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

### 1.1 Product identifier

| | | |
|---|---|---|
| Trade name | : | 1,3-Butadiene |
| REACH Registration Number | : | 01-2119471988-16-0002, 01-2119471988-16-XXXX |
| Substance name | : | 1,3-butadiene |
| EC-No. | : | 203-450-8 |

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

| | | |
|---|---|---|
| Use of the Substance/Mixture | : | Raw material in chemical industry, Use in polymer production, Use in polymer processing, Use in rubber production and processing, Products such as pH-regulators, flocculants, precipitants, neutralization agents, Laboratory chemicals |

### 1.3 Details of the supplier of the safety data sheet

| | | |
|---|---|---|
| Manufacturer | : | Borealis Polymers Oy<br>P.O.Box 330, FI-06101 Porvoo, Finland<br>Telephone: +358 9 394900 |
| Supplier | : | Borealis AG<br>Trabrennstrasse 6-8, 1020 Vienna, Austria<br>Telephone: +43 1 22400 0 |
| E-mail address | : | sds@borealisgroup.com |

### 1.4 Emergency telephone number

+1 760 476 3962 (3E), Access code: 336296

## SECTION 2: Hazards identification

### 2.1 Classification of the substance or mixture

**Classification (REGULATION (EC) No 1272/2008)**

| | |
|---|---|
| Flammable gases, Category 1A | H220: Extremely flammable gas. |
| Gases under pressure, Liquefied gas | H280: Contains gas under pressure; may explode if heated. |

| | |
|---|---|
| Germ cell mutagenicity, Category 1B | H340: May cause genetic defects. |
| Carcinogenicity, Category 1A | H350: May cause cancer. |

### 2.2 Label elements

**Labelling (REGULATION (EC) No 1272/2008)**

Hazard pictograms :

Signal word : Danger

Hazard statements :
H220 Extremely flammable gas.
H280 Contains gas under pressure; may explode if heated.
H340 May cause genetic defects.
H350 May cause cancer.

Precautionary statements :

**Prevention:**

P202 Do not handle until all safety precautions have been read and understood.
P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P281 Use personal protective equipment as required.

**Response:**

P377 Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381 In case of leakage, eliminate all ignition sources.

**Storage:**

P410 + P403 Protect from sunlight. Store in a well-ventilated place.

**Additional Labelling**

Restricted to professional users.

EUH208 Contains 4-tert-butylpyrocatechol. May produce an allergic reaction.

### 2.3 Other hazards

This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

Ecological information: The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

Toxicological information: The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

## SECTION 3: Composition/information on ingredients

### 3.1 Substances

Substance name : 1,3-butadiene

EC-No. : 203-450-8

**Components**

| Chemical name | CAS-No.<br>EC-No. | Concentration (% w/w) | M-Factor, SCL, ATE |
|---|---|---|---|
| 1,3-butadiene | 106-99-0<br>203-450-8 | >= 90 - <= 100 | |
| 4-(1,1-dimethylethyl)-1,2-benzenediol | 98-29-3<br>202-653-9 | >= 0,1 - < 0,25 | |

## SECTION 4: First aid measures

### 4.1 Description of first aid measures

General advice : Move out of dangerous area.
In the case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

If inhaled : Move to fresh air.
Do not leave the victim unattended.
Causes asphyxiation in high concentrations. The victim will not realize that he/she is suffocating.
Keep patient warm and at rest.
Seek medical advice immediately.
If breathing is irregular or stopped, administer artificial respiration.

In case of skin contact : Contact with liquid or refrigerated gas can cause cold burns and frostbite.

Wash frost-bitten areas with plenty of water. Do not remove clothing.
Seek medical advice.

In case of eye contact : Remove contact lenses.
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.
Keep eye wide open while rinsing.

If swallowed : Not probable:
The product evaporates readily.

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

Symptoms : Shortness of breath
Unconsciousness
Frostbite

Risks : May cause effects on the central nervous system, resulting in lowering of consciousness.
May cause genetic defects.
May cause cancer.

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

Treatment : Artificial respiration and/or oxygen may be necessary.
There is no specific antidote available.
Treat frost-bitten areas as needed.

## SECTION 5: Firefighting measures

### 5.1 Extinguishing media

Suitable extinguishing media : Dry powder, carbon dioxide, foam and water mist.

Unsuitable extinguishing media : Do NOT use water jet.

### 5.2 Special hazards arising from the substance or mixture

Specific hazards during firefighting : Vapours are heavier than air and may spread along floors.
Flash back possible over considerable distance.
Do not allow run-off from fire fighting to enter drains or water courses.
Hazardous decomposition products formed under fire conditions.
See chapter 10.

### 5.3 Advice for firefighters

| | | |
|---|---|---|
| Special protective equipment for firefighters | : | Wear self-contained breathing apparatus and protective suit. |
| Further information | : | Attempt to stop leakage without personal risk.<br>If conditions permit, let fire burn itself out.<br>Cool containers/tanks with water spray. |

## SECTION 6: Accidental release measures

### 6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment.
Do not breathe vapours.
Ensure adequate ventilation, especially in confined areas.
Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
Avoid all contact with the product.
Keep people away from and upwind of spill/leak.
Attempt to stop leakage without personal risk.
For personal protection see section 8.

### 6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so.
Prevent product from entering environment and drains.
If major spillage occurs, contact the proper local authorities.

### 6.3 Methods and material for containment and cleaning up

Attempt to stop leakage without personal risk.
Ventilate the area.
Allow to evaporate.

### 6.4 Reference to other sections

For personal protection see section 8.
For disposal considerations see section 13.

## SECTION 7: Handling and storage

### 7.1 Precautions for safe handling

| | | |
|---|---|---|
| Advice on safe handling | : | To be handled by trained personnel only.<br>Refill and handle product only in closed system.<br>Prevent leaks by checking valves, pipelines and joints regularly.<br>Ensure adequate ventilation. |

In case of insufficient ventilation, wear suitable respiratory equipment.
Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
When using do not eat, drink or smoke.

Advice on protection against fire and explosion : Keep away from sources of ignition - No smoking. Take precautionary measures against static discharges. To avoid ignition of vapours by static electricity discharge, all metal parts of the equipment must be grounded. High risk of fire in case of leakage.

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

Requirements for storage areas and containers : Keep only in the original container in a cool, well-ventilated place. Keep under dry nitrogen atmosphere. Keep product and empty container away from heat and sources of ignition. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Further information on storage conditions : Ensure adequate ventilation.

Advice on common storage : Keep away from incompatible materials.
See chapter 10.

### 7.3 Specific end use(s)

Specific use(s) : Not applicable

## SECTION 8: Exposure controls/personal protection

### 8.1 Control parameters

**Occupational Exposure Limits**

| Components | CAS-No. | Value type (Form of exposure) | Control parameters | Basis |
|---|---|---|---|---|
| 1,3-butadiene | 106-99-0 | TWA | 1 ppm<br>2,2 mg/m3 | 2004/37/EC |
| Further information | Carcinogens or mutagens | | | |

For national exposure limit (OEL) values, check country specific safety data sheets.

**Derived No Effect Level (DNEL) according to Regulation (EC) No. 1907/2006:**

| Substance name | End Use | Exposure routes | Potential health effects | Value |
|---|---|---|---|---|
| 1,3-Butadiene | Workers | Inhalation | Long-term systemic effects | 2,21 mg/m3<br>1 ppm |
| Remarks: | Derived minimal effect level | | | |

| | | | | |
|---|---|---|---|---|
| | Workers | Skin contact | | |
| Remarks: | Not applicable, (gaseous) | | | |

**Predicted No Effect Concentration (PNEC) according to Regulation (EC) No. 1907/2006:**

| Substance name | Environmental Compartment | Value |
|---|---|---|
| 1,3-Butadiene | | |
| Remarks: | Not applicable | |

### 8.2 Exposure controls

**Engineering measures**

Application in a closed system
Prevent unauthorised persons entering the zone.

**Personal protective equipment**

Eye protection : Use eye protection according to EN 166.
If splashes are likely to occur, wear:
Face-shield

Hand protection
Material : Viton®
Break through time : > 8 h

Material : Trellchem HPS
Break through time : > 8 h

Material : Trellchem VPS
Break through time : > 8 h

Material : Silver Shield(R) gloves
Break through time : > 8 h

Remarks : The selected protective gloves have to satisfy the specifications of Regulation (EU) 2016/425 and the standard EN 374 derived from it. Please observe the instructions regarding permeability and breakthrough time which are provided by the supplier of the gloves. Also take into consideration the specific local conditions under which the product is used, such as the danger of cuts, abrasion, and the contact time.

Skin and body protection : Wear suitable protective clothing and rubber boots.

Respiratory protection : In case of insufficient ventilation: Respirator with AX filter or self-contained breathing apparatus.
Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.

