

FH-C20-033\_V.10/ 09.10.2020

**SAFETY DATA SHEET**  
**MELAMINE**

According to EC Regulation no. 1907/2006 (REACH) / EC Regulation no. 1272/2008 / Regulation no. 830/ 2015.

**SECTION 1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND THE COMPANY**

**1.1. Product identification**

Name: MELAMINE  
Other names: CYANUROTRIAMIDE, 2.4.6-TRIAMINE-1.3.5-TRIAZINE, TECHNICAL MELAMINE  
IUPAC name: 1.3.5-triazine-2.4.6-triamine  
Chemical formula: C<sub>3</sub>H<sub>6</sub>N<sub>6</sub>  
SMILES notation: Nc1nc(N)nc(N)n1  
CAS number: 108-78-1  
EINECS number: 203-615-4  
ECHA reference number: 01-2119485947-16-0011

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

Identified uses

*Industrial use: Manufacturing of the substance, including handling, storage and quality control  
Formulation or re-packing: Adhesives, sealants; Coatings and paints, thinners, paint removes; Laboratory chemicals; Leather treatment products; Polymer preparations and compounds; Washing and cleaning products  
Use as intermediate for resins (reacted melamine)  
Use of resins with unreacted residual melamine  
Use as intermediate for the production of other substances e.g. melamine salt (reacted melamine)  
Use as additive in foams  
Use as additive in intumescent coatings*

*Professional use: Use as additive in intumescent coatings*

*Consumer use: Intumescent coating  
PU foams*

Uses advised against: *Uses at industrial sites advised against  
Addition to food or feed products*

**1.3. Details concerning the supplier of the Safety Data Sheet**

**Producer:**

Azomureș S.A.Tg.-Mureș, 300 Gheorghe Doja St., tel.0040-265 253 700, Romania

**FH-C20-033\_V.10/ 09.10.2020**

Fax: 0040-265 252 986, e-mail: [office@azomures.com](mailto:office@azomures.com), [www.azomures.com](http://www.azomures.com)  
e-mail (competent person responsible for the SDS): [fds.azo@azomures.com](mailto:fds.azo@azomures.com)

#### 1.4. Emergency telephone number

The institution responsible with providing information in case of a health emergency is The National Institute for Public Health, Department for the International Sanitary Regulation and Toxicological Information.

**Telephone: 0040-21.318.36.06, working hours: Monday – Friday from 8 a.m. to 3 p.m.**

## SECTION 2. HAZARDS IDENTIFICATION

### 2.1. Classification of the substance or mixture

Melamine is an organic monoconstituent substance of an organic nature; being classified in hazard class – reproductive toxicity category 2, as a substance suspected of damaging fertility, in accordance with Regulation (EC) No. 1272/2008.

#### **Classification according to EC Regulation no. 1272/2008 (CLP)**

Hazard Classes/Categories: Reproductive toxicity, category 2

Hazard statements H: H361f – Suspected of damaging fertility.

#### **Human health hazard**

The following aspect will be taken into consideration.

Skin contact: *no acute effect is known after overexposure to this product.*

Eye contact: *may cause irritations*

Ingestion: *no acute effect is known after overexposure to this product.*

Inhalation: *overexposure by inhalation may cause respiratory irritation (cough)*

#### **Environmental hazards**

*There are no indications for a classification of melamine based on ecotoxicity and / or environmental behavior.*

### 2.2. Labelling

#### **Labeling according to CLP Regulation**

The substance is classified as dangerous according to the criteria of Regulation (EC) 1272/2008 (CLP)

#### **EU label**

Substance name: MELAMINE

ECHA reference number: 01-2119485947-16-0011

EINECS number: 203-615-4

Producer:

Azomureș S.A.Tg.-Mureș, 300 Gheorghe Doja St., tel. 0040-265 253 700, Romania

Fax: 0040-265 252 986, e-mail: [office@azomures.com](mailto:office@azomures.com), [www.azomures.com](http://www.azomures.com)

Emergency telephone number: 0040-21.318.36.06,

**FH-C20-033\_V.10/ 09.10.2020**

Working hours: Monday – Friday from 8 a.m. to 3 p.m.

Hazard labels: symbol

GHS08 – health hazard

Signal word: Attention!



GHS08 – Reproductive toxicity, cat.2

Hazard statements H: **H361f** - Suspected of damaging fertility.

Precautionary statements:

Prevention: **P201** - Obtain special instructions before use.

**P202** - Do not handle until all safety precautions have been read and understood.

**P280** - Wear protective gloves/protective clothing/eye protection/face protection/hearing protection/...

Intervention: **P308+P313** - IF exposed or concerned: Get medical advice/attention

Storage: **P405** - Store locked up.

Elimination: **P501** - Dispose of container according to the national legal requirements

Content: melamine min. 99.7%

Net weight of the fertilizer

### 2.3. Other hazards

Melamine is neither a PBT nor a vPvB-substance because of the low bioconcentration potential, the low partition coefficient n-octanol/water and the low (eco)toxicity.

## SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

### 3.1. Chemical identity of the substance

**The product must be considered: Substance**

Melamine is a monoconstituent substance (origin:organic)

CAS number: 108-78-1

EINECS number: 203-615-4

IUPAC name: 1.3.5-TRIAZINE-2.4.6-TRIAMINE

EC name: MELAMINE

Molecular formula: C<sub>3</sub>H<sub>6</sub>N<sub>6</sub>

Molecular weight range: 126.1199

Purity degree: >= 99.7% (w/w)

FH-C20-033\_V.10/ 09.10.2020

Typical concentration: 99.8% (w/w)  
Concentration limit:  $\geq 99.7\%$  -  $\leq 100\%$  (w/w)

#### Chemical identification of impurities

Water - CAS number: 7732-18-5

EINECS number: 231-791-2

IUPAC name: oxidane

Typical concentration: 0.1% (w/w)

Concentration limit:  $\geq 0$  -  $\leq 0.2\%$  (w/w)

Unknown impurities - IUPAC name: unknown impurity

Typical concentration: 0.1% (w/w)

Concentration limit:  $\geq 0$  -  $\leq 0.2\%$  (w/w)

## SECTION 4. FIRST AID MEASURES

### 4.1. Description of the first aid measures

4.1.1 First aid instructions are provided depending on the relevant exposure routes.

Skin contact: *remove contaminated clothing and wash the affected area with soap and water.*

*If symptoms occur, seek medical advice.*

Eye contact: *rinse with plenty of water. If symptoms occur, seek medical advice.*

Ingestion: if swallowed, rinse mouth with water (only if the person is conscious). *If symptoms occur, seek medical advice.*

Inhalation: *remove the person from the contaminated area, keep the person at rest in a warm area, get immediately medical help.*

4.1.2 Recommendations:

Remove the contaminated person from the exposure area. There are no special recommendations referring to special first-aid equipment.

### 4.2. The most important symptoms and effects, acute as well as delayed

Overexposure by inhalation may lead to irritations of the airways (cough).

There are no known acute effects following overexposure to this product in case of skin contact or ingestion. It may cause irritations in case of eye contact.

### 4.3. Indications concerning any emergency medical assistance and necessary special treatments

*There are no special recommendations.*

## SECTION 5. FIREFIGHTING MEASURES

### 5.1. Fire extinguishing means

**Adequate extinguishing means**

**FH-C20-033\_V.10/ 09.10.2020**

#### Small fire

Non-flammable substance: use the most efficient available means to extinguish the fire, depending on the materials involved.

#### Large fires

Non-flammable substance: use the most efficient available means to extinguish the fire, depending on the materials involved.

*Use the most effective fire extinguishing methods available.*

*If the product is directly involved in the fire: call the fire department immediately.*

*Firefighting agents: water spray, chemical foam, mechanical foam, steam, inert gas.*

#### **Inadequate extinguishing means**

There are no data available for the products that must not be used for fire extinguishing.

### **5.2. Special hazards caused by the substance or mixture**

Unusual fire and explosion hazards: no specific hazard

Hazardous thermal decomposition products: in case of fire, hazardous decomposition products may be released, such as: carbon monoxide, carbon dioxide, nitrogen oxides, ammonia, amines, hydrocyanic acid at  $t > 600$  °C.

#### Special procedures for firefighting

Extinguish the fire from a safe area, or from the maximum possible distance. Keep temperatures low in the area surrounding the fire

### **5.3. Advice for firefighters**

The protection of the firefighters is ensured with a self-contained breathing apparatus and adequate protection equipment.

## **SECTION 6. ACCIDENTAL RELEASE MEASURES**

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

#### **6.1.1 For personnel not involved in emergency situations**

##### **(a) Protective equipment**

Hand protection: adequate protective gloves (PVC, neoprene)

Eye protection: protective glasses with side shields

##### Skin protection

Protective clothing:

Dust resistant overalls (breastplate duck overalls, coat).

Winter or summer shirt (natural fibers – duck)

Protective footwear:

Protective boots resistant to corrosive chemical agents (rubber, PVC).

Chemical and mechanical aggression resistant boots, with anti-static properties that allow usage in explosive environments (leather with rubber soles).

**FH-C20-033\_V.10/ 09.10.2020**

**(b)** Avoid generation of dust and prevent dispersion by the wind. Wear adequate protection equipment.

## **6.2. Precautions for the environment**

*Avoid contamination of river flows and sewage system and in case of accident, report to local authorities. No special measures are requested.*

## **6.3. Methods and material for containing fires and for cleaning**

*Any quantity of spilled product must be fully recovered and the area must be washed with plenty of water. Depending on the contamination degree and nature, reuse the product or give it to an authorised waste collecting company.*

*If possible, reuse the material. Prevent the formation of dust clouds. Wash the affected area with a large amount of water.*

## **6.4. Reference to other sections**

Note: see chapter Exposure control / individual protection, for information concerning personal protection equipment and the section Disposal considerations.

## **SECTION 7. HANDLING AND STORAGE**

### **7.1. Precautions for safe handling**

#### **7.1.1 Recommendations for safe handling**

Avoid generation of dust and prevent dispersion by the wind.

*Avoid inhaling the powder while emptying melamine bags.*

Wear adequate protection equipment - P2 protective mask, *chemical resistant gloves according to EN374.*

*Use basic general ventilation system.*

#### **7.1.2 Recommendations concerning good general hygiene practices at the work place**

(a) Do not eat, drink or smoke in the working area. "NO SMOKING" signs are to be placed in the working area.

(b) Wash hands thoroughly after each use.

(c) Remove contaminated clothing and protection equipment before entering lunch areas.

### **7.2. Safe storage conditions, including possible incompatibilities**

The product should be stored in closed, dry, clean and well ventilated areas away from heat of and fire sources.

The storage area will be protected.

Do not store together with incompatible substances.

## FH-C20-033\_V.10/ 09.10.2020

*The product will not be stored with incompatible or potentially hazardous materials.*

Prolonged contact with the moisture in the atmosphere may cause the caking of the packed product. The storage spaces should preferably be single level and be constructed of brick, concrete, not from combustible materials (like wood); the flooring must be flat, dry and smooth, without cavities.

The storage facilities must provide a good protection against bad weather against and avoid humidity absorption.

The storage facility must be cleaned before, during and after delivery of the product.

Melamine is packed in waxed polypropylene big bags of 350 kg, 500 kg, 750 kg, 1000 kg and 1200 kg, or in 25 kg multi-layer paper bags with a valve. The tolerance is  $\pm 1\%$  of the net weight of the quantity packed in each bag.

Do not stack the 1000 kg bags on more than 2 rows, as there is the risk of ripping /breaking.

The storage area will be protected.

Adequate packing materials: wood, plastic.

The melamine bags are placed on wooden pallets and are manipulated using forklifts or pallet trucks. The melamine is delivered in covered vehicles, clean and dry, the bags loaded on these vehicles being seated and secured in such a way as to avoid tipping over during transport.

The bulk melamine is delivered in clean, dry and sealed silo tanks.

The marking on the bag is in compliance with the legislation in use.

The marking on the bags and as well as all the accompanying documents must be edited in at least one official language of the member state where the product is traded, unless the contract specifies another official language. Packed chemical products are identified through the information written on labels or package.

The identification information for the bulk product are specified in the accompanying documents.

### 7.3 Specific end use (s)

*The technical melamine is used in resin synthesis processes, as a condensing agent for ureaformaldehyde resin.*

## SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

### 8.1. Control parameters

No official exposure limits are specified according to ACGIH (1995-1996): no testing.

Relevant DNEL / DMEL values and NOAEL values are provided in the CSA, depending on the type of exposure for workers in an industrial setting and for the general public.

No local effects were observed following dermal and inhalation exposure, therefore no DNEL values were derived for local effects.

#### Workers exposure

Acute systemic effects - dermal - DNEL: 117 mg/kg bw

NOAEL: 417 mg/kg bw/day

- inhalation - DNEL: 82.3 mg/m<sup>3</sup>

Long term systemic effects - dermal - DNEL: 11.8 mg/kg bw/day



**FH-C20-033\_V.10/ 09.10.2020**

(repeated dose) *LOAEL: 126 mg/kg bw/day*  
- inhalation - *DNEL: 8.3 mg/m<sup>3</sup>*  
*LOAEL: 126 mg/ kg bw/day*

#### Public exposure

Long term systemic effects - dermal - *DNEL: 4.2 mg/kg bw/day*  
(repeated dose) *LOAEL: 126 mg/kg bw/day*  
- inhalation - *DNEL: 1.5 mg/m<sup>3</sup>*  
*LOAEL: 126 mg/m<sup>3</sup>*  
- oral - *DNEL: 0.42 mg/kg bw/day*  
*LOAEL: 126 mg/kg bw/day*

## **8.2. Exposure control**

### **8.2.1 Appropriate Engineering Controls**

#### **General measures at company level**

The CSSM (The Committee for Work Health and Safety) was constituted at the company level, where the risk factors of professional injury and illness in the work place are assessed.

The evaluation of the risks of professional injury and illness at the work place was carried out by committees established by the management; preventive measures were taken to eliminate or to diminish the risks that cannot be avoided, having as purpose the work safety and health, reduction of work injuries and of professional illnesses.

#### **The Chemical Plant:**

- Risk evaluation when using dangerous chemical substances
- Ammonium Nitrate Plant II-III-ADEX (operation – chemists, mechanic, electric and automation maintenance, packing machinists)

As a result of the analysis and evaluation of the risks at the work place:

The plan for prevention and protection at company level was elaborated and approved

A record is held of the work places of great danger and imminent danger of injury

A situation of the hazardous chemical substances used in the work process is kept

The toxic gases, released by chemical substances at the work place, are monitored.

The health of the staff exposed to the action of chemical substances is supervised and monitored

The auditing of the safety and health at the work place is carried out, establishing the noncompliance with the law in force and taking measures to ensure compliance with such laws.

Statistics are drafted, referring to work accidents and professional illnesses caused by hazardous chemical substances

Intervention teams in case of chemical accident with periodically instructed staff are organized at company level

Authorized employees of the internal prevention and protection service perform the inspection of the work places according to the operational procedure

The explosion protection document is elaborated according to Government Ordinance no. 1058/2006 for the following plants: Ammonia, Nitric Acid, and Ammonium Nitrate.

The equipment used in areas with danger of explosion is certified upon availability date.

Workers have access to personal instructions regarding the usage of dangerous chemical substances:



**FH-C20-033\_V.10/ 09.10.2020**

- The staff has individual protection equipment
- Measures of collective protection are ensured.

### **Collective protection measures for the source of risk – Melamine**

#### **Technical Measures**

Monitoring system of the main functioning parameters for the safety of the equipment (pressure, temperature, concentration, flow capacity, level etc), with acoustic and optical warning signals in case of malfunction.

Toxic gas, fire and explosion detectors

Protection devices – flange fenders on all the dangerous liquids layouts

Ammonia and nitric acid layouts painted in conventional colors

Signaling for work safety health and according to Government Ordinance no. 971/2006 (safety, warning, interdiction, obligation marks, delimitation of danger zones)

Ventilation systems.

Rescue showers for the danger of splashing with corrosive substances.

Water sources with upward jet (for washing the eyes in case of splashing)

Periodical IS CIR inspections of under-pressure equipment.

Toxic gases level control

Organization and provision of individual insulating protection equipment

Endowment and organization of medical help trained in case of gassing.

#### **Administrative measures**

Manufacturing regulation, work instructions regarding work safety and health and fire prevention

Safety data sheets for hazardous substances

Organization of an information system for surveillance and intervention:

- Action plan in case of fire
- Internal Emergency Plan (PUI).
- Evacuation action plan in emergency situations
- Action plan in case of earthquake
- Action plan for safe road transport (PSTR).

Authorization for the job position, employees in the production sector, maintenance, repair (mechanic, electric, automation) in technological installations.

Work safety and health training for Azomures employees, in all stages (upon hiring, at work, periodically, supplementary) and work safety and health instruction for the employees from the companies that perform services based on contract and for the persons that are on the platform with the employer's permission, related to:

- risk of professional injury and illness at the work place
- minimal requests of health and safety of work, stipulated by legal regulations applicable to the specific activity at the work place
- tasks and responsibilities of the employees
- usage of work equipment and individual protection equipment
- prevention and protection measures, action plan in case of danger
- giving first aid to the injured at the work place

#### **Risk management measures for human health**

No risk management measures were identified.

FH-C20-033\_V.10/ 09.10.2020

### 8.2.2. Personal protection measures, such as personal protection equipment

- (a) Respiratory protection: P2 protective mask
- (b) Hand protection: *chemical resistant protective gloves according to EN374*
- (c) Eye protection: protective goggles with side shields
- (d) Skin protection:

Protection clothing:

Dust resistant overalls (breastplate duck overalls, coat).

Winter or summer shirt (natural fibers – duck)

Protective footwear:

Protective boots resistant to corrosive chemical agents (rubber, PVC).

Chemical and mechanical aggression resistant boots, with anti-static properties that allow usage in explosive environments (leather with rubber soles).

### 8.2.3 Environmental exposure control

*In sections 9 and 10 of the CSR (generated with Chesar 3.5 using in addition a separate environmental assessment in EUSES), regional environmental concentrations are set.*

*Quantitative risk assessments show that the risk of effects is considered to be controlled for potential combined exposures in the exposure scenarios.*

## SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

### 9.1. Information concerning the main physical and chemical properties

a) Aspect of the substance/mixture

Aspect: fine, crystalline powder

b) Odor: odorless

No	Properties	Results	Values used for CSA / Discussions
(c)	Physical state 20 °C and 1013 hPa	Melamine is a white powder	Value used for CSA: solid
(d)	Boiling point/ boiling temperature interval	<i>According to Annex VII of REACH, the study should not be performed for solids that melt above 300 °C. The melting point of melamine is &gt; 300 °C.</i>	Melamine decomposes and sublimates at temperatures close to and above the melting temperature.
(e)	Melting / freezing point	361 °C	Value used for CSA: 634 K at 1013 hPa
(f)	Flammability	non flammable	Value used for CSA: non flammable
(g)	Relative density	1.57	Value used for CSA: 1.57 at 20 °C

**FH-C20-033\_V.10/ 09.10.2020**

No	Properties	Results	Values used for CSA / Discussions
(h)	Granulometry	Particle median diameter <100µm	
(i)	Vapour pressure	A waiver is requested. <i>Available studies indicate a very low vapor pressure.</i>	Value used for CSA: 0.00000001 Pa at 20 °C
(j)	Water solubility	3.48 g/L at 20 °C	Value used for CSA: 3.48 g/L at 20 °C
(k)	Partition coefficient n-octanol/water	-1.22	Value used for CSA: log Kow (Pow): -1.22 at 20 °C
(l)	<i>Solubility in organic solvents / fat solubility</i>		<i>The solubility of melamine was determined in acetone (0.3 g / L), ethanol (0.6 g / L), dimethylformamide (0.1 g / L) and ethylcellosolv (11.2 g / L) at 30 °C.</i>
(m)	Autoflammability	>400°C	No autoflammability was observed
(n)	Dissociation constant	pKb1 = 7.3	Value used for CSA: pKa at 20 °C: 6.7
(o)	Oxidising properties		Value used for CSA: Oxidizing: no
(p)	Stability in organic solvents and identity of relevant degradation products	The stability of melamine is considered to be high	According to Annex IX of REACH, the study is "only required if the stability of the substance is considered to be critical". The stability of melamine is high and is not considered to be critical.
(r)	Surface tension	A waiver is requested	Melamine does not have tensioactive properties.  Surface activity is not a desired property of melamine.
(s)	Flash point	The flash point is a possible characteristic of liquids. The method is not applicable.	Although the flash point is a property of liquids, it was reported in 3 documents (possibly referring to the same source) for the solid melamine to be >280 °C.
(ș)	Explosive properties	Melamine powder has a low potential for explosibility	Value used for CSA: non explosive

**FH-C20-033\_V.10/ 09.10.2020**

No	Properties	Results	Values used for CSA / Discussions
(t)	Viscosity		Melamine is a solid. Therefore the determination of the viscosity is technically not feasible.
(u)	Thermal stability	Melamine is stable until cca. 280 °C.	Combustible vapours develop at >280 °C. Hazardous decomposition products are possible: > 300 °C: liberation of NH <sub>3</sub> > 600 °C: liberation of HCN
(v)	<i>Storage stability and reactivity to the container material</i>	<i>There is no indication of the danger of corrosion of metals</i>	<i>Solids and solids that cannot become liquid during transport are exempted from metal corrosion testing.</i>

**9.2. Additional information**

No available additional information.

