

Safety Data Sheet dated 21/4/2023, version 12

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

1.1. Product identifier

Mixture identification:

Trade name: B105 - Silver Pencils 12
Trade code: B105
CAS number: 7761-88-8
EC number: 231-853-9
Index 67/548/EEC: 047-001-00-2
REACH number: 01-2119513705-43

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

Recommended use:

Galvanic, base and lab chemistry
Manufacture of silver nitrate
Formulation of silver nitrate into mixture
Use of silver nitrate in coating
Use of silver nitrate in the production of catalysts
Use of silver nitrate as intermediate in the production of silver or silver compounds
Use of silver nitrate as non-reactive laboratory reagent
Use of silver nitrate as reactive laboratory reagent
Service life of articles coated with metallic silver

1.3. Details of the supplier of the safety data sheet

Company:
CABRO SPA - AREZZO
Road Setteponti 141
52100 - Italy
CABRO SPA
Phone n. +39 0575 984442
Office hours: 9-13 / 14.30-17.30

Competent person responsible for the safety data sheet:

info@cabro.it

1.4. Emergency telephone number

CABRO SPA
Phone n. +39 0575 984442
Office hours: 9-13 / 14.30-17.30
Single European emergency number: 112
Poison Information Center - 24/24h Foggia Hospital - Phone +39 0881-732326
Poison Information Center - 24/24h Bergamo Hospital - Phone +39 800 883300

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

EC regulation criteria 1272/2008 (CLP)

- ⚠ Danger, Repr. 1B, May damage the unborn child.
- ⚠ Danger, Ox. Sol. 1, May cause fire or explosion; strong oxidiser.
- ⚠ Warning, Met. Corr. 1, May be corrosive to metals.
- ⚠ Danger, Skin Corr. 1A, Causes severe skin burns and eye damage.
- ⚠ Warning, Aquatic Acute 1, Very toxic to aquatic life.
- ⚠ Warning, Aquatic Chronic 1, Very toxic to aquatic life with long lasting effects.

Adverse physicochemical, human health and environmental effects:

No other hazards

2.2. Label elements

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Hazard pictograms:



Danger

Hazard statements:

- H360D May damage the unborn child.
- H271 May cause fire or explosion; strong oxidiser.
- H290 May be corrosive to metals.
- H314 Causes severe skin burns and eye damage.
- H410 Very toxic to aquatic life with long lasting effects.

Precautionary statements:

- P201 Obtain special instructions before use.
- P202 Do not handle until all safety precautions have been read and understood.
- P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
- P220 Keep away from clothing and other combustible materials.
- P273 Avoid release to the environment.
- P280 Wear protective gloves/clothing and eye/face protection.
- P303+P361+P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower.
- P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- P308+P313 IF exposed or concerned: Get medical advice/attention.
- P310 Immediately call a POISON CENTER/doctor.
- P370+P378 In case of fire, use a dry powder fire extinguisher to extinguish.
- P371+P380+P375 In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion.
- P391 Collect spillage.

Special Provisions:

None

Special provisions according to Annex XVII of REACH and subsequent amendments:

None

2.3. Other hazards

No PBT, vPvB or endocrine disruptor substances present in concentration $\geq 0.1\%$

Other Hazards:

No other hazards

SECTION 3: Composition/information on ingredients

3.1. Substances

Identification of the substance

Trade code: B105
CAS number: 7761-88-8
EC number: 231-853-9
REACH number: 01-2119513705-43

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Qty	Name	Ident. Number	Classification
100 %	silver nitrate	Index number: 047-001-00-2 CAS: 7761-88-8 EC: 231-853-9 REACH No.: 01-2119513705-43	3.7/1B Repr. 1B H360D 2.14/1 Ox. Sol. 1 H271 2.16/1 Met. Corr. 1 H290 3.2/1A Skin Corr. 1A H314 4.1/A1 Aquatic Acute 1 H400 M=1000. 4.1/C1 Aquatic Chronic 1 H410 M=100.

M factor:

M: 1000

M (chronic): 100

3.2. Mixtures

N.A.

SECTION 4: First aid measures

4.1. Description of first aid measures

In case of skin contact:

Immediately take off all contaminated clothing.

OBTAIN IMMEDIATE MEDICAL ATTENTION.

Remove contaminated clothing immediately and dispose off safely.

After contact with skin, wash immediately with soap and plenty of water.

In case of eyes contact:

After contact with the eyes, rinse with water with the eyelids open for a sufficient length of time, then consult an ophthalmologist immediately.

Protect uninjured eye.

In case of Ingestion:

Do not under any circumstances induce vomiting. OBTAIN A MEDICAL EXAMINATION IMMEDIATELY.

In case of Inhalation:

Remove casualty to fresh air and keep warm and at rest.

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

None

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

In case of accident or unwellness, seek medical advice immediately (show directions for use or safety data sheet if possible).

Treatment:

None

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media:

In case of fire, use a dry powder fire extinguisher to extinguish.

Extinguishing media which must not be used for safety reasons:

None in particular.

5.2. Special hazards arising from the substance or mixture

Do not inhale combustion gases

Burning produces heavy smoke.

5.3. Advice for firefighters

Use suitable breathing apparatus .

Collect contaminated fire extinguishing water separately. This must not be discharged into drains.

Move undamaged containers from immediate hazard area if it can be done safely.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

For non emergency personnel:
Wear personal protection equipment.
Remove persons to safety.
See protective measures under point 7 and 8.
For emergency responders:
Wear personal protection equipment.

6.2. Environmental precautions

Do not allow to enter into soil/subsoil. Do not allow to enter into surface water or drains.
Retain contaminated washing water and dispose it.
In case of gas escape or of entry into waterways, soil or drains, inform the responsible authorities.

Suitable material for taking up: absorbing material, organic, sand

6.3. Methods and material for containment and cleaning up

Wash with plenty of water.

6.4. Reference to other sections

See also section 8 and 13

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Avoid contact with skin and eyes, inhalation of vapours and mists.
Exercise the greatest care when handling or opening the container.
Don't use empty container before they have been cleaned.
Before making transfer operations, assure that there aren't any incompatible material residuals in the containers.
See also section 8 for recommended protective equipment.
Advice on general occupational hygiene:
Contaminated clothing should be changed before entering eating areas.
Do not eat or drink while working.

7.2. Conditions for safe storage, including any incompatibilities

Store at below 20 °C. Keep away from unguarded flame and heat sources. Avoid direct exposure to sunlight.
Keep away from unguarded flame, sparks, and heat sources. Avoid direct exposure to sunlight.
Keep away from food, drink and feed.
Incompatible materials:
Keep away from combustible materials.
Instructions as regards storage premises:
Cool and adequately ventilated.

7.3. Specific end use(s)

None in particular

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

silver nitrate - CAS: 7761-88-8

TLV - TWA: 0.01 mg/m³ - Notes: as Ag

DNEL Exposure Limit Values

silver nitrate - CAS: 7761-88-8

Exposure: Human Inhalation

silver nitrate - CAS: 7761-88-8

Worker Industry: 600 µg/m³ - Consumer: 150 µg/m³ - Exposure: Human Inhalation -

Frequency: Long Term, systemic effects

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Worker Industry: 220 mg/kg bw/day - Consumer: 110 mg/kg bw/day - Exposure: Human
Dermal - Frequency: Long Term, systemic effects
Consumer: 110 mg/kg bw/day - Exposure: Human Oral - Frequency: Long Term,
systemic effects

PNEC Exposure Limit Values

silver nitrate - CAS: 7761-88-8

Target: Fresh Water - Value: 46 ng/L

Target: Marine water - Value: 860 ng/L

Target: Sewage treatment plant - Value: 25 µg/l

Target: Freshwater sediments - Value: 438.13 mg/kg dwt

Target: Marine water sediments - Value: 438.13 mg/kg dwt

Target: Soil (agricultural) - Value: 1.05 mg/kg dwt

8.2. Exposure controls

Eye protection:

Use close fitting safety goggles, don't use eye lens.

Protection for skin:

Use clothing that provides comprehensive protection to the skin, e.g. cotton, rubber, PVC or viton.

Protection for hands:

Use protective gloves that provides comprehensive protection, e.g. P.V.C., neoprene or rubber.

Respiratory protection:

Not needed for normal use.

Thermal Hazards:

None

Environmental exposure controls:

None

Appropriate engineering controls:

None

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Properties	Value	Method:	Notes
Physical state:	Solid	--	Crystalline
Colour:	Whitish	--	--
Odour:	odorless	--	--
Melting point/freezing point:	212 °C	--	--
Boiling point or initial boiling point and boiling range:	N.A.	--	--
Flammability:	It's capable of catching fire or being set on fire	--	--
Lower and upper explosion limit:	N.A.	--	--
Flash point:	N.A.	--	--

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Auto-ignition temperature:	N.A.	--	--
Decomposition temperature:	N.A.	--	--
pH:	3.8-6.0	--	--
Kinematic viscosity:	N.A.	--	--
Solubility in water:	Soluble	--	--
Solubility in oil:	N.A.	--	--
Partition coefficient n-octanol/water (log value):	N.A.	--	--
Vapour pressure:	N.A.	--	--
Density and/or relative density:	N.A.	--	--
Relative vapour density:	N.A.	--	--
Particle characteristics:			
Particle size:	N.A.	--	--

9.2. Other information

Properties	Value	Method:	Notes
Miscibility:	N.A.	--	--

SECTION 10: Stability and reactivity

10.1. Reactivity

Stable under normal conditions

10.2. Chemical stability

Stable under normal conditions

10.3. Possibility of hazardous reactions

None

10.4. Conditions to avoid

Stable under normal conditions.

10.5. Incompatible materials

Avoid contact with combustible materials: the product may explode.

10.6. Hazardous decomposition products

None.

SECTION 11: Toxicological information

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

Toxicological information of the substance:

silver nitrate - CAS: 7761-88-8

a) acute toxicity

Not classified

- Based on available data, the classification criteria are not met
- b) skin corrosion/irritation
The product is classified: Skin Corr. 1A H314
Route: Skin - Species: Human species
Yes
 - c) serious eye damage/irritation
Not classified
Based on available data, the classification criteria are not met
 - d) respiratory or skin sensitisation
Not classified
Based on available data, the classification criteria are not met
 - e) germ cell mutagenicity
Not classified
Based on available data, the classification criteria are not met
 - f) carcinogenicity
Not classified
Based on available data, the classification criteria are not met
 - g) reproductive toxicity
The product is classified: Repr. 1B H360D
Test: NOAEL - Route: Ingestion - Species: Rat = 120 mg/kg bw
 - h) STOT-single exposure
Not classified
Based on available data, the classification criteria are not met
 - i) STOT-repeated exposure
Not classified
Based on available data, the classification criteria are not met
 - j) aspiration hazard
Not classified
Based on available data, the classification criteria are not met

11.2. Information on other hazards

Endocrine disrupting properties:

No endocrine disruptor substances present in concentration $\geq 0.1\%$

SECTION 12: Ecological information

12.1. Toxicity

Adopt good working practices, so that the product is not released into the environment.

silver nitrate - CAS: 7761-88-8

The product is classified: Aquatic Acute 1 - H400; Aquatic Chronic 1 - H410

silver nitrate - CAS: 7761-88-8

a) Aquatic acute toxicity:

Endpoint: LC50 - Species: Fish = 1.2 µg/l - Duration h: 96

Endpoint: LC50 - Species: Invertebrates = 220 ng/L - Duration h: 48

b) Aquatic chronic toxicity:

Endpoint: EC10 - Species: Fish = 440 ng/L - Duration h: 768

Endpoint: EC10 - Species: Fish = 50-590 ng/L - Duration h: 792

Endpoint: EC10 - Species: Fish = 950-1410 ng/L - Duration h: 816

Endpoint: NOEC - Species: Invertebrates = 310 ng/L - Duration h: 480

e) Plant toxicity:

Endpoint: EC10 - Species: plants = 6.4-16.67 µg/l - Duration h: 168

12.2. Persistence and degradability

N.A.

12.3. Bioaccumulative potential

N.A.

12.4. Mobility in soil

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N.A.

12.5. Results of PBT and vPvB assessment

vPvB Substances: None - PBT Substances: None

12.6. Endocrine disrupting properties

No endocrine disruptor substances present in concentration $\geq 0.1\%$

12.7. Other adverse effects

None

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Recover, if possible. Send to authorised disposal plants or for incineration under controlled conditions. In so doing, comply with the local and national regulations currently in force.

