## SECTION 1. Substance/mixture and company identification

**1.1 Product identification:**

**Name**: Selenium

**Commercial name**: Technical selenium

**IUPAC Name**: -

**UN No.:** 3077

**CAS No.:** 7782-49-2

**WE No.:** 231-957-4

**Index No.:** 034-001-00-2

**No. of REACH registration:** 01-2119981706-25-0003

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

**Identified uses**: for production of selenium compounds, selenium sand, selenium powder, selenium granulate (aggregate), selenium ingots.

**Uses advised against:** not known

**1.3 Details of the supplier of the material safety data sheet:**

KGHM Polska Miedź S.A.
"GŁOGÓW" Copper Smelter
ul. Żukowicka 1 67-200 Głogów

**Person responsible for preparing the MSDS**: Agnieszka Piechota, phone no.: (+48 76) 747 7176, e-mail: a.piechota@kghm.pl

**1.4 Emergency telephone numbers:**

Manufacturer (Poland): (+48 76) 747 65 01 – available 24/7.

Fire Dept. (Poland): 998 – available 24/7.

General Emergency (Poland): 112 – available 24/7.

**Emergency telephone numbers** for marine transport (foreign countries):
Emergency Telephone Response Number, Emergency CONTACT (24-Hour-Number), GBK/Infotrac ID 105036: (USA domestic): 1 800 535 5053 or international (001) 352 323 3500

## SECTION 2. Hazards identification

### 2.1. Classification of the substance or mixture:

Classification according to Directive 1272/2008 (CLP):

**Acute Tox. 3; H331** – Toxic when inhaled.

**Acute Tox. 3; H301** – Toxic when ingested.

**STOT RE 2; H373** – May cause injury to organs in case of long-term or repeated exposure.

**Aquatic Chronic 4; H413** – May cause long-term adverse effects to aqueous organisms.

Classification according to Directive 67/548/EEC:

**T; R23/25** – Toxic when inhaled and ingested.

**R33** – Hazard of cumulation in organism.

**R53** – May cause long-term adverse changes in aqueous environment.

- according to the Decree No. 1272/2008 (CLP):

**2.2. Marking:**

GHS06 GHS08

Warning phrase: “HAZARD”

Warning phrases (H):

**H331** – Toxic when inhaled.

**H301** – Toxic when ingested.

**H373** – May cause injury to organs in case of long-term or repeated exposure. H413 – May cause long-term adverse effects to aqueous organisms.

Phrases specifying conditions of safe use (P):

**P270** – Do not eat, drink or smoke when using the product.

**P301+310** – When ingested, seek immediate medical attention or help at intoxication centre.

**P314** – In case of discomfort, seek medical attention.

**P405** – Keep closed.

**P501** – Dispose of the content/container to the product manufacturer

**2.3 Other hazards:**

Freshly precipitated selenium reacts with water at temperature >50℃ forming toxic

Hydrogen selenide creating explosive mix with air.

## SECTION 3. Composition/information on ingredients

3.1 Substances:

a) according to the Decree No. 1272/2008 (CLP):

| No. | Name of substance | CAS No. | Index No. | ontent [mass fraction in %] | Symbols | H phrases |
|---|---|---|---|---|---|---|
| 1 | Selenium | 7782-49-2 | 034-001-00-2 | 77≤ c≤ 99 | Acute Tox. 3<br>Acute Tox. 3<br>STOT RE 2<br>Aquatic Chronic 4 | H331<br>H301<br>H373<br>H413 |
| 2 | Water | 124-38-9 | - | 3 ≤ c ≤ 23 | - | - |
| 3. | Tellurium | 13494-80-9 | - | up to 0,5 | - | - |

b) according to the Directive 67/548/EEC:

| No. | Name of substance | CAS No. | Index No. | Content [mass fraction in %] | Symbols | R phrases |
|---|---|---|---|---|---|---|
| 1 | Selenium | 7782-49-2 | 034-001-00-2 | 77 ≤ c ≤ 99 | T | 23/25 - 33 - 53 |
| 2 | Water | 124-38-9 | - | 3 ≤ c ≤ 23 | - | - |
| 3. | Tellurium | 13494-80-9 | - | up to 0,5 | - | - |

Content of Phrases H and R not given in section 2 can be found in section 16.

**3.2 Mixtures**

Not applicable

## SECTION 4. First Aid measures

**4.1 Description of first aid measures**

Respiratory ways: Take the victim out of the place of exposure. Provide calmness in any position. Protect against loss of body heat. If the victim does not breathe, provide artificial respiration with a respirator (do not attempt the mouth-to-mouth procedure). Necessary immediate medical help.

Contact with eyes: Immediately rinse with a lot of cool water, running water would be best, for about 15 minutes. Avoid intensive water jet because conjunctiva may become damaged. **Necessary immediate medical help**.

**Note**: Persons endangered to eye intoxication should be instructed about the necessity and method of immediate flushing.

Skin contact: Remove clothes, wash the intoxicated skin with a lot of running water with soap at room temperature. In case changes and/or ailments occur, seek medical attention.

Alimentary way: After ingestion, the victim should induce vomiting, after each vomiting, flush the mouth with water. Unconscious persons should not be administered anything orally. Immediate medical help necessary.

**4.2 Most important symptoms and effects, both acute and delayed:**

Symptoms of acute intoxication according to ways of exposure:

- alimentary way: metallic taste in mouth, garlicky smell of inhaled air, nausea, vomiting, raised body temperature, headaches;
- respiratory ways: irritation of mucosa of upper respiratory ways with symptoms of dry cough, sneeze, dyspnoea; at increased concentrations difficulties with breathing, inflammation and lungs edema;
- eyes contact: pain, lacrimation and redness of conjunctiva; may lead to chemical burns and damages of cornea;

- skin contact: inflammation, changes of skin colour; intoxication of naked, moist skin may cause redness, pain and chemical burns with necrosis.

Long-term exposure: Symptoms syndrome called selenosis: stomach and intestine disorders, injuries to parenchymatous organs (jaundice), nervous system disorders (nervousness, emotional disorders, depression, vertigoes), anaemia, nails atrophy, hair fall, acute tooth decay, skin diseases.

**4.3 Indication of any immediate medical attention and special treatment needed:**

If the victim is unconscious, make sure that the respiratory tract is not obstructed and place the victim in a recovery position. Provide medical assistance.

## SECTION 5. Procedure in case of fire

**5.1 Extinguishing agents:**

Appropriate extinguishing agents: Extinguishing powders for metals, powdered dolomite.

Unsuitable extinguishing agents: Do not use water or extinguishing agents containing water.

**5.2 Special hazards arising from the substance or mixture:** Solid substance in the form of powder of melting point 220℃. When heated up, reac ts with atmospheric oxygen, what can lead to fire and explosion. As a result of combustion, selenium dioxide is formed which is toxic to humans and environment.

In air, combusts with blue flame.

**5.3 Information for fire-fighters:**

Personnel participating in extinguishing a fire should wear gastight protective clothing with breathing apparatus.

Additional information:

Tanks within the range of fire should be cooled with sprayed water, do not let the water penetrate to the tank, remove them from the area if possible.

Notify those in the surroundings about the fire. Remove all personnel not participating in the breakdown liquidation procedure from the area of hazard. Call fire department or police

department. If possible, remove containers from fire hazard area. Do not let the fire water, contaminated with the substance, to penetrate surface or underground water.

## SECTION 6. Procedure in case of accidental release to the environment

**6.1 Personal precautions, protective equipment and emergency procedures:**

6.1.1 For non-emergency personnel:

Do not inhale dusts. Avoid direct contact. In case of choosing evacuation route consider the direction of the dust/fume movement.

6.1.2 For emergency responders: Avoid dust generation, do not inhale dusts. Avoid direct contact. Apply clothing protecting against chemicals as well as eye protection. In case of dust formation, wear dust mask.

Additional information:

Notify those in the surroundings about the emergency. Remove all personnel not participating in the breakdown liquidation procedure from the area of hazard. Call fire department and police if necessary. Protect the spilt substance against rain and wind by covering it with canvas cover.

**6.2 Precautionary measures within the scope of environment protection:** Do not let the substance penetrate sewage system or water, secure catch basing bates and sink basins. Protect the spilt substance against propagation due to wind or rain by covering with foil.

**6.3 Methods and materials protecting against spreading the contamination and for removing contamination:**

Operations can only be undertaken with full isolation of the body from the environment. Collect the spilt substance to closed container, avoid generation of dust. Substance collected together with impurities (soil, sand and other) to be treated as hazardous waste.

**6.4 Reference to other sections:**

Disposal considerations in section 13.

Additional information:

Use personal protection equipment isolating the body (gastight suit equipped with isolating equipment protecting the respiratory system). Liquidate the sources of ignition. Avoid generation of dust. Avoid direct contact with the substance.

## SECTION 7. Handling the substance and mixtures and their storage

### 7.1 Precautions for safe handling:

During operation: do not eat, drink, smoke, avoid contact with the substance, avoid inhalation of dust, observe personal hygiene principles. Avoid generation of dust within the works stand. Use only in identified premises with proper local exhaust ventilation with housing around the area of emission to aerial environment and general ventilation (ventilation installation and equipment should correspond to conditions established due to fire or explosion hazard). In case of insufficient ventilation, apply proper protection clothing and equipment (as provided in section 8). Containers with the substance should be tight closed and identified. Avoid open flame anywhere near the substance and temperature exceeding 50℃.

### 7.2 Conditions for safe storage, including any incompatibilities:

Store at room temperature, do not let continuous contact with air. Warehouse should be fireproof with mechanical ventilation and explosion-proof electrical installation, floor with electro-conductive lining.

Do not store near acids, bases or oxidants.

Detailed ventilation requirements described in Section 8.2.1.

### 7.3 Specific end uses:

The uses identified in item 1.2.

## SECTION 8. Exposure control/personal protection equipment

### 8.1 Exposure control values:

Values of the highest admissible concentrations that should be controlled:

Selenium and its compounds, except selanium – calculated as Se:

| No. | Country | TLV-TWA [mg/m$^3$] | TLV-STEL [mg/m$^3$] |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1. | Poland | 0.1 | 0.3 |

Note:

The consignee is obliged to control the work environment against concentration or intensity of harmful substances within frequency and range necessary to determine exposure rate of the employees according to national legislation in force.

Legal basis:

Decree of the Minister of Labour and Social Policy of November 29th, 2002 on the highest allowable concentrations and intensities of agents harmful for health in the work environment (Official Journal 02.217.1833, with subsequent amendments);

Selenium levels not causing adverse changes in the organism (DNELs) - employees

- Long-term exposure, inhalation, DNEL = 0,05 mg/$m^3$
- Long-term exposure, skin contact, DNEL = 7mg/kg of body weight per day

Selenium levels not causing adverse changes in the organism (DNELs) - others

- Long-term exposure, after swallowing, DNEL = 4,3 µg/kg of body weight per day
- Long-term exposure, inhalation, DNEL = 0,015 mg/$m^3$
- Long-term exposure, skin contact, DNEL = 4,3 mg/kg of body weight per day

Determination in air within the work stand (Poland):

PN-89/Z-04172/03:1989P: Air purity protection. Examination of selenium and its compounds. Identification of selenium and its compounds at the work stands with atomic absorption spectrometry method.

**8.2 Exposure control:**

8.2.1 Appropriate engineering controls:

Necessary local exhaust ventilation with housing in case of dust emission to air as well as general ventilation of the room. Suction holes of the local ventilation to be located at the working surface or below. Intake ventilators of the general ventilation in upper part of the room and uptake ventilators in lower part. Ventilation installations must correspond to conditions

established due to fire and explosion hazard. Equipment for selenium processing should be tight.

8.2.2 Personal protection measures same as personal protection equipment:

**Eye and face protection:**

In case of hazard of exposure, wear goggles protecting against fine dust. Do not wear contact lenses.

**Skin protection:** Wear protective clothing of materials coated with butyl, Viton, polyvinyl chloride;.

**Hands and feet protection:** Wear protective gloves made of neoprene, nitrile, butyl, vinyl chloride; protective leather shoes

**Respiratory ways protection:** Depending on the substance concentration in the work environment, use: half-mask equipped with filter of class P3 (up to 20 NDS) or mask equipped with filter of class P3 (up to 100 NDS). In case of emergency, if the substance concentration is not known, apply personal protection equipment isolating the organism (isolating respiratory system protective equipment).

**Thermal hazards:**

Not applicable

**Hygiene means:**

Immediately remove contaminated clothing and store in closed containers, clean before next use. Wash your hands and face after working with the substance. Do not eat and drink during substance handling.

8.2.3 Environmental exposure controls:

Environmental exposure should be controlled in compliance with national environment protection legislation in force.

## SECTION 9. Physical and chemical properties

**9.1 Basic physical and chemical properties information:**

Appearance: formless, moist powder of dark grey colour,

Odour: odourless,

Level of odour perception: n.a.

pH: n.a.

*Se* melting point: 221℃,

*Se* boiling point: 685℃,

Spontaneous ignition temperature: no data,

Evaporation rate: n.a.

Flammability: no data,

*Se* vapour pressure: at temperature 234℃ – 1.33 Pa
at temperature 287℃ – 13.3 Pa
at temperature 348℃ – 133 Pa

*Se* density at temp. 20℃: 4.81 g/cm $^3$,

Density of vapours in relation to air: no data,

Explosion limits: no data,

Solubility:

- in water: it does not dissolve,

- in organic solvents: soluble in chloroform,

Distribution coefficient: n-octanol/ water: n.a.

Self ignition temperature: n.d.

Decomposition temperature: n.a.

Viscosity: n.a.

Explosion properties: n.a.

Oxidizing properties: n.a.

**9.2 Other information:**

Heat of combustion in oxygen 223 kJ/g.

## SECTION 10. Stability and reactivity

**10.1 Reactivity**

Selenium reacts violently with pure oxygen and halogens with emission of significant amount of heat, creating toxic dioxide and toxic halides.

**10.2 Chemical stability:**

The substance is stable under normal conditions.

**10.3 Possibility of hazardous reactions:**

Dangerously reacts with sodium peroxide, silver oxide, nitric acid, nitrogen trichloride, chlorates, chromium trichloride, bromates, carbides (lithium, calcium, barium), alkali metals and alkali soil metals.

**10.4 Conditions to avoid:**

Do not heat up the substance above 50℃ due to the possibility of occurrence of the following reaction:

$3Se + 3H_2O = H_2SeO_3 + 3H_2Se\uparrow$ as a result of which toxic products are formed; the symptom of the reaction is an odour of rotten radish characteristic of hydrogen selenide.

**10.5 Incompatible materials:**

Pure oxygen, halogens, sodium peroxide, silver oxide, nitric acid, nitrogen trichloride, chlorates, chromium trichloride, bromates, carbides (lithium, calcium, barium), alkali metals and alkali soil metals.

**10.6 Hazardous decomposition products:**

Do not form under normal conditions.

## SECTION 11. Toxicological information

**11.1 Information on toxicological effects**

a) acute toxicity:

Acute toxicity (alimentary way):

Selenium is listed in harmonized classification and labelling of dangerous substances (chart 3.1. appendix VI of CLP) as toxic if swallowed (Acute Toxicity 3;H301).

Acute toxicity (inhalation):

Selenium is listed in harmonized classification and labelling of dangerous substances (chart 3.1. appendix VI of CLP) as toxic if inhaled (Acute Toxicity 3;H301).

Acute toxicity(skin contact):

on the basis of available data the classification criteria are not met.

Lethal and toxic concentrations and doses:

LD50 (rat, ingestion) – 5000 mg/kg

LC50 4h (rat, inhalation) – 5,67 mg/l of air (calculation method)

LD50 (rabbit, rat, skin) – no data

b) skin corrosion/irritation:

on the basis of available data the classification criteria are not met.

c) serious eye damage/ eye irritating:

on the basis of available data the classification criteria are not met.

d) respiratory tract or skin sensitization:

on the basis of available data the classification criteria are not met.

e) reproductive cells mutagenicity:

on the basis of available data the classification criteria are not met.

f) carcinogenicity:

on the basis of available data the classification criteria are not met.

g) harmful for reproduction:

on the basis of available data the classification criteria are not met.

h) toxicity to specific organs – single exposure:

on the basis of available data the classification criteria are not met.

i) toxicity to specific organs – repeated exposure:

Selenium is listed in harmonized classification and labelling of dangerous substances (chart 3.1. appendix VI of CLP) and is classified as causing possible organs damage in long-term or repeated exposure (STOT RE 1; H372)

j) aspiration hazard:

on the basis of available data the classification criteria are not met.

Additional information:

Toxin action of selenium is multithreaded, i.e. consists in competitive action in relation to sulphur contained in biologically active compounds. Selenium is cumulated in liver, kidneys, nails and hair. Selenium is excreted with urine, sweat and exhaled air (garlicky smell).
Information related to possible exposure ways, product properties related symptoms and possible product exposure effects described in section 4.2.

## SECTION 12. Ecological information

### 12.1 Toxicity:

Selenium is listed in harmonized classification and labelling of dangerous substances (chart 3.1. appendix VI of CLP) as substance which may cause long-term adverse effects to aqueous organisms (Aquatic Chronic 4; H413).

Toxic concentration for aqueous animal and plant organisms:

$LC_{50}$/96 h fish *Oncorhynchus mykiss*: > 26,2 µg/l

NOEC/28d fish *Oncorhynchus mykiss*: 1,57 µg/l

$LC_{50}$/48 h crustaceans *Daphnia magna*: > 160,3 *µg/*l

NOEC/21d crustaceans *Daphnia magna*: 3,42 µg/l

$EC_{50}$/72 algea *Pseudokirchnerella subcapitata:* 99 mg/l

$LC_{50}$/24 h fry Cyprinodon Variegatus – 56 mg/l

### 12.2 Persistence and degradability:

Selenium is persistent in water. It is oxidized in time by oxygen present in water to ions of $Se^{+4}$ i $Se^{+6}$ which form unsoluble salts with ions of metals other than alkali metals.

### 12.3 Bioaccumulative potential

Selenium is drawn and cumulated from soil by plants. Some of them, called plant selenium index (e.g. milkvetch, broom) may cumulate from 1 g/kg to 15 g/kg of Se. Pasture or feeding of animals with such plants may lead to intoxication.

Selenium is a trace element of high biological activity. Both deficiency and excess of selenium is harmful. Selenium toxic hazard occurs at content in soil exceeding 2 mg/kg.

### 12.4 Mobility in soil

Selenium compounds behaviour in environment is determined by complex geochemical properties as well as multivalency of the element ($Se^{6+}$, $Se^{4+}$, $Se^{0}$, $Se^{2-}$). These factors contribute to the emergence of various forms of Se, potentially bio-available in soil solution. Soil nad climate factors significantly affect this element availability. The increase of ambient temperature and soil pH favours selenium migration in the environment and its absorption by plants and other soil organisms.

Total amount of selenium in soil is strictly dependant on the type and kind of soil, showing a strict dependence on the granulometric composition of the soil.

**12.5 Results of PBT and vPvB assessment.**

Product not classifies as PBT and vPvB.

**12.6 Other adverse effects:**

Not known.

## SECTION 13. Disposal considerations

**13.1 Waste treatment methods:**

**Waste treatment:**Do not dispose of to sewage system. Do not store at municipal dump yards. Do not let the substance to contaminate surface and underground water and soil. Consider the opportunity to reuse. Store in tightly closed containers resistant to waste and atmospheric conditions.

Waste management according to the Directive of the European Parliament and Council 2006/12/EC of April 5th, 2006 on waste (Official Journal EC L 114 of 27.04.2006, with subsequent amendments).

Packages: Disposable packages must be handed over to an authorized collector of package waste. Multiple use packages can be still used after previous cleaning.

Waste management according to the Directive of the European Parliament and Council 94/62/EC of December 20th, 1994 on packages and waste packages (Official Journal EC L 365 of 31.12.1994, with subsequent amendments).

Methods of neutralization of harmless waste: Consolidation on hazardous waste dump yard. Do not neutralize applying thermal methods and do not dispose to sewerage. Selenium compounds (except cadmium orange) are compounds harmful to environment.

## SECTION 14. Information concerning transportation

**14.1 UN number**: 3077

**14.2 UN proper shipping name**:

**ADR**: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.

**RID**: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.

**14.3 Transport hazard classes:** RID/ADR: 9;

**14.4 Packing group:** RID/ADR: III;

**14.5 Environmental hazards**

Due to toxic effects of the product on aquatic organisms, means of transport should be labelled with the following mark:

**14.6.** Special precautions for the user:

Do not damage the containers. In case of unintentional product release: liquidate the leakage (seal, place damaged container in a protection packaging. Collect spilt substance to airtight tank and treat as hazardous waste. These actions can be taken if total person – environment isolation is provided. Personal protection measures as described in section 8.2.2.

**14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code**

**IBC:** N/A

**Additional information:**

**Commercial name of material**: Technical selenium

**Class/Classification Code:** RID/ADR: M7,

**Limited quantities:** RID/ADR 5 kg

**Packing instructions:**

- ADR: P002, IBC08, LP02, R001,
- RID: P002, DPPL08, LP02, R001,

**Warning labels:** RID/ADR: 9,

**Hazard identification number:** RID/ADR: 90

**Special provisions**: RID/ADR: 274, 335, 601;

**Other data:** special provisions of 5.2.1.8 apply.

## SECTION 15. Information regarding legal regulations

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

The substance is not subject to regulations of the Decree of the European Parliament and Council (EC) No. 2037/2000 of June 29th, 2000 on substances depleting ozone layer (Official Journal L 244 of 29.09.2000, with subsequent amendments).