**SECTION 10. STABILITY AND REACTIVITY**
**10.1. Reactivity**

No available data.

**10.2. Chemical stability**

The product is stable in normal conditions of storage, handling and usage.

**10.3. Hazardous reactions potential**

Not applicable.

**10.4. Conditions to avoid**

**Temperature** – heating above 300 °C  
 Keep away from heat sources, sparks and flames.

**10.5. Incompatible materials**

*There are no special recommendations.*

**10.6. Hazardous decomposition products**

**FH-C20-033\_V.10/ 09.10.2020**

When heated at temperatures > 600°C it may release toxic gases: carbon monoxide, carbon dioxide, nitrogen oxides, ammonia, amines, and hydrocyanic acid.

Keeping the product at high temperatures for long periods of time may lead to the decomposition of melamine, releasing ammonia and forming melem, melam and melon (corrosive polycondensation products).

## **SECTION 11. TOXICOLOGICAL INFORMATION**

### **Toxicokinetics (absorption, metabolism, distribution and elimination)**

Oral absorption: *Fast, with a distribution / absorption half-life of 0.25 h in rats.*

*Absorption: quite complete; 73-98% are reported in rats. The maximum plasma concentration time is 0.75 to 2.7 hours in rats, 2.7 hours in monkeys. No first pass effect was observed.*

Absorption mainly in the small intestine.

*Plasma elimination: half-lives of 1.6 to 4.9 hours are reported in rats; 4.4 hours in monkeys, 4.1 hours in pigs.*

*Elimination: mainly in urine in rats. The urine excretion peak in monkeys is delayed compared to rats.*

*Distribution: to body water. Distribution volume: 0.1 to 1.3 ml / g are reported in rats. Melamine crosses the placental barrier and is detected in fetal tissues.*

Metabolism: none; melamine is excreted unchanged.

Value used for CSA:

*Bioaccumulation potential: no bioaccumulation potential*

*Additional information:*

*Studies on the kinetics and metabolism of melamine were performed in rat, human, monkey, pig, cow and sheep. The placental transfer and transfer to milk were investigated.*

### **11.1. Information on toxicological effects**

**The relevant hazard classes** for which information is provided are:

- (a) Acute toxicity
- (b) Skin corrosion / irritation
- (c) Eye irritation / damage
- (d) Sensitization of the skin or the respiratory system
- (e) Mutagenicity germ cell
- (f) Carcinogenicity
- (g) Toxicity for reproduction
- (h) STOT (specific target organs of toxicity) – unique exposure
- (i) STOT (specific target organs of toxicity) – repeated exposure
- (j) Aspiration hazard

#### **11.1.1 Information for each hazard class**

##### **(a) Acute toxicity**

oral - rat - LD50 > 3000 mg/kg bw

dermal - rat - LD50 > 2000 mg/kg bw

**FH-C20-033\_V.10/ 09.10.2020**

inhalation - rat - LC50 > 5190 mg/m<sup>3</sup>

Melamine has a low acute toxicity by the oral, dermal and inhalation route.

Value used for CSA: LD50 (oral, rat): 3161 mg/kg bw

**(b) Repeated dose toxicity**

oral - NOAEL: 72 mg/kg bw/day (13 weeks, rat)

dermal - *based on the estimated low dermal absorption of melamine and toxicokinetic behavior (rapid oral absorption, without metabolism), it can be estimated that the dermal toxicity of melamine will be much lower than oral. Therefore, no dermal study is required.*

inhalation - NOAEC : 54.8 mg/m<sup>3</sup> (13 weeks, rat)

Value used for CSA (route: oral):

NOAEL: 63 mg/kg bw/day (subchronic and long-term; rat)

Affected organs: urinary tract: urinary bladder

*LOAEL: 150 mg / kg body weight / day (13 weeks, rat) in the key study is higher than the guideline value for a severe toxic effect in a subchronic study of <100 mg / kg body weight per day, which is mentioned in CLP . Therefore, no classification is required regarding "specific target organ toxicity - repeated exposure".*

**(b) Skin corrosion / irritation**

Melamine is not irritant for the skin.

**(c) Eye irritation**

Eye irritation: studies indicate that melamine is not irritant for the eyes.

**(d) Sensitization of the skin or the respiratory system**

Studies indicate that melamine is not a skin or respiratory sensitizer.

**(e) Mutagenicity**

Evaluation of results: mostly negative

Value used for CSA: genetic toxicity: negative

Therefore no classification of melamine as to genotoxicity is required.

**(f) Carcinogenicity –**

Value used for CSA (route: oral): NOAEL: ca. 140 mg / kg body weight / day (2 years, male rats).

Affected organs: urogenital tract: bladder

Classification for carcinogenicity is not required.

Value used for CSA (route: oral): observed adverse effect

*(LOAEL: 126 mg / kg body weight / day (chronic); (rat [common rodent species])*

Target organs: bladder

Value used for CSA (pathway: dermal): no study available

Value used for CSA (pathway: inhalation): no study available

Melamine should not be classified as a carcinogen according to CLP.

**(g) Toxicity for reproduction**

*For risk assessment, the observed effects on the testis and sperm are relevant and are therefore considered when obtaining NOAEL for toxicity to reproductive function.*

Value used for CSA (route: oral): observed adverse effect

*(NOAEL: > = 150 mg / kg body weight / day (subacute, 168 hours / week rat) [common rodent species]*

Value used for CSA (pathway: dermal): no study available

Value used for CSA (pathway: inhalation): no studies available



FH-C20-033\_V.10/ 09.10.2020

***Based on the available experimental data on animals, melamine is classified as Toxic for reproduction, category 2 (H361f) according to Regulation (EC) No 1907/2006. 1272/2008.***

(h) STOT – single exposure - no data available

(i) STOT – repeated exposure - no data available

(j) Aspiration hazard - no data available

**11.1.2** The data in this subsection apply to the melamine – they are available in the Chemical Safety Report.

**11.1.3 The results of experimental studies by route of exposure:**

The acute toxicity after oral administration – experimental studies were done on mice male/female, rats male/female.

LD50 was determined by methods: NTP standards, BASF – test and Internal guidelines of Hoechst AG. The study result provides LD50 > 3000 mg/kg bw. NTP study was selected as the key study. It reports an LD50 = 3161 mg/kg bw.

The acute toxicity after administration by inhalation – experimental studies were done on rats male/female. LC50 was determined by methods: Muijser H (1998), OECD Guideline 403, EU Methode B.2, BASF test.

Muijser (1988) study is considered to be sufficiently reliable, the LC50 inhalation, rat > 5190 mg/m<sup>3</sup>.

The acute toxicity after dermal administration - experimental studies were done on rabbit, the results reporting an LD50: > 1000 mg/kg bw. The determination of the LD50 dermal, rat is waived, but an old study yielding an LD50 dermal, rat > 1000 mg/kg bw.

The studies results lead to the conclusion that melamine has a low acute toxicity by the oral, dermal and inhalation route.

**11.1.4** For the following hazard classes: STOT – single exposure, STOT – repeated exposure, aspiration hazard - no data available.

**11.1.5** Information on the likely routes of exposure

On the likely routes of exposure are inhalation, ingestion et exposing skin / eyes.

Dermal exposure - there was no study has been carried out, because it was not considered necessary.

Inhalation exposure – one study was performed, but it is clear if the exposure was made from dust, fumes, or aerosols; the NOAEL being different depending on the duration of exposure.

Ingestion exposure – no data available.

Details of the exposure can be found in the Chemical Safety Report.

**11.1.6** Symptoms related to the physical, chemical and toxicological characteristics

No data available.

**11.1.7** The known delayed and immediate effects and the chronic effects of long term exposure and short term exposure

Known effects after long term exposure - rat NOAEL: 63 mg/kg bw/day affected organs are urinary tract: bladder.

Observations related to human exposure

*The incidence of urolithiasis in infants, especially in China, caused by milk and adulterated formulas is reported in many papers.*

In humans, produces melamine crystals in urine when the concentration exceeds a certain threshold.

Toxic effects on animals and pets



**FH-C20-033\_V.10/ 09.10.2020**

Melamine has been detected in the food of various animals: dogs, cats, pigs, ducks, fish, shrimp. In reviews and case studies, it is reported that melamine in feed can cause renal toxic effects, crystals and / or stones in the urinary tract.

**11.1.8 Interactive effects**

No data available.

**11.1.9 Absence of specific data**

No data available.

<b>SECTION 12.</b>	<b>ECOLOGICAL INFORMATION</b>
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<b>12.1. Toxicity</b>
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**Aquatic compartment (including sediments)**

Melamine is of low toxicity (ecotoxicity) for aquatic organisms.

Short-term toxicity for fish

Acute toxicity: The acute toxicity of melamine to fish is low:

LC50 (48 hours) > 500 mg/L

Long-term toxicity for fish

Melamine has a low long-term toxicity to fish.

Value used for CSA: EC10/LC10 or NOEC: 5.1 mg/L

Toxicity for aquatic invertebrates

Short-term toxicity - freshwater - Daphnia magna

EC50 / LC50 (48 hours): 200 mg/L based on mortality and immobility

Long-term toxicity - freshwater - Daphnia magna

Value used for CSA: NOEC: 18 mg/L

Toxicity for algae

Value used for CSA: EC10/LC10 or NOEC for freshwater algae: 98 mg/L

EC50/LC50 for freshwater algae: 325 mg/L

Other aquatic organisms – no available data.

PNEC calculation - PNEC aqua (freshwater): 1.8 mg/L

PNEC aqua (marine water): 0.18 mg/L

PNEC aqua (intermittent releases): 2 mg/L

PNEC sediments (freshwater): 19.4 mg/kg dry sediment

PNEC sediments (marine water): 1.94 mg/kg dry sediment

*air: no hazard identified*

*secondary poisoning: no potential for bioaccumulation*

**Terrestrial compartment**

Toxicity to soil macro-organisms, except for arthropods

Melamine has a low potential to adsorb to soil. Based on the low n-octanol/water partition coefficient also the adsorption to soil or sediment is expected to be low.

Toxicity to terrestrial plants - low

FH-C20-033\_V.10/ 09.10.2020

**Atmospheric compartment** - No available data.

### **Microbiological activity in STP**

#### Toxicity for aquatic micro-organisms

Value used for CSA: EC10 / LC10 or NOEC for aquatic micro-organisms: 2000 mg / L

For wastewater treatment plant: PNEC STP: 2000 mg / L

## **12.2. Persistence and degradability**

### Abiotic degradability

#### Hydrolysis

Melamine is a stable molecule that is hydrolysed only by mineral acid or inorganic alkali. Hydrolysis proceeds stepwise, with loss of one, two, or all three amino groups, i.e. producing ammeline, ammelide and cyanuric acid.

Photolysis - No data except for the light absorption spectra are available. The maximum light absorption was determined at 235 nm.

Phototransformation in air, water and soil - no data are available

#### Biodegradation

Value used for CSA: Biodegradation in water: under test conditions no biodegradation observed.

Melamine is not readily biodegradable and also not inherently biodegradable.

*Melamine has a low adsorption potential in the soil, logKoc is estimated at 1.1 to 1.5.*

Melamine can be degraded by adapted micro-organisms or if additional energy is supplied to the micro-organisms.

## **12.3. Potential for bioaccumulation**

### Aquatic bioaccumulation

Bioconcentration factors BCF of <1 were reported for fish in most cases. Melamine is of low toxicity to aquatic organisms, no classification is required. Melamine does not bioaccumulate.

Value used for CSA:

BCF: 3.8 L / kg ww

### Terrestrial bioaccumulation

No available data.

### Secondary poisoning

*Based on the available information, there is no indication of a potential for bioaccumulation and therefore secondary poisoning is not considered relevant.*

## **12.4. Mobility in soil**

### Adsorption/desorption

Melamine has a low potential for adsorption. LogKoc estimated by QSAR is low, between 1.1 and 1.5.

### Volatilization

**FH-C20-033\_V.10/ 09.10.2020**

Volatilisation as indicated by the Henry's law constant is very low. The Henry's law constant is estimated to  $2 \cdot 10 \exp(-13)$  atm. m<sup>3</sup>/mol at 25 °C.

Distribution modeling - Melamine distributes only to the water (94%) and to the air (6%).

**12.5. PBT and vPvB assessment results**

Melamine is not a PBT nor a vPvB substance.

**12.6. Other adverse effects**

There is no information concerning other adverse effects on the environment.

**SECTION 13. DISPOSAL CONSIDERATIONS**

**13.1. Waste treatment methods**

Recycle the product in accordance with local regulations in use.

Packaging wastes contaminated with melamine that cannot be reused must be directed to a company authorized for the disposal of packaging wastes.

**Relevant provisions of the harmonized EU legislation and domestic legislation regarding waste.**

National legislation in force:

Law no. 211/2011 concerning wastes treatment.

Law no. 265/2006 – The Law on environment protection.

Law no. 249/2015 related to the packaging and waste packaging management.

GD no. 856/2002 - The evidence of wastes management, with subsequent modifications.

Law on labor security and health no. 319/2006, GD no. 1425/2006 on approving the Methodological Norms for the enforcement of the provisions set by the Law on labor security and health no. 319/2006, GD no.355/2007 on the surveillance of workers' health with subsequent modifications.

Decision no. 1061/2008 on transport of hazardous or non-hazardous wastes on Romanian territory, with subsequent modifications.

UE Legislation in force:

Regulation (EC) no. 1907/2006 of the European Parliament and of the Council regarding the Registration, evaluation authorization and restriction of chemicals (REACH).

Regulation (EC) no. 1272/2008 of the European Parliament and of the Council on the classification, labeling and packaging of substances and mixtures.

European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR).

European Agreement concerning the International Carriage of Dangerous Goods by Rail (RID).

Regulations on the International Carriage of Dangerous Goods by Sea (IMDG)

**SECTION 14. TRANSPORT INFORMATION**

Melamine is not classified according to UN Orange Book, RID, ADR, and IMDG; it is not considered dangerous for transportation.

**FH-C20-033\_V.10/ 09.10.2020**

Chapters 14.1; 14.2; 14.3; 14.4 are not applicable.

#### **14.5. Environmental hazards**

No available information.

#### **14.6. Special precautions for users**

Melamine is packed in waxed polypropylene big bags of 350 kg, 500 kg, 750 kg, 1000 kg and 1200 kg, or in 25 kg multi-layer paper bags with a valve. The tolerance is  $\pm 1\%$  of the net weight of the quantity packed in each bag.

The marking on the bag is in compliance with the legislation in use.

The marking on the bags and as well as all the accompanying documents must be edited in at least one official language of UE (for export).

Packed chemical products are identified by the data written on the label or on the package. Identification data for the product delivered in bulk are specified in accompanying documents.

Each delivery is accompanied by the Declaration of Conformity.

At the client's request the product is accompanied by the Test Report.

Melamine is delivered in clean, dry, covered transport means. The bags must be placed so as not to turn over during transportation.

#### **14.7. Bulk transport, according to Annex II to MARPOL convention and IBC Code**

Not applicable.

### **SECTION 15. REGULATORY INFORMATION**

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

##### **Relevant information regarding the domestic legislation**

Law on labor security and health no. 319/2006, GD no.1425/2006 on approving the Methodological Norms for the enforcement of the provisions set by the Law on labor security and health no. 319/2006, GD no. 355/2007 on the surveillance of workers' health with subsequent modifications.

Law no. 265/2006 for the amendment of GEO no.195/2005 on environment protection

Decision no. 1391/2006 for the approval of the Regulation concerning the application of Government Emergency Ordinance no. 195/2002 regarding traffic on public roads, with subsequent amendments and supplements.

Government Ordinance no. 651/2003 for the modification and completion of Government Decision no. 716/2001 for establishing trading conditions for chemicals fertilizers coming from domestic production and import.

Law no. 278/2013 on industrial emissions.

##### **Relevant information regarding the EU legislation**

10.1.0.11/iso

Page: 19 / 23

**FH-C20-033\_V.10/ 09.10.2020**

Regulation (EC) no. 1907/2006 of the European Parliament and of the Council regarding the Registration, evaluation authorization and restriction of chemicals (REACH).

Regulation (EC) no. 1272/2008 of the European Parliament and of the Council on the classification, labeling and packaging of substances and mixtures.

Regulation (EU) no. 286/2011 by the Commission from 10.03.2011 amending Regulation (EC) no. 1272/2008.

Regulation (EC) no. 830/2015 of the Commission from date of 28.05.2015 amending Regulation (EC) no. 1907/2006.

EC no. 2003/2003 regulation of the European Parliament regarding fertilizers with its subsequent amendments relating to EN standards drawn up by the European Committee for Standardization.

European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), 2017 edition.

Regulation referring to the International Carriage of Dangerous Goods by Rail (RID), 2017 edition  
International Maritime Dangerous Goods (IMDG), 2017 edition.

**15.2 Chemical safety assessment**

A chemical safety assessment (CSA) was conducted and a chemical safety report (CSR) was elaborated for melamine.

**SECTION 16. ADDITIONAL INFORMATION**

**a) A clear evidence of added, deleted or modified information**

Version (revision, edition) number	Date	Page number	Evolution of the information
edition 5, revision 0	06.01.2014	7, 14	At page 7, chapter 8.2.1. Organizational measures, Monitoring and intervention plans were modified. At page 14 section 15.1 – information regarding national legislation was modified.
version 6	06.11.2014	1, 2, 5	All pages were replaced edition and revision with version. At page 1 was modified the form number. At page 2, section 2.2 – labeling, the value melamine content was modified. At page 5, section 7.2 – safe storage conditions were added 1200 kg bags.
version 7	01.06.2015	1, 2, 13	At page 1, section 1.4 emergency telephone number was modified.