Protective measures : Avoid and prevent all spillage, contact and exposure.

**Environmental exposure controls**

General advice : Prevent further leakage or spillage if safe to do so. Prevent product from entering environment and drains. If major spillage occurs, contact the proper local authorities.

## SECTION 9: Physical and chemical properties

### 9.1 Information on basic physical and chemical properties

| | | |
|---|---|---|
| Physical state | : | Liquefied gas |
| Colour | : | clear |
| Odour | : | characteristic, mild, aromatic |
| Odour Threshold | : | 1,6 ppm |
| Melting point | : | -109 °C |
| Boiling point | : | -4 °C |
| Flammability | : | Extremely flammable. |
| Upper explosion limit / Upper flammability limit | : | Upper flammability limit<br>12 %(V) |
| Lower explosion limit / Lower flammability limit | : | Lower flammability limit<br>2 %(V) |
| Flash point | : | -76 °C |
| Decomposition temperature | : | No data available |
| pH | : | Not applicable |
| Viscosity | | |
| Viscosity, dynamic | : | Not applicable<br>(gaseous) |
| Viscosity, kinematic | : | Not applicable<br>(gaseous) |
| Solubility(ies) | | |
| Water solubility | : | 0,735 g/l (20 °C) |
| Partition coefficient: n-octanol/water | : | log Pow: 1,99 |

| | | |
|---|---|---|
| Vapour pressure | : | 245 kPa (20 °C) |
| Relative density | : | 0,6 |
| Density | : | 0,0023 g/cm³ (15 °C) |
| Relative vapour density | : | 1,9 |

**9.2 Other information**

| | | |
|---|---|---|
| Explosives | : | Not applicable |
| Oxidizing properties | : | Not applicable |
| Self-ignition | : | 420 °C |
| Evaporation rate | : | Not applicable |
| Surface tension | : | Not applicable |

## SECTION 10: Stability and reactivity

**10.1 Reactivity**

Stable under recommended storage conditions.
Vapours may form explosive mixture with air.
Risk of violent reaction.

**10.2 Chemical stability**

No decomposition if stored and applied as directed.

**10.3 Possibility of hazardous reactions**

Hazardous reactions : Polymerises with risk of fire and explosion in contact with:
Air

**10.4 Conditions to avoid**

Conditions to avoid : Keep away from heat and sources of ignition.

**10.5 Incompatible materials**

Materials to avoid : air
Oxidizing agents
Ozone
Nitrogen oxides (NOx)
Copper
Copper alloys

phenol
chlorine dioxide
crotonaldehyde
hydroquinone

### 10.6 Hazardous decomposition products

Under fire conditions:
Carbon monoxide, carbon dioxide and unburned hydrocarbons (smoke).

## SECTION 11: Toxicological information

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

**Acute toxicity**

Based on available data, the classification criteria are not met.

**Product:**

| | | |
|---|---|---|
| Acute oral toxicity | : | Remarks: Not relevant (gaseous) |
| Acute inhalation toxicity | : | LC50 (Rat): 285 mg/l<br>Exposure time: 4 h<br>Test atmosphere: gas<br>Remarks: Not applicable (gaseous) |
| Acute dermal toxicity | : | Remarks: Not relevant (gaseous) |
| Assessment: | | Vapours can cause suffocation by reducing oxygen available for breathing. |

**Skin corrosion/irritation**

Based on available data, the classification criteria are not met.

**Product:**

| | | |
|---|---|---|
| Remarks | : | Not applicable (gaseous)<br>Contact with liquid or refrigerated gas can cause cold burns and frostbite. |

**Serious eye damage/eye irritation**

Based on available data, the classification criteria are not met.

**Product:**

| | | |
|---|---|---|
| Species | : | Rabbit |

| | | |
|---|---|---|
| Species | : | Dog |
| Result | : | No eye irritation |
| Remarks | : | Contact with liquid or refrigerated gas can cause cold burns and frostbite. |

**Respiratory or skin sensitisation**

**Skin sensitisation**

Based on available data, the classification criteria are not met.

**Respiratory sensitisation**

Based on available data, the classification criteria are not met.

**Product:**

| | | |
|---|---|---|
| Remarks | : | Not applicable (gaseous) |

**Germ cell mutagenicity**

May cause genetic defects.

**Product:**

| | | |
|---|---|---|
| Genotoxicity in vitro | : | Test Type: Ames test<br>Metabolic activation: with and without metabolic activation<br>Method: Mutagenicity (in vitro mammalian cytogenetic test)<br>Result: positive |
| Genotoxicity in vivo | : | Test Type: in vivo assay<br>Species: Mouse<br>Method: Mutagenicity (micronucleus test)<br>Result: positive |

**Carcinogenicity**

May cause cancer.

**Reproductive toxicity**

Based on available data, the classification criteria are not met.

**Product:**

| | | |
|---|---|---|
| Effects on fertility | : | Species: Rat<br>Application Route: Inhalation<br>General Toxicity - Parent: No observed adverse effect level: 13.276 mg/m³ |
| Effects on foetal development | : | Species: Mouse<br>Application Route: Inhalation |

Developmental Toxicity: NOAEL: 88 mg/m³

**STOT - single exposure**

Based on available data, the classification criteria are not met.

**Product:**

| | | |
|---|---|---|
| Remarks | : | Not applicable<br>(gaseous) |

**STOT - repeated exposure**

Based on available data, the classification criteria are not met.

**Repeated dose toxicity**

**Product:**

| | | |
|---|---|---|
| Species | : | Rat |
| NOAEL | : | 2212 mg/m3 |
| Application Route | : | Inhalation |

**Aspiration toxicity**

Based on available data, the classification criteria are not met.

**Product:**

Not classified due to data which are conclusive although insufficient for classification.

**11.2 Information on other hazards**

**Endocrine disrupting properties**

**Product:**

| | | |
|---|---|---|
| Assessment | : | The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher. |

**Further information**

**Product:**

| | | |
|---|---|---|
| Remarks | : | Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.<br>High concentration of vapours may induce unconsciousness. |

## SECTION 12: Ecological information

### 12.1 Toxicity

**Product:**

| | | |
|---|---|---|
| Toxicity to fish | : | LC50 (fathead minnow (Pimephales promelas)): 45 mg/l<br>Exposure time: 96 h<br>Method: QSAR<br>Remarks: estimated |
| Toxicity to daphnia and other aquatic invertebrates | : | LC50 (Daphnia magna (Water flea)): 33 mg/l<br>Exposure time: 48 h<br>Method: QSAR<br>Remarks: estimated |
| Toxicity to algae/aquatic plants | : | EC50 (algae): 33 mg/l<br>Exposure time: 72 h<br>Method: QSAR<br>Remarks: estimated |
| Toxicity to fish (Chronic toxicity) | : | 6,62 mg/l<br>Exposure time: 21 d<br>Species: Oncorhynchus mykiss (rainbow trout)<br>Method: QSAR |
| Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity) | : | NOEC: 12,384 mg/l<br>Exposure time: 21 d<br>Species: Daphnia magna (Water flea)<br>Method: QSAR |
| Toxicity to microorganisms | : | Remarks: Not applicable (gaseous) |
| Plant toxicity | : | Remarks: Not applicable (gaseous) |

**Ecotoxicology Assessment**

| | | |
|---|---|---|
| Short-term (acute) aquatic hazard | : | Not classified due to data which are conclusive although insufficient for classification. |
| Long-term (chronic) aquatic hazard | : | Not classified due to data which are conclusive although insufficient for classification. |

### 12.2 Persistence and degradability

**Product:**

| | | |
|---|---|---|
| Biodegradability | : | Water<br>Result: rapidly biodegradable |
| Photodegradation | : | Remarks: Prone to photochemical degradation, reacting with OH radicals and ozone. |

### 12.3 Bioaccumulative potential

**Product:**

| | | |
|---|---|---|
| Bioaccumulation | : | Bioconcentration factor (BCF): 9,8<br>Remarks: Bioaccumulation not expected: Partition coefficient (n-octanol/water) log Pow < 3. |

### 12.4 Mobility in soil

**Product:**

| | | |
|---|---|---|
| Mobility | : | Remarks: Not expected to adsorb on soil., Partition coefficient (n-octanol/water) log Kow < 3. |
| Distribution among environmental compartments | : | Koc: 51,5Method: QSAR<br>Remarks: The product evaporates readily. |

### 12.5 Results of PBT and vPvB assessment

**Product:**

| | | |
|---|---|---|
| Assessment | : | This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.. |

### 12.6 Endocrine disrupting properties

**Product:**

| | | |
|---|---|---|
| Assessment | : | The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher. |

### 12.7 Other adverse effects

**Product:**

| | | |
|---|---|---|
| Additional ecological information | : | Should not be released into the environment. |

