Toluene

Safety Data Sheet

according to Regulation (EC) No. 453/2010

Revision date: 8/07/2011 Supersedes: 08/12/2010 Version: 1.0

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

1.1. Product identifier

Chemical type	:	Substance
Substance name	:	Toluene
Trade name	:	Toluene
EC index no	:	601-021-00-3
EC no	:	203-625-9
CAS No.	:	108-88-3
REACH registration No.	:	01-2119471310-51-0031
Product code	:	692, SDS # PbR0122
Synonyms	:	Phenylmethane / Methylbenzene / Methylbenzol / Toluol

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

1.2.1. Relevant identified uses

Use of the substance/preparation	:	Manufacture of substances Intermediate Cleaning agent Fuels Coatings Use in Oil and Gas field drilling and production operations Binding agent Release agent. Use as laboratory reagent. Functional fluids Manufacture of rubber products. Formulation [mixing] of preparations and/or re-packaging Building and construction work. Road work Cleansing agent

1.2.2. Uses advised against

No additional information available

1.3. Details of the supplier of the safety data sheet

Only representative:
Petrobras Europe Ltd.
4th Floor, 20 North Audley Street
London W1K 6WL, United Kingdom
Fax number: +44(0) 20 7355 8750
E-mail: reach@petrobras.com.br

Manufacturer:
Petróleo Brasileiro S. A.
Avenida Chile, 65.
20035-900 Rio de Janeiro - Brazil
E-mail: sac@petrobras.com.br

1.4. Emergency telephone number

Emergency number	:	For Chemical Emergency, Spill, Leak, Fire, Exposure or Accident Call CHEMTREC Day or Night Within USA and Canada: 1-800-424-9300 Outside USA and Canada (collect calls accepted): 1-703-527-3887

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Flam. Liq. 2 H225
Skin Irrit. 2 H315
Repr. 2 H361
STOT SE 3 H336
STOT RE 2 H373
Asp. Tox. 1 H304

Full text of H-phrases: see section 16.

Classification according to Directive 67/548/EEC or 1999/45/EC

F; R11
Repr.Cat.3; R63
Xn; R48/20-65
Xi; R38
R67

Full text of R-phrases: see section 16.

Adverse physicochemical, human health and environmental effects

Inhalation may affect the nervous system causing headache, possibly dizziness, nausea, weakness, loss of coordination and unconsciousness.

2.2. Label elements

Labelling according to Regulation (EC) No. 1272/2008 [CLP]

Hazard pictograms (CLP) :

GHS02 GHS07 GHS08

Signal word (CLP) : Danger

Hazard statements (CLP) : H225 - Highly flammable liquid and vapour
H304 - May be fatal if swallowed and enters airways
H315 - Causes skin irritation
H336 - May cause drowsiness or dizziness
H361 - Suspected of damaging fertility. Suspected of damaging the unborn child.
H373 - May cause damage to organs through prolonged or repeated exposure

Precautionary statements (CLP) : P202 - Do not handle until all safety precautions have been read and understood
P210 - Keep away from open flames, heat, sparks. - No smoking.
P243
Take precautionary measures against static discharge
P260 - Do not breathe mist, spray, vapours.
P280 - Wear eye protection, face protection, protective clothing, protective gloves.
P301+P310 - If swallowed, immediately call a doctor.
P303+P361+P353
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P304+P340 - IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing
P308+P313 - IF exposed or concerned: Get medical advice/attention
P331 - Do NOT induce vomiting

2.3. Other hazards

This substance/mixture does not meet the PBT/vPvB criteria of REACH, annex XIII.

other hazards which do not result in classification : Vapours can travel considerable distances to a source of ignition where they can ignite, flash back, or explode.