The substance is not subject to regulations of the Decree of the European Parliament and Council (EC) No. 850/2004 of April 29th, 2004 on permanent organic contaminations and changing the Directive 79/117/EEC (Official Journal L 158 of 30.04.2004, with subsequent amendments).

The substance is not subject to regulations of the Decree of the European Parliament and Council (EC) No. 689/2008 of June 17th, 2008 on export and import of hazardous chemicals (Official Journal L 204 of 31.07.2008, with subsequent amendments).

Category of the substance according to Seveso Directive/substances listed in the annex I to the Directive of the Council 96/82/EC of December 9th, 1996, on control of significant breakdowns hazard related to hazardous substances (Official Journal L 192, 08/07/1998, with subsequent amendments): toxic substance.

Selenium and tellurium are not listed in the annex X to the Decision No. 2455/2001/EC of the European Parliament and Council of November 20th, 2001, establishing the list of priority

substances within the scope of water policy, changing the Directive 2000/60/EC (Official Journal L 331, 15/12/2001).

Provisions of law:

Decree (EC) No. 1907/2006 of the European Parliament and Council of December 18th, 2006 on Registration, Evaluation, Authorisation and Restriction of Chemical substances (REACH), creating European Chemicals Agency, changing the Directive 1999/45/EC as well as revoking the Council (EC) decree No 793/93 as well as the Commission Directive (EC) No. 1488/94 as well as the Council Directive 76/769/EWG and Council Directive 91/155/EEC, 93/67/EEC, 93/105/EC and 2006/21/EC.

Decree of the European Parliament and Council (EC) No. 1272/2008 dated December 16th, 2008 on classification, marking and packing hazardous substances and mixtures, changing and revoking the Directive 67/548/EWG and 1999/45/EWG as well as changing the Decree (EC) No. 1907/2006 with subsequent amendments;

Directive of the Council 67/548/EEC of June 27th, 1967, on approaching the statutory, executive and administrative regulations related to classification, packing and labelling hazardous substances (with subsequent amendments);

Act of April 27th, 2001, Environment Protection Law (Official Journal 01.62.627 with subsequent amendments);

Decree of the Minister of Labour and Social Policy of November 29th, 2002 on the highest allowable concentrations and intensities of substances harmful for health in the work environment (Official Journal 02.217.1833, with subsequent amendments);

Decree of the Minister of Health of December 30th, 2004, on Safety at Work related to handling with chemicals in work environment (Official Journal 05.11.86, with subsequent amendments);

Act of April 27th, 2001, on waste (Official Journal 01.62.628 with subsequent amendments);

Ordinance of the Minister of Environment of September 27th, 2001 on the catalogue of waste (Official Journal 01.112.1206).

Act of May 11th, 2001, on packages and packages waste (Official Journal 01.63.638 with subsequent amendments);

Decree of the Commission (EC) No. 453/2010 of May 20th, 2010, changing the Decree (EC) No. 1907/ 2007 of the European Parliament and Council on Registration, Evaluation, Authorisation and Restriction of Chemical substances (REACH) (Official Journal L 133 with subsequent amendments).

Directive of the Commission 2000/93/EC of June 8th, 2000, establishing the first list of indicative limit values of exposure to extrinsic factors during the work in relation to execution of the Directive of the Council 98/42/EEC on health protection and safety of employees against risk related to chemicals at work environment (Official Journal L No. 142 of 16.06.2000).

**15.2 Chemical safety assessment:**

Chemical safety assessment for selenium has been carried out. Chemical safety report available at KGHM Polska Miedz S.A.

## SECTION 16. Other information

**16. Other information**

Amendments have been made to sections: 1, 3, 8, 11, 12, 15, 16

Explanations of abbreviations and acronyms used in the MSDS:

**CAS number** – means numerical identification assigned to chemical substance by the American organization of Chemical Abstract Service (CAS), enabling substance identification.

**Index number** – it is an identification code given in part 3 of the annex VI to the Decree of the European Parliament and Council (EC) No. 1272/2008 dated December 16th, 2008, on classification, marking and packing hazardous substances and mixtures, changing and revoking the Directive 67/548/EEC and 1999/45/EEC as well as changing the Decree (EC) No. 1907/2006.

**WE number –** the number assigned to chemical substance in EINECS -. European Inventory of Existing Chemical Substances, or the number assigned to chemical substance in ELINCS -

European List of Notified Chemical Substances or the number in chemical substances inventory included in “No-longer polymers” document.

**Registration number** – number given by ECHA after substance/intermediate registration by the manufacturer/importer according to REACH Decree.

**UN number** – unequivocal marking of hazardous substances and goods assigned by United Nations Central Committee to provide international recognition and use.

**Name according to IUPAC** – name of a substance given by IUPAC - *International Union of Pure and Applied ChemistryCommittee*

**NDS/TLV-TWA** – the highest admissible concentration/threshold limit value – weighted average value – concentration of toxic chemical whose impact on an employee during 8-hour daily shift and average weekly time of work provided in the Labour Code during the period of his occupational activity should not cause negative changes of his health condition and of health condition of his next generations.

**NDSCh/TLV-STEL** – the highest admissible short term concentration/short term exposure limit – weighted average of concentration of the specified, toxic chemical compound which should not cause negative changes of an employee’s health if present in the work environment for not longer than 15 minutes and not more often than twice per shift with occurrences separated by more than 1 hour.

**$LD_{50}$** – dose of toxic substance expressed in milligrams per kilogram of body mass necessary to kill 50% of the examined population.

**$LC_{50}$** – concentration of a substance in the inhaled air, expressed in milligrams per litre, which causes death of 50% of the examined population after specified period of exposure.

**$EC_{50}$** – substance dose expressed in milligrams per litre causing the given pharmacological effect (e.g. inhibition of growth) at 50% of the examined population within specified time.

**NOEC** – (*no observed effect concentration*) – the highest concentration of the toxin, which during defined time of a test does not cause any noticeable changes in tested organisms.

Sources of information used during preparation of the MSDS:

- Own results of qualitative and quantitative analyses of technical selenium;
- Selenium Chemical Safety Report (2013);
- European Chemical Substance Information System (http://ecb.jrc.ec.europa.eu/esis/);

– TOXNET – Toxicology Data Network (http://toxnet.nlm.nih.gov/);

- ChemPortal – The Global Portal to Information on Chemical Substances (http://webnet3.oecd.org/eChemPortal/Home.aspx);
- Hazardous Substances – Practical Guide, Ulrich Welzbacher, Wyd. ALFA-WEKA, Warszawa, 1997r.;ALFA-WEKA;
- Material Safety Data Sheet – selenium. Publication CIOP;
- CHEMISTRY – structure and reactions. Milton K. Snyder, Wydawnictwa Naukowo-Techniczne, Warszawa, 1975r;

Necessary training: Post-related training within the scope of safe use of a substance considering its hazardous properties for humans and environment.

Information contained in the material safety data sheet is to describe the product within the scope of safety requirements. User is responsible for taking any steps in order to meet the provisions of the national law and to create safe conditions for use of the product. User is held responsible for effects resulting from improper application of this product.

Further information can be obtained under the telephone numbers given in section 1.

# 9. EXPOSURE ASSESSMENT

## 9.0. Introduction

### 9.0.1. Overview of uses and Exposure Scenarios

**Tonnage information:**

Assessed tonnage: 1035.0 tonnes/year based on:

- 535.0 tonnes/year manufactured
- 500.0 tonnes/year imported

Tonnage supplied per market sector:

Market Sector (PC 14: Metal surface treatment products, including galvanic and electroplating products): 100.0 tonnes/year

The following table list all the exposure scenarios (ES) assessed in this CSR.

**Table 1. Overview of exposure scenarios and contributing scenarios**

| Identifiers | Market Sector | Titles of exposure scenarios and the related contributing scenarios | Tonnage (tonnes per year) |
|---|---|---|---|
| ES1 - M1 | | Manufacture - Manufacture<br>- Manufacture (ERC 1)<br>- Worker contributing scenario (PROC 3)<br>- Worker contributing scenario (PROC 22)<br>- Worker contributing scenario (PROC 23)<br>- Worker contributing scenario (PROC 26)<br>- Worker contributing scenario (PROC 27a)<br>- Worker contributing scenario (PROC 27b) | 500.0 |
| ES2 - M2 | | Manufacture - Manufacture: Recovery<br>- Manufacture (ERC 1)<br>- Worker contributing scenario (PROC 2)<br>- Worker contributing scenario (PROC 22)<br>- Worker contributing scenario (PROC 23)<br>- Worker contributing scenario (PROC 26)<br>- Worker contributing scenario (PROC 27a)<br>- Worker contributing scenario (PROC 27b) | 35.0 |
| ES3 - F1 | | Formulation - Formulation: Melting of selenium metal and alloying of metals<br>- Formulation: Melting of selenium metal and alloying of metals (ERC 3)<br>- Worker contributing scenario (PROC 1)<br>- Worker contributing scenario (PROC 3)<br>- Worker contributing scenario (PROC 4)<br>- Worker contributing scenario (PROC 22)<br>- Worker contributing scenario (PROC 23)<br>- Worker contributing scenario (PROC 26)<br>- Worker contributing scenario (PROC 27a)<br>- Worker contributing scenario (PROC 27b) | 165.0 |
| ES4 - IW1 | | Use at industrial site - Use at industrial site: Intermediate, manufacture of selenium compounds<br>- Use at industrial site: Intermediate, manufacture of selenium compounds (ERC 6a)<br>- Worker contributing scenario Intermediate, manufacture of selenium compounds (PROC 3) | 300.0 |

| Identifiers | Market Sector | Titles of exposure scenarios and the related contributing scenarios | Tonnage (tonnes per year) |
|---|---|---|---|
| | | - Worker contributing scenario Intermediate, manufacture of selenium compounds (PROC 4)<br>- Worker contributing scenario Intermediate, manufacture of selenium compounds (PROC 26) | |
| ES5 - IW2 | | Use at industrial site - Use at industrial site: Coating of surfaces<br>- Use at industrial site: Coating of surfaces (ERC 6b)<br>- Worker contributing scenario Coating of surfaces (PROC 1) | 50.0 |
| ES6 - IW3 | | Use at industrial site - Use at industrial site: Use as additive in glass manufacture<br>- Use at industrial site: Use as additive in glass manufacture (ERC 6b)<br>- Worker contributing scenario: Use as additive in glass manufacture (PROC 26) | 50.0 |
| ES7 - IW4 | | Use at industrial site - Use at industrial site: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles<br>- Use at industrial site: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles (ERC 5)<br>- Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles (PROC 3)<br>- Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles (PROC 14)<br>- Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles (PROC 15)<br>- Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles (PROC 21)<br>- Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles (PROC 23)<br>- Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles (PROC 25)<br>□ *Related subsequent service life:* ES8 | 50.0 |
| ES8 - SL-IW1 | | Service life (worker at industrial site) - Service life (worker at industrial site)<br>- Service life (worker at industrial site) (ERC 12a) | 1000.0 |
| ES9 - IW5 | | Use at industrial site - Use at industrial site: Thin Film Production by Physical Vapor Deposition (PVD)<br>- Use at industrial site (ERC 5)<br>- Worker contributing scenario: Thin Film Production by Physical Vapor Deposition (PVD) (PROC 2)<br>□ *Related subsequent service life:* ES8; ES10 | 50.0 |
| ES10 - SL-IW2 | | Service life (worker at industrial site) - Service life (worker at industrial site: Thin Film Production by Physical Vapor Deposition (PVD)<br>- Service life (worker at industrial site: Thin Film Production by Physical Vapor Deposition (PVD) () | 1000.0 |
| ES11 - IW6 | | Use at industrial site - Use at industrial site: Vulcanization of rubber<br>- Use at industrial site: Vulcanization of rubber (ERC 6b) | 50.0 |
| ES12 - SL-IW3 | | Service life (worker at industrial site) - Service life (worker at industrial site) | 100.0 |

| Identifiers | Market Sector | Titles of exposure scenarios and the related contributing scenarios | Tonnage (tonnes per year) |
|---|---|---|---|
| | | - Service life (worker at industrial site) (ERC 12a) | |
| ES13 - SL-PW1 | | Service life (professional worker) - Service life (professional worker) - Service life (professional worker) (ERC 10a) | 100.0 |
| **Manufacture: M-#, Formulation: F-#, Industrial end use at site: IW-#, Professional end use: PW-#, Consumer end use: C-#, Service life (by workers in industrial site): SL-IW-#, Service life (by professional workers): SL-PW-#, Service life (by consumers): SL-C-#.)** | | | |

## 9.0.2. Introduction to the assessment

### 9.0.2.1. Environment

**Scope and type of assessment**

The scope of exposure assessment and type of risk characterisation required for the environment are described in the following table based on the hazard conclusions presented in section 7.

For a better understanding of the exposure assessment the following hints may be helpful:

- The figures for the release of the substance into the environment were set in a step by step approach, because the calculation of ERC based scenarios lead to an overestimation of the exposure, which exceeds the reality by far.
- EUORMETAUX has developed spERCs for some use scenarios (see http://www.reach-metals.eu/index.php?option=com_content&task=view&id=124&Itemid=203), which were transferred to the evaluated scenarios as far as possible. It is important for users and DUs of selenium to check, whether their scenarios are covered, because the respective spERCs are based on specific Risk Management Measures and physical-chemical properties of the substance, which are documented on the website above. It may be possible, that scaling is required!
- For each scenario a scenario was calculated (based on available data from the industry), which is defined as typical and which should be adopted by each user and DU on the conditions of its site.
- If available, specific release data were used as starting parameters, which are based on questionnaires and provided by registrants.
- The naturals background level of selenium was not considered in the exposure calculations, because an added risk approach is the only adequate algorithm for such an ubiquitous element.
- For Eurometaux spERCS and for company data the release into water was calculated without using a municipal STP and after an onsite WWSTP. The sludge of onsite WWSTP is transported to specific waste treatment sites according to local legal bindings. From this follows, that the path sludge-> soil is not relevant.

**Table 2. Type of risk characterisation required for the environment**

| Protection target | Type of risk characterisation | Hazard conclusion (see section 7) |
|---|---|---|
| Freshwater | Quantitative | PNEC aqua (freshwater) = 2.67 µg/L |
| Sediment (freshwater) | Quantitative | PNEC sediment (freshwater) = 8.2 mg/kg sediment dw |
| Marine water | Quantitative | PNEC aqua (marine water) = 2 µg/L |
| Sediment (marine water) | Quantitative | PNEC sediment (marine water) = 6.2 mg/kg sediment dw |
| Sewage treatment plant | Quantitative | PNEC STP = 1.5E3 µg/L |
| Air | Not needed | No hazard identified |
| Agricultural soil | Quantitative | PNEC soil = 0.1 mg/kg soil dw |
| Predator | Quantitative | PNEC oral = 1 mg/kg food |

**Comments on assessment approach:**

The regional concentrations are reported in section 10.2.1.2 (see Table 77, “Predicted regional exposure concentrations

(Regional PEC)"). The local Predicted Exposure Concentrations (PECs) reported for each contributing scenario correspond to the sum of the local concentrations (Clocal) and the regional concentrations (PEC regional).

**9.0.2.2. Man via environment**

**Scope and type of assessment**

The scope of exposure assessment and type of risk characterisation required for man via the environment are described in the following table based on the hazard conclusions reported and justified in section 5.11.

The calculation of the exposure was conducted by using the tool MEASE,

**Table 3. Type of risk characterisation required for man via the environment**

| Route of exposure and type of effects | Type of risk characterisation | Hazard conclusion (see section 5.11) |
|---|---|---|
| **Inhalation:** Systemic Long Term | Quantitative | DNEL (Derived No Effect Level) = 0.015 mg/m³ |
| **Oral:** Systemic Long Term | Quantitative | DNEL (Derived No Effect Level) = 4.3 µg/kg bw/day |

**9.0.2.3. Workers**

**Scope and type of assessment**

The scope of exposure assessment and type of risk characterisation required for workers are described in the following table based on the hazard conclusions presented in section 5.11.

**Table 4. Type of risk characterisation required for workers**

| Route | Type of effect | Type of risk characterisation | Hazard conclusion (see section 5.11) |
|---|---|---|---|
| **Inhalation** | Systemic Long Term | Quantitative | DNEL (Derived No Effect Level) = 0.05 mg/m³ |
| | Systemic Acute | Qualitative | No hazard identified |
| | Local Long Term | Qualitative | No hazard identified |
| | Local Acute | Not needed | No hazard identified |
| **Dermal** | Systemic Long Term | Quantitative | DNEL (Derived No Effect Level) = 7 mg/kg bw/day |
| | Systemic Acute | Qualitative | No hazard identified |
| | Local Long Term | Not needed | No hazard identified |
| | Local Acute | Not needed | No hazard identified |
| **Eye** | Local | Not needed | No hazard identified |

**9.0.2.4. Consumers**

Exposure assessment is not applicable as there are no consumer-related uses for the substance.

# 9.1. Exposure scenario 1: Manufacture - Manufacture

| | |
|---|---|
| **Environment contributing scenario(s):** | |
| Manufacture | ERC 1 |
| **Worker contributing scenario(s):** | |
| Worker contributing scenario | PROC 3 |
| Worker contributing scenario | PROC 22 |
| Worker contributing scenario | PROC 23 |
| Worker contributing scenario | PROC 26 |
| Worker contributing scenario | PROC 27a |
| Worker contributing scenario | PROC 27b |

## 9.1.1. Environmental contributing scenario 1: Manufacture

### 9.1.1.1. Conditions of use

The exposure assessment for the environment was calculated using ECETOC TRA v3 as TIER2 model. The input parameters are documented in the following tables.

All tables are copied directly from ECETOC TRA v3.

### 9.1.1.2. Releases

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

**Table 5. Local releases to the environment**

| | |
|---|---|
| RELEASE ESTIMATION BASED ON RELEASE RATES, e.g. measured data (releases in kg/day) | |
| Daily amount used at site [kg/d] (release rates) | 2.00E+03 |
| Release times per year (d/year) | 3.65E+02 |
| Name of Monitoring Site or other source of information | |
| Remark | |
| Monitoring regime | |
| Remark | |
| Measured. Release to air (kg/d) | 8.00E-01 |
| Measured Release to sewage (kg/d) | see below* |
| Measured Release to soil (kg/d) | 0.00E+00 |

Remark: Release rates are based on company data.

*The $PEC_{freshwater\ local}$ was calculated from company data of the concentration of selenium in Based on company data for the released water into the water of 0.2 mg/l. Assuming a standard dilution factor of 1,000 a PEC local of 0.002 (rounded) could be derived. This figure is clearly below the $PNEC_{local\ freshwater}$ of 0.00267 mg/l and was used as starting point for the calculation of the aquatic compartments using ECETOC TRA3.

### 9.1.1.3. 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.

**Table 6. Exposure concentrations and risks for the environment**

| | |
|---|---|
| RCR | |
| RCR in STP (-) | no STP |
| RCR for local freshwater (-) | 0.757584336 |
| RCR for local freshwater sediment (-) | 0.763119506 |
| RCR for local terrestrial environment (-) | 0.02365446 |

| | |
|---|---|
| RCR for local marine water (-) | 0.101045263 |
| RCR for local marine sediments (-) | 0.100836654 |
| RCR for humans via the environment (-) | 0.001359636 |
| PREDICTED CONCENTRATIONS | |
| PECs | |
| Regional PEC in surface water (total) (mgc.L-1) | 1.65061E-05 |
| Regional PEC in sea water (total) (mgc.L-1) | 1.41451E-06 |
| Regional PEC in air (total) (mgc.m-3) | 5.10221E-06 |
| Regional PEC in agricultural soil (total)(mgc.kgdwt-1) | 0.001053107 |
| Regional PEC in natural soil (total) (mgc.kgdwt-1) | 5.53913E-05 |
| Regional PEC in industrial soil (total) (mgc.kgdwt-1) | 5.53913E-05 |
| Regional PEC in sediment (total) (mgc.kgdwt-1) | 0.082732462 |
| Regional PEC in sea water sediment (total) (mgc.kgdwt-1) | 0.0057158 |
| Annual average local PEC in air (total) (mgc.m-3) | 0.000227502 |
| Local PEC in surface water during emission episode (dissolved) (mgc.L-1) | 0.00202275 |
| Annual average local PEC in surface water (dissolved) (mgc.L-1) | 0.00202275 |
| Local PEC in fresh water sediment during emission episode (mgc.kgdwt-1) | 6.257579946 |
| Local PEC in sea water during emission episode (dissolved) (mgc.L-1) | 0.000202091 |
| Annual average local PEC in sea water (dissolved) (mgc.L-1) | 0.000202091 |
| Local PEC in marine sediment during emission episode (mgc.kgdwt-1) | 0.625187253 |
| Local PEC in agricultural soil, averaged over 30 days (mgc.kgdwt-1) | 0.002365446 |
| Local PEC agricultural soil, averaged over 180 days (mgc.kgdwt-1) | 0.002400412 |
| Local PEC in grass land, averaged over 180 days (mgc.kgdwt-1) | 0.003728149 |
| PEC for microorganisms in STP (mgc.L-1) | 0.021 |
| PEC for microorganisms in STP with intermittent release (mgc.L-1) | 0.021 |
| | |
| Secondary poisoning | |
| Environment | |
| Conc. in fish for secondary poisoning in freshwater environment (mgc.kgwwt-1) | 0.091246008 |
| Conc. in fish for secondary poisoning in marine environment (mgc.kgwwt-1) | 0.009108085 |
| Conc. in fish-eating predator for marine toppredators (mgc.kgwwt-1) | 0.00192137 |
| Conc. in earthworms for secondary poisoning (mgc.kgwwt-1) | 0.000634219 |
| Humans | |
| Regional daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1.45777E-06 |
| Regional total daily intake for humans (mgc.kgbw-1.d-1) | 5.84644E-06 |
| Local daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 6.50006E-05 |
| Local total daily intake for humans (mgc.kgbw-1.d-1) | 0.000394947 |
| | |
| PREDICTED NO-EFFECT LEVELS | |
| | |
| CUSTOMER TOOL INFORMATION | |
| Amount used locally (Muse) (kg.d-1) | 2.00E+03 |
| Percent emission to air | 4.00E-02 |
| Percent emission to wastewater | 2.10E-03 |
| Elimination in STP (fraction) | 0.00E+00 |
| Number of emission days [d/a] | 3.65E+02 |
| Effluent discharge rate of this STP (m3.d-1) | 2.00E+03 |
| Flow rate of the river (m3.d-1) | 1.80E+04 |
| Dilution factor (rivers) | 1.00E+01 |
| Dilution factor (coastal areas) | 1.00E+02 |
| | |
| ENVIRONMENTAL RISK | |
| Local | |

| | |
|---|---|
| Water | |
| Freshwater aquatic RCR | 0.757584336 |
| Marine aquatic RCR | 0.101045263 |
| Sediment | |
| Freshwater sediment RCR | 0.763119506 |
| Marine sediment RCR | 0.100836654 |
| Soil | |
| Terrestrial RCR | 0.02365446 |
| STP | |
| Sewage treatment Plant RCR, intermittent releases | 0.014 |
| Predators | |
| Freshwater fish-eating birds and mammals RCR | 0.091246008 |
| Marine fish-eating birds and mammals RCR | 0.009108085 |
| Marine top predator RCR | 0.00192137 |
| Worm-eating birds and mammals RCR | 0.000634219 |
| RCR for humans via the environment (-) | 0.001359636 |

If a DU has OC (operational conditions)/RMMs outside the OC/RMM specifications in the ES, then the DU can evaluate whether he works inside the boundaries set by the ES through scaling.