## SECTION 13: Disposal considerations

### 13.1 Waste treatment methods

| | | |
|---|---|---|
| Product | : | Dispose of as hazardous waste in compliance with local and national regulations.<br>Where possible recycling is preferred to disposal or incineration.<br>European waste code:<br>07 01 99 (wastes not otherwise specified (basic organic chemicals)) |
| Contaminated packaging | : | Handle with care.<br>Dispose of as hazardous waste in compliance with local and national regulations. |

## SECTION 14: Transport information

### 14.1 UN number or ID number

| | | |
|---|---|---|
| **ADR** | : | UN 1010 |
| **IMDG** | : | UN 1010 |

### 14.2 UN proper shipping name

| | | |
|---|---|---|
| **ADR** | : | BUTADIENES, STABILIZED |
| **IMDG** | : | BUTADIENES, STABILIZED |

### 14.3 Transport hazard class(es)

| | | |
|---|---|---|
| **ADR** | : | 2 |
| **IMDG** | : | 2.1 |

### 14.4 Packing group

**ADR**

| | | |
|---|---|---|
| Packing group | : | Not assigned by regulation |
| Classification Code | : | 2F |
| Hazard Identification Number | : | 239 |
| Labels | : | 2.1 |
| Tunnel restriction code | : | (B/D) |

**IMDG**

| | | |
|---|---|---|
| Packing group | : | Not assigned by regulation |
| Labels | : | 2.1 |

EmS Code : F-D, S-U

**14.5 Environmental hazards**

**ADR**
Environmentally hazardous : no

**IMDG**
Marine pollutant : no

**14.6 Special precautions for user**

Remarks : not required

The transport classification(s) provided herein are for informational purposes only, and solely based upon the properties of the unpackaged material as it is described within this Safety Data Sheet. Transportation classifications may vary by mode of transportation, package sizes, and variations in regional or country regulations.

**14.7 Maritime transport in bulk according to IMO instruments**

Ship type : N/A
Pollution category : N/A

## SECTION 15: Regulatory information

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

Seveso III: Directive 2012/18/EU of the European Parliament and of the Council on the control of major-accident hazards involving dangerous substances.

| Category | | Quantity 1 | Quantity 2 |
|---|---|---|---|
| P2 | FLAMMABLE GASES | 10 t | 50 t |
| P2 | FLAMMABLE GASES | 10 t | 50 t |

**Other regulations:**

Comply with below indicated regulations, relevant updatings and amendments, as applicable: Europe. Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work

**15.2 Chemical safety assessment**

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

## SECTION 16: Other information

### Full text of other abbreviations

| | | |
|---|---|---|
| 2004/37/EC | : | Europe. Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work |
| 2004/37/EC / TWA | : | Long term exposure limit |

### Further information

| | | |
|---|---|---|
| Training advice | : | Provide adequate information, instruction and training for operators.<br>Regular trainings of all employees which are involved in the transport of dangerous goods (according to chapter 1.3 ADR). |
| Other information | : | Issued according to Regulation (EC) No 1907/2006, Annex II, and its amendments.<br>Changes since the last version are highlighted in the margin.<br>This version replaces all previous versions. |
| Issuer | : | Borealis, Group Product Stewardship |
| Sources of key data used to compile the Safety Data Sheet | : | Chemical Safety Report, 1,3-butadiene, Lower Olefins and Aromatics REACH Consortium, 2023<br>International Chemical Safety Card, 1,3-Butadiene, April 2000 (http://www.inchem.org/documents/icsc/icsc/eics0017.htm) |

### Disclaimer

To the best of our knowledge, the information contained herein is accurate and reliable as of the date of publication; however we do not assume any liability whatsoever for the accuracy and completeness of such information.

**Borealis makes no warranties which extend beyond the description contained herein. Nothing herein shall constitute any warranty of merchantability or fitness for a particular purpose.**

**It is the customer's responsibility to inspect and test our products in order to satisfy itself as to the suitability of the products for the customer's particular purpose. The customer is responsible for the appropriate, safe and legal use, processing and handling of our products.**

No liability can be accepted in respect of the use of Borealis' products in conjunction with other materials. The information contained herein relates exclusively to our products when not used in conjunction with any third party materials.

# Annex: Exposure Scenarios

### Table of Contents

## ES1: Manufacture of substance

### 1.1. Title section

| | | |
|---|---|---|
| **Structured Short Title** | : | Manufacture, Manufacture of substance |

| | | |
|---|---|---|
| **Environment** | | |
| **CS1** | **Manufacture of substance, Environment** | ERC1 |
| **Worker** | | |
| **CS2** | **General measures applicable to all activities** | PROC1, PROC2, PROC3, PROC8a, PROC8b, PROC9, PROC15 |
| **CS3** | **General exposures (closed systems)** | PROC1 |
| **CS4** | **General exposures (closed systems), Product sampling** | PROC2 |
| **CS5** | **General exposures (closed systems), Use in contained batch processes** | PROC3 |
| **CS6** | **Process sampling** | PROC9 |
| **CS7** | **Laboratory activities** | PROC15 |
| **CS8** | **Laboratory activities, Local exhaust ventilation** | PROC15 |
| **CS9** | **Bulk transfers, Closed systems** | PROC8b |
| **CS10** | **Equipment cleaning and maintenance** | PROC8a |
| **CS11** | **Storage, Product sampling** | PROC2 |

### 1.2. Conditions of use affecting exposure

#### 1.2.1. Control of environmental exposure: Manufacture of the substance (ERC1)

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Daily amount per site | : | 833 t |

| | | |
|---|---|---|
| Annual amount per site | : | 230000 t |
| **Conditions and measures related to sewage treatment plant** | | |
| STP type | : | Municipal sewage treatment plant |
| STP sludge treatment | : | No application of sewage sludge to soil |
| STP effluent | : | 2.000 m³/d |
| **Other conditions affecting environmental exposure** | | |
| Receiving surface water flow | : | 18.000 m³/d |

**1.2.2. Control of worker exposure: General measures applicable to all activities**
**Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC1) / Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2) / Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3) / Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC8a) / Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b) / Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9) / Use as laboratory reagent (PROC15)**

| | | |
|---|---|---|
| **Product (article) characteristics** | | |
| Covers percentage substance in the product up to 100 %. | | |
| Physical form of product | : | Liquid |
| **Amount used, frequency and duration of use (or from service life)** | | |
| Duration | : | Covers use up to 8 h |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | | |
| Use suitable eye protection and gloves.<br>Low temperature resistant gloves<br>Dermal - minimum efficiency of 80 % | | |
| **Other conditions affecting workers exposure** | | |
| Temperature | : | Assumes process temperature up to 20 °C |

**1.2.3. Control of worker exposure: General exposures (closed systems)**

**Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC1)**

| **Technical and organisational conditions and measures** |
|---|
| Closed systems<br>Occupational Health and Safety Management System: Advanced |
| Provide a basic standard of general ventilation (1 to 3 air changes per hour). |

**1.2.4. Control of worker exposure: General exposures (closed systems), Product sampling**
**Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). | | |
| Use in closed, continuous process with occasional controlled exposure<br>Handle substance within a predominantly closed system provided with extract ventilation. | | |
| Local exhaust ventilation<br>Inhalation - minimum efficiency of 95 % | | |

**1.2.5. Control of worker exposure: General exposures (closed systems), Use in contained batch processes**
**Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 0,25 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). | | |
| Closed batch process with occasional controlled exposure<br>Handle substance within a predominantly closed system provided with extract ventilation. | | |
| Local exhaust ventilation | | |

| |
|---|
| Inhalation - minimum efficiency of 95 % |

**1.2.6. Control of worker exposure: Process sampling**
**Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 0,25 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). | | |
| Sample via a closed loop or other system to avoid exposure.<br>Inhalation - minimum efficiency of 95 % | | |
| Local exhaust ventilation | | |

**1.2.7. Control of worker exposure: Laboratory activities**
**Use as laboratory reagent (PROC15)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). | | |
| Handle in a fume cupboard or under extract ventilation.<br>Inhalation - minimum efficiency of 95 % | | |

**1.2.8. Control of worker exposure: Laboratory activities, Local exhaust ventilation**
**Use as laboratory reagent (PROC15)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced | | |

| |
|---|
| Provide a basic standard of general ventilation (1 to 3 air changes per hour). |
| Handle in a fume cupboard or under extract ventilation.<br>Inhalation - minimum efficiency of > 95 % |

**1.2.9. Control of worker exposure: Bulk transfers, Closed systems**
**Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). | | |
| Use dry break couplings for material transfer.<br>Local exhaust ventilation<br>Inhalation - minimum efficiency of > 95 % | | |

**1.2.10. Control of worker exposure: Equipment cleaning and maintenance**
**Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC8a)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). | | |
| Local exhaust ventilation<br>Drain down and flush system prior to equipment break-in or maintenance.<br>Inhalation - minimum efficiency of 95 % | | |

