold	Not applicable
Colour	Silvery
Particle size	MMAD ; ISO 13320:2009 ; 1220 µm
Explosion limits	No data available
Flammability	Not classified as flammable
Log Kow	5.9 ; Literature study ; 22 °C
Dynamic viscosity	No data available
Kinematic viscosity	No data available
Melting point	157 °C ; 1013 hPa ; OECD 102
Boiling point	2080 °C ; 1013 hPa
Relative vapour density	Not applicable
Vapour pressure	< 0.01 hPa ; 25 °C
Solubility	Water ; < 1 mg/l ; 20 °C ; OECD 105
Relative density	7.3 ; 20 °C ; OECD 109
Absolute density	7290 kg/m³ ; 20 °C ; OECD 109
Decomposition temperature	No data available
Auto-ignition temperature	No data available
Flash point	Not applicable
pH	No data available

9.2. Other information

No data available

SECTION 10: Stability and reactivity

10.1. Reactivity
No data available.

10.2. Chemical stability
Stable under normal conditions.

10.3. Possibility of hazardous reactions
In molten state: violent to explosive reaction with water (moisture). Oxidizes slowly in moist air.

10.4. Conditions to avoid
Precautionary measures
Avoid raising dust.

10.5. Incompatible materials
(strong) acids, oxidizing agents, halogens.

10.6. Hazardous decomposition products
On burning: formation of metal oxides.

SECTION 11: Toxicological information

11.1. Information on hazard classes as defined in Regulation (EC) No 1272/2008
11.1.1 Test results

- Toxicokinetics: summary
The toxicokinetics of In compounds is likely dependent upon the form (solubility) of the compound administered, the dose, and the route of administration.
Absorption:
Indium and indium compounds are poorly absorbed by the oral route (0.5 -<2%) and moderately by the inhalation route (up to 18%). The absorption rate of indium is very likely a function of the chemical form. More indium can be absorbed in the lungs and tracheobronchial lymph nodes than in the gastrointestinal tract, likely due to the longer retention time when indium is deposited in the lungs.
Following inhalation or intracheal instillation, indium salts are retained in the lung and rapidly absorbed, having half-lives of approximately 1h; insoluble indium compounds, like In2O3 are absorbed slowly, with half-lives of approximately 2 months. For poorly water-soluble particles, only a few percent of inhaled particles may reach the systemic circulation by the slow dissolution and progressive absorption; a further fraction may be translocated as particles to the tracheobronchial lymph nodes and from there to the systemic circulation
Distribution and elimination:
Ionic indium is concentrated in the kidneys, producing renal failure; colloidal indium is taken up by the reticuloendothelial system, causing damage to the liver and spleen. Ionic indium is excreted primarily in urine while fecal elimination is the predominant route for the removal of colloidal indium. A biphasic pattern of excretion and a whole-body biological half-time in the order of 2 weeks have been reported for ionic and colloidal forms of indium.
The most common routes of exposure for the general population are inhalation and ingestion; for occupationally exposed persons it is inhalation.

Acute toxicity

indium, solid, in massive state

Route of exposure	Parameter	Method	Value	Exposure time	Species	Value determination	Remark
Oral	LD50	OECD 401	> 2000 mg/kg bw		Rat (male / female)	Experimental value	
Dermal						Data waiving	
Inhalation						Data waiving	

Conclusion
Not classified for acute toxicity

Corrosion/irritation

indium, solid, in massive state

Route of exposure	Result	Method	Exposure time	Time point	Species	Value determination	Remark
Not applicable (in vitro test)	Not irritating	OECD 438	10 seconds		Isolated chicken eye	Experimental value	
Not applicable (in vitro test)	Not irritating	OECD 439	15 minutes		Reconstructed human epidermis	Experimental value	

Conclusion
Not classified as irritating to the skin
Not classified as irritating to the eyes
Not classified as irritating to the respiratory system