**FH-C20-033\_V.10/ 09.10.2020**

Version (revision, edition) number	Date	Page number	Evolution of the information
			At page 2, in section 2.1 it was removed classification in accordance with directive 67/548/ EEC. At page 13, chapter 13.1 - Waste treatment methods national legislation was modified.
version 8	04.04.2016	11, 16	At page 11, section 11 they have introduced additional toxicological data. At page 16, section 15.1 it was introduced Regulation no.830/2015.
version 9	08.02.2018	2, 3, 6, 16	At page 2 section 2.2 has changed the content of melamine. At page 3 section 3.1 changed purity degree of melamine. At page 6 and 16 section 7.2 și 14.6 were added 350 kg bags.
version 10	09.10.2020	1	1.2: text deleted; text introduced
		2	2.1: text deleted; text introduced
		3	2.2: introduced the classification
		4	4.1: text introduced
		4	4.3: text introduced
		5	5: text introduced
		6	6: text deleted; text introduced
		6	7: text introduced
		8	8.1: text deleted; text introduced
		8	8.2.3: text deleted; text introduced
		11	9: text deleted; text introduced
		13	10.5: text deleted; text introduced
		13	11: text deleted; text introduced
17	12: text deleted; text introduced		

**b) List of abbreviations and acronyms used throughout the Safety Data Sheet**

SDS	- Safety Data Sheet
ECHA	- European Chemicals Agency
EC	- European Commission
ESIS	- European Chemical Substances Information System
(FE) EFMA	- Fertilizers Europe (European Fertilizer Manufacturers Association)

**FH-C20-033\_V.10/ 09.10.2020**

REACH	- EC Regulation No. 1907/2006 of the European Parliament and Council concerning the registration, evaluation, authorization and restriction of chemical substances
CSR	- Chemical Safety Report
CSA	- Chemical Safety Assessment
DNEL	- Derived no effect level
DMEL	- Derived minimal effect level
PNEC	- Predicted No Effect Concentration
LOAEL	- Lowest observed adverse effect level
LOAEC	- Lowest observed adverse effect concentration
STP	- Sewage treatment plant
BCF	- Bioconcentration factor
NOAEL	- No observed adverse effect level
NOAEC	- No observed adverse effect concentration
QSAR	- Quantitative structure-activity relationship
EC50	- Concentration of toxic material for which 50% of the tested organisms survive
LD50	- Lethal dose for 50% of the tested population
LC50	- Lethal concentration for 50% of the tested population
STOT	- Specific target organs of toxicity
PBT	- Persistent, Bioaccumulative, Toxic
vPvB	- Very Persistent, Very Bioaccumulative
ISCIR	- State Inspection for the Control of Boilers, Under-Pressure Vessels and Lifting Devices
ACGIH	- American Conference of Governmental Industrial Hygienists
ADR	- European Agreement referring to the International Carriage of Dangerous Goods by Road, 2017 edition
RID	- Regulation referring to the International Carriage of Dangerous Goods by Rail (RID), 2017 edition
IMDG	- Regulations referring to the maritime transportation of hazardous Substances, 2017 edition
MARPOL	- International Convention for the Prevention of Pollution from Ships
IBC	- International Code for the construction and equipment of ships carrying dangerous chemicals in bulk
w/w	- mass unit

**c) Bibliography**

Studies according to the Chemical Safety Report

Guidance on safe use – The joint/individual ECHA Registration file for the substance

Official Journal of the European Union – EU Regulation no. 830/2015 of the European Council of 28.05.2015

EFMA - Guidance for the Compilation of Safety Data Sheets for Fertilizer Materials.



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**FH-C20-033\_V.10/ 09.10.2020**

ESIS - European Chemical Substances Information System

Official Journal of the European Union – EC Regulation no. 1907/2006 of the European Parliament and Council concerning the registration, evaluation, authorization and restriction of chemical substances (REACH)

**Note:**

The information included in this safety data sheet is based on the data available at the time of publication.

The client and the user assume all risks regarding usage, handling and storage of this product.

There are no guarantees for the product in case of improper handling, transport and storage of the product, not complying with the specifications of the Technical Specification and the Safety Data Sheet.

## 9. EXPOSURE ASSESSMENT (and related risk characterisation)

The sections 9 and 10 of this CSR have been generated with Chesar 3.5, using additionally a separate environmental assessment in EUSES, due to the taken approach for establishing the regional environmental concentrations (see section 10 for details).

### 9.0. Introduction

#### 9.0.1. Overview on uses

See the description of the various uses in section 2 of the CSR.

#### 9.0.2. Assessment entity groups

Not applicable

#### 9.0.3. Introduction to the assessment for the environment

##### 9.0.3.1. Tonnage

The following table provides the tonnage per use and the local tonnages used in the assessment for each environmental contributing activity. The local tonnage corresponds to a tonnage at the site for uses taking place at industrial sites and to a tonnage assumed for a town of 10 000 inhabitants for widespread uses.

**Table 9.1. Tonnage for assessment**

ES#	Exposure scenario (ES) name and related environmental contributing scenarios	Tonnage per use (t/year)	Daily local tonnage (t/day)	Annual local tonnage (t/year)
ES1 (M)	Manufacturing of substance	≥1E3		
	- Manufacturing of substance (ERC 1)		a	b
ES2 (F)	Formulation or re-packaging	≥1E3		
	- Formulation or re-packaging (ERC 2)		a	b
ES3 (IS)	Use as intermediate for resins (reacted melamine)	≥1E3		
	- Use as intermediate for resins (reacted melamine) (ERC 6c)		a	b
ES4 (IS)	Use of resins with unreacted residual melamine	≥1E3		
	- Use of resins with unreacted residual melamine (ERC 5)		a	b
ES5 (IS)	Use as intermediate for the production of other substances e.g. melamine salt (reacted melamine)	≥1E3		
	- Use as intermediate for the production of other substances e.g. melamine salt (reacted melamine) (ERC 6a)		a	b
ES6 (IS)	Use as additive in foams	≥1E3		
	- Use as additive in foams (ERC 5)		a	b
ES7 (IS)	Use as additive in intumescent coatings	≥1E3		
	- Use as additive in intumescent coatings (ERC 5)		a	b
ES8 (PW)	Use as additive in intumescent coatings	≥1E3		
	- Use as additive in intumescent coatings (ERC 8c)		a	-
ES9 (SL)	PU foams - Workers (industrial)	≥1E3		

**FH-C20-033\_V.10/ 09.10.2020**

ES#	Exposure scenario (ES) name and related environmental contributing scenarios	Tonnage per use (t/year)	Daily local tonnage (t/day)	Annual local tonnage (t/year)
	- PU foams - Workers (industrial) (ERC 12a)		a	b
ES10 (SL)	Intumescent coatings - Workers (industrial)	≥1E3		
	- Intumescent coatings - Workers (industrial) (ERC 12a)		a	b
ES11 (SL)	Intumescent coatings - Professional Workers	≥1E3		
	- Intumescent coatings - Professional Workers (ERC 11a)		a	-
ES12 (SL)	PU foams – Consumers	≥1E3		
	- PU foams – Consumers (ERC 11a)		a	-
ES13 (SL)	Intumescent coating – Consumers	≥1E3		
	- Intumescent coating – Consumers (ERC 11a)		a	-

a: multiple uses, multiple sites and use of site specific releases do not allow for a single value for the daily local tonnage

b: multiple uses, multiple sites and use of site specific releases do not allow for a single value for the annual local tonnage

**9.0.3.2. Scope and type of assessment for the environment**

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

**Table 9.2. Type of risk characterisation required for the environment**

Protection target	Risk characterisation type	Hazard conclusion (see section 7)
Fresh water	Quantitative	PNEC aqua (freshwater) = 0.51 mg/L
Sediment (freshwater)	Quantitative	PNEC sediment (freshwater) = 2.524 mg/kg sediment dw
Marine water	Quantitative	PNEC aqua (marine water) = 0.051 mg/L
Sediment (marine water)	Quantitative	PNEC sediment (marine water) = 0.252 mg/kg sediment dw
Sewage Treatment Plant	Quantitative	PNEC STP = 200 mg/L
Air	Not needed	No hazard identified
Agricultural soil	Quantitative	PNEC soil = 0.206 mg/kg soil dw
Predator's prey (freshwater)	Not needed	No potential for bioaccumulation
Predator's prey (marine water)	Not needed	No potential for bioaccumulation
Top predator's prey (marine water)	Not needed	No potential for bioaccumulation
Predator's prey (terrestrial)	Not needed	No potential for bioaccumulation

**9.0.3.3. Fate and distribution parameters**

**FH-C20-033\_V.10/ 09.10.2020**

### **Physicochemical properties used for exposure estimation**

The following substance properties are used in the fate estimation done by EUSES. They correspond to the “value used for CSA” reported in sections 1 and 4.

**Table 9.3. Substance key phys-chem and fate properties**

Substance property	Value
Molecular weight used for the assessment	126.1
Melting point at 101 325 Pa	634 K
Vapour pressure	1E-8 Pa at 20 °C
Partition coefficient (Log Kow)	-1.22 at 20 °C
Water solubility	3.48 g/L at 20 °C
Biodegradation in water: screening tests	under test conditions no biodegradation observed
Bioaccumulation: BCF (aquatic species)	3.8 L/kg ww
Adsorption/Desorption: Koc at 20 °C	13.49

### **Fate (release percentage) in the modelled biological sewage treatment plant**

In a standard (modelled) biological STP, the emissions are distributed in the following way:

Release to water	99.83%
Release to air	4.75E-10%
Release to sludge	0.169%
Release degraded	0%

The above fractions are calculated by the SIMPLETREAT model integrated in EUSES (resulting in an effectiveness water of 0.169%).

#### **9.0.3.4. Comments on assessment approach for the environment**

The regional concentrations are reported in section 10.2. The local Predicted Exposure Concentrations (PECs) reported for each contributing scenario correspond to the sum of the local concentrations (Clocal) and the regional concentrations (PEC regional).

#### **9.0.3.5. Scope and type of assessment for man via environment**

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

**Table 9.4. Type of risk characterisation required for man via the environment**

Route of exposure and type of effects	Risk characterisation type	Hazard conclusion (see section 5.11)
<b>Inhalation:</b> Long term, Systemic	Quantitative	DNEL (Derived No Effect Level) = 1.5 mg/m <sup>3</sup>
<b>Inhalation:</b> Long term, Local	Not needed	No hazard identified
<b>Oral:</b> Long term, Systemic	Quantitative	DNEL (Derived No Effect Level) = 0.42 mg/kg bw/day

### **9.0.4. Introduction to the assessment for workers**

#### **9.0.4.1. Scope and type of assessment for workers**

**FH-C20-033\_V.10/ 09.10.2020**

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

In Chesar worker inhalation exposure to dust is modelled in most cases, as this is the most relevant way in which workers may be exposed to the substance. Also it can be considered a worst-case approach, as due to the vapour pressure of the substance any vapour exposure due to the use of a liquid containing the substance is considered to result in lower exposure estimates.

For uses where it is known that it is liquid exposure (while safe use cannot be shown by modelling exposure to dust, e.g. where aerosol formation may be relevant), exposure to liquid is modelled instead. Using either Chesar, for cases where aerosol formation is not relevant, or Stoffenmanager® (in case of PROC 7, 10, 11 and 19).

**Table 9.5. Type of risk characterisation required for workers**

Route	Type of effect	Risk characterisation type	Hazard conclusion (see section 5.11)
Inhalation	Systemic effects - long term	Quantitative	DNEL (Derived No Effect Level) = 8.3 mg/m <sup>3</sup>
	Systemic effects - acute	Quantitative	DNEL (Derived No Effect Level) = 82.3 mg/m <sup>3</sup>
	Local effects - long term	Not needed	No hazard identified
	Local effects - acute	Not needed	No hazard identified
Dermal	Systemic effects - long term	Quantitative	DNEL (Derived No Effect Level) = 11.8 mg/kg bw/day
	Systemic effects - acute	Not needed (see below)	DNEL (Derived No Effect Level) = 117 mg/kg bw/day
	Local effects - long term	Not needed	No hazard identified
	Local effects - acute	Not needed	No hazard identified
Eye	Local effects	Not needed	No hazard identified

Dermal, systemic effects, acute

TRA Workers does not predict short-term dermal exposures. Also the ECHA Guidance provides no guidance on the (numerical) relationship between an 8 hour estimate and its related short-term exposure estimate. While for the inhalation route an 8 hour exposure estimate is multiplied with a factor of 4, for all PROCs. As the difference in the short- and long-term DNEL is a factor of 10 (117 vs. 11.8 mg/kg bw/day), it is not considered needed to perform additional exposure and risk assessment for short-term dermal exposure. When the risk of systemic effects due to long-term exposure is controlled, also the risk of systemic effects due to short-term exposure is considered controlled, given this large difference in DNELs and the way any exposure estimate would be derived (e.g. by applying a multiplication factor on the long-term estimate).

**9.0.5. Introduction to the assessment for consumers**

**9.0.5.1. Scope and type of assessment for consumers**

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

**Table 9.6. Type of risk characterisation required for consumers**

Route	Type of effect	Risk characterisation type	Hazard conclusion (see section 5.11)
Inhalation	Systemic effects -	Quantitative	DNEL (Derived No Effect Level) = 1.5 mg/m <sup>3</sup>

**FH-C20-033\_V.10/ 09.10.2020**

Route	Type of effect	Risk characterisation type	Hazard conclusion (see section 5.11)
	long term		
	Systemic effects - acute	Not needed	No hazard identified
	Local effects - long term	Not needed	No hazard identified
	Local effects - acute	Not needed	No hazard identified
<b>Dermal</b>	Systemic effects - long term	Quantitative	DNEL (Derived No Effect Level) = 4.2 mg/kg bw/day
	Systemic effects - acute	Not needed	No hazard identified
	Local effects - long term	Not needed	No hazard identified
	Local effects - acute	Not needed	No hazard identified
<b>Oral</b>	Systemic effects - long term	Quantitative	DNEL (Derived No Effect Level) = 0.42 mg/kg bw/day
<b>Eye</b>	Local effects	Not needed	No hazard identified

**9.1. Exposure scenario 1: Manufacture - Manufacturing of substance**

Environment contributing scenario(s):		
CS 1	Manufacturing of substance	ERC 1
Worker contributing scenario(s):		
CS 2	Chemical production or refinery in closed process without PROC 1 likelihood of exposure or processes with equivalent containment conditions	
CS 3	Chemical production or refinery in closed continuous process with PROC 2 occasional controlled exposure or processes with equivalent containment conditions	
CS 4	Transfer of substance or mixture (charging and discharging) at PROC 8a non-dedicated facilities	
CS 5	Transfer of substance or mixture (charging and discharging) at PROC 8b dedicated facilities	
CS 6	Transfer of substance or mixture into small containers (dedicated PROC 9 filling line, including weighing)	
CS 7	Use as laboratory reagent	PROC 15
CS 8	Manual maintenance (cleaning and repair) of machinery	PROC 28

**9.1.1. Env CS 1: Manufacturing of substance (ERC 1)**

**9.1.1.1. Conditions of use**

Amount used, frequency and duration of use (or from service life)
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**FH-C20-033\_V.10/ 09.10.2020**

• Daily use amount at site: not relevant for the assessment
• Annual use amount at site: not relevant for the assessment
Conditions and measures related to on-site treatment of waste water containing the substance
• On-site wastewater treatment plant (WWTP), working continuously (365 days/year)
• Discharge rate of WWTP (directly to the river): 24000 m <sup>3</sup> /day
• Application of the WWTP sludge on agricultural soil: No
Other conditions affecting environmental exposure
• Receiving surface water flow rate (river): 2195424 m <sup>3</sup> /day (Dilution: 92.5)

**9.1.1.2. Releases**

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

**Table 9.7. Local releases to the environment**

Release	Release estimation method	Explanations
Water	Company specific data (measured)	<b>Local release rate (measured):</b> 72 kg/day (365 days/year)  It has been measured that the concentration of the substance in the effluent of the on-site WWTP is approx. 3 mg/L. Using this measured concentration and the flow rate of this effluent (24000 m <sup>3</sup> /day), the local release rate is calculated.
Air	Company specific data (measured)	<b>Local release rate (measured):</b> 0.61 kg/day (365 days/year)  It has been measured that approx. 1.7 mg/Nmc is released. Using this measurement and the flow rate of the released air, it is assessed that approx. 222 kg/year is released to the environment.
Non agricultural soil	Estimated release factor	<b>Release factor after on site RMM:</b> 0%

**9.1.1.3. Exposure and risks for the environment and man via the environment**

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.2.0 unless stated otherwise.

As this is a site-specific environmental assessment for the registrant and the effluent of the on-site wastewater treatment plant is discharged (directly) to the river, the protection targets Sewage Treatment Plant, Marine water and Sediment (marine water) are not included. There is no emission to a municipal STP nor to a coastal area.

**Table 9.8. Exposure concentrations and risks for the environment and man via the environment**

Protection target	Exposure concentration	Risk quantification
Fresh water	<b>Local PEC:</b> 0.037 mg/L	RCR = 0.073
Sediment (freshwater)	<b>Local PEC:</b> 0.185 mg/kg dw	RCR = 0.073
Agricultural soil	<b>Local PEC:</b> 4.22E-03 mg/kg dw	RCR = 0.021



**FH-C20-033\_V.10/ 09.10.2020**

Protection target	Exposure concentration	Risk quantification
Man via environment - Inhalation (systemic effects)	<b>Concentration in air:</b> 1.7E-04 mg/m <sup>3</sup>	RCR < 0.01
Man via environment - Oral	<b>Exposure via food consumption:</b> 6.25E-03 mg/kg bw/day	RCR = 0.015
Man via environment - combined routes		RCR = 0.015

**9.1.2. Worker CS 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC 1)**
**9.1.2.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.1.2.2. Exposure and risks for workers**

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

**Table 9.9. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.01 mg/m <sup>3</sup> (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.04 mg/m <sup>3</sup> (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR < 0.01

**9.1.3. Worker CS 3: Chemical production or refinery in closed continuous process with occasional controlled**

**FH-C20-033\_V.10/ 09.10.2020**

**exposure or processes with equivalent containment conditions (PROC 2)**

**9.1.3.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.1.3.2. Exposure and risks for workers**

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

**Table 9.10. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.06
Inhalation, systemic, acute	2 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.024
Dermal, systemic, long term	1.37 mg/kg bw/day (TRA Workers)	RCR = 0.116
Combined routes, systemic, long-term		RCR = 0.176

**9.1.4. Worker CS 4: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities (PROC 8a)**

**9.1.4.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	

**FH-C20-033\_V.10/ 09.10.2020**

	Method
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.1.4.2. Exposure and risks for workers**

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

**Table 9.11. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**9.1.5. Worker CS 5: Transfer of substance or mixture (charging and discharging) at dedicated facilities (PROC 8b)**
**9.1.5.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0

**FH-C20-033\_V.10/ 09.10.2020**

	Method
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.1.5.2. Exposure and risks for workers**

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

**Table 9.12. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.12
Inhalation, systemic, acute	4 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.049
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.353

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

**9.1.6.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0

**FH-C20-033\_V.10/ 09.10.2020**

	Method
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.1.6.2. Exposure and risks for workers**

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

**Table 9.13. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	1.372 mg/kg bw/day (TRA Workers)	RCR = 0.116
Combined routes, systemic, long-term		RCR = 0.719

**9.1.7. Worker CS 7: Use as laboratory reagent (PROC 15)**

**9.1.7.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.1.7.2. Exposure and risks for workers**

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

**Table 9.14. Exposure concentrations and risks for workers**

**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.06
Inhalation, systemic, acute	2 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.024
Dermal, systemic, long term	0.34 mg/kg bw/day (TRA Workers)	RCR = 0.029
Combined routes, systemic, long-term		RCR = 0.089

**9.1.8. Worker CS 8: Manual maintenance (cleaning and repair) of machinery (PROC 28)**
**9.1.8.1. Conditions of use**

	Method	
Product (article) characteristics		
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	ECETOC Workers 3.1	TRA
• Physical form of the used product: Solid (medium dusty form)	ECETOC Workers 3.1	TRA
Amount used (or contained in articles), frequency and duration of use/exposure		
• Duration of activity: ≤ 8 h/day	ECETOC Workers 3.1	TRA
Technical and organisational conditions and measures		
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	ECETOC Workers 3.1	TRA
• Occupational Health and Safety Management System: Advanced	ECETOC Workers 3.1	TRA
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	ECETOC Workers 3.1	TRA
Conditions and measures related to personal protection, hygiene and health evaluation		
• Respiratory protection: No [Effectiveness Inhalation: 0%]	ECETOC Workers 3.1	TRA
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	ECETOC Workers 3.1	TRA
Other conditions affecting workers exposure		
• Place of use: Indoor	ECETOC Workers 3.1	TRA
• Operating temperature: ≤ 40 °C	ECETOC Workers 3.1	TRA

**9.1.8.2. Exposure and risks for workers**

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

**Table 9.15. Exposure concentrations and risks for workers**

**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.243
Dermal, systemic, long term	2.742 mg/kg bw/day (ECETOC TRA Workers 3.1)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**Remarks on exposure data from external estimation tools:**

**ECETOC TRA Workers 3.1:**

Explanation: The exposure estimates for PROC 8a are used, as TRA Workers cannot predict exposure for PROC 28 and these estimates can be considered suitable for estimating exposures during manual maintenance.