**1.2.11. Control of worker exposure: Storage, Product sampling**
**Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |

| Technical and organisational conditions and measures |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). |
| Use in closed, continuous process with occasional controlled exposure |
| Local exhaust ventilation<br>Store substance within a closed system.<br>Inhalation - minimum efficiency of 95 % |

## 1.3. Exposure estimation and reference to its source

### 1.3.1. Environmental release and exposure: Manufacture of the substance (ERC1)

| Release route | Release rate | Release estimation method |
|---|---|---|
| Water | 389,8 kg/day | |
| Air | 13,32 kg/day | |

| Compartment | Exposure level | RCR |
|---|---|---|
| Man via environment - Inhalation | 0,077 mg/m³ | 0,29 |

### 1.3.3. Worker exposure: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC1)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,023 mg/m³ | 0,01 | |

### 1.3.4. Worker exposure: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,789 mg/m³ | 0,357 | |

### 1.3.5. Worker exposure: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)

| Exposure route | Health effect | Exposure | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|

| | | indicator | | | |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,789 mg/m³ | 0,357 | |

**1.3.6. Worker exposure: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,352 mg/m³ | 0,612 | |

**1.3.7. Worker exposure: Use as laboratory reagent (PROC15)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,127 mg/m³ | 0,51 | |

**1.3.8. Worker exposure: Use as laboratory reagent (PROC15)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,127 mg/m³ | 0,51 | |

**1.3.9. Worker exposure: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

**1.3.10. Worker exposure: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC8a)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,789 mg/m³ | 0,357 | |

**1.3.11. Worker exposure: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,789 mg/m³ | 0,357 | |

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

The safety data sheet at hand provides the user with risk management measures and operational conditions which enables him to work safely with the substance / mixture. If other risk management measures / operational conditions are adopted, the user has to ensure, that the risks are managed to at least equivalent levels.

## ES2: Formulation & (re)packing of substances and mixtures

### 2.1. Title section

| | | |
|---|---|---|
| **Structured Short Title** | : | Formulation or re-packing, Formulation & (re)packing of substances and mixtures |

| | | |
|---|---|---|
| **Environment** | | |
| **CS1** | **Formulation & (re)packing of substances and mixtures, Environment** | ERC2 |
| **Worker** | | |
| **CS2** | **General measures applicable to all activities** | PROC1, PROC2, PROC3, PROC5, PROC8a, PROC8b, PROC9, PROC14, PROC15 |
| **CS3** | **General exposures (closed systems)** | PROC1 |
| **CS4** | **General exposures (closed systems), With sample collection, Product sampling** | PROC2 |
| **CS5** | **General exposures (closed systems), Use in contained batch processes** | PROC3 |
| **CS6** | **Batch processes at elevated temperatures** | PROC3 |
| **CS7** | **Process sampling** | PROC9 |
| **CS8** | **Laboratory activities** | PROC15 |
| **CS9** | **Laboratory activities, Local exhaust ventilation** | PROC15 |
| **CS10** | **Bulk transfers** | PROC8b |
| **CS11** | **Mixing operations (open systems), With potential for aerosol generation** | PROC5 |
| **CS12** | **Manual, Transfer from/pouring from containers** | PROC8a |
| **CS13** | **Drum/batch transfers** | PROC8b |
| **CS14** | **Production or preparation or articles by tabletting, compression, extrusion or pelletisation** | PROC14 |
| **CS15** | **Drum and small package filling** | PROC9 |

| | | |
|---|---|---|
| **CS16** | **Equipment cleaning and maintenance** | PROC8a |
| **CS17** | **Storage** | PROC2 |

## 2.2. Conditions of use affecting exposure

### 2.2.1. Control of environmental exposure: Formulation into mixture (ERC2)

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Daily amount per site | : | 125 t |
| Annual amount per site | : | 37500 t |
| **Conditions and measures related to sewage treatment plant** | | |
| STP type | : | Municipal sewage treatment plant |
| STP sludge treatment | : | No application of sewage sludge to soil |
| STP effluent | : | 2.000 m³/d |

### 2.2.2. Control of worker exposure: General measures applicable to all activities
**Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC1) / Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2) / Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3) / Mixing or blending in batch processes (PROC5) / Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC8a) / Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b) / Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9) / Tabletting, compression, extrusion, pelettisation, granulation (PROC14) / Use as laboratory reagent (PROC15)**

| **Product (article) characteristics** | | |
|---|---|---|
| Covers percentage substance in the product up to 100 %. | | |
| Physical form of product | : | Liquid |
| **Amount used, frequency and duration of use (or from service life)** | | |
| Duration | : | Covers use up to 8 h |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | | |

| |
|---|
| Use suitable eye protection and gloves.<br>Low temperature resistant gloves<br>Dermal - minimum efficiency of 80 % |

| **Other conditions affecting workers exposure** | | |
|---|---|---|
| Temperature | : | Assumes process temperature up to 20 °C |

**2.2.3. Control of worker exposure: General exposures (closed systems)**
**Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC1)**

| **Technical and organisational conditions and measures** |
|---|
| Closed systems<br>Occupational Health and Safety Management System: Advanced |
| Provide a basic standard of general ventilation (1 to 3 air changes per hour). |

**2.2.4. Control of worker exposure: General exposures (closed systems), With sample collection, Product sampling**
**Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |

| **Technical and organisational conditions and measures** |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). |
| Use in closed, continuous process with occasional controlled exposure |
| Sample via a closed loop or other system to avoid exposure.<br>Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.<br>Inhalation - minimum efficiency of 95 % |

**2.2.5. Control of worker exposure: General exposures (closed systems), Use in contained batch processes**
**Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)**

| **Amount used, frequency and duration of use (or from service life)** |
|---|

| | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). | | |
| Closed batch process with occasional controlled exposure | | |
| Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.<br>Inhalation - minimum efficiency of 95 % | | |

**2.2.6. Control of worker exposure: Batch processes at elevated temperatures**
**Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)**

| | | |
|---|---|---|
| **Amount used, frequency and duration of use (or from service life)** | | |
| Use frequency | : | Covers use up to 4 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). | | |
| Closed batch process with occasional controlled exposure | | |
| Handle substance within a predominantly closed system provided with extract ventilation.<br>Inhalation - minimum efficiency of 95 % | | |
| **Other conditions affecting workers exposure** | | |
| Temperature | : | Assumes process temperature up to 40 °C |

**2.2.7. Control of worker exposure: Process sampling**
**Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9)**

| | | |
|---|---|---|
| **Amount used, frequency and duration of use (or from service life)** | | |
| Use frequency | : | Covers use up to 0,25 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). | | |

| |
|---|
| Sample via a closed loop or other system to avoid exposure.<br>Inhalation - minimum efficiency of 95 % |

**2.2.8. Control of worker exposure: Laboratory activities**
**Use as laboratory reagent (PROC15)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced | | |
| Handle in a fume cupboard or under extract ventilation.<br>Inhalation - minimum efficiency of 95 % | | |
| Provide a basic standard of general ventilation (1 to 3 air changes per hour). | | |
| **Other conditions affecting workers exposure** | | |
| Body parts exposed | : | One hand face only (240 cm2) |
| Indoor or outdoor use | : | Indoor use |

**2.2.9. Control of worker exposure: Laboratory activities, Local exhaust ventilation**
**Use as laboratory reagent (PROC15)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a basic standard of general ventilation (1 to 3 air changes per hour). | | |
| Handle in a fume cupboard or under extract ventilation.<br>Inhalation - minimum efficiency of > 95 % | | |

**2.2.10. Control of worker exposure: Bulk transfers**
**Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |

| Technical and organisational conditions and measures |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). |
| Ensure material transfers are under containment or extract ventilation.<br>Inhalation - minimum efficiency of > 95 % |

**2.2.11. Control of worker exposure: Mixing operations (open systems), With potential for aerosol generation**
**Mixing or blending in batch processes (PROC5)**

| Amount used, frequency and duration of use (or from service life) | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). | | |
| Provide extract ventilation to points where emissions occur.<br>Inhalation - minimum efficiency of 95 % | | |

**2.2.12. Control of worker exposure: Manual, Transfer from/pouring from containers**
**Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC8a)**

| Amount used, frequency and duration of use (or from service life) | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). | | |
| Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.<br>Inhalation - minimum efficiency of 95 % | | |

**2.2.13. Control of worker exposure: Drum/batch transfers**
**Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)**

| Amount used, frequency and duration of use (or from service life) |
|---|

| | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |

| **Technical and organisational conditions and measures** |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). |
| Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.<br>Inhalation - minimum efficiency of 95 % |

**2.2.14. Control of worker exposure: Production or preparation or articles by tabletting, compression, extrusion or pelletisation**
**Tabletting, compression, extrusion, pelettisation, granulation (PROC14)**

| **Product (article) characteristics** |
|---|
| Covers concentrations up to 1 % |

| **Technical and organisational conditions and measures** |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). |
| Handle substance within a predominantly closed system provided with extract ventilation.<br>Inhalation - minimum efficiency of 95 % |