SECTION 14: Transport information



14.1. UN number or ID number

ADR-UN Number: 1493
IATA-UN Number: 1493
IMDG-UN Number: 1493

14.2. UN proper shipping name

ADR-Shipping Name: SILVER NITRATE
IATA-Shipping Name: SILVER NITRATE
IMDG-Shipping Name: SILVER NITRATE

14.3. Transport hazard class(es)

ADR-Class: 5.1
ADR - Hazard identification number: 50
IATA-Class: 5.1
IATA-Label: 5.1
IMDG-Class: 5.1

14.4. Packing group

ADR-Packing Group: II
IATA-Packing group: II
IMDG-Packing group: II

14.5. Environmental hazards

ADR-Environmental Pollutant: Yes
IMDG-Marine pollutant: Marine Pollutant
IMDG-EmS: F-A,
S-Q

14.6. Special precautions for user

ADR-Subsidiary hazards: -
ADR-S.P.: -
ADR-Transport category (Tunnel restriction code): 2 (E)
IATA-Passenger Aircraft: 558
IATA-Subsidiary hazards: -
IATA-Cargo Aircraft: 562
IATA-S.P.: -
IATA-ERG: 5L
IMDG-Subsidiary hazards: -
IMDG-Stowage and handling: Category A
IMDG-Segregation: -

14.7. Maritime transport in bulk according to IMO instruments
N.A.

SECTION 15: Regulatory information

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

Dir. 98/24/EC (Risks related to chemical agents at work)
Dir. 2000/39/EC (Occupational exposure limit values)
Regulation (EC) n. 1907/2006 (REACH)
Regulation (EC) n. 1272/2008 (CLP)
Regulation (EC) n. 790/2009 (ATP 1 CLP) and (EU) n. 758/2013
Regulation (EU) n. 2020/878
Regulation (EU) n. 286/2011 (ATP 2 CLP)
Regulation (EU) n. 618/2012 (ATP 3 CLP)
Regulation (EU) n. 487/2013 (ATP 4 CLP)
Regulation (EU) n. 944/2013 (ATP 5 CLP)
Regulation (EU) n. 605/2014 (ATP 6 CLP)
Regulation (EU) n. 2015/1221 (ATP 7 CLP)
Regulation (EU) n. 2016/918 (ATP 8 CLP)
Regulation (EU) n. 2016/1179 (ATP 9 CLP)
Regulation (EU) n. 2017/776 (ATP 10 CLP)
Regulation (EU) n. 2018/669 (ATP 11 CLP)
Regulation (EU) n. 2018/1480 (ATP 13 CLP)
Regulation (EU) n. 2019/521 (ATP 12 CLP)
Regulation (EU) n. 2020/217 (ATP 14 CLP)
Regulation (EU) n. 2020/1182 (ATP 15 CLP)
Regulation (EU) n. 2021/643 (ATP 16 CLP)
Regulation (EU) n. 2021/849 (ATP 17 CLP)

Restrictions related to the product or the substances contained according to Annex XVII Regulation (EC) 1907/2006 (REACH) and subsequent modifications:

Restrictions related to the product:

No restriction.

Restrictions related to the substances contained:

Restriction 75

Where applicable, refer to the following regulatory provisions :

Directive 2012/18/EU (Seveso III)
Regulation (EC) nr 648/2004 (detergents).
Dir. 2004/42/EC (VOC directive)

Provisions related to directive EU 2012/18 (Seveso III):

N.A.

15.2. Chemical safety assessment

A Chemical Safety Assessment has been carried out for the substance.

SECTION 16: Other information

Full text of phrases referred to in Section 3:

H360D May damage the unborn child.
H271 May cause fire or explosion; strong oxidiser.
H290 May be corrosive to metals.
H314 Causes severe skin burns and eye damage.
H400 Very toxic to aquatic life.
H410 Very toxic to aquatic life with long lasting effects.

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Hazard class and hazard category	Code	Description
Ox. Sol. 1	2.14/1	Oxidising solid, Category 1
Met. Corr. 1	2.16/1	Substance or mixture corrosive to metals, Category 1
Skin Corr. 1A	3.2/1A	Skin corrosion, Category 1A
Repr. 1B	3.7/1B	Reproductive toxicity, Category 1B
Aquatic Acute 1	4.1/A1	Acute aquatic hazard, category 1
Aquatic Chronic 1	4.1/C1	Chronic (long term) aquatic hazard, category 1

This document was prepared by a competent person who has received appropriate training.

Main bibliographic sources:

ECDIN - Environmental Chemicals Data and Information Network - Joint Research Centre,
Commission of the European Communities

SAX's DANGEROUS PROPERTIES OF INDUSTRIAL MATERIALS - Eight Edition - Van
Nostrand Reinold

The information contained herein is based on our state of knowledge at the above-specified date. It refers solely to the product indicated and constitutes no guarantee of particular quality.

It is the duty of the user to ensure that this information is appropriate and complete with respect to the specific use intended.

This MSDS cancels and replaces any preceding release.

Exposure scenario 3: Use at industrial sites - Use of silver nitrate in coating

Product category used: PC 7: Base metals and alloys; PC 14: Metal surface treatment products; PC 15: Non-metal-surface treatment products; PC 20: Products such as ph-regulators, flocculants, precipitants, neutralization agents

Sector of use: SU 13: Manufacture of other non-metallic mineral products, e.g. plasters, cement; SU 16: Manufacture of computer, electronic and optical products, electrical equipment; SU 24: Scientific research and development

Environment contributing scenario(s):			SPERC
CS 1	Use of silver nitrate in coating	ERC 5	Eurometaux SPERC 5.1.v3
CS 2	Use of silver nitrate in coating - no emissions to water	ERC 5	
Worker contributing scenario(s):			SWED
CS 3	Chemical production where opportunity for exposure arises	PROC 4	
CS 4	Mixing or blending in batch processes	PROC 5	
CS 5	Industrial spraying	PROC 7	
CS 6	Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	PROC 9	
CS 7	Roller application or brushing	PROC 10	
CS 8	Treatment of articles by dipping and pouring	PROC 13	
CS 9	Production of metal powders (wet processes)	PROC 27b	
CS 10	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions	PROC 2	
CS 11	Transfer of substance or mixture (charging/discharging) at dedicated facilities	PROC 8b	
CS 12	Manual activities involving hand contact	PROC 19	
CS 13	Manual maintenance (cleaning and repair) of machinery	PROC 28	

Subsequent service life exposure scenario(s):

ES10: Service life (consumers) - Service life of articles coated with metallic silver

3.1. Env CS 1: Use of silver nitrate in coating (ERC 5)

Assessment entity group used for the assessment of this contributing scenario: ENV RA

3.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
<ul style="list-style-type: none"> Annual use amount at site: ≤ 0.5 tonnes/year <i>All the amounts are expressed as Ag as this is the driver for the environmental risk assessment.</i> Daily use amount at site: $\leq 2.3E-3$ tonnes/day <i>220 days per year is the 10th percentile of reported site-specific number of emission days for 97 sites. Default number of emission days are derived from a multi-metal background database of measured site-specific release factors collected under the former Directive of New and Existing Substances and REACH 2010 registration dossiers.</i>
Technical and organisational conditions and measures
<ul style="list-style-type: none"> On site treatment of off-air: Electrostatic precipitators or wet electrostatic precipitators or cyclones or fabric/bag filter or ceramic/metal mesh filter according to the BAT Reference Document in the Non-Ferrous Metals Industry

<p><i>Direct air emissions should be reduced by implementing one or more of the following RMMs (air concentration range for which the RMM is suitable is specified in parenthesis):</i></p> <ul style="list-style-type: none"> • <i>Electrostatic precipitators using wide electrode spacing: 5 – 15 mg/Nm³</i> • <i>Wet electrostatic precipitators: < 5 mg/Nm³</i> • <i>Cyclones, but as primary collector: < 50 mg/Nm³</i> • <i>Fabric or bag filters: high efficiency in controlling fine particulate (melting): achieve emission values < 5mg/Nm³. Membrane filtration techniques can achieve < 1 mg/Nm³</i> • <i>Ceramic and metal mesh filters. PM10 particles are removed: 0.1 mg/Nm³</i> <p><i>Wet scrubbers: < 4 mg/Nm³</i></p>
<ul style="list-style-type: none"> • On site treatment of wastewater: Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange according to the BAT Reference Document in the Non-Ferrous Metals Industry (2017) applying minimum xx% removal efficiency <p><i>Direct water emissions should be reduced by implementing one or more of the following RMMs:</i></p> <ul style="list-style-type: none"> • <i>Chemical precipitation: used primarily to remove the metal ions (e.g. the use of Ca(OH)₂ to a pH 11: >99% removal efficiency; the use of Fe(OH)₃ to a pH 11: 96% removal efficiency)</i> • <i>Sedimentation (e.g. Na₂S, pH 11, >99% removal efficiency) • Filtration: used as final clarification step (e.g. ultrafiltration, pH 5.1: 93% removal efficiency, nanofiltration: 97% removal efficiency, reverse osmosis, pH 4-11: 99% removal efficiency)</i> • <i>Electrolysis: for low metal concentration at about 2 g/L (e.g. electrodialysis: 13% removal efficiency within 2 hours, membrane electrolysis, electrochemical precipitation, pH 4-10, >99% removal efficiency) • Reverse osmosis: extensively used for the removal of dissolved metals; Ion exchange: final cleaning step in the removal of heavy metal from process wastewater (e.g. 90% removal efficiency for clinoptinolite and 100% removal efficiency for synthetic zeolite)</i> <p><i>Following the Integrated Pollution Prevention and Control – BAT Reference note document, the treatment methods are very much dependent on the specific processes and the metals involved. More information can be found in the BAT Reference Document for the Non-Ferrous Metals Industry (2017).</i></p>
Conditions and measures related to biological sewage treatment plant
<ul style="list-style-type: none"> • Biological STP: Site specific [Effectiveness Water: 80.1%]
<ul style="list-style-type: none"> • Discharge rate of STP: >= 2E3 m3/day
<ul style="list-style-type: none"> • Application of the STP sludge on agricultural soil: No
Conditions and measures related to external treatment of waste (including article waste)
<ul style="list-style-type: none"> • Particular considerations on the waste treatment operations: No (low concentration) <p><i>Particular risks from waste treatment unlikely due low concentration of substance in waste stream. Waste disposal according to national/local legislation is sufficient. If the metal content of the waste is elevated enough, internal or external recovery/recycling is considered.</i></p>

Fate (release percentage) in the biological sewage treatment plant

The biological STP is site specific and the releases to the various compartments have been set by the assessor for some assessment entities. They are distributed in the following way:

Assessment entities	Ag dissolved
Release to water	19.9%
Release to air	0%
Release to sludge	80.1%
Release degraded	0%

Explanation for Ag dissolved:

Based on available monitoring data and values cited in the literature.

3.1.2. Releases

The releases have been estimated on the basis of SPERC Eurometaux SPERC 5.1.v3: Industrial use of metals and metal compounds in metallic coating

Modification date: 09/09/2021

Description of activities/processes covered by the SPERC

Since metal SPERCs are based on measured data at end-of-pipe on-site, all indicated PROCs are integrated in the release fractions from raw materials handling to cleaning and maintenance. A distinction can be made between hot dip batch process, continuous hot dip process and continuous electroplating process. Electroplating is a plating process that uses electrical current to reduce cations of a desired material from a solution and coat a conductive object with a thin layer of the material, such as a metal. Mechanical milling to remove oxide layers. Pickling. Chemical treatment or blasting of internal tube surfaces. Cleaning and stain removal. Polishing. Pre-patination. Raw materials handling and storing of produced substances are also included in this SPERC. Release defaults are derived from measured emissions.

Product/substance domain:

Scope of the SPERC

User groups: Industrial use of metals and metal compounds in plating, galvanising.

Substance groups or functions:

Metal (compounds). Included in the metal definition (Eurometaux SPERCs): alkali metals, alkaline earth metals, transition metals, post-transition metals, metalloids and their compounds

Excluded from the metal definition: non-metals, halogens, noble gases and metallo-organic compounds.

SPERC valid for metals with solid water partition coefficient for suspended matter between 25,000 L/kg and 400,000 L/kg.

Types of products: Metal and/or metal compounds (solid, powder, salts in solution)

Sub-SPERC Eurometaux SPERC 5.1.v3 is used for Ag dissolved:

Explanation for the release factor to water:

release after STP

Default release factors are derived from a multi-metal background database of measured site-specific release factors collected from peer-reviewed EU Risk Assessment Reports under the former Directive of New and Existing Substances and REACH 2010 registration dossiers.

The 90th percentile of reported site-specific release factors to wastewater for 114 sites.

Explanation for the release factor to air:

release after RMM

Default release factors are derived from a multi-metal background database of measured site-specific release factors collected from peer-reviewed EU Risk Assessment Reports under the former Directive of New and Existing Substances and REACH 2010 registration dossiers.

The 90th percentile of reported site-specific release factors to air for 97 sites.

Explanation for the release factor to soil:

ERC default

The local releases to the environment are reported in the following table.

Table 36. Local releases to the environment

Release	Assessment entity	Release factor	Local release rate
Water	Ag dissolved	0.5%	0.011 kg/day
Air	Ag dissolved	0.2%	4.6E-3 kg/day
Non agricultural soil	Ag dissolved	1%	- kg/day

Releases to waste

Release factor to external waste: 1 %

Default release factors are derived from a multi-metal background database of measured site-specific release factors collected from peer-reviewed EU Risk Assessment Reports under the former Directive of New and Existing Substances and REACH 2010 registration dossiers.