Respiratory or skin sensitisation

indium, solid, in massive state

Route of exposure	Result	Method	Exposure time	Observation time point	Species	Value determination	Remark
Skin	Not sensitizing	OECD 406		24; 48 hours	Guinea pig (male)	Read-across	

Conclusion

Not classified as sensitizing for skin
Not classified as sensitizing for inhalation

Specific target organ toxicity

indium, solid, in massive state

Route of exposure	Parameter	Method	Value	Organ	Effect	Exposure time	Species	Value determination
Oral (stomach tube)	LD50	Equivalent to OECD 407	1000 mg/kg bw/day		No effect	28 days (1x / day)	Rat (male / female)	Experimental value
Dermal								Data waiving
Inhalation (aerosol)	NOAEL	OECD 413	0.1 mg/m³ air		No effect	13 weeks (6h / day, 5 days / week)	Rat (male / female)	Read-across
Inhalation (aerosol)	LOAEL	OECD 413	1 mg/m³ air	Lungs	Lung tissue affection/degeneration	13 weeks (6h / day, 5 days / week)	Rat (male / female)	Read-across

Conclusion

Causes damage to organs (lungs) through prolonged or repeated exposure if inhaled.
Not classified as sub-chronically toxic in contact with skin
Not classified as sub-chronically toxic if swallowed

Mutagenicity (in vitro)

indium, solid, in massive state

Result	Method	Test substrate	Effect	Value determination	Remark
Negative with metabolic activation, negative without metabolic activation	Equivalent to OECD 471	Bacteria (S.typhimurium)		Experimental value	
Negative with metabolic activation, negative without metabolic activation	Equivalent to OECD 473	CHL/IU cells		Experimental value	

Mutagenicity (in vivo)

indium, solid, in massive state

Result	Method	Exposure time	Test substrate	Organ	Value determination
Negative (Oral (stomach tube))	OECD 474		Mouse (male)		Experimental value

Conclusion

Not classified for mutagenic or genotoxic toxicity

Carcinogenicity

indium, solid, in massive state

No (test)data available

Conclusion

Not classified for carcinogenicity

Reproductive toxicity

indium, solid, in massive state

	Parameter	Method	Value	Exposure time	Species	Effect	Organ	Value determination
Developmental toxicity (Oral (stomach tube))	NOAEL	OECD 414	50 mg/kg bw/day	21 day(s)	Rat	No effect		Read-across
	NOAEL (P)	OECD 414	100 mg/kg bw/day	21 day(s)	Rat	Malformations	Foetus	Read-across
Maternal toxicity (Oral (stomach tube))	NOAEL	OECD 414	50 mg/kg bw/day	21 day(s)	Rat	No effect		Read-across
	NOAEL (F1)	OECD 414	100 mg/kg bw/day	21 day(s)	Rat	Body weight, organ weight		Read-across
Effects on fertility (Oral (stomach tube))	NOAEL		250 mg/kg bw/day		Mouse (male / female)	No effect		Experimental value

Conclusion

Not classified for reprotoxic or developmental toxicity

Toxicity other effects

indium, solid, in massive state

No (test)data available

Chronic effects from short and long-term exposure

indium, solid, in massive state

No effects known.

11.2. Information on other hazards

No evidence of endocrine disrupting properties

SECTION 12: Ecological information

12.1. Toxicity

indium, solid, in massive state

	Parameter	Method	Value	Duration	Species	Test design	Fresh/salt water	Value determination
Acute toxicity fishes	LC50		37.6 mg/l	4 day(s)	Oreochromis mossambicus	Static system		Read-across; Nominal concentration
Acute toxicity crustacea	EC50	OECD 202	26220 µg/l	48 h	Daphnia magna	Static system	Fresh water	Experimental value; Locomotor effect
Toxicity algae and other aquatic plants	EC50	OECD 201	1584 µg/l	72 h	Pseudokirchneriella subcapitata	Static system	Fresh water	Experimental value; Growth
Long-term toxicity fish	NOEC		3.76 mg/l	16 day(s)	Oreochromis mossambicus	Static system		Read-across; Nominal concentration
Long-term toxicity aquatic crustacea	NOEC	US EPA	58.1 µg/l	7 day(s)	Ceriodaphnia dubia	Semi-static system	Fresh water	Read-across; Reproduction
Toxicity aquatic micro-organisms	EC50	OECD 209	> 1000 mg/l	3 h	Activated sludge	Static system	Fresh water	Experimental value; GLP

Conclusion

Toxic to aquatic life with long lasting effects.