**2.2.15. Control of worker exposure: Drum and small package filling**
**Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 8 h/day |

| **Technical and organisational conditions and measures** |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). |
| Fill containers/cans at dedicated fill points supplied with local extract ventilation.<br>Transfer via enclosed lines.<br>Inhalation - minimum efficiency of 95 % |

**2.2.16. Control of worker exposure: Equipment cleaning and maintenance**

**Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC8a)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 4 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). | | |
| Drain down and flush system prior to equipment break-in or maintenance.<br>Inhalation - minimum efficiency of 95 % | | |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | | |
| Respiratory protection<br>Efficiency: APF 20 | | |

**2.2.17. Control of worker exposure: Storage**
**Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 4 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). | | |
| Store substance within a closed system. | | |
| Ensure material transfers are under containment or extract ventilation.<br>Inhalation - minimum efficiency of 95 % | | |

## 2.3. Exposure estimation and reference to its source

### 2.3.1. Environmental release and exposure: Formulation into mixture (ERC2)

| Release route | Release rate | Release estimation method |
|---|---|---|
| Water | 250 kg/day | |
| Air | 0,034 kg/day | |

| Compartment | Exposure level | RCR |
|---|---|---|
| Man via environment - Inhalation | 0,037 mg/m³ | 0,202 |

**2.3.3. Worker exposure: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC1)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,023 mg/m³ | 0,01 | |

**2.3.4. Worker exposure: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,789 mg/m³ | 0,357 | |

**2.3.5. Worker exposure: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,676 mg/m³ | 0,306 | |

**2.3.6. Worker exposure: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 2,028 mg/m³ | 0,918 | |

**2.3.7. Worker exposure: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,352 mg/m³ | 0,612 | |

**2.3.8. Worker exposure: Use as laboratory reagent (PROC15)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,11 mg/m³ | 0,502 | |

### 2.3.9. Worker exposure: Use as laboratory reagent (PROC15)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,127 mg/m³ | 0,51 | |

### 2.3.10. Worker exposure: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

### 2.3.11. Worker exposure: Mixing or blending in batch processes (PROC5)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,789 mg/m³ | 0,357 | |

### 2.3.12. Worker exposure: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC8a)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,789 mg/m³ | 0,357 | |

### 2.3.13. Worker exposure: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

### 2.3.14. Worker exposure: Tabletting, compression, extrusion, pelettisation, granulation (PROC14)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,69 mg/m³ | 0,765 | |

**2.3.15. Worker exposure: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,352 mg/m³ | 0,612 | |

**2.3.16. Worker exposure: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC8a)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,183 mg/m³ | 0,535 | |

**2.3.17. Worker exposure: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

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

The safety data sheet at hand provides the user with risk management measures and operational conditions which enables him to work safely with the substance / mixture. If other risk management measures / operational conditions are adopted, the user has to ensure, that the risks are managed to at least equivalent levels.

## ES3: Use in rubber production and processing

### 3.1. Title section

| | | |
|---|---|---|
| **Structured Short Title** | : | Use at industrial sites, Use in rubber production and processing |

| | | |
|---|---|---|
| **Environment** | | |
| **CS1** | **Use in rubber production and processing, Environment** | ERC4 |
| **Worker** | | |
| **CS2** | **Use in rubber production and processing, General measures applicable to all activities** | PROC1, PROC2, PROC3, PROC6, PROC8a, PROC8b, PROC9, PROC14, PROC15 |
| **CS3** | **Material transfers** | PROC1 |
| **CS4** | **Material transfers, With occasional controlled exposure** | PROC2 |
| **CS5** | **Material transfers, Dedicated facility** | PROC8b |
| **CS6** | **Bulk weighing, Closed systems** | PROC1 |
| **CS7** | **Bulk weighing, With occasional controlled exposure** | PROC2 |
| **CS8** | **Small scale weighing, Dedicated facility** | PROC9 |
| **CS9** | **Additive premixing, Batch process, Closed systems** | PROC3 |
| **CS10** | **Material transfers** | PROC9 |
| **CS11** | **Calendering (including Banburys)** | PROC6 |
| **CS12** | **Pressing uncured rubber blanks** | PROC14 |
| **CS13** | **Laboratory activities** | PROC15 |
| **CS14** | **Laboratory activities, Local exhaust ventilation** | PROC15 |
| **CS15** | **Vulcanisation** | PROC6 |
| **CS16** | **Cooling cured articles** | PROC6 |
| **CS17** | **Equipment maintenance** | PROC8a |

## 3.2. Conditions of use affecting exposure

### 3.2.1. Control of environmental exposure: Industrial use of processing aids in processes and products, not becoming part of articles (ERC4)

| | | |
|---|---|---|
| **Amount used, frequency and duration of use (or from service life)** | | |
| Daily amount per site | : | 500 t |
| Annual amount per site | : | 150000 t |
| **Technical and organisational conditions and measures** | | |
| User sites are assumed to be provided with oil/water separators and for waste water to be discharged via public sewer system. | | |
| **Conditions and measures related to sewage treatment plant** | | |
| STP type | : | Municipal sewage treatment plant |
| STP effluent | : | 2.000 m³/d |
| **Other conditions affecting environmental exposure** | | |
| Receiving surface water flow | : | 18.000 m³/d |

### 3.2.2. Control of worker exposure: Use in rubber production and processing, General measures applicable to all activities

**Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC1) / Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2) / Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3) / Calendering operations (PROC6) / Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC8a) / Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b) / Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9) / Tabletting, compression, extrusion, pelettisation, granulation (PROC14) / Use as laboratory reagent (PROC15)**

| | | |
|---|---|---|
| **Product (article) characteristics** | | |
| Covers percentage substance in the product up to 100 %. | | |
| Physical form of product | : | Liquid |

| | | |
|---|---|---|
| **Amount used, frequency and duration of use (or from service life)** | | |
| Duration | : | Covers use up to 8 h |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | | |
| Use suitable eye protection and gloves.<br>Low temperature resistant gloves | | |
| **Other conditions affecting workers exposure** | | |
| Temperature | : | Assumes process temperature up to 20 °C |

**3.2.3. Control of worker exposure: Material transfers**
**Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC1)**

| |
|---|
| **Technical and organisational conditions and measures** |
| Occupational Health and Safety Management System: Advanced<br>Provide a basic standard of general ventilation (1 to 3 air changes per hour). |

**3.2.4. Control of worker exposure: Material transfers, With occasional controlled exposure**
**Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| | | |
|---|---|---|
| **Amount used, frequency and duration of use (or from service life)** | | |
| Use frequency | : | Covers use up to 4 hours/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). | | |
| Use in closed, continuous process with occasional controlled exposure | | |
| Ensure material transfers are under containment or extract ventilation.<br>Transfer via enclosed lines.<br>Inhalation - minimum efficiency of 95 % | | |

**3.2.5. Control of worker exposure: Material transfers, Dedicated facility**
**Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 hours/day |

| **Technical and organisational conditions and measures** |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). |
| Ensure material transfers are under containment or extract ventilation.<br>Transfer via enclosed lines.<br>Inhalation - minimum efficiency of > 95 % |

**3.2.6. Control of worker exposure: Bulk weighing, Closed systems**
**Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC1)**

| **Technical and organisational conditions and measures** |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). |

**3.2.7. Control of worker exposure: Bulk weighing, With occasional controlled exposure**
**Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 4 hours/day |

| **Technical and organisational conditions and measures** |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). |
| Use in closed, continuous process with occasional controlled exposure |
| Ensure material transfers are under containment or extract ventilation.<br>Inhalation - minimum efficiency of 95 % |

**3.2.8. Control of worker exposure: Small scale weighing, Dedicated facility**
**Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9)**

| **Product (article) characteristics** |
|---|
| Covers concentrations up to 5 % |
| **Amount used, frequency and duration of use (or from service life)** |
| Use frequency : Covers use up to 4 hours/day |
| **Technical and organisational conditions and measures** |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). |
| Ensure material transfers are under containment or extract ventilation.<br>Inhalation - minimum efficiency of 95 % |

**3.2.9. Control of worker exposure: Additive premixing, Batch process, Closed systems Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)**

| **Amount used, frequency and duration of use (or from service life)** |
|---|
| Use frequency : Covers use up to 1 hours/day |
| **Technical and organisational conditions and measures** |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). |
| Closed batch process with occasional controlled exposure |
| Ensure material transfers are under containment or extract ventilation.<br>Inhalation - minimum efficiency of 95 % |

**3.2.10. Control of worker exposure: Material transfers**
**Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9)**

| **Product (article) characteristics** |
|---|
| Covers concentrations up to 1 % |
| **Amount used, frequency and duration of use (or from service life)** |
| Use frequency : Covers use up to 4 hours/day |

| Technical and organisational conditions and measures |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). |
| Ensure material transfers are under containment or extract ventilation.<br>Transfer via enclosed lines.<br>Inhalation - minimum efficiency of 95 % |