SECTION 3: Composition/information on ingredients

3.1. Substances

Name	Product identifier	%	Classification according to Directive 67/548/EEC
Toluene	(CAS No.) 108-88-3 (EC no) 203-625-9 (EC index no) 601-021-00-3	100	F; R11 Repr.Cat.3; R63 Xn; R48/20-65 Xi; R38 R67

Name	Product identifier	%	Classification according to Regulation (EC) No. 1272/2008 [CLP]
Toluene	(CAS No.) 108-88-3 (EC no) 203-625-9 (EC index no) 601-021-00-3	100	Flam. Liq. 2, H225 Skin Irrit. 2, H315 Repr. 2, H361d STOT SE 3, H336 STOT RE 2, H373 Asp. Tox. 1, H304

Full text of R-, H- and EUH-phrases: see section 16.

3.2. Mixtures

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures after inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. In case of breathing difficulties administer oxygen. If medical advice is needed, have product container or label at hand.

First-aid measures after skin contact : Remove contaminated clothing immediatley and dispose off safely. Rinse thoroughly with plenty of water for at least 20 minutes and take medical advice. If medical advice is needed, have product container or label at hand.

First-aid measures after eye contact : Rinse immediately and plentifully with water, also under the eyelids, for at least 20 minutes. If medical advice is needed, have product container or label at hand.

First-aid measures after ingestion : Do not induce vomiting. If swallowed, rinse mouth with water (only if the person is conscious). Seek immediate medical advice.

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

Symptoms/injuries : Symptoms include headache, dizziness, fatigue, muscular weakness, drowsiness and in extreme cases, loss of consciousness. Impaired consciousness.

Symptoms/injuries after inhalation : Irritant effect on the respiratory tract:.

Symptoms/injuries after skin contact : Irritating to skin. Prolonged/repetitive skin contact may cause skin defattening or dermatitis.

Symptoms/injuries after eye contact : Irritating to eyes. Causes severe inflammation of conjunctiva and may cause severe damage of the cornea.

Symptoms/injuries after ingestion : Risk of aspiration pneumonia.

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

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media: : Foam. Extinguishing powder. Water spray. Carbon dioxide (CO2).

5.2. Special hazards arising from the substance or mixture

Fire hazard : Flammable liquid. Vapours can travel considerable distances to a source of ignition where they can ignite, flash back, or explode.

Reactivity : On combustion, forms. Carbon dioxide (CO2). Carbon monoxide. Nitrogen oxides (NOx). Sulfur oxides.

5.3. Advice for firefighters

Firefighting instructions : Cool tanks/drums with water spray/remove them into safety.

Protective equipment for firefighters : Refer to section 8. In case of fire: Wear self-contained breathing apparatus.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Use water spray/stream to protect personnel and to cool endangered containers. Remove product from area of fire.

6.1.1. For non-emergency personnel

Protective equipment : Wear suitable protective clothing, gloves and eye/face protection. Refer to section 8.

Emergency procedures : Stop leak if safe to do so. Remove all sources of ignition.

6.1.2. For emergency responders

Protective equipment : Wear suitable protective clothing, gloves and eye/face protection. In case of fire: Wear self-contained breathing apparatus. Refer to section 8.

Emergency procedures : Evacuate unnecessary personnel. Remove all sources of ignition. Stop leak if safe to do so. Eliminate leaks immediately.

6.2. Environmental precautions

Stop leak if safe to do so. Do not discharge into surface water. Do not discharge into drains or the environment. Prevent spreading over great surfaces (e.g. by damming or installing oil booms). Avoid contact with water. Contaminated fire-fighting water must be collected separately. Ensure all waste water is collected and treated via a waste water treatment plant.

6.3. Methods and material for containment and cleaning up

Methods for cleaning up : Absorb with liquid-binding material (e.g. sand, diatomaceous earth, acid- or universal binding agents). Collect in closed containers for disposal. Do not empty into drains or the aquatic environment. Dispose of this material and its container to hazardous or special waste collection point. Consult the local waste disposal expert about waste disposal.

Other information : Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

6.4. Reference to other sections

Refer to sections 8 and 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Use only non-sparking tools. Handle in accordance with good industrial hygiene and safety procedures. Use personal protective equipment as required. Ensure the grounding of containers, apparatus, pumps and suction equipment. Use only in well-ventilated areas. Do not breathe dust/fume/gas/mist/vapours/spray.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures: : Floors should be impenetrable, resistant to liquids and easy to clean. The floor should be leak tight, jointless and not absorbent. Provide adequate ventilation.