The 90th percentile of reported site-specific release factors to solid waste for 32 downstream user sites covering zinc, nickel, lead, antimony

3.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 37. Exposure concentrations and risks for the environment and man via the environment

Protection target	Assessment entity	Exposure concentration	Risk quantification
Fresh water	Ag dissolved	Local PEC: 3.57E-5 mg/L RCR = 0.776	Final RCR = 0.776
Sediment (freshwater)	Ag dissolved	Local PEC: 6.806 mg/kg dw RCR = 0.016	Final RCR = 0.016
Marine water	Ag dissolved	Local PEC: 4.88E-6 mg/L RCR = 5.67E-3	Final RCR < 0.01
Sediment (marine water)	Ag dissolved	Local PEC: 0.929 mg/kg dw RCR = 2.12E-3	Final RCR < 0.01
Sewage Treatment Plant	Ag dissolved	Local PEC: 1.14E-3 mg/L RCR = 0.046	Final RCR = 0.046
Agricultural soil	Ag dissolved	Local PEC: 0.096 mg/kg dw RCR = 0.092	Final RCR = 0.092
Man via environment - Inhalation (systemic effects)	Ag dissolved	Concentration in air: 8.47E-7 mg/m ³ RCR = 5.65E-6	Final RCR < 0.01
Man via environment - Oral	Ag dissolved	Exposure via food consumption: 3.84 µg/kg bw/day RCR = 0.035	Final RCR = 0.035
Man via environment - combined routes			Final RCR = 0.035

Remarks on measured exposure:

Identity of the substance used: Ag

Explanation: Worst case exposure of 3.84 µg Ag/kg bw/day from food was taken forward to the risk characterisation.

The intake via drinking water calculated with CHESAR was 3-4 orders of magnitudes lower compared to the intake via food and has thus not been taken into account.

3.2. Env CS 2: Use of silver nitrate in coating - no emissions to water (ERC 5)

Assessment entity group used for the assessment of this contributing scenario: ENV RA

3.2.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
<ul style="list-style-type: none"> Annual use amount at site: ≤ 200 tonnes/year <i>All the amounts are expressed as Ag as this is the driver for the environmental risk assessment.</i> Daily use amount at site: ≤ 0.909 tonnes/day <i>220 days per year is the 10th percentile of reported site-specific number of emission days for 97 sites. Default number of emission days are derived from a multi-metal background database of measured site-specific release factors collected under the former Directive of New and Existing Substances and REACH 2010 registration dossiers.</i>
Technical and organisational conditions and measures
<ul style="list-style-type: none"> On site treatment of off-air: Electrostatic precipitators or wet electrostatic precipitators or cyclones or fabric/bag filter or ceramic/metal mesh filter according to the BAT Reference Document in the Non-Ferrous Metals Industry <i>Direct air emissions should be reduced by implementing one or more of the following RMMs (air concentration range for which the RMM is suitable is specified in parenthesis):</i> <ul style="list-style-type: none"> Electrostatic precipitators using wide electrode spacing: 5 – 15 mg/Nm³ Wet electrostatic precipitators: < 5 mg/Nm³

<ul style="list-style-type: none"> • Cyclones, but as primary collector: < 50 mg/Nm³ • Fabric or bag filters: high efficiency in controlling fine particulate (melting): achieve emission values < 5mg/Nm³. Membrane filtration techniques can achieve < 1 mg/Nm³ • Ceramic and metal mesh filters. PM10 particles are removed: 0.1 mg/Nm³ Wet scrubbers: < 4 mg/Nm ³
<ul style="list-style-type: none"> • The substance should not be released to water <i>Emissions to surface water or to the sewage system are not allowed in this scenario</i>
Conditions and measures related to biological sewage treatment plant
<ul style="list-style-type: none"> • Biological STP: None [Effectiveness Water: 0%]
Conditions and measures related to external treatment of waste (including article waste)
<ul style="list-style-type: none"> • Particular considerations on the waste treatment operations: No (low concentration) <i>Particular risks from waste treatment unlikely due low concentration of substance in waste stream. Waste disposal according to national/local legislation is sufficient. If the metal content of the waste is elevated enough, internal or external recovery/recycling is considered.</i>
Other conditions affecting environmental exposure
<ul style="list-style-type: none"> • Discharge rate of effluent: >= 2E3 m³/day

3.2.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 38. Local releases to the environment

Release	Assessment entity	Release estimation method	Explanations
Water	Ag dissolved	Estimated release factor	Release factor before on site RMM: 0% Release factor after on site RMM: 0% Local release rate: 0 kg/day Explanation: Based on questionnaire responses some companies have no emissions to water so a scenario without emissions has been included as well.
Air	Ag dissolved	Estimated release factor (based on SPERC Eurometaux SPERC 5.1.v3)	Release factor before on site RMM: 0.2% Release factor after on site RMM: 0.2% Local release rate: 1.818 kg/day Explanation: release after RMM Default release factors are derived from a multi-metal background database of measured site-specific release factors collected from peer-reviewed EU Risk Assessment Reports under the former Directive of New and Existing Substances and REACH 2010 registration dossiers. The 90th percentile of reported site-specific release factors to air for 97 sites.
Non agricultural soil	Ag dissolved	Estimated release factor	Release factor after on site RMM: 0% Explanation: No direct emissions to soil.

Releases to waste

Release factor to external waste: 1 %

Default release factors are derived from a multi-metal background database of measured site-specific release factors collected from peer-reviewed EU Risk Assessment Reports under the former Directive of New and Existing Substances and REACH 2010 registration dossiers.

The 90th percentile of reported site-specific release factors to solid waste for 32 downstream user sites covering zinc, nickel, lead, antimony

3.2.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 39. Exposure concentrations and risks for the environment and man via the environment

Protection target	Assessment entity	Exposure concentration	Risk quantification
Fresh water	Ag dissolved	Local PEC: 6.06E-6 mg/L RCR = 0.132	Final RCR = 0.132
Sediment (freshwater)	Ag dissolved	Local PEC: 1.155 mg/kg dw RCR = 2.64E-3	Final RCR < 0.01
Marine water	Ag dissolved	Local PEC: 1.91E-6 mg/L RCR = 2.22E-3	Final RCR < 0.01
Sediment (marine water)	Ag dissolved	Local PEC: 0.364 mg/kg dw RCR = 8.31E-4	Final RCR < 0.01
Sewage Treatment Plant	Ag dissolved	Local PEC: 0 mg/L RCR = 0	Final RCR < 0.01
Agricultural soil	Ag dissolved	Local PEC: 0.179 mg/kg dw RCR = 0.171	Final RCR = 0.171
Man via environment - Inhalation (systemic effects)	Ag dissolved	Concentration in air: 3.05E-4 mg/m ³ RCR = 2.03E-3	Final RCR < 0.01
Man via environment - Oral	Ag dissolved	Exposure via food consumption: 3.84 µg/kg bw/day RCR = 0.035	Final RCR = 0.035
Man via environment - combined routes			Final RCR = 0.037

Remarks on measured exposure:

Identity of the substance used: Ag

Explanation: Worst case exposure of 3.84 µg Ag/kg bw/day from food was taken forward to the risk characterisation.

The intake via drinking water calculated with CHESAR was 3-4 orders of magnitudes lower compared to the intake via food and has thus not been taken into account.

3.3. Worker CS 3: Chemical production where opportunity for exposure arises (PROC 4)

Assessment entity group used for the assessment of this contributing scenario: HH RA

3.3.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Note that 'aqueous solution' was selected in MEASE to reflect the very low emission potential of the substance.</i>	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	

	Method
• Duration of activity: ≤ 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

3.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 40. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.05 mg/m ³ (MEASE 1.02.01) RCR = 0.052	Final RCR = 0.052
Inhalation, local, long term	Silver nitrate	0.05 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.153

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

3.4. Worker CS 4: Mixing or blending in batch processes (PROC 5)

Assessment entity group used for the assessment of this contributing scenario: HH RA

3.4.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	MEASE 1.02.01
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Note that 'aqueous solution' was selected in MEASE to reflect the very low emission potential of the substance.</i>	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

3.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 41. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.05 mg/m ³ (MEASE 1.02.01) RCR = 0.052	Final RCR = 0.052
Inhalation, local, long term	Silver nitrate	0.05 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.153

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

3.5. Worker CS 5: Industrial spraying (PROC 7)

Assessment entity group used for the assessment of this contributing scenario: HH RA

3.5.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Note that 'aqueous solution' was selected in MEASE to reflect the very low emission potential of the substance.</i>	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
• Generic local exhaust ventilation: Lower confidence limit (industrial use) [Effectiveness Inhalation: 78%] <i>Standard efficiency</i> Inhalation explanation: <i>Efficiency for industrial use</i>	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Respiratory protection: Yes (APF >= 10)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

3.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 42. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.44 mg/m ³ (MEASE 1.02.01) RCR = 0.458	Final RCR = 0.458
Inhalation, local, long term	Silver nitrate	0.44 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.559

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local)

3.6. Worker CS 6: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9)

Assessment entity group used for the assessment of this contributing scenario: HH RA

3.6.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	MEASE 1.02.01
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Note that 'aqueous solution' was selected in MEASE to reflect the very low emission potential of the substance.</i>	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes	

	Method
<i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

3.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 43. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.01 mg/m ³ (MEASE 1.02.01) RCR = 0.01	Final RCR = 0.01
Inhalation, local, long term	Silver nitrate	0.01 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.111

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

3.7. Worker CS 7: Roller application or brushing (PROC 10)

Assessment entity group used for the assessment of this contributing scenario: HH RA

3.7.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Note that 'aqueous solution' was selected in MEASE to reflect the very low emission potential of the substance.</i>	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting	

	Method
from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
<ul style="list-style-type: none"> Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i> 	
<ul style="list-style-type: none"> Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i> 	
Other conditions affecting workers exposure	
<ul style="list-style-type: none"> Place of use: Indoor 	

3.7.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 44. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.05 mg/m ³ (MEASE 1.02.01) RCR = 0.052	Final RCR = 0.052
Inhalation, local, long term	Silver nitrate	0.05 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.153

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

3.8. Worker CS 8: Treatment of articles by dipping and pouring (PROC 13)

Assessment entity group used for the assessment of this contributing scenario: HH RA

3.8.1. Conditions of use

	Method
Product (article) characteristics	
<ul style="list-style-type: none"> Percentage (w/w) of substance in mixture/article: <= 100 % 	MEASE 1.02.01
<ul style="list-style-type: none"> Physical form of the used product: Liquid, including paste/slurry/suspension <i>Note that 'aqueous solution' was selected in MEASE to reflect the very low emission potential of the substance.</i> 	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
<ul style="list-style-type: none"> Duration of activity: <= 8 h/day 	MEASE 1.02.01

	Method
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

3.8.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 45. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.01 mg/m ³ (MEASE 1.02.01) RCR = 0.01	Final RCR = 0.01
Inhalation, local, long term	Silver nitrate	0.01 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.111

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

3.9. Worker CS 9: Production of metal powders (wet processes) (PROC 27b)

Assessment entity group used for the assessment of this contributing scenario: HH RA

3.9.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	MEASE 1.02.01
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Note that 'aqueous solution' was selected in MEASE to reflect the very low emission potential of the substance.</i>	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

3.9.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 46. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01) RCR = 0.104	Final RCR = 0.104
Inhalation, local, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.205

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

3.10. Worker CS 10: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC 2)

Assessment entity group used for the assessment of this contributing scenario: HH RA

3.10.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Incidental	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

3.10.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 47. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.01 mg/m ³ (MEASE 1.02.01) RCR = 0.01	Final RCR = 0.01

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, local, long term	Silver nitrate	0.01 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.111

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

3.11. Worker CS 11: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC 8b)

Assessment entity group used for the assessment of this contributing scenario: HH RA

3.11.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

3.11.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 48. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01) RCR = 0.104	Final RCR = 0.104
Inhalation, local, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.205

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

3.12. Worker CS 12: Manual activities involving hand contact (PROC 19)

Assessment entity group used for the assessment of this contributing scenario: HH RA

3.12.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	

	Method
<ul style="list-style-type: none"> Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i> 	
Other conditions affecting workers exposure	
<ul style="list-style-type: none"> Place of use: Indoor 	

3.12.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 49. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.5 mg/m ³ (MEASE 1.02.01) RCR = 0.521	Final RCR = 0.521
Inhalation, local, long term	Silver nitrate	0.5 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.141 mg/kg bw/day (MEASE 1.02.01) RCR = 0.415	Final RCR = 0.415
Combined routes, systemic, long-term			Final RCR = 0.936

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

3.13. Worker CS 13: Manual maintenance (cleaning and repair) of machinery (PROC 28)

Assessment entity group used for the assessment of this contributing scenario: HH RA
Covers maintenance of both the solid (low dustiness) and liquid form (aqueous solution)

3.13.1. Conditions of use

	Method
Product (article) characteristics	
<ul style="list-style-type: none"> Percentage (w/w) of substance in mixture/article: <= 100 % 	MEASE 1.02.01
<ul style="list-style-type: none"> Physical form of the used product: Solid (material with low dustiness) 	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
<ul style="list-style-type: none"> Duration of activity: <= 8 h/day 	MEASE 1.02.01
Technical and organisational conditions and measures	
<ul style="list-style-type: none"> Occupational Health and Safety Management System: Advanced 	MEASE 1.02.01
<ul style="list-style-type: none"> Pattern of use: Non-dispersive use 	MEASE 1.02.01
<ul style="list-style-type: none"> Pattern of exposure control: Direct handling 	MEASE 1.02.01
<ul style="list-style-type: none"> Contact level: Extensive 	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
<ul style="list-style-type: none"> Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%) 	MEASE 1.02.01

	Method
<ul style="list-style-type: none"> Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i> 	
<ul style="list-style-type: none"> Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i> 	
<ul style="list-style-type: none"> Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i> 	
Other conditions affecting workers exposure	
<ul style="list-style-type: none"> Place of use: Indoor 	

3.13.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 50. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.5 mg/m ³ (MEASE 1.02.01) RCR = 0.521	Final RCR = 0.521
Inhalation, local, long term	Silver nitrate	0.5 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.069 mg/kg bw/day (MEASE 1.02.01) RCR = 0.202	Final RCR = 0.202
Combined routes, systemic, long-term			Final RCR = 0.723

Remarks on exposure data from external estimation tools:

MEASE 1.02.01 for Silver nitrate:

Explanation:

As the MEASE 1.02.01 exposure estimation tool for workers does not provide exposure estimates for PROC 28, PROC 8a has been used instead as the input parameter assuming that there are similarities in the exposure.