**3.2.11. Control of worker exposure: Calendering (including Banburys)**
**Calendering operations (PROC6)**

| Product (article) characteristics | | |
|---|---|---|
| Covers concentrations up to 1 % | | |
| **Amount used, frequency and duration of use (or from service life)** | | |
| Use frequency | : | Covers use up to 4 hours/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). | | |
| Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.<br>Inhalation - minimum efficiency of 95 % | | |

**3.2.12. Control of worker exposure: Pressing uncured rubber blanks**
**Tabletting, compression, extrusion, pelettisation, granulation (PROC14)**

| Product (article) characteristics | | |
|---|---|---|
| Covers concentrations up to 1 % | | |
| **Amount used, frequency and duration of use (or from service life)** | | |
| Use frequency | : | Covers use up to 4 hours/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). | | |
| Ensure material transfers are under containment or extract ventilation. | | |

| |
|---|
| Inhalation - minimum efficiency of 95 % |

**3.2.13. Control of worker exposure: Laboratory activities**
**Use as laboratory reagent (PROC15)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 hours/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). | | |
| Handle in a fume cupboard or under extract ventilation.<br>Inhalation - minimum efficiency of 95 % | | |

**3.2.14. Control of worker exposure: Laboratory activities, Local exhaust ventilation**
**Use as laboratory reagent (PROC15)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a basic standard of general ventilation (1 to 3 air changes per hour). | | |
| Handle in a fume cupboard or under extract ventilation.<br>Inhalation - minimum efficiency of > 95 % | | |

**3.2.15. Control of worker exposure: Vulcanisation**
**Calendering operations (PROC6)**

| **Product (article) characteristics** | | |
|---|---|---|
| Covers concentrations up to 1 % | | |
| **Amount used, frequency and duration of use (or from service life)** | | |
| Use frequency | : | Covers use up to 4 hours/day |
| **Technical and organisational conditions and measures** | | |

| |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). |
| Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.<br>Inhalation - minimum efficiency of 95 % |

**3.2.16. Control of worker exposure: Cooling cured articles**
**Calendering operations (PROC6)**

| | | |
|---|---|---|
| **Product (article) characteristics** | | |
| Covers concentrations up to 1 % | | |
| **Amount used, frequency and duration of use (or from service life)** | | |
| Use frequency | : | Covers use up to 4 hours/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). | | |
| Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.<br>Inhalation - minimum efficiency of 95 % | | |

**3.2.17. Control of worker exposure: Equipment maintenance**
**Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC8a)**

| | | |
|---|---|---|
| **Amount used, frequency and duration of use (or from service life)** | | |
| Use frequency | : | Covers use up to 4 hours/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). | | |
| Drain down and flush system prior to equipment break-in or maintenance.<br>Inhalation - minimum efficiency of 95 % | | |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | | |
| Respiratory protection<br>Efficiency: APF 10 | | |

## 3.3. Exposure estimation and reference to its source

### 3.3.1. Environmental release and exposure: Industrial use of processing aids in processes and products, not becoming part of articles (ERC4)

| Release route | Release rate | Release estimation method |
|---|---|---|
| Water | 1.500 kg/day | |
| Air | 0,135 kg/day | |

| Compartment | Exposure level | RCR |
|---|---|---|
| Man via environment - Inhalation | 0,22 mg/m³ | 0,061 |

### 3.3.3. Worker exposure: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC1)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,023 mg/m³ | 0,01 | |

### 3.3.4. Worker exposure: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

### 3.3.5. Worker exposure: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

### 3.3.6. Worker exposure: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC1)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,016 mg/m³ | < 0,01 | |

### 3.3.7. Worker exposure: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

### 3.3.8. Worker exposure: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,623 mg/m³ | 0,734 | |

### 3.3.9. Worker exposure: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,676 mg/m³ | 0,306 | |

### 3.3.10. Worker exposure: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,811 mg/m³ | 0,367 | |

### 3.3.11. Worker exposure: Calendering operations (PROC6)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

### 3.3.12. Worker exposure: Tabletting, compression, extrusion, pelettisation, granulation (PROC14)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

### 3.3.13. Worker exposure: Use as laboratory reagent (PROC15)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,127 mg/m³ | 0,51 | |

**3.3.14. Worker exposure: Use as laboratory reagent (PROC15)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,127 mg/m³ | 0,51 | |

**3.3.15. Worker exposure: Calendering operations (PROC6)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

**3.3.16. Worker exposure: Calendering operations (PROC6)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

**3.3.17. Worker exposure: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC8a)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

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

The safety data sheet at hand provides the user with risk management measures and operational conditions which enables him to work safely with the substance / mixture. If other risk management measures / operational conditions are adopted, the user has to ensure, that the risks are managed to at least equivalent levels.

## ES4: Use in polymer production

### 4.1. Title section

| | | |
|---|---|---|
| **Structured Short Title** | : | Use at industrial sites, Use in polymer production |

| | | |
|---|---|---|
| **Environment** | | |
| **CS1** | **Use in polymer production, Environment** | ERC6c |
| **Worker** | | |
| **CS2** | **Use in polymer production, General measures applicable to all activities** | PROC1, PROC2, PROC3, PROC6, PROC8a, PROC8b, PROC14 |
| **CS3** | **General exposures (closed systems), Continuous process, no sampling** | PROC1 |
| **CS4** | **Bulk transfers, transport, With sample collection** | PROC8b |
| **CS5** | **Polymerisation, Continuous process, With sample collection** | PROC2 |
| **CS6** | **Polymerisation, Batch process, With sample collection** | PROC3 |
| **CS7** | **Polymerisation, Batch process, With sample collection, Elevated temperature** | PROC3 |
| **CS8** | **Finishing operations, Batch process, With sample collection** | PROC3 |
| **CS9** | **Additivation and stabilisation** | PROC3 |
| **CS10** | **Pelletizing, Extrusion and masterbatching** | PROC6 |
| **CS11** | **Pelletizing** | PROC14 |
| **CS12** | **Pelletisation and pellet screening, Open systems** | PROC8b |
| **CS13** | **Bulk transfers, Continuous process, With sample collection** | PROC3 |
| **CS14** | **transport, With sample collection** | PROC8b |
| **CS15** | **Equipment maintenance** | PROC8a |
| **CS16** | **Storage, With occasional controlled exposure** | PROC2 |

## 4.2. Conditions of use affecting exposure

### 4.2.1. Control of environmental exposure: Use of monomer in polymerisation processes at industrial site (inclusion or not into/onto article) (ERC6c)

| | | |
|---|---|---|
| **Amount used, frequency and duration of use (or from service life)** | | |
| Daily amount per site | : | 166,6 t |
| Annual amount per site | : | 50000 t |
| **Conditions and measures related to sewage treatment plant** | | |
| STP type | : | Municipal sewage treatment plant |
| STP sludge treatment | : | Controlled application of sewage sludge to agricultural soil |
| STP effluent | : | 2.000 m³/d |
| **Other conditions affecting environmental exposure** | | |
| Receiving surface water flow | : | 18.000 m³/d |

### 4.2.2. Control of worker exposure: Use in polymer production, General measures applicable to all activities
**Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC1) / Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2) / Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3) / Calendering operations (PROC6) / Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC8a) / Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b) / Tabletting, compression, extrusion, pelettisation, granulation (PROC14)**

| | | |
|---|---|---|
| **Product (article) characteristics** | | |
| Covers concentrations up to 100 % | | |
| Physical form of product | : | Liquid |
| **Amount used, frequency and duration of use (or from service life)** | | |
| Use frequency | : | Covers use up to 8 h/day |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | | |

| |
|---|
| Use suitable eye protection and gloves.<br>Low temperature resistant gloves |

| **Other conditions affecting workers exposure** | | |
|---|---|---|
| Temperature | : | Assumes process temperature up to 20 °C |

**4.2.3. Control of worker exposure: General exposures (closed systems), Continuous process, no sampling**
**Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC1)**

| **Technical and organisational conditions and measures** |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a basic standard of general ventilation (1 to 3 air changes per hour). |

**4.2.4. Control of worker exposure: Bulk transfers, transport, With sample collection**
**Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 hours/day |

| **Technical and organisational conditions and measures** |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). |
| Sample via a closed loop or other system to avoid exposure.<br>Transfer via enclosed lines.<br>Inhalation - minimum efficiency of > 95 % |

**4.2.5. Control of worker exposure: Polymerisation, Continuous process, With sample collection**
**Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 hours/day |

| **Technical and organisational conditions and measures** |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). |

| |
|---|
| Use in closed, continuous process with occasional controlled exposure |
| Sample via a closed loop or other system to avoid exposure.<br>Inhalation - minimum efficiency of 95 % |