The Metal EUSES calculator for DUs can be freely downloaded from http://www.arche-consulting.be/Metal-CSA-toolbox/du-scaling-tool.

In the registrant-interface, the generic default OCs and RMMs can be entered.

In the simple and easy-to-use DU-interface, key OC and RMM can be changed according to the site-specific OC and RMMs of the DU. This includes general parameters as release factors, dilution, presence/absence of municipal sewage treatment plant, etc… It also allows the DU to enter bioavailability-corrected PNECs (Predicted No Effect Concentrations).

In the background, the full EUSES model is run to calculate exposure and risks. The resulting risk characterisation ratios allow the DU to assess safe use. In this way, the DU scaling tool enables the DU to check compliance with the ES if his OCs or RMMs differ from those in the ES.

## 9.1.2. Worker contributing scenario 1: Worker contributing scenario (PROC 3)

### 9.1.2.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Dustiness of material: Medium | TRA Worker v3 |
| • Concentration of substance in mixture: Substance as such | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 8 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Good general ventilation (3-5 air changes per hour) | TRA Worker v3 |
| • Containment: Closed batch process with occasional controlled exposure | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): yes [Effectiveness Dermal: 90%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with specific activity training) [Effectiveness Dermal: 95%] | TRA Worker v3 |
| • Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhal: 90%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Ambient | TRA Worker v3 |
| • Skin surface potentially exposed: One hand face only (240 cm2) | TRA Worker v3 |

#### 9.1.2.2. Exposure and risks for workers

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

**Table 7. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.007 mg/m³** (TRA Worker v3) | RCR = 0.14 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.003 mg/kg bw/day** (TRA Worker v3) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.14 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

### 9.1.3. Worker contributing scenario 2: Worker contributing scenario (PROC 22)

#### 9.1.3.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Concentration of substance in mixture: Substance as such | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 8 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Good general ventilation (3-5 air changes per hour) | TRA Worker v3 |
| • Containment: No | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): no [Effectiveness Dermal: 0%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with specific activity training) [Effectiveness Dermal: 95%] | TRA Worker v3 |
| • Respiratory Protection: Yes (Respirator with APF of 20) [Effectiveness Inhal: 95%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Elevated temperature > melting point | TRA Worker v3 |
| • Skin surface potentially exposed: Two hands and forearms (1980 cm2) | TRA Worker v3 |

#### 9.1.3.2. Exposure and risks for workers

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

**Table 8. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.035 mg/m³** (TRA Worker v3) | RCR = 0.7 |

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.142 mg/kg bw/day** (TRA Worker v3) | RCR = 0.02 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.72 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

## 9.1.4. Worker contributing scenario 3: Worker contributing scenario (PROC 23)

### 9.1.4.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Concentration of substance in mixture: Substance as such | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 8 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Good general ventilation (3-5 air changes per hour) | TRA Worker v3 |
| • Containment: No | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): no [Effectiveness Dermal: 0%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with specific activity training) [Effectiveness Dermal: 95%] | TRA Worker v3 |
| • Respiratory Protection: Yes (Respirator with APF of 20) [Effectiveness Inhal: 95%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Elevated temperature > melting point | TRA Worker v3 |
| • Skin surface potentially exposed: Two hands and forearms (1980 cm2) | TRA Worker v3 |

### 9.1.4.2. Exposure and risks for workers

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

**Table 9. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.035 mg/m³** (TRA Worker v3) | RCR = 0.7 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.07 mg/kg bw/day** (TRA Worker v3) | RCR = 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.71 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

## 9.1.5. Worker contributing scenario 4: Worker contributing scenario (PROC 26)

### 9.1.5.1. Conditions of use

see screenshot of MEASE below

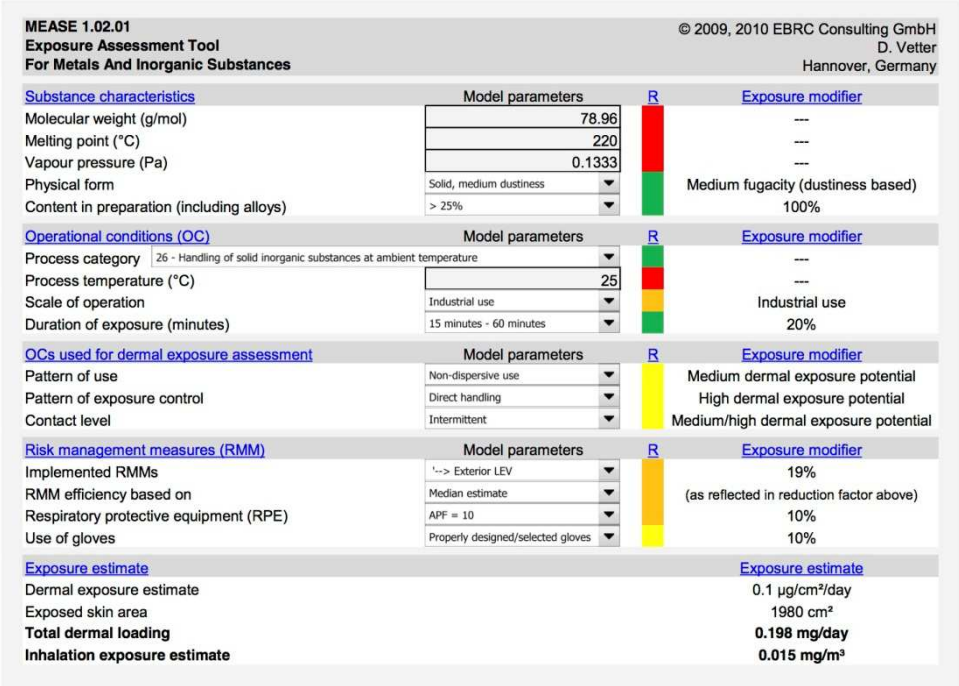
### 9.1.5.2. Exposure and risks for workers

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

**Table 10. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.015 mg/m³** (External Tool (MEASE)) | RCR = 0.3 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.003 mg/kg bw/day** (External Tool (MEASE)) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.3 |

The calculation by MEASE is documented by the following screenshot:



**MEASE 1.02.01**
**Exposure Assessment Tool**
**For Metals And Inorganic Substances**

© 2009, 2010 EBRC Consulting GmbH
D. Vetter
Hannover, Germany

| Substance characteristics | Model parameters | R | Exposure modifier |
|---|---|---|---|
| Molecular weight (g/mol) | 78.96 | | --- |
| Melting point (°C) | 220 | | --- |
| Vapour pressure (Pa) | 0.1333 | | --- |
| Physical form | Solid, medium dustiness | | Medium fugacity (dustiness based) |
| Content in preparation (including alloys) | > 25% | | 100% |

| Operational conditions (OC) | Model parameters | R | Exposure modifier |
|---|---|---|---|
| Process category | 26 - Handling of solid inorganic substances at ambient temperature | | --- |
| Process temperature (°C) | 25 | | --- |
| Scale of operation | Industrial use | | Industrial use |
| Duration of exposure (minutes) | 15 minutes - 60 minutes | | 20% |

| OCs used for dermal exposure assessment | Model parameters | R | Exposure modifier |
|---|---|---|---|
| Pattern of use | Non-dispersive use | | Medium dermal exposure potential |
| Pattern of exposure control | Direct handling | | High dermal exposure potential |
| Contact level | Intermittent | | Medium/high dermal exposure potential |

| Risk management measures (RMM) | Model parameters | R | Exposure modifier |
|---|---|---|---|
| Implemented RMMs | '--> Exterior LEV | | 19% |
| RMM efficiency based on | Median estimate | | (as reflected in reduction factor above) |
| Respiratory protective equipment (RPE) | APF = 10 | | 10% |
| Use of gloves | Properly designed/selected gloves | | 10% |

| Exposure estimate | Exposure estimate |
|---|---|
| Dermal exposure estimate | 0.1 µg/cm²/day |
| Exposed skin area | 1980 cm² |
| **Total dermal loading** | **0.198 mg/day** |
| **Inhalation exposure estimate** | **0.015 mg/m³** |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

## 9.1.6. Worker contributing scenario 5: Worker contributing scenario (PROC 27a)

### 9.1.6.1. Conditions of use

see screenshot of MEASE below

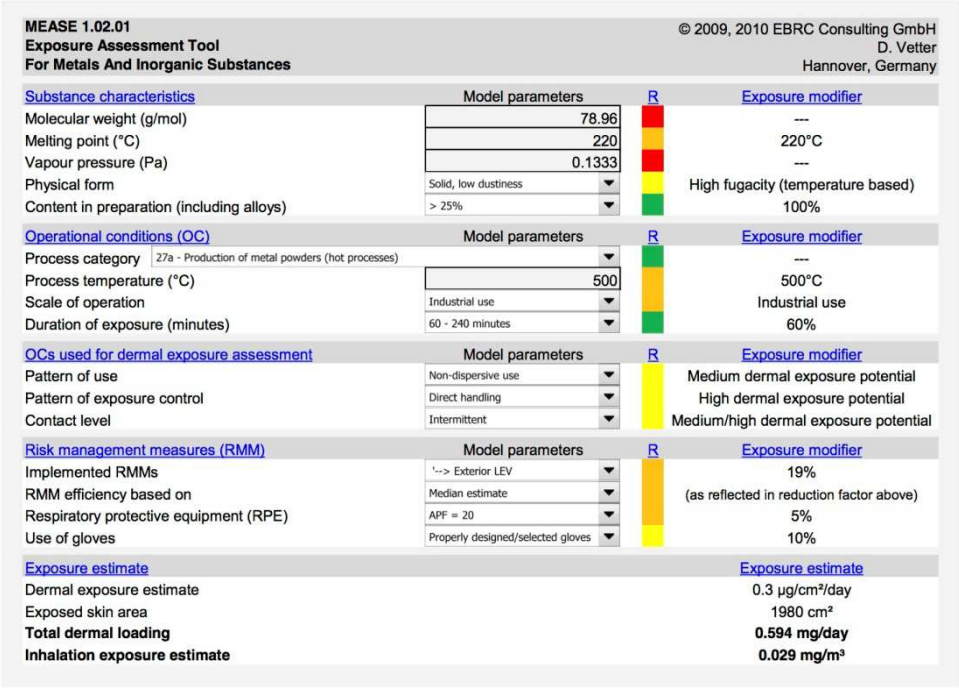
### 9.1.6.2. Exposure and risks for workers

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

**Table 11. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.03 mg/m³** (External Tool (MEASE)) | RCR = 0.6 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.009 mg/kg bw/day** (External Tool (MEASE)) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.601 |

The calculation by MEASE is documented by the following screenshot:



**MEASE 1.02.01**
**Exposure Assessment Tool**
**For Metals And Inorganic Substances**

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D. Vetter
Hannover, Germany

| Substance characteristics | Model parameters | R | Exposure modifier |
|---|---|---|---|
| Molecular weight (g/mol) | 78.96 | | --- |
| Melting point (°C) | 220 | | 220°C |
| Vapour pressure (Pa) | 0.1333 | | --- |
| Physical form | Solid, low dustiness | | High fugacity (temperature based) |
| Content in preparation (including alloys) | > 25% | | 100% |

| Operational conditions (OC) | Model parameters | R | Exposure modifier |
|---|---|---|---|
| Process category | 27a - Production of metal powders (hot processes) | | --- |
| Process temperature (°C) | 500 | | 500°C |
| Scale of operation | Industrial use | | Industrial use |
| Duration of exposure (minutes) | 60 - 240 minutes | | 60% |

| OCs used for dermal exposure assessment | Model parameters | R | Exposure modifier |
|---|---|---|---|
| Pattern of use | Non-dispersive use | | Medium dermal exposure potential |
| Pattern of exposure control | Direct handling | | High dermal exposure potential |
| Contact level | Intermittent | | Medium/high dermal exposure potential |

| Risk management measures (RMM) | Model parameters | R | Exposure modifier |
|---|---|---|---|
| Implemented RMMs | '--> Exterior LEV | | 19% |
| RMM efficiency based on | Median estimate | | (as reflected in reduction factor above) |
| Respiratory protective equipment (RPE) | APF = 20 | | 5% |
| Use of gloves | Properly designed/selected gloves | | 10% |

| Exposure estimate | Exposure estimate |
|---|---|
| Dermal exposure estimate | 0.3 µg/cm²/day |
| Exposed skin area | 1980 cm² |
| **Total dermal loading** | **0.594 mg/day** |
| **Inhalation exposure estimate** | **0.029 mg/m³** |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

## 9.1.7. Worker contributing scenario 6: Worker contributing scenario (PROC 27b)

### 9.1.7.1. Conditions of use

see screenshot of MEASE below

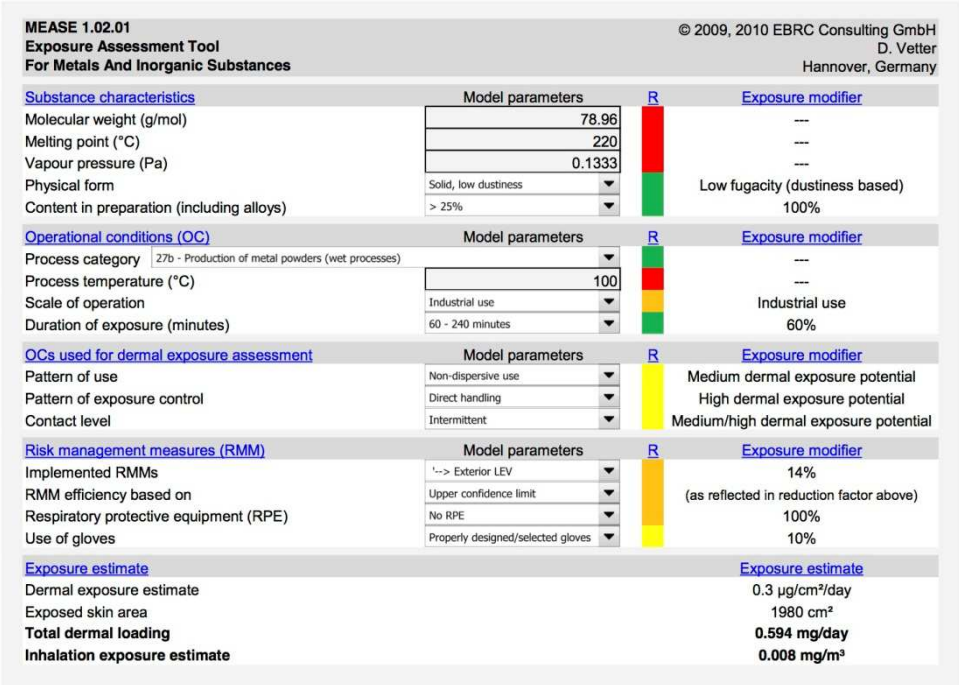
### 9.1.7.2. Exposure and risks for workers

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

**Table 12. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.008 mg/m³** (External Tool (MEASE)) | RCR = 0.58 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.008 mg/kg bw/day** (External Tool (MEASE)) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.581 |

The calculation by MEASE is documented by the following screenshot:



**MEASE 1.02.01**
**Exposure Assessment Tool**
**For Metals And Inorganic Substances**

© 2009, 2010 EBRC Consulting GmbH
D. Vetter
Hannover, Germany

| Substance characteristics | Model parameters | R | Exposure modifier |
|---|---|---|---|
| Molecular weight (g/mol) | 78.96 | | --- |
| Melting point (°C) | 220 | | --- |
| Vapour pressure (Pa) | 0.1333 | | --- |
| Physical form | Solid, low dustiness | | Low fugacity (dustiness based) |
| Content in preparation (including alloys) | > 25% | | 100% |

| Operational conditions (OC) | Model parameters | R | Exposure modifier |
|---|---|---|---|
| Process category | 27b - Production of metal powders (wet processes) | | --- |
| Process temperature (°C) | 100 | | --- |
| Scale of operation | Industrial use | | Industrial use |
| Duration of exposure (minutes) | 60 - 240 minutes | | 60% |

| OCs used for dermal exposure assessment | Model parameters | R | Exposure modifier |
|---|---|---|---|
| Pattern of use | Non-dispersive use | | Medium dermal exposure potential |
| Pattern of exposure control | Direct handling | | High dermal exposure potential |
| Contact level | Intermittent | | Medium/high dermal exposure potential |

| Risk management measures (RMM) | Model parameters | R | Exposure modifier |
|---|---|---|---|
| Implemented RMMs | '--> Exterior LEV | | 14% |
| RMM efficiency based on | Upper confidence limit | | (as reflected in reduction factor above) |
| Respiratory protective equipment (RPE) | No RPE | | 100% |
| Use of gloves | Properly designed/selected gloves | | 10% |

| Exposure estimate | Exposure estimate |
|---|---|
| Dermal exposure estimate | 0.3 µg/cm²/day |
| Exposed skin area | 1980 cm² |
| **Total dermal loading** | **0.594 mg/day** |
| **Inhalation exposure estimate** | **0.008 mg/m³** |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

# 9.2. Exposure scenario 2: Manufacture - Manufacture: Recovery

| | |
|---|---|
| **Environment contributing scenario(s):** | |
| Manufacture | ERC 1 |
| **Worker contributing scenario(s):** | |
| Worker contributing scenario | PROC 2 |
| Worker contributing scenario | PROC 22 |
| Worker contributing scenario | PROC 23 |
| Worker contributing scenario | PROC 26 |
| Worker contributing scenario | PROC 27a |
| Worker contributing scenario | PROC 27b |

## 9.2.1. Environmental contributing scenario 1: Manufacture

### 9.2.1.1. Conditions of use

### 9.2.1.2. Releases

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

**Table 13. Local releases to the environment**

| | |
|---|---|
| RELEASE ESTIMATION BASED ON RELEASE RATES, e.g. measured data (releases in kg/day) | |
| Daily amount used at site [kg/d] (release rates) | 150 |
| Release times per year (d/year) | 250 |
| Name of Monitoring Site or other source of information | |
| Remark | company data |
| Monitoring regime | |
| Remark | |
| Measured. Release to air (kg/d) | 0.005 |
| Measured Release to sewage (kg/d) | 0.005 |
| Measured Release to soil (kg/d) | 0 |

Remark: Release rates are based on company data.