**9.2. Exposure scenario 2: Formulation or re-packing - Formulation or re-packaging**

Environment contributing scenario(s):		
CS 1	Formulation or re-packaging	ERC 2
Worker contributing scenario(s):		
CS 2	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions	PROC 2
CS 3	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment conditions	PROC 3
CS 4	Chemical production where opportunity for exposure arises	PROC 4
CS 5	Mixing or blending in batch processes	PROC 5
CS 6	Transfer of substance or mixture (charging and discharging) at non-dedicated facilities	PROC 8a
CS 7	Transfer of substance or mixture (charging and discharging) at dedicated facilities	PROC 8b
CS 8	Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	PROC 9
CS 9	Tabletting, compression, extrusion, pelletisation, granulation	PROC 14
CS 10	Use as laboratory reagent	PROC 15
CS 11	Hand-mixing with intimate contact and only PPE available	PROC 19
CS 12	Manual maintenance (cleaning and repair) of machinery	PROC 28

**9.2.1. Env CS 1: Formulation or re-packaging (ERC 2)**

**9.2.1.1. Conditions of use**

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: not relevant for the assessment as scenario specific releases are estimated
• Annual use amount at site: not relevant for the assessment as scenario specific releases are estimated



FH-C20-033\_V.10/ 09.10.2020

Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 0.169%]
• Discharge rate of STP: $\geq 2E3$ m <sup>3</sup> /day
• Application of the STP sludge on agricultural soil: Yes
Other conditions affecting environmental exposure
• Receiving surface water flow rate: $\geq 1.8E4$ m <sup>3</sup> /day

### 9.2.1.2. Releases

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

**Table 9.16. Local releases to the environment**

Release	Release method	estimation	Explanations
Water	Estimated release rate		<b>Local release rate: 5 kg/day</b>
Air	Estimated release rate		<b>Local release rate: 1 kg/day</b>
Non agricultural soil	Estimated release factor		<b>Release factor after on site RMM: 0%</b>

### 9.2.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.2.0 unless stated otherwise.

**Table 9.17. Exposure concentrations and risks for the environment and man via the environment**

Protection target	Exposure concentration	Risk quantification
Fresh water	<b>Local PEC: 0.255 mg/L</b>	RCR = 0.50
Sediment (freshwater)	<b>Local PEC: 1.26 mg/kg dw</b>	RCR = 0.50
Marine water	<b>Local PEC: 0.0255 mg/L</b>	RCR = 0.50
Sediment (marine water)	<b>Local PEC: 0.126 mg/kg dw</b>	RCR = 0.50
Sewage Treatment Plant	<b>Local PEC: 2.496 mg/L</b>	RCR = 0.01
Agricultural soil	<b>Local PEC: 0.029 mg/kg dw</b>	RCR = 0.14
Man via environment - Inhalation (systemic effects)	<b>Concentration in air: 7.8E-5 mg/m<sup>3</sup></b>	RCR < 0.01
Man via environment - Oral	<b>Exposure via food consumption: 0.017 mg/kg bw/day</b>	RCR = 0.04
Man via environment - combined routes		RCR = 0.04

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

### 9.2.2.1. Conditions of use

**FH-C20-033\_V.10/ 09.10.2020**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.2.2.2. Exposure and risks for workers**

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

**Table 9.18. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.06
Inhalation, systemic, acute	2 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.024
Dermal, systemic, long term	1.37 mg/kg bw/day (TRA Workers)	RCR = 0.116
Combined routes, systemic, long-term		RCR = 0.176

**9.2.3. Worker CS 3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment conditions (PROC 3)**
**9.2.3.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	

**FH-C20-033\_V.10/ 09.10.2020**

	Method
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.2.3.2. Exposure and risks for workers**

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

**Table 9.19. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.12
Inhalation, systemic, acute	4 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.049
Dermal, systemic, long term	0.69 mg/kg bw/day (TRA Workers)	RCR = 0.058
Combined routes, systemic, long-term		RCR = 0.179

**9.2.4. Worker CS 4: Chemical production where opportunity for exposure arises (PROC 4)**

**9.2.4.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other)	TRA Workers 3.0

**FH-C20-033\_V.10/ 09.10.2020**

	Method
appropriate dermal protection [Effectiveness Dermal: 80%]	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.2.4.2. Exposure and risks for workers**

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

**Table 9.20. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	1.372 mg/kg bw/day (TRA Workers)	RCR = 0.116
Combined routes, systemic, long-term		RCR = 0.719

**9.2.5. Worker CS 5: Mixing or blending in batch processes (PROC 5)**

**9.2.5.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.2.5.2. Exposure and risks for workers**

**FH-C20-033\_V.10/ 09.10.2020**

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

**Table 9.21. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**9.2.6. Worker CS 6: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities (PROC 8a)**

**9.2.6.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.2.6.2. Exposure and risks for workers**

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

**Table 9.22. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243

**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**9.2.7. Worker CS 7: Transfer of substance or mixture (charging and discharging) at dedicated facilities (PROC 8b)**
**9.2.7.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.2.7.2. Exposure and risks for workers**

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

**Table 9.23. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.12
Inhalation, systemic, acute	4 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.049
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.353

**9.2.8. Worker CS 8: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9)**

**FH-C20-033\_V.10/ 09.10.2020**

**9.2.8.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.2.8.2. Exposure and risks for workers**

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

**Table 9.24. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	1.372 mg/kg bw/day (TRA Workers)	RCR = 0.116
Combined routes, systemic, long-term		RCR = 0.719

**9.2.9. Worker CS 9: Tableting, compression, extrusion, pelletisation, granulation (PROC 14)**

**9.2.9.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0



**FH-C20-033\_V.10/ 09.10.2020**

	Method
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.2.9.2. Exposure and risks for workers**

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

**Table 9.25. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.12
Inhalation, systemic, acute	4 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.049
Dermal, systemic, long term	3.43 mg/kg bw/day (TRA Workers)	RCR = 0.291
Combined routes, systemic, long-term		RCR = 0.411

**9.2.10. Worker CS 10: Use as laboratory reagent (PROC 15)**

**9.2.10.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0

**FH-C20-033\_V.10/ 09.10.2020**

	Method
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.2.10.2. Exposure and risks for workers**

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

**Table 9.26. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.06
Inhalation, systemic, acute	2 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.024
Dermal, systemic, long term	0.34 mg/kg bw/day (TRA Workers)	RCR = 0.029
Combined routes, systemic, long-term		RCR = 0.089

**9.2.11. Worker CS 11: Hand-mixing with intimate contact and only PPE available (PROC 19)**

**9.2.11.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 4 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.2.11.2. Exposure and risks for workers**

**FH-C20-033\_V.10/ 09.10.2020**

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

**Table 9.27. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	3 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.361
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	7.072 mg/kg bw/day (TRA Workers)	RCR = 0.599
Combined routes, systemic, long-term		RCR = 0.961

**9.2.12. Worker CS 12: Manual maintenance (cleaning and repair) of machinery (PROC 28)**

**9.2.12.1. Conditions of use**

	Method	
Product (article) characteristics		
• Percentage (w/w) of substance in mixture/article: <= 100 %	ECETOC Workers 3.1	TRA
• Physical form of the used product: Solid (medium dusty form)	ECETOC Workers 3.1	TRA
Amount used (or contained in articles), frequency and duration of use/exposure		
• Duration of activity: <= 8 h/day	ECETOC Workers 3.1	TRA
Technical and organisational conditions and measures		
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	ECETOC Workers 3.1	TRA
• Occupational Health and Safety Management System: Advanced	ECETOC Workers 3.1	TRA
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	ECETOC Workers 3.1	TRA
Conditions and measures related to personal protection, hygiene and health evaluation		
• Respiratory protection: No [Effectiveness Inhalation: 0%]	ECETOC Workers 3.1	TRA
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	ECETOC Workers 3.1	TRA
Other conditions affecting workers exposure		
• Place of use: Indoor	ECETOC Workers 3.1	TRA
• Operating temperature: <= 40 °C	ECETOC Workers 3.1	TRA

**9.2.12.2. Exposure and risks for workers**

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

FH-C20-033\_V.10/ 09.10.2020

**Table 9.28. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.243
Dermal, systemic, long term	2.742 mg/kg bw/day (ECETOC TRA Workers 3.1)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**Remarks on exposure data from external estimation tools:**

**ECETOC TRA Workers 3.1:**

Explanation: The exposure estimates for PROC 8a are used, as TRA Workers cannot predict exposure for PROC 28 and these estimates can be considered suitable for estimating exposures during manual maintenance.

**9.3. Exposure scenario 3: Use at industrial sites - Use as intermediate for resins (reacted melamine)**

Environment contributing scenario(s):		
CS 1	Use as intermediate for resins (reacted melamine)	ERC 6a; ERC 6c
Worker contributing scenario(s):		
CS 2	Chemical production or refinery in closed process without PROC 1 likelihood of exposure or processes with equivalent containment conditions	
CS 3	Chemical production or refinery in closed continuous process with PROC 2 occasional controlled exposure or processes with equivalent containment conditions	
CS 4	Manufacture or formulation in the chemical industry in closed PROC 3 batch processes with occasional controlled exposure or processes with equivalent containment conditions	
CS 5	Chemical production where opportunity for exposure arises	PROC 4
CS 6	Mixing or blending in batch processes	PROC 5
CS 7	Calendering operations	PROC 6
CS 8	Transfer of substance or mixture (charging and discharging) at PROC 8a non-dedicated facilities	
CS 9	Transfer of substance or mixture (charging and discharging) at PROC 8b dedicated facilities	
CS 10	Transfer of substance or mixture into small containers (dedicated PROC 9 filling line, including weighing)	
CS 11	Tabletting, compression, extrusion, pelletisation, granulation	PROC 14
CS 12	Use as laboratory reagent	PROC 15
CS 13	Manual maintenance (cleaning and repair) of machinery	PROC 28

**9.3.1. Env CS 1: Use as intermediate for resins (reacted melamine) (ERC 6a; ERC 6c)**

**9.3.1.1. Conditions of use**

Amount used, frequency and duration of use (or from service life)
<ul style="list-style-type: none"> <li>Daily use amount at site: not relevant for the assessment as scenario specific releases are estimated</li> <li>Annual use amount at site: not relevant for the assessment as scenario specific releases are estimated</li> </ul>
Conditions and measures related to biological sewage treatment plant
<ul style="list-style-type: none"> <li>Biological STP: Standard [Effectiveness Water: 0.169%]</li> <li>Discharge rate of STP: <math>\geq 2E3</math> m<sup>3</sup>/day</li> <li>Application of the STP sludge on agricultural soil: Yes</li> </ul>
Other conditions affecting environmental exposure
<ul style="list-style-type: none"> <li>Receiving surface water flow rate: <math>\geq 1.8E4</math> m<sup>3</sup>/day</li> </ul>

**9.3.1.2. Releases**

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

**Table 9.29. Local releases to the environment**

Release	Release method	estimation	Explanations
Water	Estimated release rate		<b>Local release rate: 3 kg/day</b>
Air	Estimated release rate		<b>Local release rate: 0.5 kg/day</b>
Non agricultural soil	Estimated release factor		<b>Release factor after on site RMM: 0%</b>

**9.3.1.3. Exposure and risks for the environment and man via the environment**

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.2.0 unless stated otherwise.

**Table 9.30. Exposure concentrations and risks for the environment and man via the environment**

Protection target	Exposure concentration	Risk quantification
Fresh water	<b>Local PEC: 0.155 mg/L</b>	RCR = 0.30
Sediment (freshwater)	<b>Local PEC: 0.766 mg/kg dw</b>	RCR = 0.30
Marine water	<b>Local PEC: 0.0155 mg/L</b>	RCR = 0.30
Sediment (marine water)	<b>Local PEC: 0.077 mg/kg dw</b>	RCR = 0.30
Sewage Treatment Plant	<b>Local PEC: 1.497 mg/L</b>	RCR < 0.01
Agricultural soil	<b>Local PEC: 0.017 mg/kg dw</b>	RCR = 0.08
Man via environment - Inhalation (systemic effects)	<b>Concentration in air: 3.97E-5 mg/m<sup>3</sup></b>	RCR < 0.01
Man via environment - Oral	<b>Exposure via food consumption: 9.70E-3 mg/kg bw/day</b>	RCR = 0.02
Man via environment - combined routes		RCR = 0.02

**FH-C20-033\_V.10/ 09.10.2020**

**9.3.2. Worker CS 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC 1)**

**9.3.2.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.3.2.2. Exposure and risks for workers**

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

**Table 9.31. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.01 mg/m <sup>3</sup> (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.04 mg/m <sup>3</sup> (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR < 0.01

**9.3.3. Worker CS 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC 2)**

**9.3.3.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0

**FH-C20-033\_V.10/ 09.10.2020**

	Method
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.3.3.2. Exposure and risks for workers**

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

**Table 9.32. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.06
Inhalation, systemic, acute	2 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.024
Dermal, systemic, long term	1.37 mg/kg bw/day (TRA Workers)	RCR = 0.116
Combined routes, systemic, long-term		RCR = 0.176

**9.3.4. Worker CS 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment conditions (PROC 3)**
**9.3.4.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0



**FH-C20-033\_V.10/ 09.10.2020**

	Method
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.3.4.2. Exposure and risks for workers**

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

**Table 9.33. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.12
Inhalation, systemic, acute	4 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.049
Dermal, systemic, long term	0.69 mg/kg bw/day (TRA Workers)	RCR = 0.058
Combined routes, systemic, long-term		RCR = 0.179

**9.3.5. Worker CS 5: Chemical production where opportunity for exposure arises (PROC 4)**
**9.3.5.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0

**FH-C20-033\_V.10/ 09.10.2020**

	Method
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.3.5.2. Exposure and risks for workers**

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

**Table 9.34. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	1.372 mg/kg bw/day (TRA Workers)	RCR = 0.116
Combined routes, systemic, long-term		RCR = 0.719

**9.3.6. Worker CS 6: Mixing or blending in batch processes (PROC 5)**

**9.3.6.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.3.6.2. Exposure and risks for workers**

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

**Table 9.35. Exposure concentrations and risks for workers**

**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**9.3.7. Worker CS 7: Calendering operations (PROC 6)**
**9.3.7.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.3.7.2. Exposure and risks for workers**

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

**Table 9.36. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	2.743 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**FH-C20-033\_V.10/ 09.10.2020**

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

**9.3.8.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.3.8.2. Exposure and risks for workers**

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

**Table 9.37. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

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

**9.3.9.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0

**FH-C20-033\_V.10/ 09.10.2020**

	Method
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.3.9.2. Exposure and risks for workers**

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

**Table 9.38. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.12
Inhalation, systemic, acute	4 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.049
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.353

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

**9.3.10.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0

**FH-C20-033\_V.10/ 09.10.2020**

	Method
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.3.10.2. Exposure and risks for workers**

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

**Table 9.39. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	1.372 mg/kg bw/day (TRA Workers)	RCR = 0.116
Combined routes, systemic, long-term		RCR = 0.719

**9.3.11. Worker CS 11: Tableting, compression, extrusion, pelletisation, granulation (PROC 14)**
**9.3.11.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	

**FH-C20-033\_V.10/ 09.10.2020**

	Method
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.3.11.2. Exposure and risks for workers**

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

**Table 9.40. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.12
Inhalation, systemic, acute	4 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.049
Dermal, systemic, long term	3.43 mg/kg bw/day (TRA Workers)	RCR = 0.291
Combined routes, systemic, long-term		RCR = 0.411

**9.3.12. Worker CS 12: Use as laboratory reagent (PROC 15)**

**9.3.12.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.3.12.2. Exposure and risks for workers**

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

**Table 9.41. Exposure concentrations and risks for workers**



**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.06
Inhalation, systemic, acute	2 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.024
Dermal, systemic, long term	0.34 mg/kg bw/day (TRA Workers)	RCR = 0.029
Combined routes, systemic, long-term		RCR = 0.089

**9.3.13. Worker CS 13: Manual maintenance (cleaning and repair) of machinery (PROC 28)**
**9.3.13.1. Conditions of use**

	Method	
Product (article) characteristics		
• Percentage (w/w) of substance in mixture/article: <= 100 %	ECETOC Workers 3.1	TRA
• Physical form of the used product: Solid (medium dusty form)	ECETOC Workers 3.1	TRA
Amount used (or contained in articles), frequency and duration of use/exposure		
• Duration of activity: <= 8 h/day	ECETOC Workers 3.1	TRA
Technical and organisational conditions and measures		
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	ECETOC Workers 3.1	TRA
• Occupational Health and Safety Management System: Advanced	ECETOC Workers 3.1	TRA
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	ECETOC Workers 3.1	TRA
Conditions and measures related to personal protection, hygiene and health evaluation		
• Respiratory protection: No [Effectiveness Inhalation: 0%]	ECETOC Workers 3.1	TRA
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	ECETOC Workers 3.1	TRA
Other conditions affecting workers exposure		
• Place of use: Indoor	ECETOC Workers 3.1	TRA
• Operating temperature: <= 40 °C	ECETOC Workers 3.1	TRA

**9.3.13.2. Exposure and risks for workers**

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

**Table 9.42. Exposure concentrations and risks for workers**

**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.243
Dermal, systemic, long term	2.742 mg/kg bw/day (ECETOC TRA Workers 3.1)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**Remarks on exposure data from external estimation tools:**

**ECETOC TRA Workers 3.1:**

Explanation: The exposure estimates for PROC 8a are used, as TRA Workers cannot predict exposure for PROC 28 and these estimates can be considered suitable for estimating exposures during manual maintenance.

**9.4. Exposure scenario 4: Use at industrial sites - Use of resins with unreacted residual melamine**

Environment contributing scenario(s):		
CS 1	Use of resins with unreacted residual melamine	ERC 5
Worker contributing scenario(s):		
CS 2	Industrial spraying	PROC 7
CS 3	Transfer of substance or mixture (charging and discharging) at non-dedicated facilities	PROC 8a
CS 4	Transfer of substance or mixture (charging and discharging) at dedicated facilities	PROC 8b
CS 5	Roller application or brushing	PROC 10
CS 6	Hand-mixing with intimate contact and only PPE available	PROC 19
CS 7	Manual maintenance (cleaning and repair) of machinery	PROC 28

**9.4.1. Env CS 1: Use of resins with unreacted residual melamine (ERC 5)**

**9.4.1.1. Conditions of use**

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: not relevant for the assessment as scenario specific releases are estimated
• Annual use amount at site: not relevant for the assessment as scenario specific releases are estimated
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 0.169%]
• Discharge rate of STP: >= 2E3 m <sup>3</sup> /day
• Application of the STP sludge on agricultural soil: Yes
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 1.8E4 m <sup>3</sup> /day

**9.4.1.2. Releases**

**FH-C20-033\_V.10/ 09.10.2020**

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

**Table 9.43. Local releases to the environment**

Release	Release method	estimation	Explanations
Water	Estimated release rate		<b>Local release rate: 0.5 kg/day</b>
Air	Estimated release rate		<b>Local release rate: 0 kg/day</b>
Non agricultural soil	Estimated release factor		<b>Release factor after on site RMM: 0%</b>

**9.4.1.3. Exposure and risks for the environment and man via the environment**

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.2.0 unless stated otherwise.