12.2. Persistence and degradability

Water

Biodegradability: not applicable

12.3. Bioaccumulative potential

indium, solid, in massive state

Log Kow

Method	Remark	Value	Temperature	Value determination
		5.9	22 °C	Literature study

Conclusion

High potential for bioaccumulation (Log Kow > 5)

12.4. Mobility in soil

No (test)data on mobility of the substance available

12.5. Results of PBT and vPvB assessment

The criteria of PBT and vPvB as listed in Annex XIII of Regulation (EC) No 1907/2006 do not apply to inorganic substances.

12.6. Endocrine disrupting properties

No evidence of endocrine disrupting properties

12.7. Other adverse effects

indium, solid, in massive state

Greenhouse gases

Not included in the list of fluorinated greenhouse gases (Regulation (EU) No 517/2014)

Ozone-depleting potential (ODP)

Not classified as dangerous for the ozone layer (Regulation (EC) No 1005/2009)

SECTION 13: Disposal considerations

The information in this section is a general description. If applicable and available, exposure scenarios are attached in annex. Always use the relevant exposure scenarios that correspond to your identified use.

13.1. Waste treatment methods

13.1.1 Provisions relating to waste

European Union

Hazardous waste according to Directive 2008/98/EC, as amended by Regulation (EU) No 1357/2014 and Regulation (EU) No 2017/997. The waste code must be assigned by the user, preferably in consultation with the (environmental) authorities concerned.

13.1.2 Disposal methods

Recycle/reuse. Remove waste in accordance with local and/or national regulations. Hazardous waste shall not be mixed together with other waste. Different types of hazardous waste shall not be mixed together if this may entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. All entities that store, transport or handle hazardous waste shall take the necessary measures to prevent risks of pollution or damage to people or animals. Use appropriate containment to avoid environmental contamination.

13.1.3 Packaging/Container

European Union

Waste material code packaging (Directive 2008/98/EC).
15 01 10* (packaging containing residues of or contaminated by dangerous substances).

SECTION 14: Transport information

Road (ADR), Rail (RID), Inland waterways (ADN), Sea (IMDG/IMSBC), Air (ICAO-TI/IATA-DGR)

14.1. UN number

Transport	Not subject

14.2. UN proper shipping name

14.3. Transport hazard class(es)

Hazard identification number	
Class	
Classification code	

14.4. Packing group

Packing group	
Labels	

14.5. Environmental hazards

Environmentally hazardous substance mark	no

14.6. Special precautions for user

Special provisions	
Limited quantities	

14.7. Maritime transport in bulk according to IMO instruments

Annex II of MARPOL 73/78	Not applicable

SECTION 15: Regulatory information

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

European legislation:

VOC content Directive 2010/75/EU

VOC content	Remark
	Not applicable (inorganic)

National legislation Belgium

No data available

National legislation The Netherlands

Waterbezwaarlijkheid	A (2); Algemene Beoordelingsmethodiek (ABM)

National legislation France

No data available

National legislation Germany

WGK	1; Verordnung über Anlagen zum Umgang mit wassergefährdenden Stoffen (AwSV) - 18. April 2017
TA-Luft	5.2.1

National legislation Austria

No data available

National legislation United Kingdom

No data available

Other relevant data

No data available

15.2. Chemical safety assessment

A chemical safety assessment has been performed.