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

Exposure scenario 4: Use at industrial sites - Use of silver nitrate in the production of catalysts

Product category used: PC 7: Base metals and alloys

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

Environment contributing scenario(s):		
CS 1	Industrial production of catalysts	ERC 5
Worker contributing scenario(s):		
CS 2	Mixing or blending in batch processes	PROC 5
CS 3	Transfer of substance or mixture (charging and discharging) at non-dedicated facilities	PROC 8a
CS 4	Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	PROC 9

Subsequent service life exposure scenario(s):

ES10: Service life (consumers) - Service life of articles coated with metallic silver

4.1. Env CS 1: Industrial production of catalysts (ERC 5)

Assessment entity group used for the assessment of this contributing scenario: ENV RA

4.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
<ul style="list-style-type: none"> Annual use amount at site: ≤ 3 tonnes/year <i>All the amounts are expressed as Ag as this is the driver for the environmental risk assessment.</i> Daily use amount at site: $\leq 8.8E-3$ tonnes/day <i>The number of release days is taken from the SpERC. Values for emission days per year were provided by 13 sites across Europe producing catalysts. The median value of 340 days per year was selected.</i>
Technical and organisational conditions and measures
<ul style="list-style-type: none"> Direct emissions to air should be mitigated by application of one or more of the following RMMs: <ul style="list-style-type: none"> HEPA filtration, Fabric filters and Bag or Ceramic Filters Wet Scrubbers Dry or semi-dry Scrubbers Metallic Grids <p><i>Data on removal efficiency were provided by Catalysts Europe member companies. One or more of these RMMs (of which HEPA/bag filtration and wet scrubbers are the most common) were reported to be present in more than 88% of sites. RMM efficiency (RE_{sperc}) was reported to be $\geq 99\%$.</i></p>
<ul style="list-style-type: none"> Direct emissions to water should be mitigated by application of one or more of the following RMMs: <ul style="list-style-type: none"> Precipitation Sedimentation Filtration Distillation Ion Exchange <p><i>Data on removal efficiency were provided by Catalysts Europe member companies. One or more of these RMMs (of which chemical precipitation is the most common) were reported to be present in more than 70% of sites. RMM efficiency was reported as 95-99.9%. RE_{sperc} is taken to be 99% (50th percentile of reported site-specific RE).</i></p>
Conditions and measures related to biological sewage treatment plant
<ul style="list-style-type: none"> Biological STP: Standard [Effectiveness Water: 80.1%] Discharge rate of STP: $\geq 2E3$ m³/day Application of the STP sludge on agricultural soil: Yes
Conditions and measures related to external treatment of waste (including article waste)

<ul style="list-style-type: none"> Particular considerations on the waste treatment operations: No (low concentration) <i>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 silver content of the waste is elevated enough, internal or external recovery/recycling might be considered.</i> <i>Appropriate waste codes: 06 05 02*, 08 01 11, 08 03 12*, 09 01 01*, 09 01 03*, 09 01 04*, 09 01 05*, 09 01 06*, 09 01 13*, 10 06 06*, 10 07 01, 10 07 02, 10 07 03, 10 07 04, 10 07 05, 11 01 09*, 15 01 10*, 15 02 02*, 16 01 18, 16 03 03*, 16 08 01, 16 11 04</i> <i>Suitable disposal: Hazardous waste produced during the manufacture and downstream use is sent to a recycler only marginal amounts are sent to a landfill or an incinerator. Waste containing silver is recycled for almost a 100%</i> <i>A detailed assessment has been performed on modelled and measured data and is reported in the Waste report (ARCHE, 2013)</i>
Other conditions affecting environmental exposure
<ul style="list-style-type: none"> Receiving surface water flow rate: $\geq 1.8E4$ m³/day

4.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 51. Local releases to the environment

Release	Assessment entity	Release estimation method	Explanations
Water	Ag dissolved	Estimated release factor (Catalysts Europe SPERC 2,1 v1.0)	Release factor before on site RMM: 0.04% Release factor after on site RMM: 0.04% Local release rate: 3.52E-3 kg/day Explanation: The release factor to water is derived from measured wastewater emission data from catalyst manufacturers in various EU member states between 2012-2016. The release factor is calculated as a realistic worst-case value based on metal-specific 90th percentile site-specific release factors from 13 sites for production of metal-containing catalysts.
Air	Ag dissolved	Estimated release factor (Catalysts Europe SPERC 2,1 v1.0)	Release factor before on site RMM: 0.018% Release factor after on site RMM: 0.018% Local release rate: 1.58E-3 kg/day Explanation: The release factor to air is derived from measured stack emission data from catalyst manufacturers in various EU member states between 2012-2016. The release factor is calculated as a realistic worst-case value based on metal-specific 90th percentile site specific release factors from 13 sites for production of metal-containing catalysts.
Non agricultural soil	Ag dissolved	Estimated release factor (Catalysts Europe SPERC 2,1 v1.0)	Release factor after on site RMM: 0% Explanation: There are no emissions to soil during manufacture or regeneration of catalysts.

4.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 52. Exposure concentrations and risks for the environment and man via the environment

Protection target	Assessment entity	Exposure concentration	Risk quantification
Fresh water	Ag dissolved	Local PEC: 1.51E-5 mg/L RCR = 0.329	Final RCR = 0.329
Sediment (freshwater)	Ag dissolved	Local PEC: 2.885 mg/kg dw RCR = 6.58E-3	Final RCR < 0.01
Marine water	Ag dissolved	Local PEC: 2.82E-6 mg/L RCR = 3.28E-3	Final RCR < 0.01
Sediment (marine water)	Ag dissolved	Local PEC: 0.537 mg/kg dw RCR = 1.23E-3	Final RCR < 0.01
Sewage Treatment Plant	Ag dissolved	Local PEC: 3.5E-4 mg/L RCR = 0.014	Final RCR = 0.014
Agricultural soil	Ag dissolved	Local PEC: 0.155 mg/kg dw RCR = 0.148	Final RCR = 0.148
Man via environment - Inhalation (systemic effects)	Ag dissolved	Concentration in air: 4.97E-7 mg/m ³ RCR = 3.31E-6	Final RCR < 0.01
Man via environment - Oral	Ag dissolved	Exposure via food consumption: 3.84 µg/kg bw/day RCR = 0.035	Final RCR = 0.035
Man via environment - combined routes			Final RCR = 0.035

Remarks on measured exposure:

Identity of the substance used: Ag

Explanation: Worst case exposure of 3.84 µg Ag/kg bw/day from food was taken forward to the risk characterisation.

The intake via drinking water calculated with CHESAR was 3-4 orders of magnitudes lower compared to the intake via food and has thus not been taken into account.

4.2. Worker CS 2: Mixing or blending in batch processes (PROC 5)

Assessment entity group used for the assessment of this contributing scenario: HH RA

Includes mixing of impregnation solution with inert carrier

4.2.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Note that 'aqueous solution' was selected in MEASE to reflect the very low emission potential of the substance.</i>	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	

	Method
<ul style="list-style-type: none"> • Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%) 	MEASE 1.02.01
<ul style="list-style-type: none"> • Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i> 	
<ul style="list-style-type: none"> • Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i> 	
<ul style="list-style-type: none"> • Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i> 	
Other conditions affecting workers exposure	
<ul style="list-style-type: none"> • Place of use: Indoor 	

4.2.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 53. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.05 mg/m ³ (MEASE 1.02.01) RCR = 0.052	Final RCR = 0.052
Inhalation, local, long term	Silver nitrate	0.05 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.153

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

4.3. Worker CS 3: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities (PROC 8a)

Assessment entity group used for the assessment of this contributing scenario: HH RA

Includes moving of wet, impregnated carrier in the plant

4.3.1. Conditions of use

	Method
Product (article) characteristics	
<ul style="list-style-type: none"> • Percentage (w/w) of substance in mixture/article: <= 100 % 	MEASE 1.02.01
<ul style="list-style-type: none"> • Physical form of the used product: Solid (material with low dustiness) 	MEASE 1.02.01

	Method
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

4.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 54. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.5 mg/m ³ (MEASE 1.02.01) RCR = 0.521	Final RCR = 0.521
Inhalation, local, long term	Silver nitrate	0.5 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.069 mg/kg bw/day (MEASE 1.02.01) RCR = 0.202	Final RCR = 0.202
Combined routes, systemic, long-term			Final RCR = 0.723

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

4.4. Worker CS 4: Transfer of substance or mixture into small containers

(dedicated filling line, including weighing) (PROC 9)

Assessment entity group used for the assessment of this contributing scenario: HH RA
Includes automated filling and weighing of drums

4.4.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

4.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 55. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01) RCR = 0.104	Final RCR = 0.104
Inhalation, local, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Combined routes, systemic, long-term			Final RCR = 0.205

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

Exposure scenario 5: Use at industrial sites - Use of silver nitrate as intermediate in the production of silver or silver compounds

Product category used: PC 7: Base metals and alloys

Sector of use: SU 5: Manufacture of textiles, leather, fur; SU 6b: Manufacture of pulp, paper and paper products; SU 9: Manufacture of fine chemicals; SU 13: Manufacture of other non-metallic mineral products, e.g. plasters, cement; SU 16: Manufacture of computer, electronic and optical products, electrical equipment; SU 19: Building and construction work; SU 20: Health services; SU 23: Electricity, steam, gas water supply and sewage treatment

Environment contributing scenario(s):			SPERC
CS 1	Use of silver nitrate as intermediate in the production of silver or silver compounds	ERC 6a	Eurometaux SPERC 6a.1.v3
CS 2	Use of silver nitrate as intermediate in the production of silver or silver compounds - no emissions to water	ERC 6a	
Worker contributing scenario(s):			SWED
CS 3	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions	PROC 1	
CS 4	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions	PROC 2	
CS 5	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	PROC 3	
CS 6	Chemical production where opportunity for exposure arises	PROC 4	
CS 7	Mixing or blending in batch processes	PROC 5	
CS 8	Transfer of substance or mixture (charging/discharging) at dedicated facilities	PROC 8a	
CS 9	Transfer of substance or mixture (charging/discharging) at dedicated facilities	PROC 8b	
CS 10	Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	PROC 9	
CS 11	Use as laboratory agent	PROC 15	
CS 12	Manual activities involving hand contact	PROC 19	
CS 13	Handling of solid inorganic substances at ambient temperature	PROC 26	
CS 14	Production of metal powders (wet processes)	PROC 27a	
CS 15	Manual maintenance (cleaning and repair) of machinery	PROC 28	
CS 16	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	PROC 3	
CS 17	Chemical production where opportunity for exposure arises	PROC 4	
CS 18	Mixing or blending in batch processes	PROC 5	
CS 19	Transfer of substance or mixture (charging/discharging) at dedicated facilities	PROC 8a	

CS 20	Transfer of substance or mixture (charging/discharging) at dedicated facilities	PROC 8b
CS 21	Production of metal powders (wet processes)	PROC 27b
CS 22	Manual maintenance (cleaning and repair) of machinery	PROC 28

5.1. Env CS 1: Use of silver nitrate as intermediate in the production of silver or silver compounds (ERC 6a)

Assessment entity group used for the assessment of this contributing scenario: ENV RA