Incompatible materials : Oxidizing agents.

Storage area : Ensure adequate ventilation of the storage area. Floors should be impenetrable, resistant to liquids and easy to clean. The floor should be leak tight, jointless and not absorbent. Only use anti-static equipped (spark-free) tools. Ensure the grounding of containers, apparatus, pumps and suction equipment. Provide for retaining containers, eg. floor pan without outflow.

7.3. Specific end use(s)

No data available.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Toluene (108-88-3)		
EU	IOELV TWA (mg/m³)	192 mg/m³
EU	IOELV TWA (ppm)	50 ppm
EU	IOELV STEL (mg/m³)	384 mg/m³
EU	IOELV STEL (ppm)	100 ppm
EU	Notation	Skin
Austria	MAK (mg/m³)	190 mg/m³
Austria	MAK (ppm)	50 ppm
Austria	MAK Short time value (mg/m³)	380 mg/m³
Austria	MAK Short time value (ppm)	100 ppm
Belgium	Limit value (mg/m³)	192 mg/m³
Belgium	Limit value (ppm)	50 ppm
Belgium	Short time value (mg/m³)	384 mg/m³
Belgium	Short time value (ppm)	100 ppm
Belgium	Remark*	D
France	VLE (mg/m³)	550 mg/m³
France	VLE (ppm)	150 ppm
France	VME (mg/m³)	375 mg/m³
France	VME (ppm)	100 ppm
Germany	TRGS 900 Occupational exposure limit value (mg/m³)	190 mg/m³
Germany	TRGS 900 Occupational exposure limit value (ppm)	50 ppm
Germany	TRGS 903 (BGW)	3 mg/l o-Kresol (Urin; bei Langzeitexposition/Expositionsende bzw. Schichtende) 1 mg/l Toluol (Blut; Expositionsende bzw. Schichtende)
Italy - Portugal - USA ACGIH	ACGIH TWA (mg/m³)	188 mg/m³
Italy - Portugal - USA ACGIH	ACGIH TWA (ppm)	50 ppm
USA NIOSH	NIOSH REL (TWA) (mg/m3)	375 mg/m³
USA NIOSH	NIOSH REL (TWA) (ppm)	100 ppm
USA NIOSH	NIOSH REL (STEL) (mg/m3)	560 mg/m³
USA NIOSH	NIOSH REL (STEL) (ppm)	150 ppm
USA OSHA	OSHA PEL (TWA) (ppm)	200 ppm
USA OSHA	OSHA PEL (STEL) (ppm)	300 ppm
USA OSHA	OSHA PEL (Ceiling) (ppm)	500 ppm
Spain	VLA-ED (mg/m³)	191 mg/m³
Spain	VLA-ED (ppm)	50 ppm
Spain	VLA-EC (mg/m³)	384 mg/m³
Spain	VLA-EC (ppm)	100 ppm
Switzerland	VLE (mg/m³)	760 mg/m³
Switzerland	VLE (ppm)	200 ppm
Switzerland	VME (mg/m³)	190 mg/m³
Switzerland	VME (ppm)	50 ppm
Switzerland	Remark (CH)	max. 4x15 min/8h
The Netherlands	MAC TGG 8H (mg/m³)	150 mg/m³
The Netherlands	MAC TGG 15MIN (mg/m³)	384 mg/m³
United Kingdom	WEL TWA (mg/m³)	191 mg/m³