### 9.2.1.3. 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.

**Table 14. Exposure concentrations and risks for the environment**

| | |
|---|---|
| VOLUMES and RELEASES (INTERIM RESULTS) | |
| EU tonnage for use (tpa) | |
| Amount used locally (kg/d) | 1.50E+02 |
| Release times per year (d/year) | 2.50E+02 |
| Release fraction air (as in ERC or SPERC background table or set in line 125) | 3.33E-05 |
| Release fraction (waste) water (as in ERC or SPERC background table or set in line 125) | 3.33E-05 |
| Release fraction soil (as in ERC or SPERC background table or set in line 125) | 0.00E+00 |
| Local release to air (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 5.00E-03 |
| Local release to waste water (kg/d) | 5.00E-03 |
| Local release to soil (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 0.00E+00 |
| RCR | |
| RCR in STP (-) | no STP |
| RCR for local freshwater (-) | 0.094116303 |
| RCR for local freshwater sediment (-) | 0.094803949 |

| | |
|---|---|
| RCR for local terrestrial environment (-) | 0.000635685 |
| RCR for local marine water (-) | 0.012493222 |
| RCR for local marine sediments (-) | 0.01246743 |
| RCR for humans via the environment (-) | 0.001 |
| PREDICTED CONCENTRATIONS | |
| PECs | |
| Regional PEC in surface water (total) (mgc.L-1) | 1,29E-01 |
| Regional PEC in sea water (total) (mgc.L-1) | 1,11E-01 |
| Regional PEC in air (total) (mgc.m-3) | 4,94E-01 |
| Regional PEC in agricultural soil (total)(mgc.kgdwt-1) | 0.000835247 |
| Regional PEC in natural soil (total) (mgc.kgdwt-1) | 5,37E+00 |
| Regional PEC in industrial soil (total) (mgc.kgdwt-1) | 5,37E+00 |
| Regional PEC in sediment (total) (mgc.kgdwt-1) | 0.064853235 |
| Regional PEC in sea water sediment (total) (mgc.kgdwt-1) | 0.004488822 |
| Annual average local PEC in air (total) (mgc.m-3) | 5,90E-01 |
| Local PEC in surface water during emission episode (dissolved) (mgc.L-1) | 0.000251291 |
| Annual average local PEC in surface water (dissolved) (mgc.L-1) | 0.000176013 |
| Local PEC in fresh water sediment during emission episode (mgc.kgdwt-1) | 0.77739238 |
| Local PEC in sea water during emission episode (dissolved) (mgc.L-1) | 2,50E+00 |
| Annual average local PEC in sea water (dissolved) (mgc.L-1) | 1,75E+00 |
| Local PEC in marine sediment during emission episode (mgc.kgdwt-1) | 0.077298064 |
| Local PEC in agricultural soil, averaged over 30 days (mgc.kgdwt-1) | 6,36E+00 |
| Local PEC agricultural soil, averaged over 180 days (mgc.kgdwt-1) | 6,37E+00 |
| Local PEC in grass land, averaged over 180 days (mgc.kgdwt-1) | 6,94E-01 |
| PEC for microorganisms in STP (mgc.L-1) | 0.0025 |
| PEC for microorganisms in STP with intermittent release (mgc.L-1) | 0.0025 |
| | |
| Secondary poisoning | |
| Environment | |
| Conc. in fish for secondary poisoning in freshwater environment (mgc.kgwwt-1) | 0.008431923 |
| Conc. in fish for secondary poisoning in marine environment (mgc.kgwwt-1) | 0.000830426 |
| Conc. in fish-eating predator for marine toppredators (mgc.kgwwt-1) | 0.000244425 |
| Conc. in earthworms for secondary poisoning (mgc.kgwwt-1) | 0.000165078 |
| Humans | |
| Regional daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1,41E-01 |
| Regional total daily intake for humans (mgc.kgbw-1.d-1) | 4,87E-02 |
| Local daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1,68E-01 |
| Local total daily intake for humans (mgc.kgbw-1.d-1) | 3,02E+00 |
| | |
| PREDICTED NO-EFFECT LEVELS | |
| | |
| CUSTOMER TOOL INFORMATION | |
| Amount used locally (Muse) (kg.d-1) | 1.50E+02 |
| Percent emission to air | 3.33E-03 |
| Percent emission to wastewater | 3.33E-03 |
| Elimination in STP (fraction) | 0.00E+00 |
| Number of emission days [d/a] | 2.50E+02 |
| Effluent discharge rate of this STP (m3.d-1) | 2.00E+03 |
| Flow rate of the river (m3.d-1) | 1.80E+04 |
| Dilution factor (rivers) | 1.00E+01 |
| Dilution factor (coastal areas) | 1.00E+02 |
| | |
| ENVIRONMENTAL RISK | |
| Local | |
| Water | |
| Freshwater aquatic RCR | 0.094116303 |

| | |
|---|---|
| Marine aquatic RCR | 0.012493222 |
| Sediment | |
| Freshwater sediment RCR | 0.094803949 |
| Marine sediment RCR | 0.01246743 |
| Soil | |
| Terrestrial RCR | 0.000635685 |
| STP | |
| Sewage treatment Plant RCR, intermittent releases | 0.001666667 |
| Predators | |
| Freshwater fish-eating birds and mammals RCR | 0.008431923 |
| Marine fish-eating birds and mammals RCR | 0.000830426 |
| Marine top predator RCR | 0.000244425 |
| Worm-eating birds and mammals RCR | 0.000165078 |
| Regional Water | |
| Freshwater aquatic RCR | 0.004630988 |
| Marine aquatic RCR | 0.000546933 |
| Regional Sediment | |
| Freshwater sediment RCR | 0.007908931 |
| Marine sediment RCR | 0.000724004 |
| Soil | |
| Terrestrial RCR | 0.008352471 |

## 9.2.2. Worker contributing scenario 1: Worker contributing scenario (PROC 2)

### 9.2.2.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Dustiness of material: Medium | TRA Worker v3 |
| • Concentration of substance in mixture: Substance as such | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 4 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Good general ventilation (3-5 air changes per hour) | TRA Worker v3 |
| • Containment: Closed continuous process with occasional controlled exposure | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): no [Effectiveness Dermal: 0%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with specific activity training) [Effectiveness Dermal: 95%] | TRA Worker v3 |
| • Respiratory Protection: No [Effectiveness Inhal: 0%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Ambient | TRA Worker v3 |
| • Skin surface potentially exposed: Two hands face (480 cm2) | TRA Worker v3 |

### 9.2.2.2. Exposure and risks for workers

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

**Table 15. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.021 mg/m³** (TRA Worker v3) | RCR = 0.42 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.068 mg/kg bw/day** (TRA Worker v3) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.43 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

## 9.2.3. Worker contributing scenario 2: Worker contributing scenario (PROC 22)

### 9.2.3.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Concentration of substance in mixture: Substance as such | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 4 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Good general ventilation (3-5 air changes per hour) | TRA Worker v3 |
| • Containment: No | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): no [Effectiveness Dermal: 0%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with specific activity training) [Effectiveness Dermal: 95%] | TRA Worker v3 |
| • Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhal: 90%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Elevated temperature > melting point | TRA Worker v3 |
| • Skin surface potentially exposed: Two hands and forearms (1980 cm2) | TRA Worker v3 |

### 9.2.3.2. Exposure and risks for workers

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

**Table 16. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.042 mg/m³** (TRA Worker v3) | RCR = 0.84 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.142 mg/kg bw/day** (TRA Worker v3) | RCR = 0.02 |

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.86 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

## 9.2.4. Worker contributing scenario 3: Worker contributing scenario (PROC 23)

### 9.2.4.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Concentration of substance in mixture: Substance as such | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 4 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Good general ventilation (3-5 air changes per hour) | TRA Worker v3 |
| • Containment: No | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): no [Effectiveness Dermal: 0%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with specific activity training) [Effectiveness Dermal: 95%] | TRA Worker v3 |
| • Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhal: 90%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Elevated temperature > melting point | TRA Worker v3 |
| • Skin surface potentially exposed: Two hands and forearms (1980 cm2) | TRA Worker v3 |

### 9.2.4.2. Exposure and risks for workers

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

**Table 17. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.042 mg/m³** (TRA Worker v3) | RCR = 0.84 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.07 mg/kg bw/day** (TRA Worker v3) | RCR = 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.85 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

## 9.2.5. Worker contributing scenario 4: Worker contributing scenario (PROC 26)

### 9.2.5.1. Conditions of use

Not defined.

### 9.2.5.2. Exposure and risks for workers

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

**Table 18. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.015 mg/m³** (External Tool (MEASE)) | RCR = 0.3 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.003 mg/kg bw/day** (External Tool (MEASE)) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.3 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

## 9.2.6. Worker contributing scenario 5: Worker contributing scenario (PROC 27a)

### 9.2.6.1. Conditions of use

Not defined.

### 9.2.6.2. Exposure and risks for workers

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

**Table 19. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.03 mg/m³** (External Tool (MEASE)) | RCR = 0.6 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.009 mg/kg bw/day** (External Tool (MEASE)) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.601 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

## 9.2.7. Worker contributing scenario 6: Worker contributing scenario (PROC 27b)

### 9.2.7.1. Conditions of use

Not defined.

**9.2.7.2. Exposure and risks for workers**

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

**Table 20. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.008 mg/m³** (External Tool (MEASE)) | RCR = 0.16 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.008 mg/kg bw/day** (External Tool (MEASE)) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.161 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

# 9.3. Exposure scenario 3: Formulation - Formulation: Melting of selenium metal and alloying of metals

| | |
|---|---|
| **Environment contributing scenario(s):** | |
| Formulation: Melting of selenium metal and alloying of metals | ERC 3 |
| **Worker contributing scenario(s):** | |
| Worker contributing scenario | PROC 1 |
| Worker contributing scenario | PROC 3 |
| Worker contributing scenario | PROC 4 |
| Worker contributing scenario | PROC 22 |
| Worker contributing scenario | PROC 23 |
| Worker contributing scenario | PROC 26 |
| Worker contributing scenario | PROC 27a |
| Worker contributing scenario | PROC 27b |

## 9.3.1. Environmental contributing scenario 1: Formulation: Melting of selenium metal and alloying of metals

#### 9.3.1.1. Conditions of use

#### 9.3.1.2. Releases

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

**Table 21. Local releases to the environment**

| | |
|---|---|
| RELEASE ESTIMATION BASED ON RELEASE RATES, e.g. measured data (releases in kg/day) | |
| Daily amount used at site [kg/d] (release rates) | 1000 |
| Release times per year (d/year) | 250 |
| Name of Monitoring Site or other source of information | |
| Remark | company data |
| Monitoring regime | |
| Remark | |
| Measured. Release to air (kg/d) | 0.035 |
| Measured Release to sewage (kg/d) | 0.03 |
| Measured Release to soil (kg/d) | 0 |

Remark: Release rates are based on company data.

#### 9.3.1.3. 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.

**Table 22. Exposure concentrations and risks for the environment**

| | |
|---|---|
| VOLUMES and RELEASES (INTERIM RESULTS) | |
| EU tonnage for use (tpa) | |
| Amount used locally (kg/d) | 1.00E+03 |
| Release times per year (d/year) | 2.50E+02 |
| Release fraction air (as in ERC or SPERC background table or set in line 125) | 3.50E-05 |
| Release fraction (waste) water (as in ERC or SPERC background table or set in line 125) | 3.00E-05 |
| Release fraction soil (as in ERC or SPERC background table or set in line 125) | 0.00E+00 |
| Local release to air (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 3.50E-02 |
| Local release to waste water (kg/d) | 3.00E-02 |
| Local release to soil (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 0.00E+00 |

| | |
|---|---|
| RCR | |
| RCR in STP (-) | no STP |
| RCR for local freshwater (-) | 0.541542875 |
| RCR for local freshwater sediment (-) | 0.545499572 |
| RCR for local terrestrial environment (-) | 0.001229021 |
| RCR for local marine water (-) | 0.07222467 |
| RCR for local marine sediments (-) | 0.072075561 |
| RCR for humans via the environment (-) | 0.001 |
| PREDICTED CONCENTRATIONS | |
| PECs | |
| Regional PEC in surface water (total) (mgc.L-1) | 1,29E-01 |
| Regional PEC in sea water (total) (mgc.L-1) | 1,11E-01 |
| Regional PEC in air (total) (mgc.m-3) | 4,94E-01 |
| Regional PEC in agricultural soil (total)(mgc.kgdwt-1) | 0.000835247 |
| Regional PEC in natural soil (total) (mgc.kgdwt-1) | 5,37E+00 |
| Regional PEC in industrial soil (total) (mgc.kgdwt-1) | 5,37E+00 |
| Regional PEC in sediment (total) (mgc.kgdwt-1) | 0.064853235 |
| Regional PEC in sea water sediment (total) (mgc.kgdwt-1) | 0.004488822 |
| Annual average local PEC in air (total) (mgc.m-3) | 1,16E+00 |
| Local PEC in surface water during emission episode (dissolved) (mgc.L-1) | 0.001445919 |
| Annual average local PEC in surface water (dissolved) (mgc.L-1) | 0.000994252 |
| Local PEC in fresh water sediment during emission episode (mgc.kgdwt-1) | 4.473.096.494 |
| Local PEC in sea water during emission episode (dissolved) (mgc.L-1) | 0.000144449 |
| Annual average local PEC in sea water (dissolved) (mgc.L-1) | 9,93E+00 |
| Local PEC in marine sediment during emission episode (mgc.kgdwt-1) | 0.446868475 |
| Local PEC in agricultural soil, averaged over 30 days (mgc.kgdwt-1) | 0.000122902 |
| Local PEC agricultural soil, averaged over 180 days (mgc.kgdwt-1) | 0.00012395 |
| Local PEC in grass land, averaged over 180 days (mgc.kgdwt-1) | 0.000163737 |
| PEC for microorganisms in STP (mgc.L-1) | 0.015 |
| PEC for microorganisms in STP with intermittent release (mgc.L-1) | 0.015 |
| | |
| Secondary poisoning | |
| Environment | |
| Conc. in fish for secondary poisoning in freshwater environment (mgc.kgwwt-1) | 0.045056978 |
| Conc. in fish for secondary poisoning in marine environment (mgc.kgwwt-1) | 0.004492931 |
| Conc. in fish-eating predator for marine toppredators (mgc.kgwwt-1) | 0.000976926 |
| Conc. in earthworms for secondary poisoning (mgc.kgwwt-1) | 0.000176139 |
| Humans | |
| Regional daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1,41E-01 |
| Regional total daily intake for humans (mgc.kgbw-1.d-1) | 4,87E-02 |
| Local daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 3,32E-01 |
| Local total daily intake for humans (mgc.kgbw-1.d-1) | 0.000163936 |
| | |
| PREDICTED NO-EFFECT LEVELS | |
| | |
| CUSTOMER TOOL INFORMATION | |
| Amount used locally (Muse) (kg.d-1) | 1.00E+03 |
| Percent emission to air | 3.50E-03 |
| Percent emission to wastewater | 3.00E-03 |
| Elimination in STP (fraction) | 0.00E+00 |
| Number of emission days [d/a] | 2.50E+02 |
| Effluent discharge rate of this STP (m3.d-1) | 2.00E+03 |
| Flow rate of the river (m3.d-1) | 1.80E+04 |
| Dilution factor (rivers) | 1.00E+01 |
| Dilution factor (coastal areas) | 1.00E+02 |
| | |

| | |
|---|---|
| ENVIRONMENTAL RISK | |
| Local | |
| Water | |
| Freshwater aquatic RCR | 0.541542875 |
| Marine aquatic RCR | 0.07222467 |
| Sediment | |
| Freshwater sediment RCR | 0.545499572 |
| Marine sediment RCR | 0.072075561 |
| Soil | |
| Terrestrial RCR | 0.001229021 |
| STP | |
| Sewage treatment Plant RCR, intermittent releases | 0.01 |
| Predators | |
| Freshwater fish-eating birds and mammals RCR | 0.045056978 |
| Marine fish-eating birds and mammals RCR | 0.004492931 |
| Marine top predator RCR | 0.000976926 |
| Worm-eating birds and mammals RCR | 0.000176139 |
| Regional Water | |
| Freshwater aquatic RCR | 0.004630988 |
| Marine aquatic RCR | 0.000546933 |
| Regional Sediment | |
| Freshwater sediment RCR | 0.007908931 |
| Marine sediment RCR | 0.000724004 |
| Soil | |
| Terrestrial RCR | 0.008352471 |

**Table 23. Contribution to oral intake for man via the environment from local contribution**

## 9.3.2. Worker contributing scenario 1: Worker contributing scenario (PROC 1)

### 9.3.2.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Dustiness of material: Medium | TRA Worker v3 |
| • Concentration of substance in mixture: Substance as such | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 4 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Good general ventilation (3-5 air changes per hour) | TRA Worker v3 |
| • Containment: Closed system (minimal contact during routine operations) | TRA Worker v3 |
| • Local exhaust ventilation: no [Effectiveness Inhal: 0%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: No [Effectiveness Dermal: 0%] | TRA Worker v3 |
| • Respiratory Protection: No [Effectiveness Inhal: 0%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Ambient | TRA Worker v3 |
| • Skin surface potentially exposed: One hand face only (240 cm2) | TRA Worker v3 |

#### 9.3.2.2. Exposure and risks for workers

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

**Table 24. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.004 mg/m³** (TRA Worker v3) | RCR = 0.084 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.034 mg/kg bw/day** (TRA Worker v3) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.089 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

## 9.3.3. Worker contributing scenario 2: Worker contributing scenario (PROC 3)

#### 9.3.3.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Dustiness of material: Medium | TRA Worker v3 |
| • Concentration of substance in mixture: Substance as such | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 4 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Good general ventilation (3-5 air changes per hour) | TRA Worker v3 |
| • Containment: Closed batch process with occasional controlled exposure | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): no [Effectiveness Dermal: 0%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with specific activity training) [Effectiveness Dermal: 95%] | TRA Worker v3 |
| • Respiratory Protection: No [Effectiveness Inhal: 0%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Ambient | TRA Worker v3 |
| • Skin surface potentially exposed: One hand face only (240 cm2) | TRA Worker v3 |

#### 9.3.3.2. Exposure and risks for workers

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

**Table 25. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.042 mg/m³** (TRA Worker v3) | RCR = 0.84 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.034 mg/kg bw/day** (TRA Worker v3) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.845 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

## 9.3.4. Worker contributing scenario 3: Worker contributing scenario (PROC 4)

### 9.3.4.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Dustiness of material: Medium | TRA Worker v3 |
| • Concentration of substance in mixture: Substance as such | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 4 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Good general ventilation (3-5 air changes per hour) | TRA Worker v3 |
| • Containment: Semi-closed process with occasional controlled exposure | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): no [Effectiveness Dermal: 0%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with specific activity training) [Effectiveness Dermal: 95%] | TRA Worker v3 |
| • Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhal: 90%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Ambient | TRA Worker v3 |
| • Skin surface potentially exposed: Two hands face (480 cm2) | TRA Worker v3 |

### 9.3.4.2. Exposure and risks for workers

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

**Table 26. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.021 mg/m³** (TRA Worker v3) | RCR = 0.42 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.343 mg/kg bw/day** (TRA Worker v3) | RCR = 0.049 |
| Dermal, systemic, acute | | Qualitative (see below) |

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Combined routes, systemic, long-term | | RCR = 0.469 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

## 9.3.5. Worker contributing scenario 4: Worker contributing scenario (PROC 22)

### 9.3.5.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Concentration of substance in mixture: Substance as such | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 4 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Good general ventilation (3-5 air changes per hour) | TRA Worker v3 |
| • Containment: No | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): no [Effectiveness Dermal: 0%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with specific activity training) [Effectiveness Dermal: 95%] | TRA Worker v3 |
| • Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhal: 90%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Elevated temperature > melting point | TRA Worker v3 |
| • Skin surface potentially exposed: Two hands and forearms (1980 cm2) | TRA Worker v3 |

### 9.3.5.2. Exposure and risks for workers

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

**Table 27. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.042 mg/m³** (TRA Worker v3) | RCR = 0.84 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.142 mg/kg bw/day** (TRA Worker v3) | RCR = 0.02 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.86 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

## 9.3.6. Worker contributing scenario 5: Worker contributing scenario (PROC 23)

#### 9.3.6.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Concentration of substance in mixture: Substance as such | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 4 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Good general ventilation (3-5 air changes per hour) | TRA Worker v3 |
| • Containment: No | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): no [Effectiveness Dermal: 0%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with specific activity training) [Effectiveness Dermal: 95%] | TRA Worker v3 |
| • Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhal: 90%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Elevated temperature > melting point | TRA Worker v3 |
| • Skin surface potentially exposed: Two hands and forearms (1980 cm2) | TRA Worker v3 |

#### 9.3.6.2. Exposure and risks for workers

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

**Table 28. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.042 mg/m³** (TRA Worker v3) | RCR = 0.84 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.07 mg/kg bw/day** (TRA Worker v3) | RCR = 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.85 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

## 9.3.7. Worker contributing scenario 6: Worker contributing scenario (PROC 26)

#### 9.3.7.1. Conditions of use

Not defined.

#### 9.3.7.2. Exposure and risks for workers

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

**Table 29. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.015 mg/m³** (External Tool (MEASE)) | RCR = 0.3 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.003 mg/kg bw/day** (External Tool (MEASE)) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.3 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

## 9.3.8. Worker contributing scenario 7: Worker contributing scenario (PROC 27a)

### 9.3.8.1. Conditions of use

Not defined.

### 9.3.8.2. Exposure and risks for workers

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

**Table 30. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.03 mg/m³** (External Tool (MEASE)) | RCR = 0.6 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.009 mg/kg bw/day** (External Tool (MEASE)) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.601 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

## 9.3.9. Worker contributing scenario 8: Worker contributing scenario (PROC 27b)

### 9.3.9.1. Conditions of use

Not defined.