5.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
<ul style="list-style-type: none"> Annual use amount at site: ≤ 25 tonnes/year <i>All the amounts are expressed as Ag as this is the driver for the environmental risk assessment.</i> Daily use amount at site: ≤ 0.137 tonnes/day <i>Default number of emission days are derived from a multi-metal background database of measured site-specific release factors collected under the former Directive of New and Existing Substances and REACH 2010 registration dossiers.</i> <i>182 days/year is the 10th percentile of reported site-specific number of emission days for 168 sites from production of metal compounds.</i>
Technical and organisational conditions and measures
<ul style="list-style-type: none"> On site treatment of off-air: Electrostatic precipitators or wet electrostatic precipitators or cyclones or fabric/bag filter or ceramic/metal mesh filter according to the BAT Reference Document in the Non-Ferrous Metals Industry <i>Direct air emissions should be reduced by implementing one or more of the following RMMs (air concentration range for which the RMM is suitable is specified in parenthesis):</i> <ul style="list-style-type: none"> Electrostatic precipitators using wide electrode spacing: $5 - 15 \text{ mg/Nm}^3$ Wet electrostatic precipitators: $< 5 \text{ mg/Nm}^3$ Cyclones, but as primary collector: $< 50 \text{ mg/Nm}^3$ Fabric or bag filters: high efficiency in controlling fine particulate (melting): achieve emission values $< 5 \text{ mg/Nm}^3$. Membrane filtration techniques can achieve $< 1 \text{ mg/Nm}^3$ Ceramic and metal mesh filters. PM10 particles are removed: 0.1 mg/Nm^3 Wet scrubbers: $< 4 \text{ mg/Nm}^3$ On site treatment of wastewater: Chemical precipitation or sedimentation or filtration or electrolysis or reverse osmosis or ion exchange according to the BAT Reference Document in the Non-Ferrous Metals Industry (2017) applying minimum xx% removal efficiency <i>Direct water emissions should be reduced by implementing one or more of the following RMMs:</i> <ul style="list-style-type: none"> Chemical precipitation: used primarily to remove the metal ions (e.g. the use of Ca(OH)_2 to a pH 11: $>99\%$ removal efficiency; the use of Fe(OH)_3 to a pH 11: 96% removal efficiency) Sedimentation (e.g. Na_2S, pH 11, $>99\%$ removal efficiency) • Filtration: used as final clarification step (e.g. ultrafiltration, pH 5.1: 93% removal efficiency, nanofiltration: 97% removal efficiency, reverse osmosis, pH 4-11: 99% removal efficiency) Electrolysis: for low metal concentration at about 2 g/L (e.g. electrodialysis: 13% removal efficiency within 2 hours, membrane electrolysis, electrochemical precipitation, pH 4-10, $>99\%$ removal efficiency) • Reverse osmosis: extensively used for the removal of dissolved metals; Ion exchange: final cleaning step in the removal of heavy metal from process wastewater (e.g. 90% removal efficiency for clinoptinolite and 100% removal efficiency for synthetic zeolite) <p><i>Following the Integrated Pollution Prevention and Control – BAT Reference note document, the treatment methods are very much dependent on the specific processes and the metals involved. More information can be found in the BAT Reference Document for the Non-Ferrous Metals Industry (2017).</i></p>
Conditions and measures related to biological sewage treatment plant
<ul style="list-style-type: none"> Biological STP: None [Effectiveness Water: 0%]
Conditions and measures related to external treatment of waste (including article waste)
<ul style="list-style-type: none"> Particular considerations on the waste treatment operations: No (low concentration)

Waste includes sludge, filter cakes and solid waste. waste shall be handled according to the Waste Framework Directive and disposed of according to national/local legislation. If the metal content of the waste is elevated, internal or external recovery/recycling is considered.

Other conditions affecting environmental exposure

- Discharge rate of effluent: $\geq 2 \text{E}3 \text{ m}^3/\text{day}$

5.1.2. Releases

The releases have been estimated on the basis of SPERC Eurometaux SPERC 6a.1.v3: Intermediate use of metal compounds

Modification date: 09/09/2021

Description of activities/processes covered by the SPERC

Since this metal SPERC is based on measured data at end-of-pipe on-site, all indicated PROCs are integrated in the release fractions from raw materials handling to cleaning and maintenance.

Product/substance domain:

Substance groups or functions:

SPERC valid for metals with solid water partition coefficient for suspended matter between 1,000 L/kg and 400,000 L/kg.

Included in the metal definition (Eurometaux SPERCs): alkali metals, alkaline earth metals, transition metals, post-transition metals, metalloids and their compounds

Excluded from the metal definition: non-metals, halogens, noble gases and metallo-organic compounds.

Explanation for the release factor to soil:

ERC default

Sub-SPERC Eurometaux SPERC 6a.1g.v3 is used for Ag dissolved:

Explanation for the release factor to water:

After on-site STP.

Realistic worst-case regression line ($RF = 10^{(1.59 - 1.14 \times \log(Kd))}$) of the metal-specific 90th percentile reported site-specific release factors to wastewater for 201 sites from the production of massive metal and metal powder.

A relationship between solid-water partitioning coefficient for suspended matter K_d and the release factor to water can be justified because the K_d expresses the distribution between aqueous phase and suspended matter. K_d is an important parameter impacting the removal efficiency especially in sedimentation and precipitation RMMs but also in on-site runoff, cleaning operations, wet processes, etc

Explanation for the release factor to air:

Release after RMM. The 90th percentile of reported site-specific release factors to air for 145 sites from the production of massive metal and metal powder

The local releases to the environment are reported in the following table.

Table 56. Local releases to the environment

Release	Assessment entity	Release factor	Local release rate
Water	Ag dissolved	2E-3%	2.74E-3 kg/day
Air	Ag dissolved	0.03%	0.041 kg/day
Non agricultural soil	Ag dissolved	0.01%	- kg/day

Releases to waste

Release factor to external waste: 2.3 %

The 90th percentile of reported site-specific release factors to solid waste for 62 manufacturing sites covering zinc, nickel, lead, cobalt, cadmium, antimony

5.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 57. Exposure concentrations and risks for the environment and man via the environment

Protection target	Assessment entity	Exposure concentration	Risk quantification
Fresh water	Ag dissolved	Local PEC: 4.16E-5 mg/L RCR = 0.904	Final RCR = 0.904
Sediment (freshwater)	Ag dissolved	Local PEC: 7.921 mg/kg dw RCR = 0.018	Final RCR = 0.018
Marine water	Ag dissolved	Local PEC: 5.46E-6 mg/L RCR = 6.35E-3	Final RCR < 0.01
Sediment (marine water)	Ag dissolved	Local PEC: 1.041 mg/kg dw RCR = 2.38E-3	Final RCR < 0.01
Sewage Treatment Plant	Ag dissolved	Local PEC: 0 mg/L RCR = 0	Final RCR < 0.01
Agricultural soil	Ag dissolved	Local PEC: 0.098 mg/kg dw RCR = 0.093	Final RCR = 0.093
Man via environment - Inhalation (systemic effects)	Ag dissolved	Concentration in air: 5.8E-6 mg/m ³ RCR = 3.87E-5	Final RCR < 0.01
Man via environment - Oral	Ag dissolved	Exposure via food consumption: 3.84 µg/kg bw/day RCR = 0.035	Final RCR = 0.035
Man via environment - combined routes			Final RCR = 0.035

Remarks on measured exposure:

Identity of the substance used: Ag

Explanation: Worst case exposure of 3.84 µg Ag/kg bw/day from food was taken forward to the risk characterisation.

The intake via drinking water calculated with CHESAR was 3-4 orders of magnitudes lower compared to the intake via food and has thus not been taken into account.

5.2. Env CS 2: Use of silver nitrate as intermediate in the production of silver or silver compounds - no emissions to water (ERC 6a)

Assessment entity group used for the assessment of this contributing scenario: ENV RA

5.2.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
<ul style="list-style-type: none"> Annual use amount at site: ≤ 1E3 tonnes/year <i>All the amounts are expressed as Ag as this is the driver for the environmental risk assessment.</i> Daily use amount at site: ≤ 5.5 tonnes/day <i>Default number of emission days are derived from a multi-metal background database of measured site-specific release factors collected under the former Directive of New and Existing Substances and REACH 2010 registration dossiers.</i> <i>182 days/year is the 10th percentile of reported site-specific number of emission days for 168 sites from production of metal compounds.</i>
Technical and organisational conditions and measures
<ul style="list-style-type: none"> On site treatment of off-air: Electrostatic precipitators or wet electrostatic precipitators or cyclones or fabric/bag filter or ceramic/metal mesh filter according to the BAT Reference Document in the Non-Ferrous

<p>Metals Industry</p> <p><i>Direct air emissions should be reduced by implementing one or more of the following RMMs (air concentration range for which the RMM is suitable is specified in parenthesis):</i></p> <ul style="list-style-type: none"> • <i>Electrostatic precipitators using wide electrode spacing: 5 – 15 mg/Nm³</i> • <i>Wet electrostatic precipitators: < 5 mg/Nm³</i> • <i>Cyclones, but as primary collector: < 50 mg/Nm³</i> • <i>Fabric or bag filters: high efficiency in controlling fine particulate (melting): achieve emission values < 5mg/Nm³. Membrane filtration techniques can achieve < 1 mg/Nm³</i> • <i>Ceramic and metal mesh filters. PM10 particles are removed: 0.1 mg/Nm³</i> <p><i>Wet scrubbers: < 4 mg/Nm³</i></p>
<ul style="list-style-type: none"> • The substance should not be released to water <p><i>Emissions to surface water or to the sewage system are not allowed in this scenario</i></p>
Conditions and measures related to biological sewage treatment plant
<ul style="list-style-type: none"> • Biological STP: None [Effectiveness Water: 0%]
Conditions and measures related to external treatment of waste (including article waste)
<ul style="list-style-type: none"> • Particular considerations on the waste treatment operations: No (low concentration) <p><i>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 silver content of the waste is elevated enough, internal or external recovery/recycling might be considered.</i></p> <p><i>Appropriate waste codes: 06 05 02*, 08 01 11, 08 03 12*, 09 01 01*, 09 01 03*, 09 01 04*, 09 01 05*, 09 01 06*, 09 01 13*, 10 06 06*, 10 07 01, 10 07 02, 10 07 03, 10 07 04, 10 07 05, 11 01 09*, 15 01 10*, 15 02 02*, 16 01 18, 16 03 03*, 16 08 01, 16 11 04</i></p> <p><i>Suitable disposal: Hazardous waste produced during the manufacture and downstream use is sent to a recycler only marginal amounts are sent to a landfill or an incinerator. Waste containing silver is recycled for almost a 100%</i></p> <p><i>A detailed assessment has been performed on modelled and measured data and is reported in the Waste report (ARCHE, 2013)</i></p>
Other conditions affecting environmental exposure
<ul style="list-style-type: none"> • Receiving surface water flow rate: $\geq 1.8E4$ m³/day
<ul style="list-style-type: none"> • Discharge rate of effluent: $\geq 2E3$ m³/day

5.2.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 58. Local releases to the environment

Release	Assessment entity	Release estimation method	Explanations
Water	Ag dissolved	Estimated release factor	<p>Release factor before on site RMM: 0%</p> <p>Release factor after on site RMM: 0%</p> <p>Local release rate: 0 kg/day</p> <p>Explanation:</p> <p>Several companies have reported that they do not have emissions to water.</p>
Air	Ag dissolved	Estimated release factor (based on SPERC Eurometaux SPERC 6a.1.v3)	<p>Release factor before on site RMM: 0.026%</p> <p>Release factor after on site RMM: 0.026%</p> <p>Local release rate: 1.441 kg/day</p> <p>Explanation:</p> <p>Release after RMM. The 90th percentile of reported site-specific release factors to air for 145 sites from the production of massive metal and metal powder</p>
Non agricultural	Ag dissolved	Estimated release	Release factor after on site RMM: 0%

Release	Assessment entity	Release estimation method	Explanations
soil		factor	Explanation: No direct release to soil.

5.2.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 59. Exposure concentrations and risks for the environment and man via the environment

Protection target	Assessment entity	Exposure concentration	Risk quantification
Fresh water	Ag dissolved	Local PEC: 6.06E-6 mg/L RCR = 0.132	Final RCR = 0.132
Sediment (freshwater)	Ag dissolved	Local PEC: 1.155 mg/kg dw RCR = 2.64E-3	Final RCR < 0.01
Marine water	Ag dissolved	Local PEC: 1.91E-6 mg/L RCR = 2.22E-3	Final RCR < 0.01
Sediment (marine water)	Ag dissolved	Local PEC: 0.364 mg/kg dw RCR = 8.31E-4	Final RCR < 0.01
Sewage Treatment Plant	Ag dissolved	Local PEC: 0 mg/L RCR = 0	Final RCR < 0.01
Agricultural soil	Ag dissolved	Local PEC: 0.15 mg/kg dw RCR = 0.143	Final RCR = 0.143
Man via environment - Inhalation (systemic effects)	Ag dissolved	Concentration in air: 2E-4 mg/m ³ RCR = 1.33E-3	Final RCR < 0.01
Man via environment - Oral	Ag dissolved	Exposure via food consumption: 3.84 µg/kg bw/day RCR = 0.035	Final RCR = 0.035
Man via environment - combined routes			Final RCR = 0.036

Remarks on measured exposure:

Identity of the substance used: Ag

Explanation: Worst case exposure of 3.84 µg Ag/kg bw/day from food was taken forward to the risk characterisation.