SECTION 16: Other information

Full text of any H- and EUH-statements referred to under section 3:

H372 Causes damage to organs (lungs) through prolonged or repeated exposure if inhaled.
H411 Toxic to aquatic life with long lasting effects.

(*) INTERNAL CLASSIFICATION BY BIG

ADI	Acceptable daily intake
AOEL	Acceptable operator exposure level
ATE	Acute Toxicity Estimate
CLP (EU-GHS)	Classification, labelling and packaging (Globally Harmonised System in Europe)
DMEL	Derived Minimal Effect Level
DNEL	Derived No Effect Level
EC50	Effect Concentration 50 %
ErC50	EC50 in terms of reduction of growth rate
LC50	Lethal Concentration 50 %
LD50	Lethal Dose 50 %
NOAEL	No Observed Adverse Effect Level
NOEC	No Observed Effect Concentration
OECD	Organisation for Economic Co-operation and Development
PBT	Persistent, Bioaccumulative & Toxic
PNEC	Predicted No Effect Concentration
STP	Sludge Treatment Process
vPvB	very Persistent & very Bioaccumulative

1. ES 1: Manufacture

1.1. Title section

ES name: *Manufacture of Indium*

Environment	
1: Manufacture of basic metals, including alloys; Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange	ERC 1
Worker	
2: Manufacture of basic metals, including alloys; Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange	PROC 4
3: Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange; (aqueous)	PROC 3
4: Casting operations; Dry process (no water used in process)	PROC 22
5: Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange; Casting operations	PROC 23
6: Automated metal rolling/forming	PROC 14
7: Production of metal powders (hot processes)	PROC 27a

1.2. Conditions of use affecting exposure

1.2.1. Control of environmental exposure: Manufacture of basic metals, including alloys; Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange (ERC 1)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.45 tonnes/day
Annual amount per site <= 89.0 tonnes/year
Technical and organisational conditions and measures
Electrostatic precipitators or wet electrostatic precipitators or cyclones or fabric/bag filter or ceramic/metal mesh filter
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Electrostatic precipitator or wet electrostatic precipitator or cyclones or fabric/bag filter or ceramic/metal mesh filter or wet scrubber
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Conditions and measures related to biological sewage treatment plant
Provide onsite wastewater treatment.
Assumed domestic sewage treatment plant flow >= 2000 m3/day
No application of sewage sludge to soil
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Receiving surface water flow >= 18000 m3/day

1.2.2. Control of worker exposure: Manufacture of basic metals, including alloys; Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange (PROC 4)

Product (Article) characteristics
Covers concentrations up to 100.0 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8.0 h/day
Technical and organisational conditions and measures
Local exhaust ventilation; Inhalation - minimum efficiency of
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 40.0 °C

1.2.3. Control of worker exposure: Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange; (aqueous) (PROC 3)

Product (Article) characteristics
Covers concentrations up to 100.0 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8.0 h/day
Technical and organisational conditions and measures
Local exhaust ventilation; Inhalation - minimum efficiency of
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 40.0 °C

1.2.4. Control of worker exposure: Casting operations; Dry process (no water used in process) (PROC 22)

Product (Article) characteristics
Covers concentrations up to 100.0 %

Solid, low dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8.0 h/day
Technical and organisational conditions and measures
Local exhaust ventilation; Inhalation - minimum efficiency of
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Wear suitable respiratory protection.; Inhalation - minimum efficiency of; For further specification, refer to section 8 of the SDS.
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 160.0 °C

1.2.5. Control of worker exposure: Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange; Casting operations (PROC 23)

Product (Article) characteristics
Covers concentrations up to 100.0 %
Solid, low dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8.0 h/day
Technical and organisational conditions and measures
Local exhaust ventilation; Inhalation - minimum efficiency of
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 160.0 °C

1.2.6. Control of worker exposure: Automated metal rolling/forming (PROC 14)

Product (Article) characteristics
Covers concentrations up to 100.0 %
Solid, low dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8.0 h/day
Technical and organisational conditions and measures
Local exhaust ventilation; Inhalation - minimum efficiency of
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 160.0 °C