**4.2.6. Control of worker exposure: Polymerisation, Batch process, With sample collection**
**Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)**

| | | |
|---|---|---|
| **Amount used, frequency and duration of use (or from service life)** | | |
| Use frequency | : | Covers use up to 1 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). | | |
| Closed batch process with occasional controlled exposure | | |
| Sample via a closed loop or other system to avoid exposure.<br>Inhalation - minimum efficiency of 95 % | | |

**4.2.7. Control of worker exposure: Polymerisation, Batch process, With sample collection, Elevated temperature**
**Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)**

| | | |
|---|---|---|
| **Product (article) characteristics** | | |
| Covers concentrations up to 25 % | | |
| **Amount used, frequency and duration of use (or from service life)** | | |
| Use frequency | : | Covers use up to 1 hours/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). | | |
| Closed batch process with occasional controlled exposure | | |
| Sample via a closed loop or other system to avoid exposure.<br>Inhalation - minimum efficiency of 95 % | | |
| **Other conditions affecting workers exposure** | | |

| | | |
|---|---|---|
| Temperature | : | Assumes process temperature up to 40 °C |

**4.2.8. Control of worker exposure: Finishing operations, Batch process, With sample collection Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)**

| **Product (article) characteristics** |
|---|
| Covers concentrations up to 5 % |
| **Technical and organisational conditions and measures** |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). |
| Closed batch process with occasional controlled exposure |
| Sample via a closed loop or other system to avoid exposure.<br>Inhalation - minimum efficiency of 95 % |

**4.2.9. Control of worker exposure: Additivation and stabilisation**
**Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)**

| **Product (article) characteristics** |
|---|
| Covers concentrations up to 5 % |
| **Technical and organisational conditions and measures** |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). |
| Closed batch process with occasional controlled exposure |
| Sample via a closed loop or other system to avoid exposure.<br>Inhalation - minimum efficiency of 95 % |

**4.2.10. Control of worker exposure: Pelletizing, Extrusion and masterbatching Calendering operations (PROC6)**

| **Product (article) characteristics** |
|---|
| Covers concentrations up to 1 % |

| **Technical and organisational conditions and measures** |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). |
| Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.<br>Inhalation - minimum efficiency of 95 % |

**4.2.11. Control of worker exposure: Pelletizing**
**Tabletting, compression, extrusion, pelettisation, granulation (PROC14)**

| **Product (article) characteristics** |
|---|
| Covers concentrations up to 1 % |
| **Technical and organisational conditions and measures** |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). |
| Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.<br>Inhalation - minimum efficiency of 95 % |

**4.2.12. Control of worker exposure: Pelletisation and pellet screening, Open systems**
**Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)**

| **Product (article) characteristics** |
|---|
| Covers concentrations up to 1 % |
| **Technical and organisational conditions and measures** |
| Occupational Health and Safety Management System: Advanced<br>Provide a basic standard of general ventilation (1 to 3 air changes per hour). |
| Ensure material transfers are under containment or extract ventilation.<br>Inhalation - minimum efficiency of > 95 % |

**4.2.13. Control of worker exposure: Bulk transfers, Continuous process, With sample collection**
**Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). | | |
| Closed batch process with occasional controlled exposure | | |
| Sample via a closed loop or other system to avoid exposure.<br>Inhalation - minimum efficiency of 95 % | | |

**4.2.14. Control of worker exposure: transport, With sample collection**
**Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). | | |
| Ensure material transfers are under containment or extract ventilation.<br>Inhalation - minimum efficiency of > 95 % | | |

**4.2.15. Control of worker exposure: Equipment maintenance**
**Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC8a)**

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 4 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). | | |
| Drain down and flush system prior to equipment break-in or maintenance.<br>Inhalation - minimum efficiency of 95 % | | |
| **Conditions and measures related to personal protection, hygiene and health evaluation** | | |
| Respiratory protection | | |

| |
|---|
| Efficiency: APF 10 |

#### 4.2.16. Control of worker exposure: Storage, With occasional controlled exposure Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 1 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). | | |
| Use in closed, continuous process with occasional controlled exposure | | |
| Ensure material transfers are under containment or extract ventilation.<br>Inhalation - minimum efficiency of 95 % | | |
| Store substance within a closed system. | | |

### 4.3. Exposure estimation and reference to its source

#### 4.3.1. Environmental release and exposure: Use of monomer in polymerisation processes at industrial site (inclusion or not into/onto article) (ERC6c)

| Release route | Release rate | Release estimation method |
|---|---|---|
| Water | 25 kg/day | |
| Air | 0,045 kg/day | |

| Compartment | Exposure level | RCR |
|---|---|---|
| Man via environment - Inhalation | 0,004 mg/m³ | 0,02 |

#### 4.3.3. Worker exposure: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC1)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,023 mg/m³ | 0,01 | |

**4.3.4. Worker exposure: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

**4.3.5. Worker exposure: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,789 mg/m³ | 0,357 | |

**4.3.6. Worker exposure: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,578 mg/m³ | 0,714 | |

**4.3.7. Worker exposure: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,947 mg/m³ | 0,428 | |

**4.3.8. Worker exposure: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,578 mg/m³ | 0,714 | |

**4.3.9. Worker exposure: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,578 mg/m³ | 0,714 | |

#### 4.3.10. Worker exposure: Calendering operations (PROC6)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,69 mg/m³ | 0,765 | |

#### 4.3.11. Worker exposure: Tabletting, compression, extrusion, pelettisation, granulation (PROC14)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,69 mg/m³ | 0,765 | |

#### 4.3.12. Worker exposure: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,69 mg/m³ | 0,765 | |

#### 4.3.13. Worker exposure: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,578 mg/m³ | 0,714 | |

#### 4.3.14. Worker exposure: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

#### 4.3.15. Worker exposure: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC8a)

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

**4.3.16. Worker exposure: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,789 mg/m³ | 0,357 | |

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

The safety data sheet at hand provides the user with risk management measures and operational conditions which enables him to work safely with the substance / mixture. If other risk management measures / operational conditions are adopted, the user has to ensure, that the risks are managed to at least equivalent levels.

## ES5: Use in polymer processing

### 5.1. Title section

| | | |
|---|---|---|
| **Structured Short Title** | : | Use at industrial sites, Use in polymer processing |

| | | |
|---|---|---|
| **Environment** | | |
| **CS1** | **Use in polymer processing, Environment** | ERC6d |
| **Worker** | | |
| **CS2** | **Use in polymer processing, General measures applicable to all activities** | PROC1, PROC2, PROC3, PROC6, PROC8a, PROC8b, PROC9, PROC13, PROC14 |
| **CS3** | **Bulk transfers, Closed systems** | PROC1 |
| **CS4** | **Bulk transfers, Closed systems, With occasional controlled exposure** | PROC2 |
| **CS5** | **Bulk transfers, Dedicated facility** | PROC8b |
| **CS6** | **Bulk weighing, Closed systems** | PROC8b |
| **CS7** | **Bulk weighing, With occasional controlled exposure** | PROC2 |
| **CS8** | **Small scale weighing** | PROC9 |
| **CS9** | **Additive premixing, Closed systems** | PROC3 |
| **CS10** | **Bulk transfers, Drum/batch transfers** | PROC8b |
| **CS11** | **Bulk transfers, Small package filling** | PROC9 |
| **CS12** | **Calendering (including Banburys)** | PROC6 |
| **CS13** | **Production of articles by dipping and pouring** | PROC13 |
| **CS14** | **Extrusion and masterbatching** | PROC14 |
| **CS15** | **Injection moulding of articles** | PROC14 |
| **CS16** | **Equipment maintenance** | PROC8a |
| **CS17** | **Storage, With occasional controlled exposure** | PROC2 |

## 5.2. Conditions of use affecting exposure

### 5.2.1. Control of environmental exposure: Use of reactive process regulators in polymerisation processes at industrial site (inclusion or not into/onto article) (ERC6d)

| | | |
|---|---|---|
| **Amount used, frequency and duration of use (or from service life)** | | |
| Daily amount per site | : | 41,67 t |
| Annual amount per site | : | 12500 t |
| **Conditions and measures related to sewage treatment plant** | | |
| STP type | : | Municipal sewage treatment plant |
| STP sludge treatment | : | Controlled application of sewage sludge to agricultural soil |
| STP effluent | : | 2.000 m³/d |
| **Other conditions affecting environmental exposure** | | |
| Receiving surface water flow | : | 18.000 m³/d |