### 9.3.9.2. Exposure and risks for workers

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

**Table 31. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.008 mg/m³** (External Tool (MEASE)) | RCR = 0.16 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Dermal, systemic, long-term | **0.008 mg/kg bw/day** (External Tool (MEASE)) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.161 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

# 9.4. Exposure scenario 4: Use at industrial site - Use at industrial site: Intermediate, manufacture of selenium compounds

**Sector of use:**
SU 0, Other

| | |
|---|---|
| **Environment contributing scenario(s):** | |
| Use at industrial site: Intermediate, manufacture of selenium compounds | ERC 6a |
| **Worker contributing scenario(s):** | |
| Worker contributing scenario Intermediate, manufacture of selenium compounds | PROC 3 |
| Worker contributing scenario Intermediate, manufacture of selenium compounds | PROC 4 |
| Worker contributing scenario Intermediate, manufacture of selenium compounds | PROC 26 |

## 9.4.1. Environmental contributing scenario 1: Use at industrial site: Intermediate, manufacture of selenium compounds

#### 9.4.1.1. Conditions of use

#### 9.4.1.2. Releases

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

**Table 32. Local releases to the environment**

| | |
|---|---|
| RELEASE ESTIMATION BASED ON SPECIFIC RELEASE FRACTIONS | |
| Comments 1 | Eurometaux 1.2.v2.1 |
| Comments 2 | ES-IW1 |
| Daily amount used at site [kg/d] (release fractions) | |
| Release times per year (d/year) | |
| Local release fraction to air | |
| Local release fraction to sewage | |
| Local release fraction to soil | |
| | |
| RELEASE ESTIMATION BASED ON RELEASE RATES, e.g. measured data (releases in kg/day) | |
| Daily amount used at site [kg/d] (release rates) | 1200 |
| Release times per year (d/year) | 250 |
| Name of Monitoring Site or other source of information | |
| Remark | |
| Monitoring regime | |
| Remark | |
| Measured. Release to air (kg/d) | 0.04 |
| Measured Release to sewage (kg/d) | 0.04 |
| Measured Release to soil (kg/d) | 0 |

#### 9.4.1.3. 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.

**Table 33. Exposure concentrations and risks for the environment**

| | |
|---|---|
| VOLUMES and RELEASES (INTERIM RESULTS) | |
| EU tonnage for use (tpa) | |
| Amount used locally (kg/d) | 1.20E+03 |
| Release times per year (d/year) | 2.50E+02 |
| Release fraction air (as in ERC or SPERC background table or set in line 125) | 3.33E-05 |

| | |
|---|---|
| Release fraction (waste) water (as in ERC or SPERC background table or set in line 125) | 3.33E-05 |
| Release fraction soil (as in ERC or SPERC background table or set in line 125) | 0.00E+00 |
| Local release to air (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 4.00E-02 |
| Local release to waste water (kg/d) | 4.00E-02 |
| Local release to soil (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 0.00E+00 |
| RCR | |
| RCR in STP (-) | no STP |
| RCR for local freshwater (-) | 0.720513504 |
| RCR for local freshwater sediment (-) | 0.725777822 |
| RCR for local terrestrial environment (-) | 0.00132791 |
| RCR for local marine water (-) | 0.096117248 |
| RCR for local marine sediments (-) | 0.095918813 |
| RCR for humans via the environment (-) | 0.001 |
| PREDICTED CONCENTRATIONS | |
| PECs | |
| Regional PEC in surface water (total) (mgc.L-1) | 1,29E-01 |
| Regional PEC in sea water (total) (mgc.L-1) | 1,11E-01 |
| Regional PEC in air (total) (mgc.m-3) | 4,94E-01 |
| Regional PEC in agricultural soil (total)(mgc.kgdwt-1) | 0.000835247 |
| Regional PEC in natural soil (total) (mgc.kgdwt-1) | 5,37E+00 |
| Regional PEC in industrial soil (total) (mgc.kgdwt-1) | 5,37E+00 |
| Regional PEC in sediment (total) (mgc.kgdwt-1) | 0.064853235 |
| Regional PEC in sea water sediment (total) (mgc.kgdwt-1) | 0.004488822 |
| Annual average local PEC in air (total) (mgc.m-3) | 1,26E-01 |
| Local PEC in surface water during emission episode (dissolved) (mgc.L-1) | 0.001923771 |
| Annual average local PEC in surface water (dissolved) (mgc.L-1) | 0.001321547 |
| Local PEC in fresh water sediment during emission episode (mgc.kgdwt-1) | 595.137.814 |
| Local PEC in sea water during emission episode (dissolved) (mgc.L-1) | 0.000192234 |
| Annual average local PEC in sea water (dissolved) (mgc.L-1) | 0.000132012 |
| Local PEC in marine sediment during emission episode (mgc.kgdwt-1) | 0.59469664 |
| Local PEC in agricultural soil, averaged over 30 days (mgc.kgdwt-1) | 0.000132791 |
| Local PEC agricultural soil, averaged over 180 days (mgc.kgdwt-1) | 0.000133988 |
| Local PEC in grass land, averaged over 180 days (mgc.kgdwt-1) | 0.000179459 |
| PEC for microorganisms in STP (mgc.L-1) | 0.02 |
| PEC for microorganisms in STP with intermittent release (mgc.L-1) | 0.02 |
| | |
| Secondary poisoning | |
| Environment | |
| Conc. in fish for secondary poisoning in freshwater environment (mgc.kgwwt-1) | 0.059706999 |
| Conc. in fish for secondary poisoning in marine environment (mgc.kgwwt-1) | 0.005957933 |
| Conc. in fish-eating predator for marine toppredators (mgc.kgwwt-1) | 0.001269926 |
| Conc. in earthworms for secondary poisoning (mgc.kgwwt-1) | 0.000177983 |
| Humans | |
| Regional daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1,41E-01 |
| Regional total daily intake for humans (mgc.kgbw-1.d-1) | 4,87E-02 |
| Local daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 3,59E-01 |
| Local total daily intake for humans (mgc.kgbw-1.d-1) | 0.000217036 |
| | |
| PREDICTED NO-EFFECT LEVELS | |
| | |
| CUSTOMER TOOL INFORMATION | |
| Amount used locally (Muse) (kg.d-1) | 1.20E+03 |
| Percent emission to air | 3.33E-03 |
| Percent emission to wastewater | 3.33E-03 |
| Elimination in STP (fraction) | 0.00E+00 |

| | |
|---|---|
| Number of emission days [d/a] | 2.50E+02 |
| Effluent discharge rate of this STP (m3.d-1) | 2.00E+03 |
| Flow rate of the river (m3.d-1) | 1.80E+04 |
| Dilution factor (rivers) | 1.00E+01 |
| Dilution factor (coastal areas) | 1.00E+02 |
| | |
| ENVIRONMENTAL RISK | |
| Local | |
| Water | |
| Freshwater aquatic RCR | 0.720513504 |
| Marine aquatic RCR | 0.096117248 |
| Sediment | |
| Freshwater sediment RCR | 0.725777822 |
| Marine sediment RCR | 0.095918813 |
| Soil | |
| Terrestrial RCR | 0.00132791 |
| STP | |
| Sewage treatment Plant RCR, intermittent releases | 0.013333333 |
| Predators | |
| Freshwater fish-eating birds and mammals RCR | 0.059706999 |
| Marine fish-eating birds and mammals RCR | 0.005957933 |
| Marine top predator RCR | 0.001269926 |
| Worm-eating birds and mammals RCR | 0.000177983 |
| Regional Water | |
| Freshwater aquatic RCR | 0.004630988 |
| Marine aquatic RCR | 0.000546933 |
| Regional Sediment | |
| Freshwater sediment RCR | 0.007908931 |
| Marine sediment RCR | 0.000724004 |
| Soil | |
| Terrestrial RCR | 0.008352471 |

**Table 34. Contribution to oral intake for man via the environment from local contribution**

## 9.4.2. Worker contributing scenario 1: Worker contributing scenario Intermediate, manufacture of selenium compounds (PROC 3)

### 9.4.2.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Dustiness of material: Medium | TRA Worker v3 |
| • Concentration of substance in mixture: Substance as such | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 1 hour | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Good general ventilation (3-5 air changes per hour) | TRA Worker v3 |
| • Containment: Closed batch process with occasional controlled exposure | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): no [Effectiveness Dermal: 0%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |

| | Method |
|---|---|
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with specific activity training) [Effectiveness Dermal: 95%] | TRA Worker v3 |
| • Respiratory Protection: No [Effectiveness Inhal: 0%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Ambient | TRA Worker v3 |
| • Skin surface potentially exposed: One hand face only (240 cm2) | TRA Worker v3 |

#### 9.4.2.2. Exposure and risks for workers

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

**Table 35. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.014 mg/m³** (TRA Worker v3) | RCR = 0.28 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.034 mg/kg bw/day** (TRA Worker v3) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.285 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

### 9.4.3. Worker contributing scenario 2: Worker contributing scenario Intermediate, manufacture of selenium compounds (PROC 4)

#### 9.4.3.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Dustiness of material: Medium | TRA Worker v3 |
| • Concentration of substance in mixture: Substance as such | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 1 hour | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Good general ventilation (3-5 air changes per hour) | TRA Worker v3 |
| • Containment: Semi-closed process with occasional controlled exposure | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): no [Effectiveness Dermal: 0%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with specific activity training) [Effectiveness Dermal: 95%] | TRA Worker v3 |
| • Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhal: 90%] | TRA Worker v3 |

| | Method |
|---|---|
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Ambient | TRA Worker v3 |
| • Skin surface potentially exposed: Two hands face (480 cm2) | TRA Worker v3 |

#### 9.4.3.2. Exposure and risks for workers

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

**Table 36. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.007 mg/m³** (TRA Worker v3) | RCR = 0.14 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.343 mg/kg bw/day** (TRA Worker v3) | RCR = 0.049 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.189 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

### 9.4.4. Worker contributing scenario 3: Worker contributing scenario Intermediate, manufacture of selenium compounds (PROC 26)

#### 9.4.4.1. Conditions of use

Not defined.

#### 9.4.4.2. Exposure and risks for workers

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

**Table 37. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.015 mg/m³** (External Tool (MEASE)) | RCR = 0.3 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.003 mg/kg bw/day** (External Tool (MEASE)) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.3 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

# 9.5. Exposure scenario 5: Use at industrial site - Use at industrial site: Coating of surfaces

**Sector of use:**
SU 0, Other

| | |
|---|---|
| **Environment contributing scenario(s):** | |
| Use at industrial site: Coating of surfaces | ERC 6b |
| **Worker contributing scenario(s):** | |
| Worker contributing scenario Coating of surfaces | PROC 1 |

## 9.5.1. Environmental contributing scenario 1: Use at industrial site: Coating of surfaces

### 9.5.1.1. Conditions of use

### 9.5.1.2. Releases

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

**Table 38. Local releases to the environment**

| RELEASE ESTIMATION BASED ON SPECIFIC RELEASE FRACTIONS | |
|---|---|
| Comments 1 | Eurometaux 5.1.v2.1 |
| Comments 2 | ES5-IW4 |
| Daily amount used at site [kg/d] (release fractions) | 10 |
| Release times per year (d/year) | 220 |
| Local release fraction to air | 0.002 |
| Local release fraction to sewage | 0.005 |
| Local release fraction to soil | 0 |

### 9.5.1.3. 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.

**Table 39. Exposure concentrations and risks for the environment**

| VOLUMES and RELEASES (INTERIM RESULTS) | |
|---|---|
| EU tonnage for use (tpa) | |
| Amount used locally (kg/d) | 1.00E+01 |
| Release times per year (d/year) | 2.20E+02 |
| Release fraction air (as in ERC or SPERC background table or set in line 125) | 2.00E-03 |
| Release fraction (waste) water (as in ERC or SPERC background table or set in line 125) | 5.00E-03 |
| Release fraction soil (as in ERC or SPERC background table or set in line 125) | |
| Local release to air (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 2.00E-02 |
| Local release to waste water (kg/d) | 5.00E-02 |
| Local release to soil (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 0.00E+00 |
| RCR | |
| RCR in STP (-) | no STP |
| RCR for local freshwater (-) | 0.900801062 |
| RCR for local freshwater sediment (-) | 0.907382622 |
| RCR for local terrestrial environment (-) | 0.000941314 |
| RCR for local marine water (-) | 0.120164417 |
| RCR for local marine sediments (-) | 0.119916335 |
| RCR for humans via the environment (-) | 0.00139222 |

| | |
|---|---|
| PREDICTED CONCENTRATIONS | |
| PECs | |
| Regional PEC in surface water (total) (mgc.L-1) | 1.66184E-05 |
| Regional PEC in sea water (total) (mgc.L-1) | 1.42485E-06 |
| Regional PEC in air (total) (mgc.m-3) | 5.46431E-06 |
| Regional PEC in agricultural soil (total)(mgc.kgdwt-1) | 0.001063647 |
| Regional PEC in natural soil (total) (mgc.kgdwt-1) | 5.93224E-05 |
| Regional PEC in industrial soil (total) (mgc.kgdwt-1) | 5.93224E-05 |
| Regional PEC in sediment (total) (mgc.kgdwt-1) | 0.083295751 |
| Regional PEC in sea water sediment (total) (mgc.kgdwt-1) | 0.005757577 |
| Annual average local PEC in air (total) (mgc.m-3) | 8.81554E-06 |
| Local PEC in surface water during emission episode (dissolved) (mgc.L-1) | 0.002405139 |
| Annual average local PEC in surface water (dissolved) (mgc.L-1) | 0.001455982 |
| Local PEC in fresh water sediment during emission episode (mgc.kgdwt-1) | 7.4405375 |
| Local PEC in sea water during emission episode (dissolved) (mgc.L-1) | 0.000240329 |
| Annual average local PEC in sea water (dissolved) (mgc.L-1) | 0.000145413 |
| Local PEC in marine sediment during emission episode (mgc.kgdwt-1) | 0.743481279 |
| Local PEC in agricultural soil, averaged over 30 days (mgc.kgdwt-1) | 9.41314E-05 |
| Local PEC agricultural soil, averaged over 180 days (mgc.kgdwt-1) | 9.46583E-05 |
| Local PEC in grass land, averaged over 180 days (mgc.kgdwt-1) | 0.000114665 |
| PEC for microorganisms in STP (mgc.L-1) | 0.025 |
| PEC for microorganisms in STP with intermittent release (mgc.L-1) | 0.025 |
| | |
| Secondary poisoning | |
| Environment | |
| Conc. in fish for secondary poisoning in freshwater environment (mgc.kgwwt-1) | 0.065881784 |
| Conc. in fish for secondary poisoning in marine environment (mgc.kgwwt-1) | 0.006571612 |
| Conc. in fish-eating predator for marine toppredators (mgc.kgwwt-1) | 0.001414805 |
| Conc. in earthworms for secondary poisoning (mgc.kgwwt-1) | 0.000212701 |
| Humans | |
| Regional daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1.56123E-06 |
| Regional total daily intake for humans (mgc.kgbw-1.d-1) | 5.98655E-06 |
| Local daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 2.51873E-06 |
| Local total daily intake for humans (mgc.kgbw-1.d-1) | 0.0002376 |
| | |
| PREDICTED NO-EFFECT LEVELS | |
| | |
| CUSTOMER TOOL INFORMATION | |
| Amount used locally (Muse) (kg.d-1) | 1.00E+01 |
| Percent emission to air | 2.00E-01 |
| Percent emission to wastewater | 5.00E-01 |
| Elimination in STP (fraction) | 0.00E+00 |
| Number of emission days [d/a] | 2.20E+02 |
| Effluent discharge rate of this STP (m3.d-1) | 2.00E+03 |
| Flow rate of the river (m3.d-1) | 1.80E+04 |
| Dilution factor (rivers) | 1.00E+01 |
| Dilution factor (coastal areas) | 1.00E+02 |
| | |
| ENVIRONMENTAL RISK | |
| Local | |
| Water | |
| Freshwater aquatic RCR | 0.900801062 |
| Marine aquatic RCR | 0.43729797 |
| Sediment | 0.120164417 |
| Freshwater sediment RCR | 0.907382622 |
| Marine sediment RCR | 0.119916335 |

| | |
|---|---|
| Soil | |
| Terrestrial RCR | 0.000941314 |
| STP | |
| Sewage treatment Plant RCR, intermittent releases | |
| Predators | 0.016666667 |
| Freshwater fish-eating birds and mammals RCR | |
| Marine fish-eating birds and mammals RCR | 0.065881784 |
| Marine top predator RCR | 0.006571612 |
| Worm-eating birds and mammals RCR | 0.001414805 |
| Regional Water | 0.000212701 |
| Freshwater aquatic RCR | 0.00139222 |
| Marine aquatic RCR | |
| Regional Sediment | 0.005947917 |
| Freshwater sediment RCR | 0.000701522 |
| Marine sediment RCR | |
| Soil | 0.010158018 |
| Terrestrial RCR | 0.000928641 |

**Table 40. Contribution to oral intake for man via the environment from local contribution**

## 9.5.2. Worker contributing scenario 1: Worker contributing scenario Coating of surfaces (PROC 1)

### 9.5.2.1. Conditions of use

| | **Method** |
|---|---|
| **Product (article) characteristics** | |
| • Dustiness of material: Medium | TRA Worker v3 |
| • Concentration of substance in mixture: Substance as such | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 1 hour | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Basic general ventilation (1-3 air changes per hour) | TRA Worker v3 |
| • Containment: Closed system (minimal contact during routine operations) | TRA Worker v3 |
| • Local exhaust ventilation: no [Effectiveness Inhal: 0%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with specific activity training) [Effectiveness Dermal: 95%] | TRA Worker v3 |
| • Respiratory Protection: No [Effectiveness Inhal: 0%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Ambient | TRA Worker v3 |
| • Skin surface potentially exposed: One hand face only (240 cm2) | TRA Worker v3 |

### 9.5.2.2. 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 | Exposure concentration | Risk characterisation |
|---|---|---|

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.002 mg/m³** (TRA Worker v3) | RCR = 0.04 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.002 mg/kg bw/day** (TRA Worker v3) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.04 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

# 9.6. Exposure scenario 6: Use at industrial site - Use at industrial site: Use as additive in glass manufacture

**Sector of use:**
SU 0, Other

| | |
|---|---|
| **Environment contributing scenario(s):** | |
| Use at industrial site: Use as additive in glass manufacture | ERC 6b |
| **Worker contributing scenario(s):** | |
| Worker contributing scenario: Use as additive in glass manufacture | PROC 26 |

## 9.6.1. Environmental contributing scenario 1: Use at industrial site: Use as additive in glass manufacture

### 9.6.1.1. Conditions of use

### 9.6.1.2. Releases

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

**Table 42. Local releases to the environment**

| RELEASE ESTIMATION BASED ON SPECIFIC RELEASE FRACTIONS | |
|---|---|
| Comments 1 | Eurometaux 2.5.6bv2.1 |
| Comments 2 | ES6-IW3 |
| Daily amount used at site [kg/d] (release fractions) | 100 |
| Release times per year (d/year) | 180 |
| Local release fraction to air | 0.002 |
| Local release fraction to sewage | 0.0005 |
| Local release fraction to soil | 0 |

### 9.6.1.3. 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.

**Table 43. Exposure concentrations and risks for the environment**

| VOLUMES and RELEASES (INTERIM RESULTS) | |
|---|---|
| EU tonnage for use (tpa) | |
| Amount used locally (kg/d) | 1.00E+02 |
| Release times per year (d/year) | 1.80E+02 |
| Release fraction air (as in ERC or SPERC background table or set in line 125) | 2.00E-03 |
| Release fraction (waste) water (as in ERC or SPERC background table or set in line 125) | 5.00E-04 |
| Release fraction soil (as in ERC or SPERC background table or set in line 125) | |
| Local release to air (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 2.00E-01 |
| Local release to waste water (kg/d) | 5.00E-02 |
| Local release to soil (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 0.00E+00 |
| RCR | |
| RCR in STP (-) | no STP |
| RCR for local freshwater (-) | 0.899484133 |
| RCR for local freshwater sediment (-) | 0.906056071 |
| RCR for local terrestrial environment (-) | 0.003384808 |
| RCR for local marine water (-) | 0.120009827 |
| RCR for local marine sediments (-) | 0.119762065 |

| | |
|---|---|
| RCR for humans via the environment (-) | 0.00113314 |
| PREDICTED CONCENTRATIONS | |
| PECs | |
| Regional PEC in surface water (total) (mgc.L-1) | 1.2939E-05 |
| Regional PEC in sea water (total) (mgc.L-1) | 1.11086E-06 |
| Regional PEC in air (total) (mgc.m-3) | 4.94454E-06 |
| Regional PEC in agricultural soil (total)(mgc.kgdwt-1) | 0.000835247 |
| Regional PEC in natural soil (total) (mgc.kgdwt-1) | 5.36795E-05 |
| Regional PEC in industrial soil (total) (mgc.kgdwt-1) | 5.36795E-05 |
| Regional PEC in sediment (total) (mgc.kgdwt-1) | 0.064853235 |
| Regional PEC in sea water sediment (total) (mgc.kgdwt-1) | 0.004488822 |
| Annual average local PEC in air (total) (mgc.m-3) | 3.23637E-05 |
| Local PEC in surface water during emission episode (dissolved) (mgc.L-1) | 0.002401623 |
| Annual average local PEC in surface water (dissolved) (mgc.L-1) | 0.001190629 |
| Local PEC in fresh water sediment during emission episode (mgc.kgdwt-1) | 7.429659786 |
| Local PEC in sea water during emission episode (dissolved) (mgc.L-1) | 0.00024002 |
| Annual average local PEC in sea water (dissolved) (mgc.L-1) | 0.00011892 |
| Local PEC in marine sediment during emission episode (mgc.kgdwt-1) | 0.742524804 |
| Local PEC in agricultural soil, averaged over 30 days (mgc.kgdwt-1) | 0.000338481 |
| Local PEC agricultural soil, averaged over 180 days (mgc.kgdwt-1) | 0.000342792 |
| Local PEC in grass land, averaged over 180 days (mgc.kgdwt-1) | 0.000506485 |
| PEC for microorganisms in STP (mgc.L-1) | 0.025 |
| PEC for microorganisms in STP with intermittent release (mgc.L-1) | 0.025 |
| | |
| Secondary poisoning | |
| Environment | |
| Conc. in fish for secondary poisoning in freshwater environment (mgc.kgwwt-1) | 0.053892302 |
| Conc. in fish for secondary poisoning in marine environment (mgc.kgwwt-1) | 0.005376003 |
| Conc. in fish-eating predator for marine toppredators (mgc.kgwwt-1) | 0.001156797 |
| Conc. in earthworms for secondary poisoning (mgc.kgwwt-1) | 0.000224284 |
| Humans | |
| Regional daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1.56417E-06 |
| Regional total daily intake for humans (mgc.kgbw-1.d-1) | 5.17235E-06 |
| Local daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 9.39822E-06 |
| Local total daily intake for humans (mgc.kgbw-1.d-1) | 0.000202119 |
| | |
| PREDICTED NO-EFFECT LEVELS | |
| | |
| CUSTOMER TOOL INFORMATION | |
| Amount used locally (Muse) (kg.d-1) | 1.00E+02 |
| Percent emission to air | 2.00E-01 |
| Percent emission to wastewater | 5.00E-02 |
| Elimination in STP (fraction) | 0.00E+00 |
| Number of emission days [d/a] | 1.80E+02 |
| Effluent discharge rate of this STP (m3.d-1) | 2.00E+03 |
| Flow rate of the river (m3.d-1) | 1.80E+04 |
| Dilution factor (rivers) | 1.00E+01 |
| Dilution factor (coastal areas) | 1.00E+02 |
| | |
| ENVIRONMENTAL RISK | |
| Local | |
| Water | |
| Freshwater aquatic RCR | 0.899673701 |
| Marine aquatic RCR | 0.436750687 |
| Sediment | |
| Freshwater sediment RCR | 0.120032565 |

| | |
|---|---|
| Marine sediment RCR | - |
| Soil | |
| Terrestrial RCR | 0.906247024 |
| STP | 0.119784756 |
| Sewage treatment Plant RCR, intermittent releases | |
| Predators | 0.003442354 |
| Freshwater fish-eating birds and mammals RCR | |
| Marine fish-eating birds and mammals RCR | |
| Marine top predator RCR | 0.016666667 |
| Worm-eating birds and mammals RCR | |
| Regional Water | 0.053892302 |
| Freshwater aquatic RCR | 0.005376003 |
| Marine aquatic RCR | 0.001156797 |
| Regional Sediment | 0.000224284 |
| Freshwater sediment RCR | 0.001202872 |
| Marine sediment RCR | |
| Soil | 0.004820556 |
| Terrestrial RCR | 0.00056967 |

**Table 44. Contribution to oral intake for man via the environment from local contribution**

## 9.6.2. Worker contributing scenario 1: Worker contributing scenario: Use as additive in glass manufacture (PROC 26)

### 9.6.2.1. Conditions of use

Not defined.