**Table 9.44. Exposure concentrations and risks for the environment and man via the environment**

Protection target	Exposure concentration	Risk quantification
Fresh water	<b>Local PEC: 0.03 mg/L</b>	RCR = 0.06
Sediment (freshwater)	<b>Local PEC: 0.148 mg/kg dw</b>	RCR = 0.06
Marine water	<b>Local PEC: 3E-3 mg/L</b>	RCR = 0.06
Sediment (marine water)	<b>Local PEC: 0.015 mg/kg dw</b>	RCR = 0.06
Sewage Treatment Plant	<b>Local PEC: 0.25 mg/L</b>	RCR < 0.01
Agricultural soil	<b>Local PEC: 2.2E-3 mg/kg dw</b>	RCR = 0.01
Man via environment - Inhalation (systemic effects)	<b>Concentration in air: 9.8E-16 mg/m<sup>3</sup></b>	RCR < 0.01
Man via environment - Oral	<b>Exposure via food consumption: 1.09E-3 mg/kg bw/day</b>	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

**9.4.2. Worker CS 2: Industrial spraying (PROC 7)**

**9.4.2.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 5 %	Stoffenmanager 8, TRA Workers 3.0
• Physical form of the used product: Liquid	Stoffenmanager 8, TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	Stoffenmanager 8, TRA Workers 3.0
Technical and organisational conditions and measures	

**FH-C20-033\_V.10/ 09.10.2020**

	Method
• Ventilation working room: General ventilation (mechanical)	Stoffenmanager 8
• Occupational Health and Safety Management System: Advanced	Stoffenmanager 8, TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	Stoffenmanager 8, TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	Stoffenmanager 8
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	Stoffenmanager 8, TRA Workers 3.0
• Operating temperature: <= 40 °C	Stoffenmanager 8, TRA Workers 3.0

**9.4.2.2. Exposure and risks for workers**

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

**Table 9.45. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	2.43 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR = 0.293
Inhalation, systemic, acute	2.43 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR = 0.03
Dermal, systemic, long term	1.714 mg/kg bw/day (TRA Workers)	RCR = 0.145
Combined routes, systemic, long-term		RCR = 0.438

**Remarks on exposure data from external estimation tools:**

**Stoffenmanager 8:**

Explanation: Inhalation exposure concentration estimated using Stoffenmanager® (version 8)

- Activity/type of task: Handling of liquids at high pressure resulting in substantial generation of mist or spray/haze

- Distance to task: In the breathing zone of the worker (distance head-product < 1 m) (worst-case assumption)

- Local controls: No control measures at the source

- Ventilation working room: General ventilation (mechanical)

- Volume of the working room: 100-1000 m<sup>3</sup>

- Regular cleaning of work area (daily): Yes

- Regular inspection and maintenance (at least monthly): Yes

- Presence of secondary emission sources (worst-case assumptions);

Other workers using the same substance simultaneously: Yes

A period of evaporation, drying or curing after the activity (with prolonged emission of vapours): Yes

The concentration that can be inhaled by the worker during the task due to the activity undertaken is obtained.

As the task is performed for 8 hours, the daily average concentration equals the task concentration. In accordance with the ECHA Guidance (Chapter R.14), this estimated concentration is therefore considered to be

**FH-C20-033\_V.10/ 09.10.2020**

the short-term as well as the long-term inhalation exposure estimate (90th percentiles).

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

**9.4.3.1. Conditions of use**

	Method	
Product (article) characteristics		
• Percentage (w/w) of substance in mixture/article: <= 5 %	ECETOC Workers 3.1	TRA
• Physical form of the used product: Liquid	ECETOC Workers 3.1	TRA
Amount used (or contained in articles), frequency and duration of use/exposure		
• Duration of activity: <= 8 h/day	ECETOC Workers 3.1	TRA
Technical and organisational conditions and measures		
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	ECETOC Workers 3.1	TRA
• Occupational Health and Safety Management System: Advanced	ECETOC Workers 3.1	TRA
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	ECETOC Workers 3.1	TRA
Conditions and measures related to personal protection, hygiene and health evaluation		
• Respiratory protection: No [Effectiveness Inhalation: 0%]	ECETOC Workers 3.1	TRA
• Dermal protection: No [Effectiveness Dermal: 0%]	ECETOC Workers 3.1	TRA
Other conditions affecting workers exposure		
• Place of use: Indoor	ECETOC Workers 3.1	TRA
• Operating temperature: <= 40 °C	ECETOC Workers 3.1	TRA

**9.4.3.2. Exposure and risks for workers**

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

**Table 9.46. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.105 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.013
Inhalation, systemic, acute	0.105 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR < 0.01
Dermal, systemic, long term	2.74 mg/kg bw/day (ECETOC TRA Workers 3.1)	RCR = 0.232
Combined routes, systemic, long-		RCR = 0.245

**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
term		

**Remarks on exposure data from external estimation tools:**

**ECETOC TRA Workers 3.1:**

Explanation: As solid is used as value for CSA, while liquid is used, it is considered appropriate to refine the exposure estimates, using the standalone version of TRA Workers (v3.1). The vapour pressure at operating temperature (40°C) used for the calculation is 3.71E-8 Pa (as calculated by Chesar).

**9.4.4. Worker CS 4: Transfer of substance or mixture (charging and discharging) at dedicated facilities (PROC 8b)**

**9.4.4.1. Conditions of use**

	Method
<b>Product (article) characteristics</b>	
• Percentage (w/w) of substance in mixture/article: <= 5 %	ECETOC TRA Workers 3.1
• Physical form of the used product: Liquid	ECETOC TRA Workers 3.1
<b>Amount used (or contained in articles), frequency and duration of use/exposure</b>	
• Duration of activity: <= 8 h/day	ECETOC TRA Workers 3.1
<b>Technical and organisational conditions and measures</b>	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	ECETOC TRA Workers 3.1
• Occupational Health and Safety Management System: Advanced	ECETOC TRA Workers 3.1
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	ECETOC TRA Workers 3.1
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	ECETOC TRA Workers 3.1
• Dermal protection: No [Effectiveness Dermal: 0%]	ECETOC TRA Workers 3.1
<b>Other conditions affecting workers exposure</b>	
• Place of use: Indoor	ECETOC TRA Workers 3.1
• Operating temperature: <= 40 °C	ECETOC TRA Workers 3.1

**9.4.4.2. Exposure and risks for workers**

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

**FH-C20-033\_V.10/ 09.10.2020**

**Table 9.47. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.105 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.013
Inhalation, systemic, acute	0.105 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR < 0.01
Dermal, systemic, long term	2.74 mg/kg bw/day (ECETOC TRA Workers 3.1)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.245

**Remarks on exposure data from external estimation tools:**

**ECETOC TRA Workers 3.1:**

Explanation: As solid is used as value for CSA, while liquid is used, it is considered appropriate to refine the exposure estimates, using the standalone version of TRA Workers (v3.1). The vapour pressure at operating temperature (40°C) used for the calculation is 3.71E-8 Pa (as calculated by Chesar).

**9.4.5. Worker CS 5: Roller application or brushing (PROC 10)**

**9.4.5.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 5 %	Stoffenmanager 8, TRA Workers 3.0
• Physical form of the used product: Liquid	Stoffenmanager 8, TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	Stoffenmanager 8, TRA Workers 3.0
Technical and organisational conditions and measures	
• Ventilation working room: General ventilation (mechanical)	Stoffenmanager 8
• Occupational Health and Safety Management System: Advanced	Stoffenmanager 8, TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	Stoffenmanager 8, TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	Stoffenmanager 8
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	Stoffenmanager 8, TRA Workers 3.0
• Operating temperature: <= 40 °C	Stoffenmanager 8, TRA Workers 3.0

**9.4.5.2. Exposure and risks for workers**



**FH-C20-033\_V.10/ 09.10.2020**

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

**Table 9.48. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1.1 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR = 0.133
Inhalation, systemic, acute	1.1 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR = 0.013
Dermal, systemic, long term	5.486 mg/kg bw/day (TRA Workers)	RCR = 0.465
Combined routes, systemic, long-term		RCR = 0.597

**Remarks on exposure data from external estimation tools:**

**Stoffenmanager 8:**

Explanation: Inhalation exposure concentration estimated using Stoffenmanager® (version 8)

- Activity/type of task: Handling of liquids on large surfaces or large work pieces
- Distance to task: In the breathing zone of the worker (distance head-product < 1 m) (worst-case assumption)
- Local controls: No control measures at the source
- Ventilation working room: General ventilation (mechanical)
- Volume of the working room: 100-1000 m<sup>3</sup>
- Regular cleaning of work area (daily): Yes
- Regular inspection and maintenance (at least monthly): Yes
- Presence of secondary emission sources (worst-case assumptions);

Other workers using the same substance simultaneously: Yes

A period of evaporation, drying or curing after the activity (with prolonged emission of vapours): Yes

The concentration that can be inhaled by the worker during the task due to the activity undertaken is obtained. As the task is performed for 8 hours, the daily average concentration equals the task concentration. In accordance with the ECHA Guidance (Chapter R.14), this estimated concentration is therefore considered to be the short-term as well as the long-term inhalation exposure estimate (90th percentiles).

**9.4.6. Worker CS 6: Hand-mixing with intimate contact and only PPE available (PROC 19)**

**9.4.6.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 5 %	Stoffenmanager 8, TRA Workers 3.0
• Physical form of the used product: Liquid	Stoffenmanager 8, TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	Stoffenmanager 8, TRA Workers 3.0
Technical and organisational conditions and measures	
• Ventilation working room: General ventilation (mechanical)	Stoffenmanager 8
• Occupational Health and Safety Management System: Advanced	Stoffenmanager 8, TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	Stoffenmanager 8,

**FH-C20-033\_V.10/ 09.10.2020**

	Method
	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	Stoffenmanager 8
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	Stoffenmanager 8, TRA Workers 3.0
• Operating temperature: <= 40 °C	Stoffenmanager 8, TRA Workers 3.0

**9.4.6.2. Exposure and risks for workers**

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

**Table 9.49. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.53 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR = 0.064
Inhalation, systemic, acute	0.53 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR < 0.01
Dermal, systemic, long term	5.657 mg/kg bw/day (TRA Workers)	RCR = 0.479
Combined routes, systemic, long-term		RCR = 0.543

**Remarks on exposure data from external estimation tools:**

**Stoffenmanager 8:**

Explanation: Inhalation exposure concentration estimated using Stoffenmanager® (version 8)

- Activity/type of task: Handling of liquids using low pressure, low speed or on medium-sized surfaces
- Distance to task: In the breathing zone of the worker (distance head-product < 1 m) (worst-case assumption)
- Local controls: No control measures at the source
- Ventilation working room: General ventilation (mechanical)
- Volume of the working room: 100-1000 m<sup>3</sup>
- Regular cleaning of work area (daily): Yes
- Regular inspection and maintenance (at least monthly): Yes
- Presence of secondary emission sources (worst-case assumptions);

Other workers using the same substance simultaneously: Yes

A period of evaporation, drying or curing after the activity (with prolonged emission of vapours): Yes

The concentration that can be inhaled by the worker during the task due to the activity undertaken is obtained. As the task is performed for 8 hours, the daily average concentration equals the task concentration. In accordance with the ECHA Guidance (Chapter R.14), this estimated concentration is therefore considered to be the short-term as well as the long-term inhalation exposure estimate (90th percentiles).

**9.4.7. Worker CS 7: Manual maintenance (cleaning and repair) of machinery (PROC 28)**

**9.4.7.1. Conditions of use**

**FH-C20-033\_V.10/ 09.10.2020**

	Method
<b>Product (article) characteristics</b>	
• Percentage (w/w) of substance in mixture/article: <= 5 %	ECETOC TRA Workers 3.1
• Physical form of the used product: Liquid	ECETOC TRA Workers 3.1
<b>Amount used (or contained in articles), frequency and duration of use/exposure</b>	
• Duration of activity: <= 8 h/day	ECETOC TRA Workers 3.1
<b>Technical and organisational conditions and measures</b>	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	ECETOC TRA Workers 3.1
• Occupational Health and Safety Management System: Advanced	ECETOC TRA Workers 3.1
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	ECETOC TRA Workers 3.1
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	ECETOC TRA Workers 3.1
• Dermal protection: No [Effectiveness Dermal: 0%]	ECETOC TRA Workers 3.1
<b>Other conditions affecting workers exposure</b>	
• Place of use: Indoor	ECETOC TRA Workers 3.1
• Operating temperature: <= 40 °C	ECETOC TRA Workers 3.1

**9.4.7.2. Exposure and risks for workers**

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

**Table 9.50. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.105 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.013
Inhalation, systemic, acute	0.105 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR < 0.01
Dermal, systemic, long term	2.74 mg/kg bw/day (ECETOC TRA Workers 3.1)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.245

**Remarks on exposure data from external estimation tools:**

**ECETOC TRA Workers 3.1:**

Explanation: The exposure estimates for PROC 8a are used, as TRA Workers cannot predict exposure for PROC 28 and these estimates can be considered suitable for estimating exposures during manual maintenance. The

**FH-C20-033\_V.10/ 09.10.2020**

exposure estimates are calculated for using a liquid, with the standalone version of TRA Workers (v3.1). The vapour pressure at operating temperature (40°C) used for the calculation is 3.71E-8 Pa (as calculated by Chesar).

**9.5. Exposure scenario 5: Use at industrial sites - Use as intermediate for the production of other substances e.g. melamine salt (reacted melamine)**

Environment contributing scenario(s):	
CS 1	Use as intermediate for the production of other substances e.g. ERC 6a melamine salt (reacted melamine)
Worker contributing scenario(s):	
CS 2	Chemical production or refinery in closed process without PROC 1 likelihood of exposure or processes with equivalent containment conditions
CS 3	Chemical production or refinery in closed continuous process with PROC 2 occasional controlled exposure or processes with equivalent containment conditions
CS 4	Manufacture or formulation in the chemical industry in closed PROC 3 batch processes with occasional controlled exposure or processes with equivalent containment conditions
CS 5	Chemical production where opportunity for exposure arises PROC 4
CS 6	Mixing or blending in batch processes PROC 5
CS 7	Transfer of substance or mixture (charging and discharging) at PROC 8a non-dedicated facilities
CS 8	Transfer of substance or mixture (charging and discharging) at PROC 8b dedicated facilities
CS 9	Transfer of substance or mixture into small containers (dedicated PROC 9 filling line, including weighing)
CS 10	Use as laboratory reagent PROC 15
CS 11	Manual maintenance (cleaning and repair) of machinery PROC 28

**9.5.1. Env CS 1: Use as intermediate for the production of other substances e.g. melamine salt (reacted melamine) (ERC 6a)**

**9.5.1.1. Conditions of use**

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: not relevant for the assessment as scenario specific releases are estimated
• Annual use amount at site: not relevant for the assessment as scenario specific releases are estimated
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 0.169%]
• Discharge rate of STP: $\geq 2E3$ m <sup>3</sup> /day
• Application of the STP sludge on agricultural soil: Yes
Other conditions affecting environmental exposure
• Receiving surface water flow rate: $\geq 1.8E4$ m <sup>3</sup> /day

FH-C20-033\_V.10/ 09.10.2020

### 9.5.1.2. Releases

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

**Table 9.51. Local releases to the environment**

Release	Release method	estimation	Explanations
Water	Estimated release rate		<b>Local release rate: 3 kg/day</b>
Air	Estimated release rate		<b>Local release rate: 0.5 kg/day</b>
Non agricultural soil	Estimated release factor		<b>Release factor after on site RMM: 0%</b>

### 9.5.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.2.0 unless stated otherwise.

**Table 9.52. Exposure concentrations and risks for the environment and man via the environment**

Protection target	Exposure concentration	Risk quantification
Fresh water	<b>Local PEC: 0.155 mg/L</b>	RCR = 0.30
Sediment (freshwater)	<b>Local PEC: 0.766 mg/kg dw</b>	RCR = 0.30
Marine water	<b>Local PEC: 0.0155 mg/L</b>	RCR = 0.30
Sediment (marine water)	<b>Local PEC: 0.077 mg/kg dw</b>	RCR = 0.30
Sewage Treatment Plant	<b>Local PEC: 1.497 mg/L</b>	RCR < 0.01
Agricultural soil	<b>Local PEC: 0.017 mg/kg dw</b>	RCR = 0.08
Man via environment - Inhalation (systemic effects)	<b>Concentration in air: 3.97E-5 mg/m<sup>3</sup></b>	RCR < 0.01
Man via environment - Oral	<b>Exposure via food consumption: 9.70E-3 mg/kg bw/day</b>	RCR = 0.02
Man via environment - combined routes		RCR = 0.02

### 9.5.2. Worker CS 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC 1)

#### 9.5.2.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness]	TRA Workers 3.0

**FH-C20-033\_V.10/ 09.10.2020**

	Method
Inhalation: 0%]	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.5.2.2. Exposure and risks for workers**

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

**Table 9.53. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.01 mg/m <sup>3</sup> (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.04 mg/m <sup>3</sup> (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR < 0.01

**9.5.3. Worker CS 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC 2)**

**9.5.3.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0

**FH-C20-033\_V.10/ 09.10.2020**

	Method
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.5.3.2. Exposure and risks for workers**

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

**Table 9.54. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.06
Inhalation, systemic, acute	2 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.024
Dermal, systemic, long term	1.37 mg/kg bw/day (TRA Workers)	RCR = 0.116
Combined routes, systemic, long-term		RCR = 0.176

**9.5.4. Worker CS 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment conditions (PROC 3)**

**9.5.4.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.5.4.2. Exposure and risks for workers**

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



**FH-C20-033\_V.10/ 09.10.2020**
**Table 9.55. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.12
Inhalation, systemic, acute	4 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.049
Dermal, systemic, long term	0.69 mg/kg bw/day (TRA Workers)	RCR = 0.058
Combined routes, systemic, long-term		RCR = 0.179

**9.5.5. Worker CS 5: Chemical production where opportunity for exposure arises (PROC 4)**
**9.5.5.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.5.5.2. Exposure and risks for workers**

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

**Table 9.56. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	1.372 mg/kg bw/day (TRA Workers)	RCR = 0.116
Combined routes, systemic, long-		RCR = 0.719

**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
term		

**9.5.6. Worker CS 6: Mixing or blending in batch processes (PROC 5)**
**9.5.6.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.5.6.2. Exposure and risks for workers**

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

**Table 9.57. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**9.5.7. Worker CS 7: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities (PROC 8a)**
**9.5.7.1. Conditions of use**

**FH-C20-033\_V.10/ 09.10.2020**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.5.7.2. Exposure and risks for workers**

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

**Table 9.58. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**9.5.8. Worker CS 8: Transfer of substance or mixture (charging and discharging) at dedicated facilities (PROC 8b)**
**9.5.8.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0

**FH-C20-033\_V.10/ 09.10.2020**

	Method
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.5.8.2. Exposure and risks for workers**

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

**Table 9.59. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.12
Inhalation, systemic, acute	4 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.049
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.353

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

**9.5.9.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0

**FH-C20-033\_V.10/ 09.10.2020**

	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.5.9.2. Exposure and risks for workers**

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

**Table 9.60. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	1.372 mg/kg bw/day (TRA Workers)	RCR = 0.116
Combined routes, systemic, long-term		RCR = 0.719

**9.5.10. Worker CS 10: Use as laboratory reagent (PROC 15)**
**9.5.10.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.5.10.2. Exposure and risks for workers**

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

**Table 9.61. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.06
Inhalation, systemic, acute	2 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.024
Dermal, systemic, long term	0.34 mg/kg bw/day (TRA Workers)	RCR = 0.029
Combined routes, systemic, long-term		RCR = 0.089

**9.5.11. Worker CS 11: Manual maintenance (cleaning and repair) of machinery (PROC 28)**
**9.5.11.1. Conditions of use**

	Method	
Product (article) characteristics		
• Percentage (w/w) of substance in mixture/article: <= 100 %	ECETOC	TRA Workers 3.1
• Physical form of the used product: Solid (medium dusty form)	ECETOC	TRA Workers 3.1
Amount used (or contained in articles), frequency and duration of use/exposure		
• Duration of activity: <= 8 h/day	ECETOC	TRA Workers 3.1
Technical and organisational conditions and measures		
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	ECETOC	TRA Workers 3.1
• Occupational Health and Safety Management System: Advanced	ECETOC	TRA Workers 3.1
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	ECETOC	TRA Workers 3.1
Conditions and measures related to personal protection, hygiene and health evaluation		
• Respiratory protection: No [Effectiveness Inhalation: 0%]	ECETOC	TRA Workers 3.1
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	ECETOC	TRA Workers 3.1
Other conditions affecting workers exposure		
• Place of use: Indoor	ECETOC	TRA Workers 3.1
• Operating temperature: <= 40 °C	ECETOC	TRA Workers 3.1

### 9.5.11.2. Exposure and risks for workers

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

**Table 9.62. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.243
Dermal, systemic, long term	2.742 mg/kg bw/day (ECETOC TRA Workers 3.1)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

#### Remarks on exposure data from external estimation tools:

##### ECETOC TRA Workers 3.1:

Explanation: The exposure estimates for PROC 8a are used, as TRA Workers cannot predict exposure for PROC 28 and these estimates can be considered suitable for estimating exposures during manual maintenance.