Toluene (108-88-3)		
United Kingdom	WEL TWA (ppm)	50 ppm
United Kingdom	WEL STEL (mg/m³)	574 mg/m³
United Kingdom	WEL STEL (ppm)	150 ppm
Czech Republic	Expoziční limity (PEL) (mg/m3)	200 mg/m³
Czech Republic	Expoziční limity (PEL) (ppm)	53.2 ppm
Czech Republic	Expoziční limity (NPK-P) (mg/m3)	500 mg/m³
Czech Republic	Expoziční limity (NPK-P) (ppm)	133 ppm
Czech Republic	Remark (CZ)	D
Denmark	Grænseværdie (langvarig) (mg/m3)	94 mg/m³
Denmark	Grænseværdie (langvarig) (ppm)	25 ppm
Denmark	Grænseværdie (kortvarig) (mg/m3)	188 mg/m³
Denmark	Grænseværdie (kortvarig) (ppm)	50 ppm
Finland	HTP-arvo (8h) (mg/m3)	190 mg/m³
Finland	HTP-arvo (8h) (ppm)	50 ppm
Finland	HTP-arvo (15 min)	380 mg/m³
Finland	HTP-arvo (15 min) (ppm)	100 ppm
Finland	Huomautus (FI)	iho
Hungary	AK-érték	190 mg/m³
Hungary	CK-érték	760 mg/m³
Ireland	OEL (8 hours ref) (mg/m3)	188 mg/m³
Ireland	OEL (8 hours ref) (ppm)	50 ppm
Ireland	OEL (15 min ref) (mg/m3)	560 mg/m³
Ireland	OEL (15 min ref) (ppm)	100 ppm
Ireland	Notes (IE)	Sk, IOELV
Lithuania	IPRV (mg/m3)	200 mg/m³
Lithuania	IPRV (ppm)	50 ppm
Lithuania	TPRV (mg/m3)	400 mg/m³
Lithuania	TPRV (ppm)	100 ppm
Lithuania	Remark (LT)	O
Norway	Gjennomsnittsverdier (AN) (mg/m3)	94 mg/m³
Norway	Gjennomsnittsverdier (AN) (ppm)	25 ppm
Norway	Merknader (NO)	H
Poland	NDS (mg/m3)	100 mg/m³
Poland	NDSCh (mg/m3)	350 mg/m³
Slovakia	NPHV (priemerná) (mg/m3)	192 mg/m³
Slovakia	NPHV (priemerná) (ppm)	50 ppm
Slovakia	Upozornenie (SK)	K
Sweden	nivågränsvärde (NVG) (mg/m3)	200 mg/m³
Sweden	nivågränsvärde (NVG) (ppm)	50 ppm
Sweden	kortidsvärde (KTV) (mg/m3)	400 mg/m³
Sweden	kortidsvärde (KTV) (ppm)	100 ppm
Canada (Quebec)	VEMP (mg/m³)	188 mg/m³
Canada (Quebec)	VEMP (ppm)	50 ppm
Australia	TWA (mg/m³)	191 mg/m³
Australia	TWA (ppm)	50 ppm
Australia	STEL (mg/m³)	574 mg/m³

toluene (108-88-3)	
DNEL/DMEL (Workers)	
Acute - systemic effects, inhalation	384 mg/m³

toluene (108-88-3)	
Long-term - systemic effects, dermal	384 mg/kg bodyweight/day
Long-term - systemic effects, inhalation	192 mg/m³/day
DNEL/DMEL (General population)	
Acute - systemic effects, oral	226 mg/kg bodyweight
Long-term - systemic effects,oral	8.13 mg/kg bodyweight/day
Long-term - systemic effects, inhalation	56.5 mg/m³/day
Long-term - systemic effects, dermal	226 mg/kg bodyweight/day

8.2. Exposure controls

Appropriate engineering controls : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Provide adequate ventilation.

Personal protective equipment : Gloves. Protective goggles. Protective clothing.

Hand protection : Wear protective gloves. PVC (Polyvinyl chloride).

Eye protection : Wear eye protection/face protection.

Skin and body protection : Protective apron. PVC (Polyvinyl chloride).

Respiratory protection : The filter class must be suitable for the maximum contaminant concentration (gas/vapour/aerosol/particulates) that may arise when handling the product. If the concentration is exceeded, closed-circuit breathing apparatus must be used!. In case of fire: Wear self-contained breathing apparatus.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Liquid

Colour : colourless.

Odour : Solvent.