1.2.7. Control of worker exposure: Production of metal powders (hot processes) (PROC 27a)

Product (Article) characteristics
Covers concentrations up to 100.0 %
Solid, medium dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8.0 h/day
Technical and organisational conditions and measures
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision.
Local exhaust ventilation; Inhalation - minimum efficiency of
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Wear suitable respiratory protection.; Inhalation - minimum efficiency of; For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 40.0 °C

1.3. Exposure estimation and reference to its source

1.3.1. Environmental release and exposure: Manufacture of basic metals, including alloys; Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange (ERC 1)

Release route	Release rate	Release estimation method
Water	0.188 kg/day	Measured release rate
Air	3.5E-3 kg/day	Measured release rate
Soil	0.045 kg/day	ERC

Protection target	Exposure estimate	RCR
Fresh water	2.68E-5 mg/L (EUSES 2.1.2)	< 0.01
Sediment (freshwater)	21.27 mg/kg dw (EUSES 2.1.2)	0.042
Marine water	2.68E-6 mg/L (EUSES 2.1.2)	< 0.01
Sediment (marine water)	2.132 mg/kg dw (EUSES 2.1.2)	< 0.01
Sewage Treatment Plant	3.45E-3 mg/L (EUSES 2.1.2)	< 0.01
Agricultural soil	1.42E-3 mg/kg dw (EUSES 2.1.2)	< 0.01

1.3.2. Worker exposure: Manufacture of basic metals, including alloys; Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange (PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	2.23 µg/m³ (Measured data)	0.354
Dermal, systemic, long term	0.34 µg/kg bw/day (Measured data)	< 0.01
Combined, systemic, long term		< 0.01

1.3.3. Worker exposure: Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange; (aqueous) (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	1E-3 mg/m³ (MEASE)	0.159
Dermal, systemic, long term	1.7E-3 mg/kg bw/day (MEASE)	0.014
Combined, systemic, long term		0.014

1.3.4. Worker exposure: Casting operations; Dry process (no water used in process) (PROC 22)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	1.46 µg/m³ (Measured data)	0.232
Dermal, systemic, long term	0.014 mg/kg bw/day (Measured data)	0.117
Combined, systemic, long term		0.117

1.3.5. Worker exposure: Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange; Casting operations (PROC 23)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	3.1 µg/m³ (Measured data)	0.492
Dermal, systemic, long term	0.014 mg/kg bw/day (Measured data)	0.117
Combined, systemic, long term		0.117

1.3.6. Worker exposure: Automated metal rolling/forming (PROC 14)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	7E-4 mg/m³ (MEASE)	0.111
Dermal, systemic, long term	2E-4 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

1.3.7. Worker exposure: Production of metal powders (hot processes) (PROC 27a)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	4.6E-3 mg/m³ (MEASE)	0.73
Dermal, systemic, long term	1.4E-3 mg/kg bw/day (MEASE)	0.012
Combined, systemic, long term		0.012

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

4. ES 4: Use at industrial sites; Base metals and alloys; Manufacture of fine chemicals

4.1. Title section

ES name: Use as an intermediate
Product category: Base metals and alloys (PC 7)
Sector of use: Manufacture of fine chemicals (SU 9)

Environment	
1: Use as an intermediate	ERC 6a
Worker	
2: Use as an intermediate	PROC 3

4.2. Conditions of use affecting exposure

4.2.1. Control of environmental exposure: Use as an intermediate (ERC 6a)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 1.0 tonnes/day
Annual amount per site <= 20.9 tonnes/year
Technical and organisational conditions and measures
Electrostatic precipitators or wet electrostatic precipitators or cyclones or fabric/bag filter or ceramic/metal mesh filter
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Conditions and measures related to biological sewage treatment plant
Provide onsite wastewater treatment.
Assumed domestic sewage treatment plant flow >= 2000 m3/day
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Receiving surface water flow >= 18000 m3/day