### 5.2.2. Control of worker exposure: Use in polymer processing, General measures applicable to all activities
**Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC1) / Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2) / Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3) / Calendering operations (PROC6) / Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC8a) / Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b) / Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9) / Treatment of articles by dipping and pouring (PROC13) / Tabletting, compression, extrusion, pelettisation, granulation (PROC14)**

| | | |
|---|---|---|
| **Product (article) characteristics** | | |
| Covers concentrations up to 100 % | | |
| Physical form of product | : | Liquefied gas |
| **Amount used, frequency and duration of use (or from service life)** | | |
| Use frequency | : | Covers use up to 8 h/day |

| **Conditions and measures related to personal protection, hygiene and health evaluation** |
|---|
| Use suitable eye protection and gloves.<br>Low temperature resistant gloves |
| **Other conditions affecting workers exposure** |
| Temperature : Assumes process temperature up to 20 °C |

**5.2.3. Control of worker exposure: Bulk transfers, Closed systems**
**Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC1)**

| **Technical and organisational conditions and measures** |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a basic standard of general ventilation (1 to 3 air changes per hour). |

**5.2.4. Control of worker exposure: Bulk transfers, Closed systems, With occasional controlled exposure**
**Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| **Product (article) characteristics** |
|---|
| Covers concentrations up to 1 % |
| **Technical and organisational conditions and measures** |
| Occupational Health and Safety Management System: Advanced<br>Provide a basic standard of general ventilation (1 to 3 air changes per hour). |
| Handle substance within a closed system.<br>Inhalation - minimum efficiency of 95 % |

**5.2.5. Control of worker exposure: Bulk transfers, Dedicated facility**
**Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)**

| **Product (article) characteristics** |
|---|
| Covers concentrations up to 1 % |
| **Technical and organisational conditions and measures** |

| |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a basic standard of general ventilation (1 to 3 air changes per hour). |
| Ensure material transfers are under containment or extract ventilation.<br>Inhalation - minimum efficiency of > 95 % |

**5.2.6. Control of worker exposure: Bulk weighing, Closed systems**
**Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)**

| **Technical and organisational conditions and measures** |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a basic standard of general ventilation (1 to 3 air changes per hour). |
| Use in closed process |

**5.2.7. Control of worker exposure: Bulk weighing, With occasional controlled exposure**
**Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| **Product (article) characteristics** |
|---|
| Covers concentrations up to 1 % |
| **Technical and organisational conditions and measures** |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). |
| Use in closed, continuous process with occasional controlled exposure |
| Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.<br>Inhalation - minimum efficiency of 95 % |

**5.2.8. Control of worker exposure: Small scale weighing**
**Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9)**

| **Product (article) characteristics** |
|---|
| Covers concentrations up to 1 % |
| **Technical and organisational conditions and measures** |
| Occupational Health and Safety Management System: Advanced |

| |
|---|
| Provide a good standard of controlled ventilation (5 to 10 air changes per hour). |
| Ensure material transfers are under containment or extract ventilation.<br>Inhalation - minimum efficiency of 95 % |

**5.2.9. Control of worker exposure: Additive premixing, Closed systems**
**Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)**

| **Product (article) characteristics** |
|---|
| Covers concentrations up to 1 % |
| **Technical and organisational conditions and measures** |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). |
| Closed batch process with occasional controlled exposure |
| Ensure material transfers are under containment or extract ventilation.<br>Inhalation - minimum efficiency of 95 % |

**5.2.10. Control of worker exposure: Bulk transfers, Drum/batch transfers**
**Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)**

| **Product (article) characteristics** |
|---|
| Covers concentrations up to 1 % |
| **Technical and organisational conditions and measures** |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). |
| Ensure material transfers are under containment or extract ventilation.<br>Inhalation - minimum efficiency of > 95 % |

**5.2.11. Control of worker exposure: Bulk transfers, Small package filling**
**Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9)**

| **Product (article) characteristics** |
|---|
| Covers concentrations up to 1 % |

| **Amount used, frequency and duration of use (or from service life)** | | |
|---|---|---|
| Use frequency | : | Covers use up to 4 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). | | |
| Ensure material transfers are under containment or extract ventilation.<br>Inhalation - minimum efficiency of 95 % | | |

**5.2.12. Control of worker exposure: Calendering (including Banburys)**
**Calendering operations (PROC6)**

| **Product (article) characteristics** | | |
|---|---|---|
| Covers concentrations up to 1 % | | |
| **Amount used, frequency and duration of use (or from service life)** | | |
| Use frequency | : | Covers use up to 4 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). | | |
| Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.<br>Inhalation - minimum efficiency of 95 % | | |

**5.2.13. Control of worker exposure: Production of articles by dipping and pouring**
**Treatment of articles by dipping and pouring (PROC13)**

| **Product (article) characteristics** | | |
|---|---|---|
| Covers concentrations up to 1 % | | |
| **Amount used, frequency and duration of use (or from service life)** | | |
| Use frequency | : | Covers use up to 4 h/day |
| **Technical and organisational conditions and measures** | | |

| |
|---|
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). |
| Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.<br>Inhalation - minimum efficiency of 95 % |

**5.2.14. Control of worker exposure: Extrusion and masterbatching**
**Tabletting, compression, extrusion, pelettisation, granulation (PROC14)**

| | | |
|---|---|---|
| **Product (article) characteristics** | | |
| Covers concentrations up to 1 % | | |
| **Amount used, frequency and duration of use (or from service life)** | | |
| Use frequency | : | Covers use up to 4 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). | | |
| Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.<br>Inhalation - minimum efficiency of 95 % | | |

**5.2.15. Control of worker exposure: Injection moulding of articles**
**Tabletting, compression, extrusion, pelettisation, granulation (PROC14)**

| | | |
|---|---|---|
| **Product (article) characteristics** | | |
| Covers concentrations up to 1 % | | |
| **Amount used, frequency and duration of use (or from service life)** | | |
| Use frequency | : | Covers use up to 4 h/day |
| **Technical and organisational conditions and measures** | | |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). | | |
| Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings.<br>Inhalation - minimum efficiency of 95 % | | |

**5.2.16. Control of worker exposure: Equipment maintenance**
**Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities (PROC8a)**

| **Product (article) characteristics** |
|---|
| Covers concentrations up to 1 % |
| **Technical and organisational conditions and measures** |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of controlled ventilation (5 to 10 air changes per hour). |
| Drain down and flush system prior to equipment break-in or maintenance.<br>Inhalation - minimum efficiency of 95 % |

**5.2.17. Control of worker exposure: Storage, With occasional controlled exposure**
**Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| **Product (article) characteristics** |
|---|
| Covers concentrations up to 1 % |
| **Amount used, frequency and duration of use (or from service life)** |
| Use frequency : Covers use up to 1 h/day |
| **Technical and organisational conditions and measures** |
| Occupational Health and Safety Management System: Advanced<br>Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). |
| Use in closed, continuous process with occasional controlled exposure<br>Store substance within a closed system. |

## 5.3. Exposure estimation and reference to its source

**5.3.1. Environmental release and exposure: Use of reactive process regulators in polymerisation processes at industrial site (inclusion or not into/onto article) (ERC6d)**

| Release route | Release rate | Release estimation method |
|---|---|---|
| Water | 0 kg/day | |

| | | |
|---|---|---|
| Air | 0,011 kg/day | |

| Compartment | Exposure level | RCR |
|---|---|---|
| Man via environment - Inhalation | 0,000288 mg/m³ | 0,000 |

**5.3.3. Worker exposure: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC1)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,023 mg/m³ | 0,01 | |

**5.3.4. Worker exposure: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,563 mg/m³ | 0,255 | |

**5.3.5. Worker exposure: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,69 mg/m³ | 0,765 | |

**5.3.6. Worker exposure: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,023 mg/m³ | 0,01 | |

**5.3.7. Worker exposure: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,394 mg/m³ | 0,178 | |

**5.3.8. Worker exposure: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,352 mg/m³ | 0,612 | |

**5.3.9. Worker exposure: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC3)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,789 mg/m³ | 0,357 | |

**5.3.10. Worker exposure: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC8b)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,183 mg/m³ | 0,535 | |

**5.3.11. Worker exposure: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC9)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,893 mg/m³ | 0,857 | |

**5.3.12. Worker exposure: Calendering operations (PROC6)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

**5.3.13. Worker exposure: Treatment of articles by dipping and pouring (PROC13)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

**5.3.14. Worker exposure: Tabletting, compression, extrusion, pelettisation, granulation (PROC14)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

**5.3.15. Worker exposure: Tabletting, compression, extrusion, pelettisation, granulation (PROC14)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,014 mg/m³ | 0,459 | |

**5.3.16. Worker exposure: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities (PROC8a)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 1,69 mg/m³ | 0,765 | |

**5.3.17. Worker exposure: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC2)**

| Exposure route | Health effect | Exposure indicator | Exposure level | RCR | Remarks |
|---|---|---|---|---|---|
| inhalative | systemic | long-term | 0,789 mg/m³ | 0,357 | |

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

The safety data sheet at hand provides the user with risk management measures and operational conditions which enables him to work safely with the substance / mixture. If other risk management measures / operational conditions are adopted, the user has to ensure, that the risks are managed to at least equivalent levels.