### 9.6.2.2. 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 | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.015 mg/m³** (External Tool (MEASE)) | RCR = 0.3 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.003 mg/kg bw/day** (External Tool (MEASE)) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.3 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

# 9.7. Exposure scenario 7: Use at industrial site - Use at industrial site: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles

**Sector of use:**
SU 0, Other

| | |
|---|---|
| **Environment contributing scenario(s):** | |
| Use at industrial site: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles | ERC 5 |
| **Worker contributing scenario(s):** | |
| Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles | PROC 3 |
| Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles | PROC 14 |
| Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles | PROC 15 |
| Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles | PROC 21 |
| Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles | PROC 23 |
| Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles | PROC 25 |

**Subsequent service life exposure scenario(s):**

ES8: Service life (worker at industrial site) - Service life (worker at industrial site)

## 9.7.1. Environmental contributing scenario 1: Use at industrial site: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles

#### 9.7.1.1. Conditions of use

#### 9.7.1.2. Releases

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

**Table 46. Local releases to the environment**

| RELEASE ESTIMATION BASED ON SPECIFIC RELEASE FRACTIONS | |
|---|---|
| Comments 1 | Eurometaux 5.1.v2.1 |
| Comments 2 | ES5-IW4 |
| Daily amount used at site [kg/d] (release fractions) | 10 |
| Release times per year (d/year) | 220 |
| Local release fraction to air | 0.002 |
| Local release fraction to sewage | 0.005 |
| Local release fraction to soil | 0 |

#### 9.5.1.3. 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.

**Table 47. Exposure concentrations and risks for the environment**

| | |
|---|---|
| VOLUMES and RELEASES (INTERIM RESULTS) | |
| EU tonnage for use (tpa) | |
| Amount used locally (kg/d) | 1.00E+01 |
| Release times per year (d/year) | 2.20E+02 |
| Release fraction air (as in ERC or SPERC background table or set in line 125) | 2.00E-03 |
| Release fraction (waste) water (as in ERC or SPERC background table or set in line 125) | 5.00E-03 |
| Release fraction soil (as in ERC or SPERC background table or set in line 125) | |
| Local release to air (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 2.00E-02 |
| Local release to waste water (kg/d) | 5.00E-02 |
| Local release to soil (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 0.00E+00 |
| RCR | |
| RCR in STP (-) | no STP |
| RCR for local freshwater (-) | 0.900801062 |
| RCR for local freshwater sediment (-) | 0.907382622 |
| RCR for local terrestrial environment (-) | 0.000941314 |
| RCR for local marine water (-) | 0.120164417 |
| RCR for local marine sediments (-) | 0.119916335 |
| RCR for humans via the environment (-) | 0.00139222 |
| PREDICTED CONCENTRATIONS | |
| PECs | |
| Regional PEC in surface water (total) (mgc.L-1) | 1.66184E-05 |
| Regional PEC in sea water (total) (mgc.L-1) | 1.42485E-06 |
| Regional PEC in air (total) (mgc.m-3) | 5.46431E-06 |
| Regional PEC in agricultural soil (total)(mgc.kgdwt-1) | 0.001063647 |
| Regional PEC in natural soil (total) (mgc.kgdwt-1) | 5.93224E-05 |
| Regional PEC in industrial soil (total) (mgc.kgdwt-1) | 5.93224E-05 |
| Regional PEC in sediment (total) (mgc.kgdwt-1) | 0.083295751 |
| Regional PEC in sea water sediment (total) (mgc.kgdwt-1) | 0.005757577 |
| Annual average local PEC in air (total) (mgc.m-3) | 8.81554E-06 |
| Local PEC in surface water during emission episode (dissolved) (mgc.L-1) | 0.002405139 |
| Annual average local PEC in surface water (dissolved) (mgc.L-1) | 0.001455982 |
| Local PEC in fresh water sediment during emission episode (mgc.kgdwt-1) | 7.4405375 |
| Local PEC in sea water during emission episode (dissolved) (mgc.L-1) | 0.000240329 |
| Annual average local PEC in sea water (dissolved) (mgc.L-1) | 0.000145413 |
| Local PEC in marine sediment during emission episode (mgc.kgdwt-1) | 0.743481279 |
| Local PEC in agricultural soil, averaged over 30 days (mgc.kgdwt-1) | 9.41314E-05 |
| Local PEC agricultural soil, averaged over 180 days (mgc.kgdwt-1) | 9.46583E-05 |
| Local PEC in grass land, averaged over 180 days (mgc.kgdwt-1) | 0.000114665 |
| PEC for microorganisms in STP (mgc.L-1) | 0.025 |
| PEC for microorganisms in STP with intermittent release (mgc.L-1) | 0.025 |
| | |
| Secondary poisoning | |
| Environment | |
| Conc. in fish for secondary poisoning in freshwater environment (mgc.kgwwt-1) | 0.065881784 |
| Conc. in fish for secondary poisoning in marine environment (mgc.kgwwt-1) | 0.006571612 |
| Conc. in fish-eating predator for marine toppredators (mgc.kgwwt-1) | 0.001414805 |
| Conc. in earthworms for secondary poisoning (mgc.kgwwt-1) | 0.000212701 |
| Humans | |
| Regional daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1.56123E-06 |
| Regional total daily intake for humans (mgc.kgbw-1.d-1) | 5.98655E-06 |
| Local daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 2.51873E-06 |
| Local total daily intake for humans (mgc.kgbw-1.d-1) | 0.0002376 |
| | |
| PREDICTED NO-EFFECT LEVELS | |
| | |
| CUSTOMER TOOL INFORMATION | |

| | |
|---|---|
| Amount used locally (Muse) (kg.d-1) | 1.00E+01 |
| Percent emission to air | 2.00E-01 |
| Percent emission to wastewater | 5.00E-01 |
| Elimination in STP (fraction) | 0.00E+00 |
| Number of emission days [d/a] | 2.20E+02 |
| Effluent discharge rate of this STP (m3.d-1) | 2.00E+03 |
| Flow rate of the river (m3.d-1) | 1.80E+04 |
| Dilution factor (rivers) | 1.00E+01 |
| Dilution factor (coastal areas) | 1.00E+02 |
| | |
| ENVIRONMENTAL RISK | |
| Local | |
| Water | |
| Freshwater aquatic RCR | 0.900801062 |
| Marine aquatic RCR | 0.43729797 |
| Sediment | 0.120164417 |
| Freshwater sediment RCR | 0.907382622 |
| Marine sediment RCR | 0.119916335 |
| Soil | |
| Terrestrial RCR | 0.000941314 |
| STP | |
| Sewage treatment Plant RCR, intermittent releases | |
| Predators | 0.016666667 |
| Freshwater fish-eating birds and mammals RCR | |
| Marine fish-eating birds and mammals RCR | 0.065881784 |
| Marine top predator RCR | 0.006571612 |
| Worm-eating birds and mammals RCR | 0.001414805 |
| Regional Water | 0.000212701 |
| Freshwater aquatic RCR | 0.00139222 |
| Marine aquatic RCR | |
| Regional Sediment | 0.005947917 |
| Freshwater sediment RCR | 0.000701522 |
| Marine sediment RCR | |
| Soil | 0.010158018 |
| Terrestrial RCR | 0.000928641 |

**Table 48. Contribution to oral intake for man via the environment from local contribution**

## 9.7.2. Worker contributing scenario 1: Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles (PROC 3)

### 9.7.2.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Dustiness of material: Medium | TRA Worker v3 |
| • Concentration of substance in mixture: >25% | TRA Worker v3 |
| • Solid in solid mixtures: Yes | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 8 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Good general ventilation (3-5 air changes per hour) | TRA Worker v3 |

| | Method |
|---|---|
| • Containment: Closed batch process with occasional controlled exposure | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): yes [Effectiveness Dermal: 90%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with basic employee training) [Effectiveness Dermal: 90%] | TRA Worker v3 |
| • Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhal: 90%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Ambient | TRA Worker v3 |
| • Skin surface potentially exposed: One hand face only (240 cm2) | TRA Worker v3 |

#### 9.7.2.2. 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 | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.007 mg/m³** (TRA Worker v3) | RCR = 0.14 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.007 mg/kg bw/day** (TRA Worker v3) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.141 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

### 9.7.3. Worker contributing scenario 2: Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles (PROC 14)

#### 9.7.3.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Dustiness of material: Medium | TRA Worker v3 |
| • Concentration of substance in mixture: >25% | TRA Worker v3 |
| • Solid in solid mixtures: Yes | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 8 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Good general ventilation (3-5 air changes per hour) | TRA Worker v3 |
| • Containment: No | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |

| | Method |
|---|---|
| • Local exhaust ventilation (for dermal): yes [Effectiveness Dermal: 90%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with basic employee training) [Effectiveness Dermal: 90%] | TRA Worker v3 |
| • Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhal: 90%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Ambient | TRA Worker v3 |
| • Skin surface potentially exposed: Two hands face (480 cm2) | TRA Worker v3 |

#### 9.7.3.2. 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 | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.007 mg/m³** (TRA Worker v3) | RCR = 0.14 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.034 mg/kg bw/day** (TRA Worker v3) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.145 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

## 9.7.4. Worker contributing scenario 3: Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles (PROC 15)

#### 9.7.4.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Dustiness of material: Medium | TRA Worker v3 |
| • Concentration of substance in mixture: >25% | TRA Worker v3 |
| • Solid in solid mixtures: Yes | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 8 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Enhanced general ventilation (5-10 air changes per hour) | TRA Worker v3 |
| • Containment: No | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): no [Effectiveness Dermal: 0%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |

| | Method |
|---|---|
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: No [Effectiveness Dermal: 0%] | TRA Worker v3 |
| • Respiratory Protection: No [Effectiveness Inhal: 0%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Ambient | TRA Worker v3 |
| • Skin surface potentially exposed: One hand face only (240 cm2) | TRA Worker v3 |

#### 9.7.4.2. Exposure and risks for workers

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

**Table 51. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.015 mg/m³** (TRA Worker v3) | RCR = 0.3 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.34 mg/kg bw/day** (TRA Worker v3) | RCR = 0.049 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.349 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

### 9.7.5. Worker contributing scenario 4: Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles (PROC 21)

#### 9.7.5.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Dustiness of material: Medium | TRA Worker v3 |
| • Concentration of substance in mixture: >25% | TRA Worker v3 |
| • Solid in solid mixtures: Yes | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 8 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Enhanced general ventilation (5-10 air changes per hour) | TRA Worker v3 |
| • Containment: No | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): yes [Effectiveness Dermal: 90%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with basic employee training) [Effectiveness Dermal: 90%] | TRA Worker v3 |

| | Method |
|---|---|
| • Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhal: 90%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Ambient | TRA Worker v3 |
| • Skin surface potentially exposed: Two hands and forearms (1980 cm2) | TRA Worker v3 |

#### 9.7.5.2. Exposure and risks for workers

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

**Table 52. Exposure concentrations and risks for workers**

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.009 mg/m³** (TRA Worker v3) | RCR = 0.18 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.028 mg/kg bw/day** (TRA Worker v3) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.184 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

### 9.7.6. Worker contributing scenario 5: Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles (PROC 23)

#### 9.7.6.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Concentration of substance in mixture: >25% | TRA Worker v3 |
| • Solid in solid mixtures: Yes | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 8 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Enhanced general ventilation (5-10 air changes per hour) | TRA Worker v3 |
| • Containment: No | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): yes [Effectiveness Dermal: 90%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with basic employee training) [Effectiveness Dermal: 90%] | TRA Worker v3 |
| • Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhal: 90%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |

| | Method |
|---|---|
| • Process temperature (for solid): Elevated temperature > melting point | TRA Worker v3 |
| • Skin surface potentially exposed: Two hands and forearms (1980 cm2) | TRA Worker v3 |

#### 9.7.6.2. 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 | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.03 mg/m³** (TRA Worker v3) | RCR = 0.6 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.014 mg/kg bw/day** (TRA Worker v3) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.602 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

### 9.7.7. Worker contributing scenario 6: Worker contributing scenario: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles (PROC 25)

#### 9.7.7.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Concentration of substance in mixture: >25% | TRA Worker v3 |
| • Solid in solid mixtures: Yes | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 8 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Enhanced general ventilation (5-10 air changes per hour) | TRA Worker v3 |
| • Containment: No | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): yes [Effectiveness Dermal: 90%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with basic employee training) [Effectiveness Dermal: 90%] | TRA Worker v3 |
| • Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhal: 90%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Elevated temperature > melting point | TRA Worker v3 |
| • Skin surface potentially exposed: Two hands and forearms (1980 cm2) | TRA Worker v3 |

**9.7.7.2. 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 | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.015 mg/m³** (TRA Worker v3) | RCR = 0.3 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.003 mg/kg bw/day** (TRA Worker v3) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.3 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

# 9.8. Exposure scenario 8: Service life (worker at industrial site) - Service life (worker at industrial site)

**Sector of use:**
SU 0, Other

**Article categories:**
AC 2, Machinery, mechanical appliances, electrical/electronic articles
AC 7, Metal articles

| **Environment contributing scenario(s):** | |
|---|---|
| Service life (worker at industrial site) | ERC 12a |

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

ES7: Use at industrial site - Use at industrial site: Use of selenium containing alloys in the production of electronic devices, coated drums, TFT, semiconductive layers and other articles

ES9: Use at industrial site - Use at industrial site: Thin Film Production by Physical Vapor Deposition (PVD)

## 9.8.1. Environmental contributing scenario 1: Service life (worker at industrial site)

### 9.8.1.1. Conditions of use

### 9.8.1.2. Releases

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

**Table 55. Local releases to the environment**

| RELEASE ESTIMATION BASED ON SPECIFIC RELEASE FRACTIONS | derived from Eurometaux 5.1.v2.1 |
|---|---|
| Comments 1 | |
| Comments 2 | ES8-SL-IW1 |
| Daily amount used at site [kg/d] (release fractions) | 1 |
| Release times per year (d/year) | 220 |
| Local release fraction to air | 0.002 |
| Local release fraction to sewage | 0.005 |
| Local release fraction to soil | 0 |

### 9.8.1.3. 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.

**Table 56. Exposure concentrations and risks for the environment**

| VOLUMES and RELEASES (INTERIM RESULTS) | |
|---|---|
| EU tonnage for use (tpa) | |
| Amount used locally (kg/d) | 1.00E+00 |
| Release times per year (d/year) | 2.20E+02 |
| Release fraction air (as in ERC or SPERC background table or set in line 125) | 2.00E-03 |
| Release fraction (waste) water (as in ERC or SPERC background table or set in line 125) | 5.00E-03 |
| Release fraction soil (as in ERC or SPERC background table or set in line 125) | |
| Local release to air (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 2.00E-03 |
| Local release to waste water (kg/d) | 5.00E-03 |
| Local release to soil (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 0.00E+00 |
| RCR | |
| RCR in STP (-) | no STP |

| | |
|---|---|
| RCR for local freshwater (-) | 0.094116303 |
| RCR for local freshwater sediment (-) | 0.094803949 |
| RCR for local terrestrial environment (-) | 0.000571604 |
| RCR for local marine water (-) | 0.012493222 |
| RCR for local marine sediments (-) | 0.01246743 |
| RCR for humans via the environment (-) | 0.001 |
| PREDICTED CONCENTRATIONS | |
| PECs | |
| Regional PEC in surface water (total) (mgc.L-1) | 1,29E-01 |
| Regional PEC in sea water (total) (mgc.L-1) | 1,11E-01 |
| Regional PEC in air (total) (mgc.m-3) | 4,94E-01 |
| Regional PEC in agricultural soil (total)(mgc.kgdwt-1) | 0.000835247 |
| Regional PEC in natural soil (total) (mgc.kgdwt-1) | 5,37E+00 |
| Regional PEC in industrial soil (total) (mgc.kgdwt-1) | 5,37E+00 |
| Regional PEC in sediment (total) (mgc.kgdwt-1) | 0.064853235 |
| Regional PEC in sea water sediment (total) (mgc.kgdwt-1) | 0.004488822 |
| Annual average local PEC in air (total) (mgc.m-3) | 5,28E-01 |
| Local PEC in surface water during emission episode (dissolved) (mgc.L-1) | 0.000251291 |
| Annual average local PEC in surface water (dissolved) (mgc.L-1) | 0.000156375 |
| Local PEC in fresh water sediment during emission episode (mgc.kgdwt-1) | 0.77739238 |
| Local PEC in sea water during emission episode (dissolved) (mgc.L-1) | 2,50E+00 |
| Annual average local PEC in sea water (dissolved) (mgc.L-1) | 1,55E+00 |
| Local PEC in marine sediment during emission episode (mgc.kgdwt-1) | 0.077298064 |
| Local PEC in agricultural soil, averaged over 30 days (mgc.kgdwt-1) | 5,72E+00 |
| Local PEC agricultural soil, averaged over 180 days (mgc.kgdwt-1) | 5,72E+00 |
| Local PEC in grass land, averaged over 180 days (mgc.kgdwt-1) | 5,92E+00 |
| PEC for microorganisms in STP (mgc.L-1) | 0.0025 |
| PEC for microorganisms in STP with intermittent release (mgc.L-1) | 0.0025 |
| | |
| Secondary poisoning | |
| Environment | |
| Conc. in fish for secondary poisoning in freshwater environment (mgc.kgwwt-1) | 0.007552922 |
| Conc. in fish for secondary poisoning in marine environment (mgc.kgwwt-1) | 0.000742526 |
| Conc. in fish-eating predator for marine toppredators (mgc.kgwwt-1) | 0.000226845 |
| Conc. in earthworms for secondary poisoning (mgc.kgwwt-1) | 0.000163883 |
| Humans | |
| Regional daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1,41E-01 |
| Regional total daily intake for humans (mgc.kgbw-1.d-1) | 4,87E-02 |
| Local daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1,51E-01 |
| Local total daily intake for humans (mgc.kgbw-1.d-1) | 2,68E+00 |
| | |
| PREDICTED NO-EFFECT LEVELS | |
| | |
| CUSTOMER TOOL INFORMATION | |
| Amount used locally (Muse) (kg.d-1) | 1.00E+00 |
| Percent emission to air | 2.00E-01 |
| Percent emission to wastewater | 5.00E-01 |
| Elimination in STP (fraction) | 0.00E+00 |
| Number of emission days [d/a] | 2.20E+02 |
| Effluent discharge rate of this STP (m3.d-1) | 2.00E+03 |
| Flow rate of the river (m3.d-1) | 1.80E+04 |
| Dilution factor (rivers) | 1.00E+01 |
| Dilution factor (coastal areas) | 1.00E+02 |
| | |
| ENVIRONMENTAL RISK | |
| Local | |

| | |
|---|---|
| Water | |
| Freshwater aquatic RCR | 0.094116303 |
| Marine aquatic RCR | 0.012493222 |
| Sediment | |
| Freshwater sediment RCR | 0.094803949 |
| Marine sediment RCR | 0.01246743 |
| Soil | |
| Terrestrial RCR | 0.000571604 |
| STP | |
| Sewage treatment Plant RCR, intermittent releases | 0.001666667 |
| Predators | |
| Freshwater fish-eating birds and mammals RCR | 0.007552922 |
| Marine fish-eating birds and mammals RCR | 0.000742526 |
| Marine top predator RCR | 0.000226845 |
| Worm-eating birds and mammals RCR | 0.000163883 |
| Regional Water | |
| Freshwater aquatic RCR | 0.004630988 |
| Marine aquatic RCR | 0.000546933 |
| Regional Sediment | |
| Freshwater sediment RCR | 0.007908931 |
| Marine sediment RCR | 0.000724004 |
| Soil | |
| Terrestrial RCR | 0.008352471 |