### 9.6. Exposure scenario 6: Use at industrial sites - Use as additive in foams

Environment contributing scenario(s):		
CS 1	Use as additive in foams	ERC 5
Worker contributing scenario(s):		
CS 2	Chemical production or refinery in closed process without PROC 1 likelihood of exposure or processes with equivalent containment conditions	
CS 3	Chemical production or refinery in closed continuous process with PROC 2 occasional controlled exposure or processes with equivalent containment conditions	
CS 4	Manufacture or formulation in the chemical industry in closed PROC 3 batch processes with occasional controlled exposure or processes with equivalent containment conditions	
CS 5	Chemical production where opportunity for exposure arises	PROC 4
CS 6	Mixing or blending in batch processes	PROC 5
CS 7	Transfer of substance or mixture (charging and discharging) at PROC 8a non-dedicated facilities	
CS 8	Transfer of substance or mixture (charging and discharging) at PROC 8b dedicated facilities	
CS 9	Transfer of substance or mixture into small containers (dedicated PROC 9 filling line, including weighing)	
CS 10	Use as laboratory reagent	PROC 15
CS 11	Hand-mixing with intimate contact and only PPE available	PROC 19
CS 12	Manual maintenance (cleaning and repair) of machinery	PROC 28

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

ES9: Service life (worker at industrial site) - PU foams - Workers (industrial)



**FH-C20-033\_V.10/ 09.10.2020**

ES12: Service life (consumers) - PU foams – Consumers

**9.6.1. Env CS 1: Use as additive in foams (ERC 5)**

**9.6.1.1. Conditions of use**

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: not relevant for the assessment as scenario specific releases are estimated
• Annual use amount at site: not relevant for the assessment as scenario specific releases are estimated
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 0.169%]
• Discharge rate of STP: $\geq 2E3$ m <sup>3</sup> /day
• Application of the STP sludge on agricultural soil: Yes
Other conditions affecting environmental exposure
• Receiving surface water flow rate: $\geq 1.8E4$ m <sup>3</sup> /day

**9.6.1.2. Releases**

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

**Table 9.63. Local releases to the environment**

Release	Release method	estimation	Explanations
Water	Estimated release rate		<b>Local release rate: 3 kg/day</b>
Air	Estimated release rate		<b>Local release rate: 0.5 kg/day</b>
Non agricultural soil	Estimated release factor		<b>Release factor after on site RMM: 0%</b>

**9.6.1.3. Exposure and risks for the environment and man via the environment**

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.2.0 unless stated otherwise.

**Table 9.64. Exposure concentrations and risks for the environment and man via the environment**

Protection target	Exposure concentration	Risk quantification
Fresh water	<b>Local PEC: 0.155 mg/L</b>	RCR = 0.30
Sediment (freshwater)	<b>Local PEC: 0.766 mg/kg dw</b>	RCR = 0.30
Marine water	<b>Local PEC: 0.0155 mg/L</b>	RCR = 0.30
Sediment (marine water)	<b>Local PEC: 0.077 mg/kg dw</b>	RCR = 0.30
Sewage Treatment Plant	<b>Local PEC: 1.497 mg/L</b>	RCR < 0.01
Agricultural soil	<b>Local PEC: 0.017 mg/kg dw</b>	RCR = 0.08
Man via environment - Inhalation (systemic effects)	<b>Concentration in air: 3.971E-5 mg/m<sup>3</sup></b>	RCR < 0.01
Man via environment - Oral	<b>Exposure via food consumption: 9.70E-3 mg/kg bw/day</b>	RCR = 0.02

**FH-C20-033\_V.10/ 09.10.2020**

Protection target	Exposure concentration	Risk quantification
Man via environment combined routes	-	RCR = 0.02

**9.6.2. Worker CS 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC 1)**
**9.6.2.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.6.2.2. Exposure and risks for workers**

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

**Table 9.65. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.01 mg/m <sup>3</sup> (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.04 mg/m <sup>3</sup> (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR < 0.01

**9.6.3. Worker CS 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC 2)**
**9.6.3.1. Conditions of use**

**FH-C20-033\_V.10/ 09.10.2020**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.6.3.2. Exposure and risks for workers**

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

**Table 9.66. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.06
Inhalation, systemic, acute	2 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.024
Dermal, systemic, long term	1.37 mg/kg bw/day (TRA Workers)	RCR = 0.116
Combined routes, systemic, long-term		RCR = 0.176

**9.6.4. Worker CS 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment conditions (PROC 3)**
**9.6.4.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	

**FH-C20-033\_V.10/ 09.10.2020**

	Method
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.6.4.2. Exposure and risks for workers**

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

**Table 9.67. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.12
Inhalation, systemic, acute	4 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.049
Dermal, systemic, long term	0.69 mg/kg bw/day (TRA Workers)	RCR = 0.058
Combined routes, systemic, long-term		RCR = 0.179

**9.6.5. Worker CS 5: Chemical production where opportunity for exposure arises (PROC 4)**
**9.6.5.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other)	TRA Workers 3.0

**FH-C20-033\_V.10/ 09.10.2020**

	Method
appropriate dermal protection [Effectiveness Dermal: 80%]	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.6.5.2. Exposure and risks for workers**

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

**Table 9.68. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	1.372 mg/kg bw/day (TRA Workers)	RCR = 0.116
Combined routes, systemic, long-term		RCR = 0.719

**9.6.6. Worker CS 6: Mixing or blending in batch processes (PROC 5)**

**9.6.6.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.6.6.2. Exposure and risks for workers**

**FH-C20-033\_V.10/ 09.10.2020**

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

**Table 9.69. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**9.6.7. Worker CS 7: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities (PROC 8a)**

**9.6.7.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.6.7.2. Exposure and risks for workers**

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

**Table 9.70. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243

**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**9.6.8. Worker CS 8: Transfer of substance or mixture (charging and discharging) at dedicated facilities (PROC 8b)**
**9.6.8.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.6.8.2. Exposure and risks for workers**

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

**Table 9.71. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.12
Inhalation, systemic, acute	4 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.049
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.353

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



**FH-C20-033\_V.10/ 09.10.2020**

**9.6.9.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.6.9.2. Exposure and risks for workers**

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

**Table 9.72. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	1.372 mg/kg bw/day (TRA Workers)	RCR = 0.116
Combined routes, systemic, long-term		RCR = 0.719

**9.6.10. Worker CS 10: Use as laboratory reagent (PROC 15)**

**9.6.10.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0

**FH-C20-033\_V.10/ 09.10.2020**

	Method
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.6.10.2. Exposure and risks for workers**

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

**Table 9.73. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.06
Inhalation, systemic, acute	2 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.024
Dermal, systemic, long term	0.34 mg/kg bw/day (TRA Workers)	RCR = 0.029
Combined routes, systemic, long-term		RCR = 0.089

**9.6.11. Worker CS 11: Hand-mixing with intimate contact and only PPE available (PROC 19)**
**9.6.11.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 4 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0

**FH-C20-033\_V.10/ 09.10.2020**

	Method
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.6.11.2. Exposure and risks for workers**

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

**Table 9.74. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	3 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.361
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	7.072 mg/kg bw/day (TRA Workers)	RCR = 0.599
Combined routes, systemic, long-term		RCR = 0.961

**9.6.12. Worker CS 12: Manual maintenance (cleaning and repair) of machinery (PROC 28)**
**9.6.12.1. Conditions of use**

	Method	
Product (article) characteristics		
• Percentage (w/w) of substance in mixture/article: <= 100 %	ECETOC	TRA Workers 3.1
• Physical form of the used product: Solid (medium dusty form)	ECETOC	TRA Workers 3.1
Amount used (or contained in articles), frequency and duration of use/exposure		
• Duration of activity: <= 8 h/day	ECETOC	TRA Workers 3.1
Technical and organisational conditions and measures		
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	ECETOC	TRA Workers 3.1
• Occupational Health and Safety Management System: Advanced	ECETOC	TRA Workers 3.1
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	ECETOC	TRA Workers 3.1
Conditions and measures related to personal protection, hygiene and health evaluation		
• Respiratory protection: No [Effectiveness Inhalation: 0%]	ECETOC	TRA Workers 3.1
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	ECETOC	TRA Workers 3.1

**FH-C20-033\_V.10/ 09.10.2020**

	Method
Other conditions affecting workers exposure	
• Place of use: Indoor	ECETOC TRA Workers 3.1
• Operating temperature: <= 40 °C	ECETOC TRA Workers 3.1

**9.6.12.2. Exposure and risks for workers**

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

**Table 9.75. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.243
Dermal, systemic, long term	2.742 mg/kg bw/day (ECETOC TRA Workers 3.1)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**Remarks on exposure data from external estimation tools:**

**ECETOC TRA Workers 3.1:**

Explanation: The exposure estimates for PROC 8a are used, as TRA Workers cannot predict exposure for PROC 28 and these estimates can be considered suitable for estimating exposures during manual maintenance.

**9.7. Exposure scenario 7: Use at industrial sites - Use as additive in intumescent coatings**

Environment contributing scenario(s):		
CS 1	Use as additive in intumescent coatings	ERC 5
Worker contributing scenario(s):		
CS 2	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment conditions	PROC 3
CS 3	Chemical production where opportunity for exposure arises	PROC 4
CS 4	Mixing or blending in batch processes	PROC 5
CS 5	Industrial spraying with Local Exhaust Ventilation (LEV)	PROC 7
CS 6	Industrial spraying without Local Exhaust Ventilation (LEV)	PROC 7
CS 7	Transfer of substance or mixture (charging and discharging) at non-dedicated facilities	PROC 8a
CS 8	Transfer of substance or mixture (charging and discharging) at dedicated facilities	PROC 8b
CS 9	Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	PROC 9
CS 10	Roller application or brushing	PROC 10
CS 11	Treatment of articles by dipping and pouring	PROC 13

**FH-C20-033\_V.10/ 09.10.2020**

CS 12	Use as laboratory reagent	PROC 15
CS 13	Hand-mixing with intimate contact and only PPE available	PROC 19
CS 14	Manual maintenance (cleaning and repair) of machinery	PROC 28

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

ES10: Service life (worker at industrial site) - Intumescent coatings - Workers (industrial)

ES11: Service life (professional worker) - Intumescent coatings - Professional Workers

ES13: Service life (consumers) - Intumescent coating – Consumers

**9.7.1. Env CS 1: Use as additive in intumescent coatings (ERC 5)**

**9.7.1.1. Conditions of use**

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: not relevant for the assessment as scenario specific releases are estimated
• Annual use amount at site: not relevant for the assessment as scenario specific releases are estimated
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 0.169%]
• Discharge rate of STP: $\geq 2E3$ m <sup>3</sup> /day
• Application of the STP sludge on agricultural soil: Yes
Other conditions affecting environmental exposure
• Receiving surface water flow rate: $\geq 1.8E4$ m <sup>3</sup> /day

**9.7.1.2. Releases**

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

**Table 9.76. Local releases to the environment**

Release	Release estimation method	Explanations
Water	Estimated release rate	<b>Local release rate:</b> 3 kg/day
Air	Estimated release rate	<b>Local release rate:</b> 0.5 kg/day
Non agricultural soil	Estimated release factor	<b>Release factor after on site RMM:</b> 0%

**9.7.1.3. Exposure and risks for the environment and man via the environment**

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.2.0 unless stated otherwise.

**Table 9.77. Exposure concentrations and risks for the environment and man via the environment**

Protection target	Exposure concentration	Risk quantification
Fresh water	<b>Local PEC:</b> 0.155 mg/L	RCR = 0.30
Sediment (freshwater)	<b>Local PEC:</b> 0.766 mg/kg dw	RCR = 0.30
Marine water	<b>Local PEC:</b> 0.0155 mg/L	RCR = 0.30

**FH-C20-033\_V.10/ 09.10.2020**

Protection target	Exposure concentration	Risk quantification
Sediment (marine water)	Local PEC: 0.077 mg/kg dw	RCR = 0.30
Sewage Treatment Plant	Local PEC: 1.497 mg/L	RCR < 0.01
Agricultural soil	Local PEC: 0.017 mg/kg dw	RCR = 0.08
Man via environment - Inhalation (systemic effects)	Concentration in air: 3.97E-5 mg/m <sup>3</sup>	RCR < 0.01
Man via environment - Oral	Exposure via food consumption: 9.70E-3 mg/kg bw/day	RCR = 0.02
Man via environment - combined routes		RCR = 0.02

**9.7.2. Worker CS 2: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment conditions (PROC 3)**

**9.7.2.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.7.2.2. Exposure and risks for workers**

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

**Table 9.78. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.12
Inhalation, systemic, acute	4 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.049

**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Dermal, systemic, long term	0.69 mg/kg bw/day (TRA Workers)	RCR = 0.058
Combined routes, systemic, long-term		RCR = 0.179

**9.7.3. Worker CS 3: Chemical production where opportunity for exposure arises (PROC 4)**
**9.7.3.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.7.3.2. Exposure and risks for workers**

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

**Table 9.79. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	1.372 mg/kg bw/day (TRA Workers)	RCR = 0.116
Combined routes, systemic, long-term		RCR = 0.719

**9.7.4. Worker CS 4: Mixing or blending in batch processes (PROC 5)**
**9.7.4.1. Conditions of use**



**FH-C20-033\_V.10/ 09.10.2020**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.7.4.2. Exposure and risks for workers**

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

**Table 9.80. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**9.7.5. Worker CS 5: Industrial spraying with Local Exhaust Ventilation (LEV) (PROC 7)**
**9.7.5.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 30 %	Stoffenmanager 8, TRA Workers 3.0
• Physical form of the used product: Liquid	Stoffenmanager 8, TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	

**FH-C20-033\_V.10/ 09.10.2020**

	Method
• Duration of activity: <= 8 h/day	Stoffenmanager 8, TRA Workers 3.0
Technical and organisational conditions and measures	
• Ventilation working room: General ventilation (mechanical)	Stoffenmanager 8
• Occupational Health and Safety Management System: Advanced	Stoffenmanager 8, TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 95%, Dermal: 0%]	Stoffenmanager 8, TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	Stoffenmanager 8
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	Stoffenmanager 8, TRA Workers 3.0
• Operating temperature: <= 40 °C	Stoffenmanager 8, TRA Workers 3.0

**9.7.5.2. Exposure and risks for workers**

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

**Table 9.81. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.4 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR = 0.048
Inhalation, systemic, acute	0.4 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR < 0.01
Dermal, systemic, long term	8.572 mg/kg bw/day (TRA Workers)	RCR = 0.726
Combined routes, systemic, long-term		RCR = 0.775

**Remarks on exposure data from external estimation tools:**

**Stoffenmanager 8:**

Explanation: Inhalation exposure concentration estimated using Stoffenmanager® (version 8)

- Activity/type of task: Handling of liquids at high pressure resulting in substantial generation of mist or spray/haze
- Distance to task: In the breathing zone of the worker (distance head-product < 1 m) (worst-case assumption)
- Local controls: No control measures at the source (refinement due to LEV done outside Stoffenmanager®, see below)
- Ventilation working room: General ventilation (mechanical)
- Volume of the working room: 100-1000 m<sup>3</sup>
- Regular cleaning of work area (daily): Yes
- Regular inspection and maintenance (at least monthly): Yes
- Presence of secondary emission sources (worst-case assumptions);

**FH-C20-033\_V.10/ 09.10.2020**

Other workers using the same substance simultaneously: Yes

A period of evaporation, drying or curing after the activity (with prolonged emission of vapours): Yes

The concentration during the task due to the activity undertaken is estimated to be 7.95 mg/m<sup>3</sup>, resulting in an exposure concentration of 0.4 mg/m<sup>3</sup> due to the use of LEV with an effectiveness of 95% (TRA effectiveness). As the task is performed for 8 hours, the daily average concentration equals the task concentration. In accordance with the ECHA Guidance (Chapter R.14), this estimated concentration is therefore considered to be the short-term as well as the long-term inhalation exposure estimate (90th percentiles).

**9.7.6. Worker CS 6: Industrial spraying without Local Exhaust Ventilation (LEV) (PROC 7)**

**9.7.6.1. Conditions of use**

	Method
<b>Product (article) characteristics</b>	
• Percentage (w/w) of substance in mixture/article: ≤ 30 %	Stoffenmanager 8, TRA Workers 3.0
• Physical form of the used product: Liquid	Stoffenmanager 8, TRA Workers 3.0
<b>Amount used (or contained in articles), frequency and duration of use/exposure</b>	
• Duration of activity: ≤ 8 h/day	Stoffenmanager 8, TRA Workers 3.0
<b>Technical and organisational conditions and measures</b>	
• Ventilation working room: General ventilation (mechanical)	Stoffenmanager 8
• Occupational Health and Safety Management System: Advanced	Stoffenmanager 8, TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	Stoffenmanager 8, TRA Workers 3.0
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>	
• Respiratory protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%]	Stoffenmanager 8
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
<b>Other conditions affecting workers exposure</b>	
• Place of use: Indoor	Stoffenmanager 8, TRA Workers 3.0
• Operating temperature: ≤ 40 °C	Stoffenmanager 8, TRA Workers 3.0

**9.7.6.2. Exposure and risks for workers**

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

**Table 9.82. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.795 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR = 0.096

**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, acute	0.795 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR < 0.01
Dermal, systemic, long term	8.572 mg/kg bw/day (TRA Workers)	RCR = 0.726
Combined routes, systemic, long-term		RCR = 0.822

**Remarks on exposure data from external estimation tools:**

**Stoffenmanager 8:**

Explanation: Inhalation exposure concentration estimated using Stoffenmanager® (version 8)

- Activity/type of task: Handling of liquids at high pressure resulting in substantial generation of mist or spray/haze
- Distance to task: In the breathing zone of the worker (distance head-product < 1 m) (worst-case assumption)
- Local controls: No control measures at the source
- Ventilation working room: General ventilation (mechanical)
- Volume of the working room: 100-1000 m<sup>3</sup>
- Regular cleaning of work area (daily): Yes
- Regular inspection and maintenance (at least monthly): Yes
- Presence of secondary emission sources (worst-case assumptions);

Other workers using the same substance simultaneously: Yes

A period of evaporation, drying or curing after the activity (with prolonged emission of vapours): Yes

The concentration during the task due to the activity undertaken is estimated to be 7.95 mg/m<sup>3</sup>, resulting in an exposure concentration of 0.795 mg/m<sup>3</sup> due to the use of respiratory protection with an effectiveness of 90%. As the task is performed for 8 hours, the daily average concentration equals the task concentration. In accordance with the ECHA Guidance (Chapter R.14), this estimated concentration is therefore considered to be the short-term as well as the long-term inhalation exposure estimate (90th percentiles).

**9.7.7. Worker CS 7: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities (PROC 8a)**

**9.7.7.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other)	TRA Workers 3.0

**FH-C20-033\_V.10/ 09.10.2020**

	Method
appropriate dermal protection [Effectiveness Dermal: 80%]	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.7.7.2. Exposure and risks for workers**

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

**Table 9.83. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**9.7.8. Worker CS 8: Transfer of substance or mixture (charging and discharging) at dedicated facilities (PROC 8b)**

**9.7.8.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**FH-C20-033\_V.10/ 09.10.2020**
**9.7.8.2. Exposure and risks for workers**

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

**Table 9.84. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.12
Inhalation, systemic, acute	4 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.049
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.353

**9.7.9. Worker CS 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9)**
**9.7.9.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.7.9.2. Exposure and risks for workers**

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

**Table 9.85. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602

**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	1.372 mg/kg bw/day (TRA Workers)	RCR = 0.116
Combined routes, systemic, long-term		RCR = 0.719

**9.7.10. Worker CS 10: Roller application or brushing (PROC 10)**
**9.7.10.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 30 %	Stoffenmanager 8, TRA Workers 3.0
• Physical form of the used product: Liquid	Stoffenmanager 8, TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	Stoffenmanager 8, TRA Workers 3.0
Technical and organisational conditions and measures	
• Ventilation working room: General ventilation (mechanical)	Stoffenmanager 8
• Occupational Health and Safety Management System: Advanced	Stoffenmanager 8, TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	Stoffenmanager 8, TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	Stoffenmanager 8
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	Stoffenmanager 8, TRA Workers 3.0
• Operating temperature: <= 40 °C	Stoffenmanager 8, TRA Workers 3.0

**9.7.10.2. Exposure and risks for workers**

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

**Table 9.86. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	3.59 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR = 0.433
Inhalation, systemic, acute	3.59 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR = 0.044



**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Dermal, systemic, long term	5.486 mg/kg bw/day (TRA Workers)	RCR = 0.465
Combined routes, systemic, long-term		RCR = 0.897

**Remarks on exposure data from external estimation tools:**

**Stoffenmanager 8:**

Explanation: Inhalation exposure concentration estimated using Stoffenmanager® (version 8)

- Activity/type of task: Handling of liquids on large surfaces or large work pieces
- Distance to task: In the breathing zone of the worker (distance head-product < 1 m) (worst-case assumption)
- Local controls: No control measures at the source
- Ventilation working room: General ventilation (mechanical)
- Volume of the working room: 100-1000 m<sup>3</sup>
- Regular cleaning of work area (daily): Yes
- Regular inspection and maintenance (at least monthly): Yes
- Presence of secondary emission sources (worst-case assumptions);

Other workers using the same substance simultaneously: Yes

A period of evaporation, drying or curing after the activity (with prolonged emission of vapours): Yes

The concentration that can be inhaled by the worker during the task due to the activity undertaken is obtained. As the task is performed for 8 hours, the daily average concentration equals the task concentration. In accordance with the ECHA Guidance (Chapter R.14), this estimated concentration is therefore considered to be the short-term as well as the long-term inhalation exposure estimate (90th percentiles).