The intake via drinking water calculated with CHESAR was 3-4 orders of magnitudes lower compared to the intake via food and has thus not been taken into account.

5.3. Worker CS 3: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC 1)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.3.1. Conditions of use

	Method
Product (article) characteristics	

	Method
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Closed system without breaches	MEASE 1.02.01
• Pattern of exposure control: Non-direct handling	MEASE 1.02.01
• Contact level: None	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

5.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 60. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.01 mg/m ³ (MEASE 1.02.01) RCR = 0.01	Final RCR = 0.01
Inhalation, local, long term	Silver nitrate	0.01 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	1.71E-3 mg/kg bw/day (MEASE 1.02.01) RCR = 5.03E-3	Final RCR < 0.01
Combined routes, systemic, long-term			Final RCR = 0.015

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.4. Worker CS 4: Chemical production or refinery in closed continuous

process with occasional controlled exposure or processes with equivalent containment conditions (PROC 2)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.4.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Incidental	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

5.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 61. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.01 mg/m ³ (MEASE 1.02.01) RCR = 0.01	Final RCR = 0.01
Inhalation, local, long term	Silver nitrate	0.01 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.111

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.5. Worker CS 5: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC 3)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.5.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Incidental	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

5.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 62. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01) RCR = 0.104	Final RCR = 0.104

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, local, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.017 mg/kg bw/day (MEASE 1.02.01) RCR = 0.05	Final RCR = 0.05
Combined routes, systemic, long-term			Final RCR = 0.154

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.6. Worker CS 6: Chemical production where opportunity for exposure arises (PROC 4)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.6.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

5.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 63. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.5 mg/m ³ (MEASE 1.02.01) RCR = 0.521	Final RCR = 0.521
Inhalation, local, long term	Silver nitrate	0.5 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.622

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.7. Worker CS 7: Mixing or blending in batch processes (PROC 5)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.7.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes	

	Method
<i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

5.7.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 64. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.5 mg/m ³ (MEASE 1.02.01) RCR = 0.521	Final RCR = 0.521
Inhalation, local, long term	Silver nitrate	0.5 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.622

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.8. Worker CS 8: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC 8a)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.8.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation	

	Method
<i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
<ul style="list-style-type: none"> Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i> 	
<ul style="list-style-type: none"> Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i> 	
Other conditions affecting workers exposure	
<ul style="list-style-type: none"> Place of use: Indoor 	

5.8.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 65. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.5 mg/m ³ (MEASE 1.02.01) RCR = 0.521	Final RCR = 0.521
Inhalation, local, long term	Silver nitrate	0.5 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.069 mg/kg bw/day (MEASE 1.02.01) RCR = 0.202	Final RCR = 0.202
Combined routes, systemic, long-term			Final RCR = 0.723

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.9. Worker CS 9: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC 8b)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.9.1. Conditions of use

	Method
Product (article) characteristics	
<ul style="list-style-type: none"> Percentage (w/w) of substance in mixture/article: <= 100 % 	MEASE 1.02.01
<ul style="list-style-type: none"> Physical form of the used product: Solid (material with low dustiness) 	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
<ul style="list-style-type: none"> Duration of activity: <= 8 h/day 	MEASE 1.02.01
Technical and organisational conditions and measures	
<ul style="list-style-type: none"> Occupational Health and Safety Management System: Advanced 	MEASE 1.02.01

	Method
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

5.9.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 66. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01) RCR = 0.104	Final RCR = 0.104
Inhalation, local, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.205

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.10. Worker CS 10: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.10.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)	MEASE 1.02.01
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

5.10.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 67. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01) RCR = 0.104	Final RCR = 0.104
Inhalation, local, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.205

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.11. Worker CS 11: Use as laboratory agent (PROC 15)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.11.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

5.11.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 68. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01) RCR = 0.104	Final RCR = 0.104
Inhalation, local, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic,	Silver nitrate	0.017 mg/kg bw/day (MEASE 1.02.01)	Final RCR = 0.05

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
long term		RCR = 0.05	
Combined routes, systemic, long-term			Final RCR = 0.154

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.12. Worker CS 12: Manual activities involving hand contact (PROC 19)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.12.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

5.12.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 69. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.5 mg/m ³ (MEASE 1.02.01) RCR = 0.521	Final RCR = 0.521
Inhalation, local, long term	Silver nitrate	0.5 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.141 mg/kg bw/day (MEASE 1.02.01) RCR = 0.415	Final RCR = 0.415
Combined routes, systemic, long-term			Final RCR = 0.936

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.13. Worker CS 13: Handling of solid inorganic substances at ambient temperature (PROC 26)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.13.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
• Generic local exhaust ventilation: Lower confidence limit (industrial use) [Effectiveness Inhalation: 78%] <i>Standard efficiency</i> Inhalation explanation: <i>Efficiency for industrial use</i>	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)	MEASE 1.02.01
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to</i>	

	Method
<i>the substance can be excluded.</i>	
<ul style="list-style-type: none"> Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i> 	
Other conditions affecting workers exposure	
<ul style="list-style-type: none"> Place of use: Indoor 	

5.13.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 70. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.33 mg/m ³ (MEASE 1.02.01) RCR = 0.344	Final RCR = 0.344
Inhalation, local, long term	Silver nitrate	0.33 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.141 mg/kg bw/day (MEASE 1.02.01) RCR = 0.415	Final RCR = 0.415
Combined routes, systemic, long-term			Final RCR = 0.758

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.14. Worker CS 14: Production of metal powders (wet processes) (PROC 27a)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.14.1. Conditions of use

	Method
Product (article) characteristics	
<ul style="list-style-type: none"> Percentage (w/w) of substance in mixture/article: <= 100 % 	MEASE 1.02.01
<ul style="list-style-type: none"> Physical form of the used product: Solid (material with low dustiness) 	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
<ul style="list-style-type: none"> Duration of activity: <= 8 h/day 	MEASE 1.02.01
Technical and organisational conditions and measures	
<ul style="list-style-type: none"> Occupational Health and Safety Management System: Advanced 	MEASE 1.02.01
<ul style="list-style-type: none"> Pattern of use: Non-dispersive use 	MEASE 1.02.01
<ul style="list-style-type: none"> Pattern of exposure control: Direct handling 	MEASE 1.02.01
<ul style="list-style-type: none"> Contact level: Extensive 	MEASE 1.02.01
<ul style="list-style-type: none"> Generic local exhaust ventilation: Lower confidence limit (industrial use) [Effectiveness Inhalation: 78%] <i>Standard efficiency</i> 	MEASE 1.02.01

	Method
Inhalation explanation: <i>Efficiency for industrial use</i>	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Respiratory protection: Yes (APF >= 10)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

5.14.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 71. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.11 mg/m ³ (MEASE 1.02.01) RCR = 0.115	Final RCR = 0.115
Inhalation, local, long term	Silver nitrate	0.11 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.141 mg/kg bw/day (MEASE 1.02.01) RCR = 0.415	Final RCR = 0.415
Combined routes, systemic, long-term			Final RCR = 0.529

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.15. Worker CS 15: Manual maintenance (cleaning and repair) of machinery (PROC 28)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.15.1. Conditions of use

	Method
Product (article) characteristics	

	Method
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

5.15.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 72. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.5 mg/m ³ (MEASE 1.02.01) RCR = 0.521	Final RCR = 0.521
Inhalation, local, long term	Silver nitrate	0.5 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.069 mg/kg bw/day (MEASE 1.02.01) RCR = 0.202	Final RCR = 0.202
Combined routes, systemic, long-term			Final RCR = 0.723

Remarks on exposure data from external estimation tools:

MEASE 1.02.01 for Silver nitrate:

Explanation:

As the MEASE 1.02.01 exposure estimation tool for workers does not provide exposure estimates for PROC 28, PROC 8a has been used instead as the input parameter assuming that there are similarities in the exposure.

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.16. Worker CS 16: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC 3)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.16.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Note that 'aqueous solution' was selected in MEASE to reflect the very low emission potential of the substance.</i>	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Incidental	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

5.16.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 73. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.01 mg/m ³ (MEASE 1.02.01) RCR = 0.01	Final RCR = 0.01
Inhalation, local, long term	Silver nitrate	0.01 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.017 mg/kg bw/day (MEASE 1.02.01) RCR = 0.05	Final RCR = 0.05
Combined routes, systemic, long-term			Final RCR = 0.061

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.17. Worker CS 17: Chemical production where opportunity for exposure arises (PROC 4)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.17.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Note that 'aqueous solution' was selected in MEASE to reflect the very low emission potential of the substance.</i>	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must</i>	

	Method
<i>be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

5.17.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 74. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.05 mg/m ³ (MEASE 1.02.01) RCR = 0.052	Final RCR = 0.052
Inhalation, local, long term	Silver nitrate	0.05 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.153

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.18. Worker CS 18: Mixing or blending in batch processes (PROC 5)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.18.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Note that 'aqueous solution' was selected in MEASE to reflect the very low emission potential of the substance.</i>	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to</i>	

	Method
<i>the substance can be excluded.</i>	
<ul style="list-style-type: none"> Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i> 	
<ul style="list-style-type: none"> Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i> 	
Other conditions affecting workers exposure	
<ul style="list-style-type: none"> Place of use: Indoor 	

5.18.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 75. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.05 mg/m ³ (MEASE 1.02.01) RCR = 0.052	Final RCR = 0.052
Inhalation, local, long term	Silver nitrate	0.05 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.153

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.19. Worker CS 19: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC 8a)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.19.1. Conditions of use

	Method
Product (article) characteristics	
<ul style="list-style-type: none"> Percentage (w/w) of substance in mixture/article: <= 100 % 	MEASE 1.02.01
<ul style="list-style-type: none"> Physical form of the used product: Liquid, including paste/slurry/suspension <i>Note that 'aqueous solution' was selected in MEASE to reflect the very low emission potential of the substance.</i> 	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
<ul style="list-style-type: none"> Duration of activity: <= 8 h/day 	MEASE 1.02.01
Technical and organisational conditions and measures	
<ul style="list-style-type: none"> Occupational Health and Safety Management System: Advanced 	MEASE 1.02.01

	Method
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

5.19.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 76. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.05 mg/m ³ (MEASE 1.02.01) RCR = 0.052	Final RCR = 0.052
Inhalation, local, long term	Silver nitrate	0.05 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.153

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.20. Worker CS 20: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC 8b)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.20.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	MEASE 1.02.01
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Note that 'aqueous solution' was selected in MEASE to reflect the very low emission potential of the substance.</i>	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)	MEASE 1.02.01
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

5.20.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 77. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.01 mg/m ³ (MEASE 1.02.01) RCR = 0.01	Final RCR = 0.01
Inhalation, local, long term	Silver nitrate	0.01 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.111

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.21. Worker CS 21: Production of metal powders (wet processes) (PROC 27b)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.21.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Note that 'aqueous solution' was selected in MEASE to reflect the very low emission potential of the substance.</i>	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

5.21.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 78. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic,	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01)	Final RCR = 0.104

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
long term		RCR = 0.104	
Inhalation, local, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.205

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

5.22. Worker CS 22: Manual maintenance (cleaning and repair) of machinery (PROC 28)

Assessment entity group used for the assessment of this contributing scenario: HH RA

5.22.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Note that 'aqueous solution' was selected in MEASE to reflect the very low emission potential of the substance.</i>	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	

	Method
Other conditions affecting workers exposure	
• Place of use: Indoor	

5.22.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 79. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.05 mg/m ³ (MEASE 1.02.01) RCR = 0.052	Final RCR = 0.052
Inhalation, local, long term	Silver nitrate	0.05 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.034 mg/kg bw/day (MEASE 1.02.01) RCR = 0.101	Final RCR = 0.101
Combined routes, systemic, long-term			Final RCR = 0.153

Remarks on exposure data from external estimation tools:

MEASE 1.02.01 for Silver nitrate:

Explanation:

As the MEASE 1.02.01 exposure estimation tool for workers does not provide exposure estimates for PROC 28, PROC 8a has been used instead as the input parameter assuming that there are similarities in the exposure.