**Table 57. Contribution to oral intake for man via the environment from local contribution**

# 9.9. Exposure scenario 9: Use at industrial site - Use at industrial site: Thin Film Production by Physical Vapor Deposition (PVD)

**Sector of use:**
SU 0, Other

| | |
|---|---|
| **Environment contributing scenario(s):** | |
| Use at industrial site | ERC 5 |
| **Worker contributing scenario(s):** | |
| Worker contributing scenario: Thin Film Production by Physical Vapor Deposition (PVD) | PROC 2 |

**Subsequent service life exposure scenario(s):**

ES8: Service life (worker at industrial site) - Service life (worker at industrial site)

ES10: Service life (worker at industrial site) - Service life (worker at industrial site: Thin Film Production by Physical Vapor Deposition (PVD)

## 9.9.1. Environmental contributing scenario 1: Use at industrial site

### 9.9.1.1. Conditions of use

### 9.9.1.2. Releases

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

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

**Table 58. Local releases to the environment**

| RELEASE ESTIMATION BASED ON SPECIFIC RELEASE FRACTIONS | |
|---|---|
| Comments 1 | derived from Eurometaux 5.1.v2.1 |
| Comments 2 | ES5-IW4 |
| Daily amount used at site [kg/d] (release fractions) | 10 |
| Release times per year (d/year) | 220 |
| Local release fraction to air | 0.002 |
| Local release fraction to sewage | 0.005 |
| Local release fraction to soil | 0 |

### 9.5.1.3. 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.

**Table 59. Exposure concentrations and risks for the environment**

| VOLUMES and RELEASES (INTERIM RESULTS) | |
|---|---|
| EU tonnage for use (tpa) | |
| Amount used locally (kg/d) | 1.00E+01 |
| Release times per year (d/year) | 2.20E+02 |
| Release fraction air (as in ERC or SPERC background table or set in line 125) | 2.00E-03 |
| Release fraction (waste) water (as in ERC or SPERC background table or set in line 125) | 5.00E-03 |
| Release fraction soil (as in ERC or SPERC background table or set in line 125) | |
| Local release to air (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 2.00E-02 |
| Local release to waste water (kg/d) | 5.00E-02 |
| Local release to soil (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 0.00E+00 |

| | |
|---|---|
| RCR | |
| RCR in STP (-) | no STP |
| RCR for local freshwater (-) | 0.900801062 |
| RCR for local freshwater sediment (-) | 0.907382622 |
| RCR for local terrestrial environment (-) | 0.000941314 |
| RCR for local marine water (-) | 0.120164417 |
| RCR for local marine sediments (-) | 0.119916335 |
| RCR for humans via the environment (-) | 0.00139222 |
| PREDICTED CONCENTRATIONS | |
| PECs | |
| Regional PEC in surface water (total) (mgc.L-1) | 1.66184E-05 |
| Regional PEC in sea water (total) (mgc.L-1) | 1.42485E-06 |
| Regional PEC in air (total) (mgc.m-3) | 5.46431E-06 |
| Regional PEC in agricultural soil (total)(mgc.kgdwt-1) | 0.001063647 |
| Regional PEC in natural soil (total) (mgc.kgdwt-1) | 5.93224E-05 |
| Regional PEC in industrial soil (total) (mgc.kgdwt-1) | 5.93224E-05 |
| Regional PEC in sediment (total) (mgc.kgdwt-1) | 0.083295751 |
| Regional PEC in sea water sediment (total) (mgc.kgdwt-1) | 0.005757577 |
| Annual average local PEC in air (total) (mgc.m-3) | 8.81554E-06 |
| Local PEC in surface water during emission episode (dissolved) (mgc.L-1) | 0.002405139 |
| Annual average local PEC in surface water (dissolved) (mgc.L-1) | 0.001455982 |
| Local PEC in fresh water sediment during emission episode (mgc.kgdwt-1) | 7.4405375 |
| Local PEC in sea water during emission episode (dissolved) (mgc.L-1) | 0.000240329 |
| Annual average local PEC in sea water (dissolved) (mgc.L-1) | 0.000145413 |
| Local PEC in marine sediment during emission episode (mgc.kgdwt-1) | 0.743481279 |
| Local PEC in agricultural soil, averaged over 30 days (mgc.kgdwt-1) | 9.41314E-05 |
| Local PEC agricultural soil, averaged over 180 days (mgc.kgdwt-1) | 9.46583E-05 |
| Local PEC in grass land, averaged over 180 days (mgc.kgdwt-1) | 0.000114665 |
| PEC for microorganisms in STP (mgc.L-1) | 0.025 |
| PEC for microorganisms in STP with intermittent release (mgc.L-1) | 0.025 |
| | |
| Secondary poisoning | |
| Environment | |
| Conc. in fish for secondary poisoning in freshwater environment (mgc.kgwwt-1) | 0.065881784 |
| Conc. in fish for secondary poisoning in marine environment (mgc.kgwwt-1) | 0.006571612 |
| Conc. in fish-eating predator for marine toppredators (mgc.kgwwt-1) | 0.001414805 |
| Conc. in earthworms for secondary poisoning (mgc.kgwwt-1) | 0.000212701 |
| Humans | |
| Regional daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1.56123E-06 |
| Regional total daily intake for humans (mgc.kgbw-1.d-1) | 5.98655E-06 |
| Local daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 2.51873E-06 |
| Local total daily intake for humans (mgc.kgbw-1.d-1) | 0.0002376 |
| | |
| PREDICTED NO-EFFECT LEVELS | |
| | |
| CUSTOMER TOOL INFORMATION | |
| Amount used locally (Muse) (kg.d-1) | 1.00E+01 |
| Percent emission to air | 2.00E-01 |
| Percent emission to wastewater | 5.00E-01 |
| Elimination in STP (fraction) | 0.00E+00 |
| Number of emission days [d/a] | 2.20E+02 |
| Effluent discharge rate of this STP (m3.d-1) | 2.00E+03 |
| Flow rate of the river (m3.d-1) | 1.80E+04 |
| Dilution factor (rivers) | 1.00E+01 |
| Dilution factor (coastal areas) | 1.00E+02 |
| | |

| | |
|---|---|
| ENVIRONMENTAL RISK | |
| Local | |
| Water | |
| Freshwater aquatic RCR | 0.900801062 |
| Marine aquatic RCR | 0.43729797 |
| Sediment | 0.120164417 |
| Freshwater sediment RCR | 0.907382622 |
| Marine sediment RCR | 0.119916335 |
| Soil | |
| Terrestrial RCR | 0.000941314 |
| STP | |
| Sewage treatment Plant RCR, intermittent releases | |
| Predators | 0.016666667 |
| Freshwater fish-eating birds and mammals RCR | |
| Marine fish-eating birds and mammals RCR | 0.065881784 |
| Marine top predator RCR | 0.006571612 |
| Worm-eating birds and mammals RCR | 0.001414805 |
| Regional Water | 0.000212701 |
| Freshwater aquatic RCR | 0.00139222 |
| Marine aquatic RCR | |
| Regional Sediment | 0.005947917 |
| Freshwater sediment RCR | 0.000701522 |
| Marine sediment RCR | |
| Soil | 0.010158018 |
| Terrestrial RCR | 0.000928641 |

## 9.9.2. Worker contributing scenario 1: Worker contributing scenario: Thin Film Production by Physical Vapour Deposition (PVD) (PROC 2)

### 9.9.2.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Dustiness of material: Medium | TRA Worker v3 |
| • Concentration of substance in mixture: Substance as such | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 8 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Enhanced general ventilation (5-10 air changes per hour) | TRA Worker v3 |
| • Containment: Closed continuous process with occasional controlled exposure | TRA Worker v3 |
| • Local exhaust ventilation: no [Effectiveness Inhal: 0%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: No [Effectiveness Dermal: 0%] | TRA Worker v3 |
| • Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhal: 90%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Ambient | TRA Worker v3 |
| • Skin surface potentially exposed: Two hands face (480 cm2) | TRA Worker v3 |

### 9.9.2.2. 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 | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.015 mg/m³** (TRA Worker v3) | RCR = 0.3 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **1.37 mg/kg bw/day** (TRA Worker v3) | RCR = 0.196 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.496 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

# 9.10. Exposure scenario 10: Service life (worker at industrial site) - Service life (worker at industrial site: Thin Film Production by Physical Vapour Deposition (PVD)

**Sector of use:**
SU 0, Other

**Article categories:**
AC 2, Machinery, mechanical appliances, electrical/electronic articles
AC 7, Metal articles

| **Environment contributing scenario(s):** |
|---|
| Service life (worker at industrial site: Thin Film Production by Physical Vapor Deposition (PVD) |

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

ES9: Use at industrial site - Use at industrial site: Thin Film Production by Physical Vapor Deposition (PVD)

## 9.10.1. Environmental contributing scenario 1: Service life (worker at industrial site: Thin Film Production by Physical Vapor Deposition (PVD)

#### 9.10.1.1. Conditions of use

#### 9.10.1.2. Releases

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

**Table 61. Local releases to the environment**

| RELEASE ESTIMATION BASED ON SPECIFIC RELEASE FRACTIONS | |
|---|---|
| Comments 1 | Eurometaux 5.1.v2.1 |
| Comments 2 | ES5-IW4 |
| Daily amount used at site [kg/d] (release fractions) | 10 |
| Release times per year (d/year) | 220 |
| Local release fraction to air | 0.002 |
| Local release fraction to sewage | 0.005 |
| Local release fraction to soil | 0 |

#### 9.5.1.3. 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.

**Table 62. Exposure concentrations and risks for the environment**

| VOLUMES and RELEASES (INTERIM RESULTS) | |
|---|---|
| EU tonnage for use (tpa) | |
| Amount used locally (kg/d) | 1.00E+01 |
| Release times per year (d/year) | 2.20E+02 |
| Release fraction air (as in ERC or SPERC background table or set in line 125) | 2.00E-03 |
| Release fraction (waste) water (as in ERC or SPERC background table or set in line 125) | 5.00E-03 |
| Release fraction soil (as in ERC or SPERC background table or set in line 125) | |
| Local release to air (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 2.00E-02 |
| Local release to waste water (kg/d) | 5.00E-02 |
| Local release to soil (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 0.00E+00 |
| RCR | |

| | |
|---|---|
| RCR in STP (-) | no STP |
| RCR for local freshwater (-) | 0.900801062 |
| RCR for local freshwater sediment (-) | 0.907382622 |
| RCR for local terrestrial environment (-) | 0.000941314 |
| RCR for local marine water (-) | 0.120164417 |
| RCR for local marine sediments (-) | 0.119916335 |
| RCR for humans via the environment (-) | 0.00139222 |
| PREDICTED CONCENTRATIONS | |
| PECs | |
| Regional PEC in surface water (total) (mgc.L-1) | 1.66184E-05 |
| Regional PEC in sea water (total) (mgc.L-1) | 1.42485E-06 |
| Regional PEC in air (total) (mgc.m-3) | 5.46431E-06 |
| Regional PEC in agricultural soil (total)(mgc.kgdwt-1) | 0.001063647 |
| Regional PEC in natural soil (total) (mgc.kgdwt-1) | 5.93224E-05 |
| Regional PEC in industrial soil (total) (mgc.kgdwt-1) | 5.93224E-05 |
| Regional PEC in sediment (total) (mgc.kgdwt-1) | 0.083295751 |
| Regional PEC in sea water sediment (total) (mgc.kgdwt-1) | 0.005757577 |
| Annual average local PEC in air (total) (mgc.m-3) | 8.81554E-06 |
| Local PEC in surface water during emission episode (dissolved) (mgc.L-1) | 0.002405139 |
| Annual average local PEC in surface water (dissolved) (mgc.L-1) | 0.001455982 |
| Local PEC in fresh water sediment during emission episode (mgc.kgdwt-1) | 7.4405375 |
| Local PEC in sea water during emission episode (dissolved) (mgc.L-1) | 0.000240329 |
| Annual average local PEC in sea water (dissolved) (mgc.L-1) | 0.000145413 |
| Local PEC in marine sediment during emission episode (mgc.kgdwt-1) | 0.743481279 |
| Local PEC in agricultural soil, averaged over 30 days (mgc.kgdwt-1) | 9.41314E-05 |
| Local PEC agricultural soil, averaged over 180 days (mgc.kgdwt-1) | 9.46583E-05 |
| Local PEC in grass land, averaged over 180 days (mgc.kgdwt-1) | 0.000114665 |
| PEC for microorganisms in STP (mgc.L-1) | 0.025 |
| PEC for microorganisms in STP with intermittent release (mgc.L-1) | 0.025 |
| | |
| Secondary poisoning | |
| Environment | |
| Conc. in fish for secondary poisoning in freshwater environment (mgc.kgwwt-1) | 0.065881784 |
| Conc. in fish for secondary poisoning in marine environment (mgc.kgwwt-1) | 0.006571612 |
| Conc. in fish-eating predator for marine toppredators (mgc.kgwwt-1) | 0.001414805 |
| Conc. in earthworms for secondary poisoning (mgc.kgwwt-1) | 0.000212701 |
| Humans | |
| Regional daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1.56123E-06 |
| Regional total daily intake for humans (mgc.kgbw-1.d-1) | 5.98655E-06 |
| Local daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 2.51873E-06 |
| Local total daily intake for humans (mgc.kgbw-1.d-1) | 0.0002376 |
| | |
| PREDICTED NO-EFFECT LEVELS | |
| | |
| CUSTOMER TOOL INFORMATION | |
| Amount used locally (Muse) (kg.d-1) | 1.00E+01 |
| Percent emission to air | 2.00E-01 |
| Percent emission to wastewater | 5.00E-01 |
| Elimination in STP (fraction) | 0.00E+00 |
| Number of emission days [d/a] | 2.20E+02 |
| Effluent discharge rate of this STP (m3.d-1) | 2.00E+03 |
| Flow rate of the river (m3.d-1) | 1.80E+04 |
| Dilution factor (rivers) | 1.00E+01 |
| Dilution factor (coastal areas) | 1.00E+02 |
| | |
| ENVIRONMENTAL RISK | |

| | |
|---|---|
| Local | |
| Water | |
| Freshwater aquatic RCR | 0.900801062 |
| Marine aquatic RCR | 0.43729797 |
| Sediment | 0.120164417 |
| Freshwater sediment RCR | 0.907382622 |
| Marine sediment RCR | 0.119916335 |
| Soil | |
| Terrestrial RCR | 0.000941314 |
| STP | |
| Sewage treatment Plant RCR, intermittent releases | |
| Predators | 0.016666667 |
| Freshwater fish-eating birds and mammals RCR | |
| Marine fish-eating birds and mammals RCR | 0.065881784 |
| Marine top predator RCR | 0.006571612 |
| Worm-eating birds and mammals RCR | 0.001414805 |
| Regional Water | 0.000212701 |
| Freshwater aquatic RCR | 0.00139222 |
| Marine aquatic RCR | |
| Regional Sediment | 0.005947917 |
| Freshwater sediment RCR | 0.000701522 |
| Marine sediment RCR | |
| Soil | 0.010158018 |
| Terrestrial RCR | 0.000928641 |

# 9.11. Exposure scenario 11: Use at industrial site - Use at industrial site: Vulcanization of rubber

**Sector of use:**
SU 0, Other

| | |
|---|---|
| **Environment contributing scenario(s):** | |
| Use at industrial site: Vulcanization of rubber | ERC 6b |
| **Worker contributing scenario(s):** | |
| Use at industrial site: Vulcanization of rubber | PROC 3 |

## 9.11.1. Environmental contributing scenario 1: Use at industrial site: Vulcanization of rubber

### 9.11.1.1. Conditions of use

### 9.11.1.2. Releases

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

**Table 63. Local releases to the environment**

| | |
|---|---|
| RELEASE ESTIMATION BASED ON SPECIFIC RELEASE FRACTIONS | |
| Comments 1 | Eurometaux 2.5-6a.v2.1 |
| Comments 2 | ES11-IW6 |
| Daily amount used at site [kg/d] (release fractions) | 4545 |
| Release times per year (d/year) | 216 |
| Local release fraction to air | 0.00001 |
| Local release fraction to sewage | 0.00001 |
| Local release fraction to soil | |

### 9.11.1.3. 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.

**Table 64. Exposure concentrations and risks for the environment**

| | |
|---|---|
| VOLUMES and RELEASES (INTERIM RESULTS) | |
| EU tonnage for use (tpa) | |
| Amount used locally (kg/d) | 4.55E+03 |
| Release times per year (d/year) | 2.16E+02 |
| Release fraction air (as in ERC or SPERC background table or set in line 125) | 1.00E-05 |
| Release fraction (waste) water (as in ERC or SPERC background table or set in line 125) | 1.00E-05 |
| Release fraction soil (as in ERC or SPERC background table or set in line 125) | |
| Local release to air (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 4.55E-02 |
| Local release to waste water (kg/d) | 4.55E-02 |
| Local release to soil (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 0.00E+00 |
| RCR | |
| RCR in STP (-) | no STP |
| RCR for local freshwater (-) | 0.818052497 |
| RCR for local freshwater sediment (-) | 0.824029468 |
| RCR for local terrestrial environment (-) | 0.001313448 |
| RCR for local marine water (-) | 0.109138704 |
| RCR for local marine sediments (-) | 0.108913385 |
| RCR for humans via the environment (-) | 0.001 |
| PREDICTED CONCENTRATIONS | |
| PECs | |
| Regional PEC in surface water (total) (mgc.L-1) | 1,29E-01 |

| | |
|---|---|
| Regional PEC in sea water (total) (mgc.L-1) | 1,11E-01 |
| Regional PEC in air (total) (mgc.m-3) | 4,94E-01 |
| Regional PEC in agricultural soil (total)(mgc.kgdwt-1) | 0.000835247 |
| Regional PEC in natural soil (total) (mgc.kgdwt-1) | 5,37E+00 |
| Regional PEC in industrial soil (total) (mgc.kgdwt-1) | 5,37E+00 |
| Regional PEC in sediment (total) (mgc.kgdwt-1) | 0.064853235 |
| Regional PEC in sea water sediment (total) (mgc.kgdwt-1) | 0.004488822 |
| Annual average local PEC in air (total) (mgc.m-3) | 1,24E+00 |
| Local PEC in surface water during emission episode (dissolved) (mgc.L-1) | 0.0021842 |
| Annual average local PEC in surface water (dissolved) (mgc.L-1) | 0.001297615 |
| Local PEC in fresh water sediment during emission episode (mgc.kgdwt-1) | 6.757.041.637 |
| Local PEC in sea water during emission episode (dissolved) (mgc.L-1) | 0.000218277 |
| Annual average local PEC in sea water (dissolved) (mgc.L-1) | 0.000129619 |
| Local PEC in marine sediment during emission episode (mgc.kgdwt-1) | 0.67526299 |
| Local PEC in agricultural soil, averaged over 30 days (mgc.kgdwt-1) | 0.000131345 |
| Local PEC agricultural soil, averaged over 180 days (mgc.kgdwt-1) | 0.00013252 |
| Local PEC in grass land, averaged over 180 days (mgc.kgdwt-1) | 0.00017716 |
| PEC for microorganisms in STP (mgc.L-1) | 0.022725 |
| PEC for microorganisms in STP with intermittent release (mgc.L-1) | 0.022725 |
| | |
| Secondary poisoning | |
| Environment | |
| Conc. in fish for secondary poisoning in freshwater environment (mgc.kgwwt-1) | 0.05863579 |
| Conc. in fish for secondary poisoning in marine environment (mgc.kgwwt-1) | 0.005850812 |
| Conc. in fish-eating predator for marine toppredators (mgc.kgwwt-1) | 0.001248502 |
| Conc. in earthworms for secondary poisoning (mgc.kgwwt-1) | 0.000177713 |
| Humans | |
| Regional daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1,41E-01 |
| Regional total daily intake for humans (mgc.kgbw-1.d-1) | 4,87E-02 |
| Local daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 3,55E-01 |
| Local total daily intake for humans (mgc.kgbw-1.d-1) | 0.000213132 |
| | |
| PREDICTED NO-EFFECT LEVELS | |
| | |
| CUSTOMER TOOL INFORMATION | |
| Amount used locally (Muse) (kg.d-1) | 4.55E+03 |
| Percent emission to air | 1.00E-03 |
| Percent emission to wastewater | 1.00E-03 |
| Elimination in STP (fraction) | 0.00E+00 |
| Number of emission days [d/a] | 2.16E+02 |
| Effluent discharge rate of this STP (m3.d-1) | 2.00E+03 |
| Flow rate of the river (m3.d-1) | 1.80E+04 |
| Dilution factor (rivers) | 1.00E+01 |
| Dilution factor (coastal areas) | 1.00E+02 |
| | |
| ENVIRONMENTAL RISK | |
| Local | |
| Water | |
| Freshwater aquatic RCR | 0.818052497 |
| Marine aquatic RCR | 0.109138704 |
| Sediment | |
| Freshwater sediment RCR | 0.824029468 |
| Marine sediment RCR | 0.108913385 |
| Soil | |
| Terrestrial RCR | 0.001313448 |
| STP | |

| | |
|---|---|
| Sewage treatment Plant RCR, intermittent releases | 0.01515 |
| Predators | |
| Freshwater fish-eating birds and mammals RCR | 0.05863579 |
| Marine fish-eating birds and mammals RCR | 0.005850812 |
| Marine top predator RCR | 0.001248502 |
| Worm-eating birds and mammals RCR | 0.000177713 |
| Regional Water | |
| Freshwater aquatic RCR | 0.004630988 |
| Marine aquatic RCR | 0.000546933 |
| Regional Sediment | |
| Freshwater sediment RCR | 0.007908931 |
| Marine sediment RCR | 0.000724004 |
| Soil | |
| Terrestrial RCR | 0.008352471 |

**Table 65. Contribution to oral intake for man via the environment from local contribution**

## 9.7.2. Worker contributing scenario 1: Worker contributing scenario: Use at industrial site: Vulcanization of rubber1)

### 9.7.2.1. Conditions of use

| | Method |
|---|---|
| **Product (article) characteristics** | |
| • Dustiness of material: Medium | TRA Worker v3 |
| • Concentration of substance in mixture: >25% | TRA Worker v3 |
| • Solid in solid mixtures: Yes | TRA Worker v3 |
| **Amount used (or contained in articles), frequency and duration of use/exposure** | |
| • Duration of activity: < 8 hours | TRA Worker v3 |
| **Technical and organisational conditions and measures** | |
| • General ventilation: Good general ventilation (3-5 air changes per hour) | TRA Worker v3 |
| • Containment: Closed batch process with occasional controlled exposure | TRA Worker v3 |
| • Local exhaust ventilation: yes [Effectiveness Inhal: 90%] | TRA Worker v3 |
| • Local exhaust ventilation (for dermal): yes [Effectiveness Dermal: 90%] | TRA Worker v3 |
| • Occupational Health and Safety Management System: Advanced | TRA Worker v3 |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | |
| • Dermal Protection: Yes (chemically resistant gloves conforming to EN374 with basic employee training) [Effectiveness Dermal: 90%] | TRA Worker v3 |
| • Respiratory Protection: Yes (Respirator with APF of 10) [Effectiveness Inhal: 90%] | TRA Worker v3 |
| **Other conditions affecting workers exposure** | |
| • Place of use: Indoor | TRA Worker v3 |
| • Process temperature (for solid): Ambient | TRA Worker v3 |
| • Skin surface potentially exposed: One hand face only (240 cm2) | TRA Worker v3 |

### 9.7.2.2. 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 | Exposure concentration | Risk characterisation |
|---|---|---|

| Route of exposure and type of effects | Exposure concentration | Risk characterisation |
|---|---|---|
| Inhalation, systemic, long-term | **0.007 mg/m³** (TRA Worker v3) | RCR = 0.14 |
| Inhalation, systemic, acute | | Qualitative (see below) |
| Inhalation, local, long-term | | Qualitative (see below) |
| Dermal, systemic, long-term | **0.007 mg/kg bw/day** (TRA Worker v3) | RCR < 0.01 |
| Dermal, systemic, acute | | Qualitative (see below) |
| Combined routes, systemic, long-term | | RCR = 0.141 |

**Conclusion on risk characterisation**

The risk by acute exposure is covered by the exposure assessment for long - term exposure in an appropriate way. All mentioned risks are limited by the risk management measures as laid down in this CSR in an adequate manner.