4.2.2. Control of worker exposure: Use as an intermediate (PROC 3)

Product (Article) characteristics
Covers concentrations up to 83.0 %
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8.0 h/day
Technical and organisational conditions and measures
Local exhaust ventilation; Inhalation - minimum efficiency of
Assumes that activities are undertaken with appropriate and well maintained equipment by trained personnel operating under supervision.
Conditions and measures related to personal protection, hygiene and health evaluation
Wear chemically resistant gloves (tested to EN374) in combination with ‘basic’ employee training.; If skin

contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Use suitable eye protection.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 40.0 °C

4.3. Exposure estimation and reference to its source

4.3.1. Environmental release and exposure: Use as an intermediate (ERC 6a)

Release route	Release rate	Release estimation method
Water	0.01 kg/day	Estimated release factor
Air	0.314 kg/day	Estimated release factor
Soil	1.045 kg/day	ERC

Protection target	Exposure estimate	RCR
Fresh water	3.4E-6 mg/L (EUSES 2.1.2)	< 0.01
Sediment (freshwater)	2.698 mg/kg dw (EUSES 2.1.2)	< 0.01
Marine water	3.45E-7 mg/L (EUSES 2.1.2)	< 0.01
Sediment (marine water)	0.274 mg/kg dw (EUSES 2.1.2)	< 0.01
Sewage Treatment Plant	4.33E-4 mg/L (EUSES 2.1.2)	< 0.01
Agricultural soil	0.201 mg/kg dw (EUSES 2.1.2)	0.028

4.3.2. Worker exposure: Use as an intermediate (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	7E-4 mg/m³ (MEASE)	0.111
Dermal, systemic, long term	2E-3 mg/kg bw/day (MEASE)	0.017
Combined, systemic, long term		0.017

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

5. ES 5: Use at industrial sites; Base metals and alloys; General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment.

5.1. Title section

ES name: *Use of In- alloys for production of heat transfer fluids*
Product category: Base metals and alloys (PC 7)
Sector of use: General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment. (SU 17)

Environment	
1: Heat transfer fluids; Manufacture	ERC 7
Worker	
2: Heat transfer fluids; Manufacture	PROC 3
Subsequent service life exposure scenario(s)	
ES 6: Service life (worker at industrial site); Various articles	

5.2. Conditions of use affecting exposure

5.2.1. Control of environmental exposure: Heat transfer fluids; Manufacture (ERC 7)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.3 tonnes/day
Annual amount per site <= 6.0 tonnes/year
Technical and organisational conditions and measures
Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow >= 2000 m3/day
Other conditions affecting environmental exposure
Receiving surface water flow >= 18000 m3/day

5.2.2. Control of worker exposure: Heat transfer fluids; Manufacture (PROC 3)

Product (Article) characteristics
Covers concentrations up to 25.0 %
Solid, low dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8.0 h/day
Technical and organisational conditions and measures
Local exhaust ventilation; Inhalation - minimum efficiency of
Conditions and measures related to personal protection, hygiene and health evaluation

Wear chemically resistant gloves (tested to EN374) in combination with 'basic' employee training.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Wear suitable respiratory protection.; Inhalation - minimum efficiency of; For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 40.0 °C

5.3. Exposure estimation and reference to its source

5.3.1. Environmental release and exposure: Heat transfer fluids; Manufacture (ERC 7)

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

Protection target	Exposure estimate	RCR
Fresh water	4.21E-8 mg/L (EUSES 2.1.2)	< 0.01
Sediment (freshwater)	0.033 mg/kg dw (EUSES 2.1.2)	< 0.01
Marine water	9.91E-9 mg/L (EUSES 2.1.2)	< 0.01
Sediment (marine water)	7.87E-3 mg/kg dw (EUSES 2.1.2)	< 0.01
Sewage Treatment Plant	0 mg/L (EUSES 2.1.2)	< 0.01
Agricultural soil	6.68E-4 mg/kg dw (EUSES 2.1.2)	< 0.01