**9.7.11. Worker CS 11: Treatment of articles by dipping and pouring (PROC 13)**

**9.7.11.1. Conditions of use**

	Method
<b>Product (article) characteristics</b>	
• Percentage (w/w) of substance in mixture/article: <= 30 %	ECETOC TRA Workers 3.1
• Physical form of the used product: Liquid	ECETOC TRA Workers 3.1
<b>Amount used (or contained in articles), frequency and duration of use/exposure</b>	
• Duration of activity: <= 8 h/day	ECETOC TRA Workers 3.1
<b>Technical and organisational conditions and measures</b>	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	ECETOC TRA Workers 3.1
• Occupational Health and Safety Management System: Advanced	ECETOC TRA Workers 3.1
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	ECETOC TRA Workers 3.1
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	ECETOC TRA Workers 3.1

**FH-C20-033\_V.10/ 09.10.2020**

	Method
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	ECETOC TRA Workers 3.1
Other conditions affecting workers exposure	
• Place of use: Indoor	ECETOC TRA Workers 3.1
• Operating temperature: <= 40 °C	ECETOC TRA Workers 3.1

**9.7.11.2. Exposure and risks for workers**

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

**Table 9.87. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.525 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.063
Inhalation, systemic, acute	0.525 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR < 0.01
Dermal, systemic, long term	2.743 mg/kg bw/day (ECETOC TRA Workers 3.1)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.296

**Remarks on exposure data from external estimation tools:**

**ECETOC TRA Workers 3.1:**

Explanation: As solid is used as value for CSA, while liquid is used, it is considered appropriate to refine the exposure estimates, using the standalone version of TRA Workers (v3.1). The vapour pressure at operating temperature (40°C) used for the calculation is 3.71E-8 Pa (as calculated by Chesar).

**9.7.12. Worker CS 12: Use as laboratory reagent (PROC 15)**

**9.7.12.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	

**FH-C20-033\_V.10/ 09.10.2020**

	Method
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.7.12.2. Exposure and risks for workers**

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

**Table 9.88. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.06
Inhalation, systemic, acute	2 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.024
Dermal, systemic, long term	0.34 mg/kg bw/day (TRA Workers)	RCR = 0.029
Combined routes, systemic, long-term		RCR = 0.089

**9.7.13. Worker CS 13: Hand-mixing with intimate contact and only PPE available (PROC 19)**

**9.7.13.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 30 %	Stoffenmanager 8, TRA Workers 3.0
• Physical form of the used product: Liquid	Stoffenmanager 8, TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	Stoffenmanager 8, TRA Workers 3.0
Technical and organisational conditions and measures	
• Ventilation working room: General ventilation (mechanical)	Stoffenmanager 8
• Occupational Health and Safety Management System: Advanced	Stoffenmanager 8, TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	Stoffenmanager 8, TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	Stoffenmanager 8
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%]	TRA Workers 3.0
Other conditions affecting workers exposure	

**FH-C20-033\_V.10/ 09.10.2020**

	Method
• Place of use: Indoor	Stoffenmanager 8, TRA Workers 3.0
• Operating temperature: <= 40 °C	Stoffenmanager 8, TRA Workers 3.0

**9.7.13.2. Exposure and risks for workers**

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

**Table 9.89. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1.74 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR = 0.21
Inhalation, systemic, acute	1.74 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR = 0.021
Dermal, systemic, long term	7.072 mg/kg bw/day (TRA Workers)	RCR = 0.599
Combined routes, systemic, long-term		RCR = 0.809

**Remarks on exposure data from external estimation tools:**

**Stoffenmanager 8:**

Explanation: Inhalation exposure concentration estimated using Stoffenmanager® (version 8)

- Activity/type of task: Handling of liquids using low pressure, low speed or on medium-sized surfaces
- Distance to task: In the breathing zone of the worker (distance head-product < 1 m) (worst-case assumption)
- Local controls: No control measures at the source
- Ventilation working room: General ventilation (mechanical)
- Volume of the working room: 100-1000 m<sup>3</sup>
- Regular cleaning of work area (daily): Yes
- Regular inspection and maintenance (at least monthly): Yes
- Presence of secondary emission sources (worst-case assumptions);

Other workers using the same substance simultaneously: Yes

A period of evaporation, drying or curing after the activity (with prolonged emission of vapours): Yes

The concentration that can be inhaled by the worker during the task due to the activity undertaken is obtained.

As the task is performed for 8 hours, the daily average concentration equals the task concentration. In accordance with the ECHA Guidance (Chapter R.14), this estimated concentration is therefore considered to be the short-term as well as the long-term inhalation exposure estimate (90th percentiles).

**9.7.14. Worker CS 14: Manual maintenance (cleaning and repair) of machinery (PROC 28)**

**9.7.14.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	ECETOC TRA Workers 3.1
• Physical form of the used product: Solid (medium dusty form)	ECETOC TRA Workers 3.1
Amount used (or contained in articles), frequency and duration of use/exposure	

**FH-C20-033\_V.10/ 09.10.2020**

	Method	
• Duration of activity: <= 8 h/day	ECETOC Workers 3.1	TRA
Technical and organisational conditions and measures		
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	ECETOC Workers 3.1	TRA
• Occupational Health and Safety Management System: Advanced	ECETOC Workers 3.1	TRA
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	ECETOC Workers 3.1	TRA
Conditions and measures related to personal protection, hygiene and health evaluation		
• Respiratory protection: No [Effectiveness Inhalation: 0%]	ECETOC Workers 3.1	TRA
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	ECETOC Workers 3.1	TRA
Other conditions affecting workers exposure		
• Place of use: Indoor	ECETOC Workers 3.1	TRA
• Operating temperature: <= 40 °C	ECETOC Workers 3.1	TRA

**9.7.14.2. Exposure and risks for workers**

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

**Table 9.90. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.243
Dermal, systemic, long term	2.742 mg/kg bw/day (ECETOC TRA Workers 3.1)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**Remarks on exposure data from external estimation tools:**
**ECETOC TRA Workers 3.1:**

Explanation: The exposure estimates for PROC 8a are used, as TRA Workers cannot predict exposure for PROC 28 and these estimates can be considered suitable for estimating exposures during manual maintenance.

**9.8. Exposure scenario 8: Widespread use by professional workers - Use as additive in intumescent coatings**

Environment contributing scenario(s):		
CS 1	Use as additive in intumescent coatings	ERC 8c; ERC 8f

**FH-C20-033\_V.10/ 09.10.2020**

<b>Worker contributing scenario(s):</b>		
CS 2	Mixing or blending in batch processes	PROC 5
CS 3	Transfer of substance or mixture (charging and discharging) at non-dedicated facilities	PROC 8a
CS 4	Transfer of substance or mixture (charging and discharging) at dedicated facilities	PROC 8b
CS 5	Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	PROC 9
CS 6	Roller application or brushing	PROC 10
CS 7	Non industrial spraying	PROC 11
CS 8	Treatment of articles by dipping and pouring	PROC 13
CS 9	Manual maintenance (cleaning and repair) of machinery	PROC 28

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

ES11: Service life (professional worker) - Intumescent coatings - Professional Workers

ES13: Service life (consumers) - Intumescent coating – Consumers

**9.8.1. Env CS 1: Use as additive in intumescent coatings (ERC 8c; ERC 8f)**

**9.8.1.1. Conditions of use**

Amount used, frequency and duration of use (or from service life)
<ul style="list-style-type: none"> <li>Daily local widespread use amount: not relevant for the assessment as scenario specific releases are estimated</li> </ul>
Conditions and measures related to biological sewage treatment plant
<ul style="list-style-type: none"> <li>Biological STP: Standard [Effectiveness Water: 0.169%]</li> <li>Discharge rate of STP: <math>\geq 2E3</math> m<sup>3</sup>/day</li> <li>Application of the STP sludge on agricultural soil: Yes</li> </ul>
Other conditions affecting environmental exposure
<ul style="list-style-type: none"> <li>Receiving surface water flow rate: <math>\geq 1.8E4</math> m<sup>3</sup>/day</li> </ul>

**9.8.1.2. Releases**

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

**Table 9.91. Local releases to the environment**

Release	Release estimation method	Explanations
Water	Estimated release rate	<b>Local release rate: 0 kg/day</b>
Air	Estimated release rate	<b>Local release rate: 0 kg/day</b>
Non agricultural soil	Estimated release factor	<b>Release factor after on site RMM: 0%</b>

**9.8.1.3. Exposure and risks for the environment and man via the environment**

**FH-C20-033\_V.10/ 09.10.2020**

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.2.0 unless stated otherwise.

**Table 9.92. Exposure concentrations and risks for the environment and man via the environment**

Protection target	Exposure concentration	Risk quantification
Fresh water	Local PEC: 5.0E-3 mg/L	RCR = 0.01
Sediment (freshwater)	Local PEC: 0.025 mg/kg dw	RCR = 0.01
Marine water	Local PEC: 5.0E-4 mg/L	RCR = 0.01
Sediment (marine water)	Local PEC: 2.4E-3 mg/kg dw	RCR = 0.01
Sewage Treatment Plant	Local PEC: 0 mg/L	RCR < 0.01
Agricultural soil	Local PEC: 2.52E-12 mg/kg dw	RCR < 0.01
Man via environment - Inhalation (systemic effects)	Concentration in air: 1.62E-21 mg/m <sup>3</sup>	RCR < 0.01
Man via environment - Oral	Exposure via food consumption: 1.74E-4 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

**9.8.2. Worker CS 2: Mixing or blending in batch processes (PROC 5)**
**9.8.2.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.8.2.2. Exposure and risks for workers**

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



**FH-C20-033\_V.10/ 09.10.2020**
**Table 9.93. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**9.8.3. Worker CS 3: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities (PROC 8a)**
**9.8.3.1. Conditions of use**

	Method	
Product (article) characteristics		
• Percentage (w/w) of substance in mixture/article: <= 30 %	ECETOC	TRA Workers 3.1
• Physical form of the used product: Liquid	ECETOC	TRA Workers 3.1
Amount used (or contained in articles), frequency and duration of use/exposure		
• Duration of activity: <= 8 h/day	ECETOC	TRA Workers 3.1
Technical and organisational conditions and measures		
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	ECETOC	TRA Workers 3.1
• Occupational Health and Safety Management System: Basic	ECETOC	TRA Workers 3.1
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	ECETOC	TRA Workers 3.1
Conditions and measures related to personal protection, hygiene and health evaluation		
• Respiratory protection: No [Effectiveness Inhalation: 0%]	ECETOC	TRA Workers 3.1
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	ECETOC	TRA Workers 3.1
Other conditions affecting workers exposure		
• Place of use: Indoor	ECETOC	TRA Workers 3.1
• Operating temperature: <= 40 °C	ECETOC	TRA Workers 3.1

**9.8.3.2. Exposure and risks for workers**

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

**Table 9.94. Exposure concentrations and risks for workers**

**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.525 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.063
Inhalation, systemic, acute	0.525 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR < 0.01
Dermal, systemic, long term	2.743 mg/kg bw/day (ECETOC TRA Workers 3.1)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.296

**Remarks on exposure data from external estimation tools:**

**ECETOC TRA Workers 3.1:**

Explanation: As solid is used as value for CSA, while liquid is used, it is considered appropriate to refine the exposure estimates, using the standalone version of TRA Workers (v3.1). The vapour pressure at operating temperature (40°C) used for the calculation is 3.71E-8 Pa (as calculated by Chesar).

**9.8.4. Worker CS 4: Transfer of substance or mixture (charging and discharging) at dedicated facilities (PROC 8b)**

**9.8.4.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.8.4.2. Exposure and risks for workers**

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

**Table 9.95. Exposure concentrations and risks for workers**

**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	2.742 mg/kg bw/day (TRA Workers)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.835

**9.8.5. Worker CS 5: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9)**

**9.8.5.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.8.5.2. Exposure and risks for workers**

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

**Table 9.96. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	1.372 mg/kg bw/day (TRA Workers)	RCR = 0.116
Combined routes, systemic, long-term		RCR = 0.719

FH-C20-033\_V.10/ 09.10.2020

### 9.8.6. Worker CS 6: Roller application or brushing (PROC 10)

#### 9.8.6.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 30 %	Stoffenmanager 8, TRA Workers 3.0
• Physical form of the used product: Liquid	Stoffenmanager 8, TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	Stoffenmanager 8, TRA Workers 3.0
Technical and organisational conditions and measures	
• Ventilation working room: General ventilation (mechanical)	Stoffenmanager 8
• Occupational Health and Safety Management System: Basic	Stoffenmanager 8, TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	Stoffenmanager 8, TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	Stoffenmanager 8
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	Stoffenmanager 8, TRA Workers 3.0
• Operating temperature: <= 40 °C	Stoffenmanager 8, TRA Workers 3.0

#### 9.8.6.2. Exposure and risks for workers

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

**Table 9.97. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	3.61 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR = 0.435
Inhalation, systemic, acute	3.61 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR = 0.044
Dermal, systemic, long term	5.486 mg/kg bw/day (TRA Workers)	RCR = 0.465
Combined routes, systemic, long-term		RCR = 0.9

#### Remarks on exposure data from external estimation tools:

##### Stoffenmanager 8:

Explanation: Inhalation exposure concentration estimated using Stoffenmanager® (version 8)

**FH-C20-033\_V.10/ 09.10.2020**

- Activity/type of task: Handling of liquids on large surfaces or large work pieces
- Distance to task: In the breathing zone of the worker (distance head-product < 1 m) (worst-case assumption)
- Local controls: No control measures at the source
- Ventilation working room: General ventilation (mechanical)
- Volume of the working room: 100-1000 m<sup>3</sup>
- Regular cleaning of work area (daily): No
- Regular inspection and maintenance (at least monthly): No
- Presence of secondary emission sources (worst-case assumptions);

Other workers using the same substance simultaneously: Yes

A period of evaporation, drying or curing after the activity (with prolonged emission of vapours): Yes

The concentration that can be inhaled by the worker during the task due to the activity undertaken is obtained. As the task is performed for 8 hours, the daily average concentration equals the task concentration. In accordance with the ECHA Guidance (Chapter R.14), this estimated concentration is therefore considered to be the short-term as well as the long-term inhalation exposure estimate (90th percentiles).

**9.8.7. Worker CS 7: Non industrial spraying (PROC 11)**

**9.8.7.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 30 %	Stoffenmanager 8, TRA Workers 3.0
• Physical form of the used product: Liquid	Stoffenmanager 8, TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	Stoffenmanager 8, TRA Workers 3.0
Technical and organisational conditions and measures	
• Ventilation working room: General ventilation (mechanical)	Stoffenmanager 8
• Occupational Health and Safety Management System: Basic	Stoffenmanager 8, TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	Stoffenmanager 8, TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (Respirator with APF of 20) [Effectiveness Inhalation: 95%]	Stoffenmanager 8
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	Stoffenmanager 8, TRA Workers 3.0
• Operating temperature: <= 40 °C	Stoffenmanager 8, TRA Workers 3.0

**9.8.7.2. Exposure and risks for workers**

**FH-C20-033\_V.10/ 09.10.2020**

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

**Table 9.98. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.398 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR = 0.048
Inhalation, systemic, acute	0.398 mg/m <sup>3</sup> (Stoffenmanager 8)	RCR < 0.01
Dermal, systemic, long term	10.71 mg/kg bw/day (TRA Workers)	RCR = 0.908
Combined routes, systemic, long-term		RCR = 0.956

**Remarks on exposure data from external estimation tools:**

**Stoffenmanager 8:**

Explanation: Inhalation exposure concentration estimated using Stoffenmanager® (version 8)

- Activity/type of task: Handling of liquids at high pressure resulting in substantial generation of mist or spray/haze
- Distance to task: In the breathing zone of the worker (distance head-product < 1 m) (worst-case assumption)
- Local controls: No control measures at the source
- Ventilation working room: General ventilation (mechanical)
- Volume of the working room: 100-1000 m<sup>3</sup>
- Regular cleaning of work area (daily): No
- Regular inspection and maintenance (at least monthly): No
- Presence of secondary emission sources (worst-case assumptions);

Other workers using the same substance simultaneously: Yes

A period of evaporation, drying or curing after the activity (with prolonged emission of vapours): Yes

The concentration during the task due to the activity undertaken is estimated to be 7.96 mg/m<sup>3</sup>, resulting in an exposure concentration of 0.398 mg/m<sup>3</sup> due to the use of respiratory protection. As the task is performed for 8 hours, the daily average concentration equals the task concentration. In accordance with the ECHA Guidance (Chapter R.14), this estimated concentration is therefore considered to be the short-term as well as the long-term inhalation exposure estimate (90th percentiles).

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

**9.8.8.1. Conditions of use**

	Method	
Product (article) characteristics		
• Percentage (w/w) of substance in mixture/article: ≤ 30 %	ECETOC Workers 3.1	TRA
• Physical form of the used product: Liquid	ECETOC Workers 3.1	TRA
Amount used (or contained in articles), frequency and duration of use/exposure		
• Duration of activity: ≤ 8 h/day	ECETOC Workers 3.1	TRA
Technical and organisational conditions and measures		
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	ECETOC Workers 3.1	TRA

**FH-C20-033\_V.10/ 09.10.2020**

	Method
• Occupational Health and Safety Management System: Basic	ECETOC TRA Workers 3.1
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	ECETOC TRA Workers 3.1
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	ECETOC TRA Workers 3.1
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	ECETOC TRA Workers 3.1
Other conditions affecting workers exposure	
• Place of use: Indoor	ECETOC TRA Workers 3.1
• Operating temperature: <= 40 °C	ECETOC TRA Workers 3.1

**9.8.8.2. Exposure and risks for workers**

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

**Table 9.99. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.525 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.063
Inhalation, systemic, acute	0.525 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR < 0.01
Dermal, systemic, long term	2.743 mg/kg bw/day (ECETOC TRA Workers 3.1)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.296

**Remarks on exposure data from external estimation tools:**

**ECETOC TRA Workers 3.1:**

Explanation: As solid is used as value for CSA, while liquid is used, it is considered appropriate to refine the exposure estimates, using the standalone version of TRA Workers (v3.1). The vapour pressure at operating temperature (40°C) used for the calculation is 3.71E-8 Pa (as calculated by Chesar).

**9.8.9. Worker CS 9: Manual maintenance (cleaning and repair) of machinery (PROC 28)**

**9.8.9.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 30 %	ECETOC TRA Workers 3.1
• Physical form of the used product: Liquid	ECETOC TRA Workers 3.1
Amount used (or contained in articles), frequency and duration of use/exposure	



**FH-C20-033\_V.10/ 09.10.2020**

	Method	
• Duration of activity: <= 8 h/day	ECETOC Workers 3.1	TRA
Technical and organisational conditions and measures		
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	ECETOC Workers 3.1	TRA
• Occupational Health and Safety Management System: Basic	ECETOC Workers 3.1	TRA
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	ECETOC Workers 3.1	TRA
Conditions and measures related to personal protection, hygiene and health evaluation		
• Respiratory protection: No [Effectiveness Inhalation: 0%]	ECETOC Workers 3.1	TRA
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374) and (other) appropriate dermal protection [Effectiveness Dermal: 80%]	ECETOC Workers 3.1	TRA
Other conditions affecting workers exposure		
• Place of use: Indoor	ECETOC Workers 3.1	TRA
• Operating temperature: <= 40 °C	ECETOC Workers 3.1	TRA

**9.8.9.2. Exposure and risks for workers**

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

**Table 9.100. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.525 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR = 0.063
Inhalation, systemic, acute	0.525 mg/m <sup>3</sup> (ECETOC TRA Workers 3.1)	RCR < 0.01
Dermal, systemic, long term	2.743 mg/kg bw/day (ECETOC TRA Workers 3.1)	RCR = 0.232
Combined routes, systemic, long-term		RCR = 0.296

**Remarks on exposure data from external estimation tools:**
**ECETOC TRA Workers 3.1:**

Explanation: The exposure estimates for PROC 8a are used, as TRA Workers cannot predict exposure for PROC 28 and these estimates can be considered suitable for estimating exposures during manual maintenance. The exposure estimates are calculated for using a liquid, with the standalone version of TRA Workers (v3.1). The vapour pressure at operating temperature (40°C) used for the calculation is 3.71E-8 Pa (as calculated by Chesar).