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

Exposure scenario 6: Use at industrial sites - Use of silver nitrate as non-reactive laboratory reagent

Product category used: PC 20: Products such as ph-regulators, flocculants, precipitants, neutralization agents; PC 21: Laboratory Chemicals; PC 25: Metal Working Fluids

Sector of use: SU 9: Manufacture of fine chemicals; SU 16: Manufacture of computer, electronic and optical products, electrical equipment; SU 20: Health services; SU 24: Scientific research and development

Environment contributing scenario(s):		
CS 1	Use of silver nitrate as non-reactive laboratory reagent	ERC 4
Worker contributing scenario(s):		
CS 2	Use as laboratory reagent	PROC 15

6.1. Env CS 1: Use of silver nitrate as non-reactive laboratory reagent (ERC 4)

Assessment entity group used for the assessment of this contributing scenario: ENV RA

6.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Annual use amount at site: <= 1 tonnes/year
• Daily use amount at site: <= 0.05 tonnes/day
Technical and organisational conditions and measures
• The substance should not be released to water <i>Emissions to surface water or to the sewage system are not allowed in this scenario</i>
• The substance should not be released to air <i>Emissions to air are not allowed in this scenario</i>
Conditions and measures related to biological sewage treatment plant
• Biological STP: None [Effectiveness Water: 0%]
Conditions and measures related to external treatment of waste (including article waste)
<p>• Particular considerations on the waste treatment operations: No (low concentration) <i>Particular risks from waste treatment unlikely due low concentration of substance in waste stream. Waste disposal according to national/local legislation is 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 silver content of the waste is elevated enough, internal or external recovery/recycling might be considered.</i> <i>Appropriate waste codes: 06 05 02*, 08 01 11, 08 03 12*, 09 01 01*, 09 01 03*, 09 01 04*, 09 01 05*, 09 01 06*, 09 01 13*, 10 06 06*, 10 07 01, 10 07 02, 10 07 03, 10 07 04, 10 07 05, 11 01 09*, 15 01 10*, 15 02 02*, 16 01 18, 16 03 03*, 16 08 01, 16 11 04</i> <i>Suitable disposal: Hazardous waste produced during the manufacture and downstream use is sent to a recycler only marginal amounts are sent to a landfill or an incinerator. Waste containing silver is recycled for almost a 100%</i> <i>A detailed assessment has been performed on modelled and measured data and is reported in the Waste report (ARCHE, 2013)</i></p>
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 1.8E4 m3/day
• Discharge rate of effluent: >= 2E3 m3/day

6.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 80. Local releases to the environment

Release	Assessment entity	Release estimation method	Explanations
Water	Ag dissolved	Estimated release factor	Release factor before on site RMM: 0% Release factor after on site RMM: 0% Local release rate: 0 kg/day Explanation: Liquid waste from laboratories is collected and treated separately and not poured down the drain.
Air	Ag dissolved	Estimated release factor	Release factor before on site RMM: 0% Release factor after on site RMM: 0% Local release rate: 0 kg/day Explanation: Small quantities are handled in solutions, due to the low vapour pressure of silver emissions to air are not considered relevant.
Non agricultural soil	Ag dissolved	Estimated release factor	Release factor after on site RMM: 0% Explanation: No direct release to soil.

6.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 81. Exposure concentrations and risks for the environment and man via the environment

Protection target	Assessment entity	Exposure concentration	Risk quantification
Fresh water	Ag dissolved	Local PEC: 6.06E-6 mg/L RCR = 0.132	Final RCR = 0.132
Sediment (freshwater)	Ag dissolved	Local PEC: 1.155 mg/kg dw RCR = 2.64E-3	Final RCR < 0.01
Marine water	Ag dissolved	Local PEC: 1.91E-6 mg/L RCR = 2.22E-3	Final RCR < 0.01
Sediment (marine water)	Ag dissolved	Local PEC: 0.364 mg/kg dw RCR = 8.31E-4	Final RCR < 0.01
Sewage Treatment Plant	Ag dissolved	Local PEC: 0 mg/L RCR = 0	Final RCR < 0.01
Agricultural soil	Ag dissolved	Local PEC: 0.096 mg/kg dw RCR = 0.091	Final RCR = 0.091
Man via environment - Inhalation (systemic effects)	Ag dissolved	Concentration in air: 8.53E-8 mg/m ³ RCR = 5.69E-7	Final RCR < 0.01
Man via environment - Oral	Ag dissolved	Exposure via food consumption: 3.84 µg/kg bw/day RCR = 0.035	Final RCR = 0.035
Man via environment - combined routes			Final RCR = 0.035

Remarks on measured exposure:

Identity of the substance used: Ag

Explanation: Worst case exposure of 3.84 µg Ag/kg bw/day from food was taken forward to the risk characterisation.

The intake via drinking water calculated with CHESAR was 3-4 orders of magnitudes lower compared to the intake via food and has thus not been taken into account.

6.2. Worker CS 2: Use as laboratory reagent (PROC 15)

Assessment entity group used for the assessment of this contributing scenario: HH RA

Covers laboratory use both as liquid and solid substance

6.2.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

6.2.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 82. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01) RCR = 0.104	Final RCR = 0.104

Exposure scenario 7: Use at industrial sites - Use of silver nitrate as reactive laboratory reagent

Product category used: PC 20: Products such as ph-regulators, flocculants, precipitants, neutralization agents; PC 21: Laboratory Chemicals

Sector of use: SU 9: Manufacture of fine chemicals; SU 20: Health services; SU 24: Scientific research and development

Environment contributing scenario(s):		
CS 1	Use of silver nitrate as reactive laboratory reagent	ERC 6a
CS 2	Use of silver nitrate as reactive laboratory reagent	ERC 6b
Worker contributing scenario(s):		
CS 3	Use as laboratory reagent	PROC 15

7.1. Env CS 1: Use of silver nitrate as reactive laboratory reagent (ERC 6a)

Assessment entity group used for the assessment of this contributing scenario: ENV RA

7.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Annual use amount at site: <= 1 tonnes/year
• Daily use amount at site: <= 0.05 tonnes/day
Technical and organisational conditions and measures
• The substance should not be released to water <i>Emissions to surface water or to the sewage system are not allowed in this scenario</i>
• The substance should not be released to air <i>Emissions to air are not allowed in this scenario</i>
Conditions and measures related to biological sewage treatment plant
• Biological STP: None [Effectiveness Water: 0%]
Conditions and measures related to external treatment of waste (including article waste)
<p>• Particular considerations on the waste treatment operations: No (low concentration) <i>Particular risks from waste treatment unlikely due low concentration of substance in waste stream. Waste disposal according to national/local legislation is 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 silver content of the waste is elevated enough, internal or external recovery/recycling might be considered.</i></p> <p><i>Appropriate waste codes: 06 05 02*, 08 01 11, 08 03 12*, 09 01 01*, 09 01 03*, 09 01 04*, 09 01 05*, 09 01 06*, 09 01 13*, 10 06 06*, 10 07 01, 10 07 02, 10 07 03, 10 07 04, 10 07 05, 11 01 09*, 15 01 10*, 15 02 02*, 16 01 18, 16 03 03*, 16 08 01, 16 11 04</i></p> <p><i>Suitable disposal: Hazardous waste produced during the manufacture and downstream use is sent to a recycler only marginal amounts are sent to a landfill or an incinerator. Waste containing silver is recycled for almost a 100%</i></p> <p><i>A detailed assessment has been performed on modelled and measured data and is reported in the Waste report (ARCHE, 2013)</i></p>
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 1.8E4 m3/day
• Discharge rate of effluent: >= 2E3 m3/day

7.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 83. Local releases to the environment

Release	Assessment entity	Release estimation method	Explanations
Water	Ag dissolved	Estimated release factor	Release factor before on site RMM: 0% Release factor after on site RMM: 0% Local release rate: 0 kg/day Explanation: Liquid waste from laboratories is collected and treated separately and not poured down the drain.
Air	Ag dissolved	Estimated release factor	Release factor before on site RMM: 0% Release factor after on site RMM: 0% Local release rate: 0 kg/day Explanation: Small quantities are handled in solutions, due to the low vapour pressure of silver emissions to air are not considered relevant.
Non agricultural soil	Ag dissolved	Estimated release factor	Release factor after on site RMM: 0% Explanation: No direct release to soil.

7.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 84. Exposure concentrations and risks for the environment and man via the environment

Protection target	Assessment entity	Exposure concentration	Risk quantification
Fresh water	Ag dissolved	Local PEC: 6.06E-6 mg/L RCR = 0.132	Final RCR = 0.132
Sediment (freshwater)	Ag dissolved	Local PEC: 1.155 mg/kg dw RCR = 2.64E-3	Final RCR < 0.01
Marine water	Ag dissolved	Local PEC: 1.91E-6 mg/L RCR = 2.22E-3	Final RCR < 0.01
Sediment (marine water)	Ag dissolved	Local PEC: 0.364 mg/kg dw RCR = 8.31E-4	Final RCR < 0.01
Sewage Treatment Plant	Ag dissolved	Local PEC: 0 mg/L RCR = 0	Final RCR < 0.01
Agricultural soil	Ag dissolved	Local PEC: 0.096 mg/kg dw RCR = 0.091	Final RCR = 0.091
Man via environment - Inhalation (systemic effects)	Ag dissolved	Concentration in air: 8.53E-8 mg/m ³ RCR = 5.69E-7	Final RCR < 0.01
Man via environment - Oral	Ag dissolved	Exposure via food consumption: 3.84 µg/kg bw/day RCR = 0.035	Final RCR = 0.035
Man via environment - combined routes			Final RCR = 0.035

Remarks on measured exposure:

Identity of the substance used: Ag

Explanation: Worst case exposure of 3.84 µg Ag/kg bw/day from food was taken forward to the risk characterisation.

The intake via drinking water calculated with CHESAR was 3-4 orders of magnitudes lower compared to the intake via food and has thus not been taken into account.

7.2. Env CS 2: Use of silver nitrate as reactive laboratory reagent (ERC 6b)

Assessment entity group used for the assessment of this contributing scenario: ENV RA

7.2.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Annual use amount at site: <= 1 tonnes/year
• Daily use amount at site: <= 0.05 tonnes/day
Technical and organisational conditions and measures
• The substance should not be released to water <i>Emissions to surface water or to the sewage system are not allowed in this scenario</i>
• The substance should not be released to air <i>Emissions to air are not allowed in this scenario</i>
Conditions and measures related to biological sewage treatment plant
• Biological STP: None [Effectiveness Water: 0%]
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: No (low concentration) <i>Particular risks from waste treatment unlikely due low concentration of substance in waste stream. Waste disposal according to national/local legislation is 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 silver content of the waste is elevated enough, internal or external recovery/recycling might be considered.</i> <i>Appropriate waste codes: 06 05 02*, 08 01 11, 08 03 12*, 09 01 01*, 09 01 03*, 09 01 04*, 09 01 05*, 09 01 06*, 09 01 13*, 10 06 06*, 10 07 01, 10 07 02, 10 07 03, 10 07 04, 10 07 05, 11 01 09*, 15 01 10*, 15 02 02*, 16 01 18, 16 03 03*, 16 08 01, 16 11 04</i> <i>Suitable disposal: Hazardous waste produced during the manufacture and downstream use is sent to a recycler only marginal amounts are sent to a landfill or an incinerator. Waste containing silver is recycled for almost a 100%</i> <i>A detailed assessment has been performed on modelled and measured data and is reported in the Waste report (ARCHE, 2013)</i>
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 1.8E4 m3/day
• Discharge rate of effluent: >= 2E3 m3/day

7.2.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 85. Local releases to the environment

Release	Assessment entity	Release estimation method	Explanations
Water	Ag dissolved	Estimated release	Release factor before on site RMM: 0%

Release	Assessment entity	Release estimation method	Explanations
		factor	Release factor after on site RMM: 0% Local release rate: 0 kg/day Explanation: Liquid waste from laboratories is collected and treated separately and not poured down the drain.
Air	Ag dissolved	Estimated release factor	Release factor before on site RMM: 0% Release factor after on site RMM: 0% Local release rate: 0 kg/day Explanation: Small quantities are handled in solutions, due to the low vapour pressure of silver emissions to air are not considered relevant.
Non agricultural soil	Ag dissolved	Estimated release factor	Release factor after on site RMM: 0% Explanation: No direct release to soil.

7.2.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 86. Exposure concentrations and risks for the environment and man via the environment

Protection target	Assessment entity	Exposure concentration	Risk quantification
Fresh water	Ag dissolved	Local PEC: 6.06E-6 mg/L RCR = 0.132	Final RCR = 0.132
Sediment (freshwater)	Ag dissolved	Local PEC: 1.155 mg/kg dw RCR = 2.64E-3	Final RCR < 0.01
Marine water	Ag dissolved	Local PEC: 1.91E-6 mg/L RCR = 2.22E-3	Final RCR < 0.01
Sediment (marine water)	Ag dissolved	Local PEC: 0.364 mg/kg dw RCR = 8.31E-4	Final RCR < 0.01
Sewage Treatment Plant	Ag dissolved	Local PEC: 0 mg/L RCR = 0	Final RCR < 0.01
Agricultural soil	Ag dissolved	Local PEC: 0.096 mg/kg dw RCR = 0.091	Final RCR = 0.091
Man via environment - Inhalation (systemic effects)	Ag dissolved	Concentration in air: 8.53E-8 mg/m ³ RCR = 5.69E-7	Final RCR < 0.01
Man via environment - Oral	Ag dissolved	Exposure via food consumption: 3.84 µg/kg bw/day RCR = 0.035	Final RCR = 0.035
Man via environment - combined routes			Final RCR = 0.035

Remarks on measured exposure:

Identity of the substance used: Ag

Explanation: Worst case exposure of 3.84 µg Ag/kg bw/day from food was taken forward to the risk characterisation.