# 9.12. Exposure scenario 12: Service life (worker at industrial site) - Service life (worker at industrial site)

**Sector of use:**
SU 0, Other

**Article categories:**
AC 2, Machinery, mechanical appliances, electrical/electronic articles
AC 3, Electrical batteries and accumulators
AC 7, Metal articles

| **Environment contributing scenario(s):** | |
|---|---|
| Service life (worker at industrial site) | ERC 12a |

## 9.12.1. Environmental contributing scenario 1: Service life (worker at industrial site)

#### 9.8.1.2. Releases

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

**Table 67. Local releases to the environment**

| | |
|---|---|
| RELEASE ESTIMATION BASED ON SPECIFIC RELEASE FRACTIONS | |
| Comments 1 | |
| Comments 2 | ES10-SL-IW2 |
| Daily amount used at site [kg/d] (release fractions) | 1 |
| Release times per year (d/year) | 220 |
| Local release fraction to air | 0.002 |
| Local release fraction to sewage | 0.005 |
| Local release fraction to soil | 0 |

#### 9.8.1.3. 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.

**Table 68. Exposure concentrations and risks for the environment**

| | |
|---|---|
| VOLUMES and RELEASES (INTERIM RESULTS) | |
| EU tonnage for use (tpa) | |
| Amount used locally (kg/d) | 1.00E+00 |
| Release times per year (d/year) | 2.20E+02 |
| Release fraction air (as in ERC or SPERC background table or set in line 125) | 2.00E-03 |
| Release fraction (waste) water (as in ERC or SPERC background table or set in line 125) | 5.00E-03 |
| Release fraction soil (as in ERC or SPERC background table or set in line 125) | |
| Local release to air (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 2.00E-03 |
| Local release to waste water (kg/d) | 5.00E-03 |
| Local release to soil (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 0.00E+00 |
| RCR | |
| RCR in STP (-) | no STP |
| RCR for local freshwater (-) | 0.094116303 |
| RCR for local freshwater sediment (-) | 0.094803949 |
| RCR for local terrestrial environment (-) | 0.000571604 |
| RCR for local marine water (-) | 0.012493222 |
| RCR for local marine sediments (-) | 0.01246743 |
| RCR for humans via the environment (-) | 0.001 |
| PREDICTED CONCENTRATIONS | |
| PECs | |

| | |
|---|---|
| Regional PEC in surface water (total) (mgc.L-1) | 1,29E-01 |
| Regional PEC in sea water (total) (mgc.L-1) | 1,11E-01 |
| Regional PEC in air (total) (mgc.m-3) | 4,94E-01 |
| Regional PEC in agricultural soil (total)(mgc.kgdwt-1) | 0.000835247 |
| Regional PEC in natural soil (total) (mgc.kgdwt-1) | 5,37E+00 |
| Regional PEC in industrial soil (total) (mgc.kgdwt-1) | 5,37E+00 |
| Regional PEC in sediment (total) (mgc.kgdwt-1) | 0.064853235 |
| Regional PEC in sea water sediment (total) (mgc.kgdwt-1) | 0.004488822 |
| Annual average local PEC in air (total) (mgc.m-3) | 5,28E-01 |
| Local PEC in surface water during emission episode (dissolved) (mgc.L-1) | 0.000251291 |
| Annual average local PEC in surface water (dissolved) (mgc.L-1) | 0.000156375 |
| Local PEC in fresh water sediment during emission episode (mgc.kgdwt-1) | 0.77739238 |
| Local PEC in sea water during emission episode (dissolved) (mgc.L-1) | 2,50E+00 |
| Annual average local PEC in sea water (dissolved) (mgc.L-1) | 1,55E+00 |
| Local PEC in marine sediment during emission episode (mgc.kgdwt-1) | 0.077298064 |
| Local PEC in agricultural soil, averaged over 30 days (mgc.kgdwt-1) | 5,72E+00 |
| Local PEC agricultural soil, averaged over 180 days (mgc.kgdwt-1) | 5,72E+00 |
| Local PEC in grass land, averaged over 180 days (mgc.kgdwt-1) | 5,92E+00 |
| PEC for microorganisms in STP (mgc.L-1) | 0.0025 |
| PEC for microorganisms in STP with intermittent release (mgc.L-1) | 0.0025 |
| | |
| Secondary poisoning | |
| Environment | |
| Conc. in fish for secondary poisoning in freshwater environment (mgc.kgwwt-1) | 0.007552922 |
| Conc. in fish for secondary poisoning in marine environment (mgc.kgwwt-1) | 0.000742526 |
| Conc. in fish-eating predator for marine toppredators (mgc.kgwwt-1) | 0.000226845 |
| Conc. in earthworms for secondary poisoning (mgc.kgwwt-1) | 0.000163883 |
| Humans | |
| Regional daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1,41E-01 |
| Regional total daily intake for humans (mgc.kgbw-1.d-1) | 4,87E-02 |
| Local daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1,51E-01 |
| Local total daily intake for humans (mgc.kgbw-1.d-1) | 2,68E+00 |
| | |
| PREDICTED NO-EFFECT LEVELS | |
| | |
| CUSTOMER TOOL INFORMATION | |
| Amount used locally (Muse) (kg.d-1) | 1.00E+00 |
| Percent emission to air | 2.00E-01 |
| Percent emission to wastewater | 5.00E-01 |
| Elimination in STP (fraction) | 0.00E+00 |
| Number of emission days [d/a] | 2.20E+02 |
| Effluent discharge rate of this STP (m3.d-1) | 2.00E+03 |
| Flow rate of the river (m3.d-1) | 1.80E+04 |
| Dilution factor (rivers) | 1.00E+01 |
| Dilution factor (coastal areas) | 1.00E+02 |
| | |
| ENVIRONMENTAL RISK | |
| Local | |
| Water | |
| Freshwater aquatic RCR | 0.094116303 |
| Marine aquatic RCR | 0.012493222 |
| Sediment | |
| Freshwater sediment RCR | 0.094803949 |
| Marine sediment RCR | 0.01246743 |
| Soil | |
| Terrestrial RCR | 0.000571604 |

| | |
|---|---|
| STP | |
| Sewage treatment Plant RCR, intermittent releases | 0.001666667 |
| Predators | |
| Freshwater fish-eating birds and mammals RCR | 0.007552922 |
| Marine fish-eating birds and mammals RCR | 0.000742526 |
| Marine top predator RCR | 0.000226845 |
| Worm-eating birds and mammals RCR | 0.000163883 |
| Regional Water | |
| Freshwater aquatic RCR | 0.004630988 |
| Marine aquatic RCR | 0.000546933 |
| Regional Sediment | |
| Freshwater sediment RCR | 0.007908931 |
| Marine sediment RCR | 0.000724004 |
| Soil | |
| Terrestrial RCR | 0.008352471 |

# 9.13. Exposure scenario 13: Service life (professional worker) - Service life (professional worker)

**Sector of use:**
SU 0, Other

**Article categories:**
AC 2, Machinery, mechanical appliances, electrical/electronic articles
AC 3, Electrical batteries and accumulators
AC 7, Metal articles

| **Environment contributing scenario(s):** | |
|---|---|
| Service life (professional worker) | ERC 10a, ERC 11a |

## 9.13.1. Environmental contributing scenario 1: Service life (professional worker)

### 9.13.1.1. Conditions of use

### 9.13.1.2. Releases

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

**Table 69. Local releases to the environment**

### 9.13.1.3. 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.

**Table 70. Exposure concentrations and risks for the environment**

| VOLUMES and RELEASES (INTERIM RESULTS) | ERC 11a |
|---|---|
| EU tonnage for use (tpa) | |
| Amount used locally (kg/d) | 5.48E-01 |
| Release times per year (d/year) | 3.65E+02 |
| Release fraction air (as in ERC or SPERC background table or set in line 125) | 5.00E-04 |
| Release fraction (waste) water (as in ERC or SPERC background table or set in line 125) | 5.00E-04 |
| Release fraction soil (as in ERC or SPERC background table or set in line 125) | 0.00E+00 |
| Local release to air (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 0.00E+00 |
| Local release to waste water (kg/d) | 2.74E-04 |
| Local release to soil (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 0.00E+00 |
| RCR | |
| RCR in STP (-) | 6,92E-01 |
| RCR for local freshwater (-) | 0.005002468 |
| RCR for local freshwater sediment (-) | 0.005039018 |
| RCR for local terrestrial environment (-) | 0.00227715 |
| RCR for local marine water (-) | 0.001201524 |
| RCR for local marine sediments (-) | 0.001199043 |
| RCR for humans via the environment (-) | 0.001 |
| PREDICTED CONCENTRATIONS | |
| PECs | |
| Regional PEC in surface water (total) (mgc.L-1) | 1,29E-01 |
| Regional PEC in sea water (total) (mgc.L-1) | 1,11E-01 |
| Regional PEC in air (total) (mgc.m-3) | 4,94E-01 |
| Regional PEC in agricultural soil (total)(mgc.kgdwt-1) | 0.000835247 |
| Regional PEC in natural soil (total) (mgc.kgdwt-1) | 5,37E+00 |
| Regional PEC in industrial soil (total) (mgc.kgdwt-1) | 5,37E+00 |

| | |
|---|---|
| Regional PEC in sediment (total) (mgc.kgdwt-1) | 0.064853235 |
| Regional PEC in sea water sediment (total) (mgc.kgdwt-1) | 0.004488822 |
| Annual average local PEC in air (total) (mgc.m-3) | 5,01E-01 |
| Local PEC in surface water during emission episode (dissolved) (mgc.L-1) | 1,34E+00 |
| Annual average local PEC in surface water (dissolved) (mgc.L-1) | 1,34E+00 |
| Local PEC in fresh water sediment during emission episode (mgc.kgdwt-1) | 0.041319947 |
| Local PEC in sea water during emission episode (dissolved) (mgc.L-1) | 2,40E-01 |
| Annual average local PEC in sea water (dissolved) (mgc.L-1) | 2,40E-01 |
| Local PEC in marine sediment during emission episode (mgc.kgdwt-1) | 0.007434068 |
| Local PEC in agricultural soil, averaged over 30 days (mgc.kgdwt-1) | 0.000227715 |
| Local PEC agricultural soil, averaged over 180 days (mgc.kgdwt-1) | 0.000225755 |
| Local PEC in grass land, averaged over 180 days (mgc.kgdwt-1) | 0.000109489 |
| PEC for microorganisms in STP (mgc.L-1) | 1,04E+00 |
| PEC for microorganisms in STP with intermittent release (mgc.L-1) | 0.000136986 |
| | |
| Secondary poisoning | |
| Environment | |
| Conc. in fish for secondary poisoning in freshwater environment (mgc.kgwwt-1) | 0.001151308 |
| Conc. in fish for secondary poisoning in marine environment (mgc.kgwwt-1) | 0.000156525 |
| Conc. in fish-eating predator for marine toppredators (mgc.kgwwt-1) | 0.000109645 |
| Conc. in earthworms for secondary poisoning (mgc.kgwwt-1) | 0.000194836 |
| Humans | |
| Regional daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1,41E-01 |
| Regional total daily intake for humans (mgc.kgbw-1.d-1) | 4,87E-02 |
| Local daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1,43E-01 |
| Local total daily intake for humans (mgc.kgbw-1.d-1) | 3,91E-01 |
| | |
| PREDICTED NO-EFFECT LEVELS | |
| | |
| CUSTOMER TOOL INFORMATION | |
| Amount used locally (Muse) (kg.d-1) | 5.48E-01 |
| Percent emission to air | 0.00E+00 |
| Percent emission to wastewater | 5.00E-02 |
| Elimination in STP (fraction) | 9.24E-01 |
| Number of emission days [d/a] | 3.65E+02 |
| Effluent discharge rate of this STP (m3.d-1) | 2.00E+03 |
| Flow rate of the river (m3.d-1) | 1.80E+04 |
| Dilution factor (rivers) | 1.00E+01 |
| Dilution factor (coastal areas) | 1.00E+02 |
| | |
| ENVIRONMENTAL RISK | |
| Local | |
| Water | |
| Freshwater aquatic RCR | 0.005002468 |
| Marine aquatic RCR | 0.001201524 |
| Sediment | |
| Freshwater sediment RCR | 0.005039018 |
| Marine sediment RCR | 0.001199043 |
| Soil | |
| Terrestrial RCR | 0.00227715 |
| STP | |
| Sewage treatment Plant RCR, intermittent releases | 9,13 |
| Predators | |
| Freshwater fish-eating birds and mammals RCR | 0.001151308 |
| Marine fish-eating birds and mammals RCR | 0.000156525 |
| Marine top predator RCR | 0.000109645 |

| | |
|---|---|
| Worm-eating birds and mammals RCR | 0.000194836 |
| Regional Water | |
| Freshwater aquatic RCR | 0.004630988 |
| Marine aquatic RCR | 0.000546933 |
| Regional Sediment | |
| Freshwater sediment RCR | 0.007908931 |
| Marine sediment RCR | 0.000724004 |
| Soil | |
| Terrestrial RCR | 0.008352471 |

| VOLUMES and RELEASES (INTERIM RESULTS) | ERC 11a |
|---|---|
| EU tonnage for use (tpa) | |
| Amount used locally (kg/d) | 5.48E-02 |
| Release times per year (d/year) | 3.65E+02 |
| Release fraction air (as in ERC or SPERC background table or set in line 125) | 5.00E-04 |
| Release fraction (waste) water (as in ERC or SPERC background table or set in line 125) | 3.20E-02 |
| Release fraction soil (as in ERC or SPERC background table or set in line 125) | 3.20E-02 |
| Local release to air (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 0.00E+00 |
| Local release to waste water (kg/d) | 1.75E-03 |
| Local release to soil (kg/d) (will be set to 0 for WDU - see ECHA guidance R.16) | 0.00E+00 |
| RCR | |
| RCR in STP (-) | 4.42805E-05 |
| RCR for local freshwater (-) | 0.008480235 |
| RCR for local freshwater sediment (-) | 0.008542195 |
| RCR for local terrestrial environment (-) | 0.011705683 |
| RCR for local marine water (-) | 0.00490825 |
| RCR for local marine sediments (-) | 0.004898117 |
| RCR for humans via the environment (-) | 0.001700205 |
| PREDICTED CONCENTRATIONS | |
| PECs | |
| Regional PEC in surface water (total) (mgc.L-1) | 1.70511E-05 |
| Regional PEC in sea water (total) (mgc.L-1) | 1.46007E-06 |
| Regional PEC in air (total) (mgc.m-3) | 5.22657E-06 |
| Regional PEC in agricultural soil (total)(mgc.kgdwt-1) | 0.001742282 |
| Regional PEC in natural soil (total) (mgc.kgdwt-1) | 5.67414E-05 |
| Regional PEC in industrial soil (total) (mgc.kgdwt-1) | 5.67414E-05 |
| Regional PEC in sediment (total) (mgc.kgdwt-1) | 0.085464268 |
| Regional PEC in sea water sediment (total) (mgc.kgdwt-1) | 0.005899926 |
| Annual average local PEC in air (total) (mgc.m-3) | 5.6585E-06 |
| Local PEC in surface water during emission episode (dissolved) (mgc.L-1) | 2.26422E-05 |
| Annual average local PEC in surface water (dissolved) (mgc.L-1) | 2.26422E-05 |
| Local PEC in fresh water sediment during emission episode (mgc.kgdwt-1) | 0.070045997 |
| Local PEC in sea water during emission episode (dissolved) (mgc.L-1) | 9.8165E-06 |
| Annual average local PEC in sea water (dissolved) (mgc.L-1) | 9.8165E-06 |
| Local PEC in marine sediment during emission episode (mgc.kgdwt-1) | 0.030368324 |
| Local PEC in agricultural soil, averaged over 30 days (mgc.kgdwt-1) | 0.001170568 |
| Local PEC agricultural soil, averaged over 180 days (mgc.kgdwt-1) | 0.001158025 |
| Local PEC in grass land, averaged over 180 days (mgc.kgdwt-1) | 0.00041392 |
| PEC for microorganisms in STP (mgc.L-1) | 6.64207E-05 |
| PEC for microorganisms in STP with intermittent release (mgc.L-1) | 0.000876712 |
| | |
| Secondary poisoning | |
| Environment | |
| Conc. in fish for secondary poisoning in freshwater environment (mgc.kgwwt-1) | |
| Conc. in fish for secondary poisoning in marine environment (mgc.kgwwt-1) | |

| | |
|---|---|
| Conc. in fish-eating predator for marine toppredators (mgc.kgwwt-1) | |
| Conc. in earthworms for secondary poisoning (mgc.kgwwt-1) | |
| Humans | |
| Regional daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1.49331E-06 |
| Regional total daily intake for humans (mgc.kgbw-1.d-1) | 7.31088E-06 |
| Local daily dose via inhalatory intake for humans (mgc.kgbw-1.d-1) | 1.61671E-06 |
| Local total daily intake for humans (mgc.kgbw-1.d-1) | 7.22198E-06 |
| | |
| PREDICTED NO-EFFECT LEVELS | |
| | |
| CUSTOMER TOOL INFORMATION | |
| Amount used locally (Muse) (kg.d-1) | 5.48E-02 |
| Percent emission to air | 0.00E+00 |
| Percent emission to wastewater | 3.20E+00 |
| Elimination in STP (fraction) | 9.24E-01 |
| Number of emission days [d/a] | 3.65E+02 |
| Effluent discharge rate of this STP (m3.d-1) | 2.00E+03 |
| Flow rate of the river (m3.d-1) | 1.80E+04 |
| Dilution factor (rivers) | 1.00E+01 |
| Dilution factor (coastal areas) | 1.00E+02 |
| | |
| ENVIRONMENTAL RISK | |
| Local | |
| Water | |
| Freshwater aquatic RCR | 0.008480235 |
| Marine aquatic RCR | 0.00490825 |
| Sediment | |
| Freshwater sediment RCR | 0.008542195 |
| Marine sediment RCR | 0.004898117 |
| Soil | |
| Terrestrial RCR | 0.011705683 |
| STP | |
| Sewage treatment Plant RCR, intermittent releases | 0.000584475 |
| Predators | |
| Freshwater fish-eating birds and mammals RCR | |
| Marine fish-eating birds and mammals RCR | 0.001742835 |
| Marine top predator RCR | 0.000503749 |
| Worm-eating birds and mammals RCR | 0.000203716 |
| RCR for humans via the environment (-) | 0.000532606 |
| Regional Water | |
| Freshwater aquatic RCR | 0.006102765 |
| Marine aquatic RCR | 0.000718866 |
| Regional Sediment | |
| Freshwater sediment RCR | 0.010422472 |
| Marine sediment RCR | 0.000951601 |
| Soil | |
| Terrestrial RCR | 0.017422822 |