**9.9. Exposure scenario 9: Service life (worker at industrial site) - PU foams - Workers (industrial)**

Environment contributing scenario(s):
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**FH-C20-033\_V.10/ 09.10.2020**

CS 1	PU foams - Workers (industrial)	ERC 12a
<b>Worker contributing scenario(s):</b>		
CS 2	Low energy manipulation of substances bound in materials and/or articles	PROC 21
CS 3	High (mechanical) energy work-up of substances bound in materials and/or articles	PROC 24

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

ES6: Use at industrial sites - Use as additive in foams

**9.9.1. Env CS 1: PU foams - Workers (industrial) (ERC 12a)**

**9.9.1.1. Conditions of use**

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: not relevant for the assessment as scenario specific releases are estimated
• Annual use amount at site: not relevant for the assessment as scenario specific releases are estimated
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 0.169%]
• Discharge rate of STP: $\geq 2E3$ m <sup>3</sup> /day
• Application of the STP sludge on agricultural soil: Yes
Other conditions affecting environmental exposure
• Receiving surface water flow rate: $\geq 1.8E4$ m <sup>3</sup> /day

**9.9.1.2. Releases**

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

**Table 9.101. Local releases to the environment**

Release	Release estimation method	Explanations
Water	Estimated release rate	<b>Local release rate: 0 kg/day</b>
Air	Estimated release rate	<b>Local release rate: 0 kg/day</b>
Non agricultural soil	Estimated release factor	<b>Release factor after on site RMM: 0%</b>

**9.9.1.3. Exposure and risks for the environment and man via the environment**

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.2.0 unless stated otherwise.

**Table 9.102. Exposure concentrations and risks for the environment and man via the environment**

Protection target	Exposure concentration	Risk quantification
Fresh water	<b>Local PEC: 5.0E-3 mg/L</b>	RCR = 0.01
Sediment (freshwater)	<b>Local PEC: 0.025 mg/kg dw</b>	RCR = 0.01

**FH-C20-033\_V.10/ 09.10.2020**

Protection target	Exposure concentration	Risk quantification
Marine water	Local PEC: 5.0E-4 mg/L	RCR = 0.01
Sediment (marine water)	Local PEC: 2.4E-3 mg/kg dw	RCR = 0.01
Sewage Treatment Plant	Local PEC: 0 mg/L	RCR < 0.01
Agricultural soil	Local PEC: 2.52E-12 mg/kg dw	RCR < 0.01
Man via environment - Inhalation (systemic effects)	Concentration in air: 1.62E-21 mg/m <sup>3</sup>	RCR < 0.01
Man via environment - Oral	Exposure via food consumption: 1.74E-4 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

**9.9.2. Worker CS 2: Low energy manipulation of substances bound in materials and/or articles (PROC 21)**
**9.9.2.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.9.2.2. Exposure and risks for workers**

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

**Table 9.103. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	3 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.361
Inhalation, systemic, acute	12 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.146

**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Dermal, systemic, long term	2.83 mg/kg bw/day (TRA Workers)	RCR = 0.24
Combined routes, systemic, long-term		RCR = 0.601

**9.9.3. Worker CS 3: High (mechanical) energy work-up of substances bound in materials and/or articles (PROC 24)**
**9.9.3.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.9.3.2. Exposure and risks for workers**

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

**Table 9.104. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.12
Inhalation, systemic, acute	4 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.049
Dermal, systemic, long term	2.83 mg/kg bw/day (TRA Workers)	RCR = 0.24
Combined routes, systemic, long-term		RCR = 0.36

FH-C20-033\_V.10/ 09.10.2020

### 9.10. Exposure scenario 10: Service life (worker at industrial site) - Intumescent coatings - Workers (industrial)

Environment contributing scenario(s):		
CS 1	Intumescent coatings - Workers (industrial)	ERC 12a
Worker contributing scenario(s):		
CS 2	Low energy manipulation of substances bound in materials and/or articles PROC 21	
CS 3	High (mechanical) energy work-up of substances bound in materials and/or articles PROC 24	

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

ES7: Use at industrial sites - Use as additive in intumescent coatings

#### 9.10.1. Env CS 1: Intumescent coatings - Workers (industrial) (ERC 12a)

##### 9.10.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: not relevant for the assessment as scenario specific releases are estimated
• Annual use amount at site: not relevant for the assessment as scenario specific releases are estimated
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 0.169%]
• Discharge rate of STP: $\geq 2E3$ m <sup>3</sup> /day
• Application of the STP sludge on agricultural soil: Yes
Other conditions affecting environmental exposure
• Receiving surface water flow rate: $\geq 1.8E4$ m <sup>3</sup> /day

##### 9.10.1.2. Releases

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

**Table 9.105. Local releases to the environment**

Release	Release estimation method	Explanations
Water	Estimated release rate	<b>Local release rate: 0 kg/day</b>
Air	Estimated release rate	<b>Local release rate: 0 kg/day</b>
Non agricultural soil	Estimated release factor	<b>Release factor after on site RMM: 0%</b>

##### 9.10.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.2.0 unless stated otherwise.

**Table 9.106. Exposure concentrations and risks for the environment and man via the environment**

**FH-C20-033\_V.10/ 09.10.2020**

Protection target	Exposure concentration	Risk quantification
Fresh water	Local PEC: 5.0E-3 mg/L	RCR = 0.01
Sediment (freshwater)	Local PEC: 0.025 mg/kg dw	RCR = 0.01
Marine water	Local PEC: 5.0E-4 mg/L	RCR = 0.01
Sediment (marine water)	Local PEC: 2.4E-3 mg/kg dw	RCR = 0.01
Sewage Treatment Plant	Local PEC: 0 mg/L	RCR < 0.01
Agricultural soil	Local PEC: 2.52E-12 mg/kg dw	RCR < 0.01
Man via environment - Inhalation (systemic effects)	Concentration in air: 1.62E-21 mg/m <sup>3</sup>	RCR < 0.01
Man via environment - Oral	Exposure via food consumption: 1.74E-4 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

**9.10.2. Worker CS 2: Low energy manipulation of substances bound in materials and/or articles (PROC 21)**

**9.10.2.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.10.2.2. Exposure and risks for workers**

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

**Table 9.107. Exposure concentrations and risks for workers**

**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	3 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.361
Inhalation, systemic, acute	12 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.146
Dermal, systemic, long term	2.83 mg/kg bw/day (TRA Workers)	RCR = 0.24
Combined routes, systemic, long-term		RCR = 0.601

**9.10.3. Worker CS 3: High (mechanical) energy work-up of substances bound in materials and/or articles (PROC 24)**
**9.10.3.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.10.3.2. Exposure and risks for workers**

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

**Table 9.108. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.12
Inhalation, systemic, acute	4 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.049
Dermal, systemic, long term	2.83 mg/kg bw/day (TRA Workers)	RCR = 0.24
Combined routes, systemic, long-		RCR = 0.36



FH-C20-033\_V.10/ 09.10.2020

Route of exposure and type of effects	Exposure concentration	Risk quantification
term		

### 9.11. Exposure scenario 11: Service life (professional worker) - Intumescent coatings - Professional Workers

Environment contributing scenario(s):		
CS 1	Intumescent coatings - Professional Workers	ERC 10a; ERC 11a
Worker contributing scenario(s):		
CS 2	Low energy manipulation of substances bound in materials and/or articles PROC 21	

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

ES7: Use at industrial sites - Use as additive in intumescent coatings

ES8: Widespread use by professional workers - Use as additive in intumescent coatings

#### 9.11.1. Env CS 1: Intumescent coatings - Professional Workers (ERC 10a; ERC 11a)

##### 9.11.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
<ul style="list-style-type: none"> <li>Daily local widespread use amount: not relevant for the assessment as scenario specific releases are estimated</li> </ul>
Conditions and measures related to biological sewage treatment plant
<ul style="list-style-type: none"> <li>Biological STP: Standard [Effectiveness Water: 0.169%]</li> <li>Discharge rate of STP: <math>\geq 2E3</math> m<sup>3</sup>/day</li> <li>Application of the STP sludge on agricultural soil: Yes</li> </ul>
Other conditions affecting environmental exposure
<ul style="list-style-type: none"> <li>Receiving surface water flow rate: <math>\geq 1.8E4</math> m<sup>3</sup>/day</li> </ul>

##### 9.11.1.2. Releases

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

**Table 9.109. Local releases to the environment**

Release	Release estimation method	Explanations
Water	Estimated release rate	<b>Local release rate: 0 kg/day</b>
Air	Estimated release rate	<b>Local release rate: 0 kg/day</b>
Non agricultural soil	Estimated release factor	<b>Release factor after on site RMM: 0%</b>

##### 9.11.1.3. Exposure and risks for the environment and man via the environment

**FH-C20-033\_V.10/ 09.10.2020**

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.2.0 unless stated otherwise.

**Table 9.110. Exposure concentrations and risks for the environment and man via the environment**

Protection target	Exposure concentration	Risk quantification
Fresh water	Local PEC: 5.0E-3 mg/L	RCR = 0.01
Sediment (freshwater)	Local PEC: 0.025 mg/kg dw	RCR = 0.01
Marine water	Local PEC: 5.0E-4 mg/L	RCR = 0.01
Sediment (marine water)	Local PEC: 2.4E-3 mg/kg dw	RCR = 0.01
Sewage Treatment Plant	Local PEC: 0 mg/L	RCR < 0.01
Agricultural soil	Local PEC: 2.52E-12 mg/kg dw	RCR < 0.01
Man via environment - Inhalation (systemic effects)	Concentration in air: 1.62E-21 mg/m <sup>3</sup>	RCR < 0.01
Man via environment - Oral	Exposure via food consumption: 1.74E-4 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

**9.11.2. Worker CS 2: Low energy manipulation of substances bound in materials and/or articles (PROC 21)**
**9.11.2.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (medium dusty form)	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Dermal protection: No [Effectiveness Dermal: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

**9.11.2.2. Exposure and risks for workers**

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

FH-C20-033\_V.10/ 09.10.2020

**Table 9.111. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	5 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.602
Inhalation, systemic, acute	20 mg/m <sup>3</sup> (TRA Workers)	RCR = 0.243
Dermal, systemic, long term	2.83 mg/kg bw/day (TRA Workers)	RCR = 0.24
Combined routes, systemic, long-term		RCR = 0.842

### 9.12. Exposure scenario 12: Service life (consumers) - PU foams – Consumers

Environment contributing scenario(s):		
CS 1	PU foams – Consumers	ERC 10a; ERC 11a
Consumer contributing scenario(s):		
CS 2	Use of articles containing foam with encapsulated the substance	AC1; AC1a; AC 13; AC13e

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

ES6: Use at industrial sites - Use as additive in foams

#### 9.12.1. Env CS 1: PU foams – Consumers (ERC 10a; ERC 11a)

##### 9.12.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
<ul style="list-style-type: none"> <li>Daily local widespread use amount: not relevant for the assessment as scenario specific releases are estimated</li> </ul>
Conditions and measures related to biological sewage treatment plant
<ul style="list-style-type: none"> <li>Biological STP: Standard [Effectiveness Water: 0.169%]</li> <li>Discharge rate of STP: &gt;= 2E3 m<sup>3</sup>/day</li> <li>Application of the STP sludge on agricultural soil: Yes</li> </ul>
Other conditions affecting environmental exposure
<ul style="list-style-type: none"> <li>Receiving surface water flow rate: &gt;= 1.8E4 m<sup>3</sup>/day</li> </ul>

##### 9.12.1.2. Releases

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

**Table 9.112. Local releases to the environment**

Release	Release estimation method	Explanations
Water	Estimated release rate	<b>Local release rate: 0 kg/day</b>
Air	Estimated release rate	<b>Local release rate: 0 kg/day</b>
Non agricultural	Estimated release factor	<b>Release factor after on site RMM: 0%</b>

**FH-C20-033\_V.10/ 09.10.2020**

Release	Release method	estimation	Explanations
soil			

**9.12.1.3. Exposure and risks for the environment and man via the environment**

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.2.0 unless stated otherwise.

**Table 9.113. Exposure concentrations and risks for the environment and man via the environment**

Protection target	Exposure concentration	Risk quantification
Fresh water	Local PEC: 5.0E-3 mg/L	RCR = 0.01
Sediment (freshwater)	Local PEC: 0.025 mg/kg dw	RCR = 0.01
Marine water	Local PEC: 5.0E-4 mg/L	RCR = 0.01
Sediment (marine water)	Local PEC: 2.4E-3 mg/kg dw	RCR = 0.01
Sewage Treatment Plant	Local PEC: 0 mg/L	RCR < 0.01
Agricultural soil	Local PEC: 2.52E-12 mg/kg dw	RCR < 0.01
Man via environment - Inhalation (systemic effects)	Concentration in air: 1.62E-21 mg/m <sup>3</sup>	RCR < 0.01
Man via environment - Oral	Exposure via food consumption: 1.74E-4 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

**9.12.2. Cons CS 2: Use of articles containing foam with encapsulated the substance (AC1; AC1a; AC 13; AC13e)**

**9.12.2.1. Conditions of use**

Product (article) characteristics
• Percentage (w/w) of substance in mixture/article: ≤ 30 %
• Exposure via inhalation route: Inhalation exposure is considered to be not relevant
• Exposure via oral route: Oral exposure is considered to be not relevant

**9.12.2.2. Exposure and risks for consumers**

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

**Table 9.114. Exposure concentrations and risks for consumers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	Negligible (Migration study)	RCR < 0.01
Dermal, systemic, long term	0.1484 mg/kg bw/day for a baby, when using additional sheets for mattress protection and comfort (Migration study)	RCR = 0.035
	0.06375 mg/kg bw/day for an adult, when using additional sheets for mattress protection and	RCR = 0.015

**FH-C20-033\_V.10/ 09.10.2020**

Route of exposure and type of effects	Exposure concentration	Risk quantification
	comfort (Migration study)  0.6375 mg/kg bw/day for an adult, when sleeping directly on the mattress cover (Migration study) 1.484 mg/kg bw/day for a baby, when sleeping directly on the mattress cover (Migration study)	
Oral, systemic, long term	Negligible (Migration study)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.035 for a baby  RCR = 0.015 for an adult

**Remarks on exposure data:**

**Migration study:**

Explanation: The substance is used in foam mattresses, as a non-halogenated flame retardant. The European association of flexible polyurethane foam blocks manufacturers (EUROPUR) commissioned a migration study, to evaluate the potential exposure of humans from melamine used in flexible PU foam used in mattresses. The study was submitted to ECHA by EUROPUR, as part of their response to the public consultation on the CLH report for melamine dated November 2019 and can be found on the ECHA website.

Based on the vapour pressure of the substance and since mattresses are flat and not mouthed, inhalation and oral exposure are considered negligible, while potential dermal exposure is deemed the most relevant route of exposure due to the prolonged contact duration, with a large part of the body and the possible effect of sweat as a vehicle.

The migration of melamine into synthetic sweat soaked filter papers from these foams was investigated. As a mattress typically consists of a PUR foam core surrounded with a fabric layer, migration was investigated with and without the use of a polyester-polypropylene mattress cover placed between the foam and filter paper. The set-up was compressed to 70% of its depth in order to simulate a person sleeping on the mattress and incubated at 40°C for 2 hours.

When the foam was covered, a standard practice for every mattress with flexible PU foam, the migration was below the limit of detection (LOD) and LOD/2 was used as estimate for people sleeping directly on the mattress cover (0.6375 mg/kg bw/day for an adult and 1.484 for a baby). Note that this is a worst-case assessment as usually people don't sleep directly on the mattress cover but put additional sheets for additional mattress protection and comfort. When refined due to the use of additional sheets for mattress protection and comfort, the dermal exposure estimates were concluded to be 0.06375 for an adult and 0.1484 for a baby. Note that no melamine was detected when the mattress cover was included in the test set-up and that the calculations are therefore done based on the LOD/2.

**9.13. Exposure scenario 13: Service life (consumers) - Intumescent coating – Consumers**

Environment contributing scenario(s):		
CS 1	Intumescent coating – Consumers	ERC 10a; ERC 11a
Consumer contributing scenario(s):		
CS 2	Use of articles with intumescent coating with encapsulated the AC 13 substance	

**FH-C20-033\_V.10/ 09.10.2020**

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

ES7: Use at industrial sites - Use as additive in intumescent coatings

ES8: Widespread use by professional workers - Use as additive in intumescent coatings

**9.13.1. Env CS 1: Intumescent coating – Consumers (ERC 10a; ERC 11a)**

**9.13.1.1. Conditions of use**

Amount used, frequency and duration of use (or from service life)
<ul style="list-style-type: none"> <li>Daily local widespread use amount: not relevant for the assessment as scenario specific releases are estimated</li> </ul>
Conditions and measures related to biological sewage treatment plant
<ul style="list-style-type: none"> <li>Biological STP: Standard [Effectiveness Water: 0.169%]</li> <li>Discharge rate of STP: <math>\geq 2E3</math> m<sup>3</sup>/day</li> <li>Application of the STP sludge on agricultural soil: Yes</li> </ul>
Other conditions affecting environmental exposure
<ul style="list-style-type: none"> <li>Receiving surface water flow rate: <math>\geq 1.8E4</math> m<sup>3</sup>/day</li> </ul>

**9.13.1.2. Releases**

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

**Table 9.115. Local releases to the environment**

Release	Release estimation method	Explanations
Water	Estimated release rate	<b>Local release rate:</b> 0 kg/day
Air	Estimated release rate	<b>Local release rate:</b> 0 kg/day
Non agricultural soil	Estimated release factor	<b>Release factor after on site RMM:</b> 0%

**9.13.1.3. Exposure and risks for the environment and man via the environment**

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.2.0 unless stated otherwise.

**Table 9.116. Exposure concentrations and risks for the environment and man via the environment**

Protection target	Exposure concentration	Risk quantification
Fresh water	<b>Local PEC:</b> 5.0E-3 mg/L	RCR = 0.01
Sediment (freshwater)	<b>Local PEC:</b> 0.025 mg/kg dw	RCR = 0.01
Marine water	<b>Local PEC:</b> 5.0E-4 mg/L	RCR = 0.01
Sediment (marine water)	<b>Local PEC:</b> 2.4E-3 mg/kg dw	RCR = 0.01
Sewage Treatment Plant	<b>Local PEC:</b> 0 mg/L	RCR < 0.01
Agricultural soil	<b>Local PEC:</b> 2.52E-12 mg/kg dw	RCR < 0.01
Man via environment Inhalation (systemic effects)	<b>Concentration in air:</b> 1.62E-21 mg/m <sup>3</sup>	RCR < 0.01

**FH-C20-033\_V.10/ 09.10.2020**

Protection target	Exposure concentration	Risk quantification
Man via environment - Oral	<b>Exposure via food consumption:</b> 1.74E-4 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

**9.13.2. Cons CS 2: Use of articles with intumescent coating with encapsulated the substance (AC 13)**

**9.13.2.1. Conditions of use**

Product (article) characteristics
• Percentage (w/w) of substance in mixture/article: <= 30 %
• Exposure via inhalation route: Inhalation exposure is considered to be not relevant
• Exposure via dermal route: Dermal exposure assumed to be negligible
• Exposure via oral route: Oral exposure is considered to be not relevant

**9.13.2.2. Exposure and risks for consumers**

As any (dermal) contact by consumers with these coatings will be incidental and as the substance is embedded in a matrix, inhalation, dermal and oral exposure (and therefore risks) are considered to be negligible.