5.3.2. Worker exposure: Heat transfer fluids; Manufacture (PROC 3)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	2E-3 mg/m³ (MEASE)	0.318
Dermal, systemic, long term	2E-4 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

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

7. ES 7: Use at industrial sites; Base metals and alloys; Manufacture of computer, electronic and optical products, electrical equipment

7.1. Title section

ES name: Semiconductor and photovoltaic agent; Manufacture
Product category: Base metals and alloys (PC 7)
Sector of use: Manufacture of computer, electronic and optical products, electrical equipment (SU 16)

Environment	
1: Semiconductor and photovoltaic agent; Manufacture	ERC 5
Worker	
2: Semiconductor and photovoltaic agent; Manufacture	PROC 3, PROC 4
Subsequent service life exposure scenario(s)	
ES 9: Service life (consumers); Machinery, mechanical appliances, electrical/electronic articles	
ES 8: Service life (professional worker); Machinery, mechanical appliances, electrical/electronic articles	

7.2. Conditions of use affecting exposure

7.2.1. Control of environmental exposure: Semiconductor and photovoltaic agent; Manufacture (ERC 5)

Amount used, frequency and duration of use (or from service life)
Daily amount per site <= 0.25 tonnes/day
Annual amount per site <= 5.0 tonnes/year
Conditions and measures related to biological sewage treatment plant
Municipal sewage treatment plant is assumed.
Assumed domestic sewage treatment plant flow >= 2000 m3/day
Conditions and measures related to external treatment of waste (including article waste)
Dispose of waste product or used containers according to local regulations.
Other conditions affecting environmental exposure
Receiving surface water flow >= 18000 m3/day

7.2.2. Control of worker exposure: Semiconductor and photovoltaic agent; Manufacture (PROC 3, PROC 4)

Product (Article) characteristics
Covers concentrations up to 10.0 %
Solid, low dustiness
Amount used (or contained in articles), frequency and duration of use/exposure
Covers use up to 8.0 h/day

Technical and organisational conditions and measures
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Conditions and measures related to personal protection, hygiene and health evaluation
Wear suitable gloves tested to EN374.; If skin contamination is expected to extend to other parts of the body, then these body parts should also be protected with impervious garments in a manner equivalent to those described for the hands.; For further specification, refer to section 8 of the SDS.
Wear suitable respiratory protection.; Inhalation - minimum efficiency of; For further specification, refer to section 8 of the SDS.
Other conditions affecting workers exposure
Indoor use
Assumes process temperature up to 40.0 °C

7.3. Exposure estimation and reference to its source

7.3.1. Environmental release and exposure: Semiconductor and photovoltaic agent; Manufacture (ERC 5)

Release route	Release rate	Release estimation method
Water	7.5E-3 kg/day	Estimated release factor
Air	7.5E-3 kg/day	Estimated release factor
Soil	2.5 kg/day	ERC

Protection target	Exposure estimate	RCR
Fresh water	2.45E-6 mg/L (EUSES 2.1.2)	< 0.01
Sediment (freshwater)	1.945 mg/kg dw (EUSES 2.1.2)	< 0.01
Marine water	2.51E-7 mg/L (EUSES 2.1.2)	< 0.01
Sediment (marine water)	0.199 mg/kg dw (EUSES 2.1.2)	< 0.01
Sewage Treatment Plant	3.11E-4 mg/L (EUSES 2.1.2)	< 0.01
Agricultural soil	0.144 mg/kg dw (EUSES 2.1.2)	0.02

7.3.2. Worker exposure: Semiconductor and photovoltaic agent; Manufacture (PROC 3, PROC 4)

Route of exposure and type of effects	Exposure estimate	RCR
Inhalation, local, long term	4.6E-3 mg/m³ (MEASE)	0.73
Dermal, systemic, long term	1E-4 mg/kg bw/day (MEASE)	< 0.01
Combined, systemic, long term		< 0.01

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