The intake via drinking water calculated with CHESAR was 3-4 orders of magnitudes lower compared to the intake via food and has thus not been taken into account.

7.3. Worker CS 3: Use as laboratory reagent (PROC 15)

Assessment entity group used for the assessment of this contributing scenario: HH RA
Covers laboratory use both as liquid and solid substance

7.3.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation <i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
• Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i>	
• Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i>	
Other conditions affecting workers exposure	
• Place of use: Indoor	

7.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 87. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01) RCR = 0.104	Final RCR = 0.104
Inhalation, local, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01)	Qualitative risk

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Dermal, systemic, long term	Silver nitrate	0.017 mg/kg bw/day (MEASE 1.02.01) RCR = 0.05	Final RCR = 0.05
Combined routes, systemic, long-term			Final RCR = 0.154

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

Exposure scenario 8: Widespread use by professional workers - Use of silver nitrate as non-reactive laboratory reagent

Product category used: PC 20: Products such as ph-regulators, flocculants, precipitants, neutralization agents;
PC 21: Laboratory Chemicals

Sector of use: SU 20: Health services; SU 24: Scientific research and development

Environment contributing scenario(s):		
CS 1	Use of silver nitrate as non-reactive laboratory reagent	ERC 8a
Worker contributing scenario(s):		
CS 2	Use as laboratory reagent	PROC 15

8.1. Env CS 1: Use of silver nitrate as non-reactive laboratory reagent (ERC 8a)

Assessment entity group used for the assessment of this contributing scenario: ENV RA

8.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: $\leq 5.5E-6$ tonnes/day
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 80.1%]
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations

8.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 88. Local releases to the environment

Release	Assessment entity	Release estimation method	Explanations
Water	Ag dissolved	ERC	Release factor before on site RMM: 100% Release factor after on site RMM: 100% Local release rate: $5.5E-3$ kg/day
Air	Ag dissolved	ERC	Release factor before on site RMM: 100% Release factor after on site RMM: 100%
Non agricultural soil	Ag dissolved	ERC	Release factor after on site RMM: 0%

8.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 89. Exposure concentrations and risks for the environment and man via the environment

Protection target	Assessment entity	Exposure concentration	Risk quantification
Fresh water	Ag dissolved	Local PEC: $2.02E-5$ mg/L RCR = 0.44	Final RCR = 0.44
Sediment	Ag dissolved	Local PEC: 3.858 mg/kg dw	Final RCR < 0.01

Protection target	Assessment entity	Exposure concentration	Risk quantification
(freshwater)		RCR = 8.8E-3	
Marine water	Ag dissolved	Local PEC: 3.33E-6 mg/L RCR = 3.87E-3	Final RCR < 0.01
Sediment (marine water)	Ag dissolved	Local PEC: 0.634 mg/kg dw RCR = 1.45E-3	Final RCR < 0.01
Sewage Treatment Plant	Ag dissolved	Local PEC: 5.47E-4 mg/L RCR = 0.022	Final RCR = 0.022
Agricultural soil	Ag dissolved	Local PEC: 0.189 mg/kg dw RCR = 0.18	Final RCR = 0.18
Man via environment - Inhalation (systemic effects)	Ag dissolved	Concentration in air: 8.53E-8 mg/m ³ RCR = 5.69E-7	Final RCR < 0.01
Man via environment - Oral	Ag dissolved	Exposure via food consumption: 3.84 µg/kg bw/day RCR = 0.035	Final RCR = 0.035
Man via environment - combined routes			Final RCR = 0.035

Remarks on measured exposure:

Identity of the substance used: Ag

Explanation: Worst case exposure of 3.84 µg Ag/kg bw/day from food was taken forward to the risk characterisation.

The intake via drinking water calculated with CHESAR was 3-4 orders of magnitudes lower compared to the intake via food and has thus not been taken into account.

8.2. Worker CS 2: Use as laboratory reagent (PROC 15)

Assessment entity group used for the assessment of this contributing scenario: HH RA

Covers laboratory use both as liquid and solid substance

8.2.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	MEASE 1.02.01
• Physical form of the used product: Solid (material with low dustiness)	MEASE 1.02.01
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	MEASE 1.02.01
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Basic	MEASE 1.02.01
• Pattern of use: Non-dispersive use	MEASE 1.02.01
• Pattern of exposure control: Direct handling	MEASE 1.02.01
• Contact level: Extensive	MEASE 1.02.01
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	MEASE 1.02.01
• Respiratory protective equipment (RPE) as precautionary measure: RPE protecting from local effects via inhalation	

	Method
<i>Due to potential adverse effects of the substance to the respiratory tract, RPE is prescribed on a precautionary basis for all workplaces unless inhalation exposure to the substance can be excluded.</i>	
<ul style="list-style-type: none"> Gloves as precautionary measure: Gloves protecting from local effects to the skin (high hazard) <i>Due to the potential adverse effects of the substance to skin, protective gloves according to EN 374 have to be worn at all workplaces. Additionally, face protection is required to be worn as appropriate.</i> 	
<ul style="list-style-type: none"> Eye protection: Eye protection to be worn to protect from adverse effects to the eyes <i>Due to the adverse effects of the substance to the eyes, direct contact of the eyes with the substance is to be avoided including hand to eye transfer after touching contaminated surfaces. Suitable eye protection equipment (e.g. goggles or visors) must be worn.</i> 	
Other conditions affecting workers exposure	
<ul style="list-style-type: none"> Place of use: Indoor 	

8.2.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 90. Exposure concentrations and risks for workers

Route of exposure and type of effects	Assessment entity	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01) RCR = 0.104	Final RCR = 0.104
Inhalation, local, long term	Silver nitrate	0.1 mg/m ³ (MEASE 1.02.01)	Qualitative risk
Dermal, systemic, long term	Silver nitrate	0.017 mg/kg bw/day (MEASE 1.02.01) RCR = 0.05	Final RCR = 0.05
Combined routes, systemic, long-term			Final RCR = 0.154

Risk characterisation

Qualitative risk characterisation (Inhalation, local, long term, Inhalation, local, acute, Dermal, local, long term, Dermal, local, acute, Eye, local):

Exposure scenario 10: Service life (consumers) - Service life of articles coated with metallic silver

Environment contributing scenario(s):			SPERC
CS 1	Service life of articles coated with metallic silver	ERC 11a	Eurometaux SPERC 11A.3.v1
Consumer contributing scenario(s):			SCED
CS 2	Electrical/electronics articles coated with metallic silver	AC 2	
CS 3	Glass articles coated with metallic silver	AC 4	
CS 4	Metal articles coated with metallic silver	AC 7	

Exposure scenario(s) of the uses leading to the inclusion of the substance into the article(s):

ES3: Use at industrial sites - Use of silver nitrate in coating

ES4: Use at industrial sites - Use of silver nitrate in the production of catalysts

Further description of the use:

After metal surface treatment the treated articles are not expected to contain silver nitrate since the substance is transformed to silver metal during deposition on the article.

Explanation on the approach taken for the ES:

The treated articles contain silver in metallic form with > 99.9% purity, as a result the articles don't contain residual silver nitrate in concentrations above those triggering classification.

Silver metal (EC 231-131-3) is registered in the > 1000 T/y tonnage band. Massive silver has no classification and silver powder is classified for environment. As a worst case approach the PNECs for silver powder have been used. Both massive silver and silver powder don't have DNELs. No hazards have been identified.

10.1. Env CS 1: Service life of articles coated with metallic silver (ERC 11a)

Assessment entity group used for the assessment of this contributing scenario: ENV RA

This service life step is not relevant for silver nitrate anymore since the substance transformed to silver metal.

10.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 1.1E-4 tonnes/day
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Dedicated recollection infrastructure required
Other conditions affecting environmental exposure
• Place of use: Indoor
• Water contact during use: No
• Biological STP: Standard [Effectiveness Water: 80.1%]

10.1.2. Releases

The releases have been estimated on the basis of SPERC Eurometaux SPERC 11A.3.v1: Service life of metallic articles with no emission

Modification date: 09/09/2021

Description of activities/processes covered by the SPERC

Service life of metallic articles with no emission

Service life covers foreseen use of articles by consumers.

The service life covers only uses with no water-contact (either by using the article away from water or if the metal in the article is encapsulated or coated to avoid water-contact) and uses with no emissions from the article. Processes such as sanding, polishing, machining etc. are not covered.

Product/substance domain:

Scope of the SPERC

Substance groups or function:

Included in the metal definition (Eurometaux SPERCs): alkali metals, alkaline earth metals, transition metals, post-transition metals, metalloids Excluded from the metal definition: non-metals, halogens, noble gases and metallo-organic compounds.

Type of products: Products are metallic articles where the metal is either encapsulated / there is a mechanical barrier (to avoid direct contact with water) or there is no intended contact with water because incompatible with water (because this would lead to disfunctioning of the article): electronic and electric devices such as screens, monitors, IT and telecommunication equipment (e.g. mobile phone), large household appliances, small household appliances, photovoltaic cells, vehicles, etc..

Excluded type of products: brake pads, tyres, monitoring instruments.

Explanation for the release factor to water:

Metal in either encapsulated / there is a mechanical barrier (to avoid direct contact with water) or there is no intended contact with water because incompatible with water (because this would lead to disfunctioning of the article) AND there is no abrasion of the article

Explanation for the release factor to air:

Metals and metal compounds do not volatilise. Due to the massive physical state in service life, there is no dust formation that can become air-borne.

Explanation for the release factor to soil:

ERC default: not applicable

Sub-SPERC Eurometaux SPERC 11A.3.v2 is used for Ag dissolved:

The local releases to the environment are reported in the following table.

Table 94. Local releases to the environment

Release	Assessment entity	Release factor	Local release rate
Water	Ag dissolved	0%	0 kg/day
Air	Ag dissolved	0%	- kg/day
Non agricultural soil	Ag dissolved	0%	- kg/day

Releases to waste

Release factor to external waste: 54 %

Recycling rates for WEEE in the EU was in 2016 46% (range between 30% and 96%) (Eurostat). Potential fraction for solid waste is then 54%.

10.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 95. Exposure concentrations and risks for the environment and man via the environment

Protection target	Assessment entity	Exposure concentration	Risk quantification
Fresh water	Ag dissolved	Local PEC: 6.06E-6 mg/L RCR = 0.132	Final RCR = 0.132
Sediment (freshwater)	Ag dissolved	Local PEC: 1.155 mg/kg dw RCR = 2.64E-3	Final RCR < 0.01
Marine water	Ag dissolved	Local PEC: 1.91E-6 mg/L RCR = 2.22E-3	Final RCR < 0.01
Sediment (marine water)	Ag dissolved	Local PEC: 0.364 mg/kg dw RCR = 8.31E-4	Final RCR < 0.01

Protection target	Assessment entity	Exposure concentration	Risk quantification
Sewage Treatment Plant	Ag dissolved	Local PEC: 0 mg/L RCR = 0	Final RCR < 0.01
Agricultural soil	Ag dissolved	Local PEC: 0.096 mg/kg dw RCR = 0.091	Final RCR = 0.091
Man via environment - Inhalation (systemic effects)	Ag dissolved	Concentration in air: 8.53E-8 mg/m ³ RCR = 5.69E-7	Final RCR < 0.01
Man via environment - Oral	Ag dissolved	Exposure via food consumption: 3.84 µg/kg bw/day RCR = 0.035	Final RCR = 0.035
Man via environment - combined routes			Final RCR = 0.035

Remarks on measured exposure:

Identity of the substance used: Ag

Explanation: Worst case exposure of 3.84 µg Ag/kg bw/day from food was taken forward to the risk characterisation.

The intake via drinking water calculated with CHESAR was 3-4 orders of magnitudes lower compared to the intake via food and has thus not been taken into account.

10.2. Cons CS 2: Electrical/electronics articles coated with metallic silver (AC 2)

This service life step is not relevant for silver nitrate anymore since the substance transformed to silver metal. Silver metal (EC 231-131-3) is registered in the > 1000 T/y tonnage band. Massive silver has no classification and silver powder is only classified for environment. Both massive silver and silver powder don't have DNELs. No hazards have been identified.

10.3. Cons CS 3: Glass articles coated with metallic silver (AC 4)

This service life step is not relevant for silver nitrate anymore since the substance transformed to silver metal. Silver metal (EC 231-131-3) is registered in the > 1000 T/y tonnage band. Massive silver has no classification and silver powder is only classified for environment. Both massive silver and silver powder don't have DNELs. No hazards have been identified.

10.4. Cons CS 4: Metal articles coated with metallic silver (AC 7)

This service life step is not relevant for silver nitrate anymore since the substance transformed to silver metal. Silver metal (EC 231-131-3) is registered in the > 1000 T/y tonnage band. Massive silver has no classification and silver powder is only classified for environment. Both massive silver and silver powder don't have DNELs. No hazards have been identified.