Odour threshold : 1.6 ppm

pH : No data available

Melting point : No data available

Solidification point : No data available

Boiling point : ≥ 110.1 °C

Flash point : 4.4 °C ASTM D 56

Relat. evapor. rate comp. to butylacetate : 2

Flammability (solid, gas) : No data available

Explosive limits : 1.2-7 vol %

Vapour pressure : 38 mmHg @ 20ºC

Relative vapour density at 20 °C : 4.5

Relative density : 0.865-0.87 g/cm³ @ 20ºC

Solubility : Soluble in organic solvents.
Water: not significant

Log Pow : < 3

Self ignition temperature : 536 °C

Decomposition temperature : No data available

Viscosity, kinematic : 0.59 cSt @ 40ºC

Viscosity, dynamic : No data available

Explosive properties : No data available

Oxidising properties : No data available

9.2. Other information

Other properties : No data available.

SECTION 10: Stability and reactivity

10.1. Reactivity

On combustion, forms. Carbon dioxide (CO2). Carbon monoxide. Nitrogen oxides (NOx). Sulfur oxides.

10.2. Chemical stability

Stable at ambient temperature and under normal conditions of use.

10.3. Possibility of hazardous reactions

No data available.

10.4. Conditions to avoid

Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

10.5. Incompatible materials

Oxidizing agents.

10.6. Hazardous decomposition products

On heating/burning: release of (highly) toxic gases/vapours e.g.: carbon monoxide - carbon dioxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Toluene (108-88-3)	
LD50 oral rat	> 5000 mg/kg
LD50 dermal rabbit	> 5000 mg/kg
LC50 inhalation rat (mg/l)	> 20 mg/l/4h

Skin corrosion/irritation : Causes skin irritation.

Serious eye damage/irritation : Not classified
May cause irritation to the eyes

Respiratory or skin sensitisation : Not classified
Not sensitizing

Germ cell mutagenicity : Not classified
Negative

Carcinogenicity : Not classified

Reproductive toxicity : Suspected of damaging fertility. Suspected of damaging the unborn child.

Specific target organ toxicity (single exposure) : May cause drowsiness or dizziness.

Specific target organ toxicity (repeated exposure) : May cause damage to organs through prolonged or repeated exposure.

Toluene (108-88-3)	
NOAEL (oral,rat,75 days)	1250 mg/kg bodyweight/day
NOAEL (inhalation,rat,gas,75 days)	625 ppmV/6h/day

Aspiration hazard : May be fatal if swallowed and enters airways.

Potential Adverse human health effects and symptoms : Inhalation may affect the nervous system causing headache, possibly dizziness, nausea, weakness, loss of coordination and unconsciousness.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : Product is easily volatile.

Toluene (108-88-3)	
LC50 fishes	> 2.6 mg/l 96 hours
EC50 Daphnia	> 1 mg/l 24 hours
LC50 fishes	> 6.3 mg/l 96 hours
EC50 Daphnia	> 3.4 mg/l 48 hours
NOEC (acute)	> 0.96 mg/l 7 days- daphnia
NOEC (chronic)	> 1.3 mg/l fishes-56d
ErC50 (algae)	> 2.2 mg/l 72 hours
ErC50 (other aquatic plants)	> 3.9 mg/l 8 days

12.2. Persistence and degradability

Toluene (108-88-3)	
Persistence and degradability	No data available.

12.3. Bioaccumulative potential

Toluene (108-88-3)	
Log Pow	< 3
Bioaccumulative potential	No data available.

12.4. Mobility in soil

Toluene (108-88-3)	
Ecology - soil	Do not allow to enter into soil/subsoil. If product enters soil, it will be mobile and may contaminate groundwater.

12.5. Results of PBT and vPvB assessment

toluene (108-88-3)
This substance/mixture does not meet the PBT/vPvB criteria of REACH, annex XIII.

12.6. Other adverse effects

Other adverse effects : No data available.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Consult the local waste disposal expert about waste disposal. Do not empty into drains or the aquatic environment. Waste is to be kept separate from other types of waste until its disposal. Dispose of this material and its container to hazardous or special waste collection point. Disposal must be done according to official regulations.

SECTION 14: Transport information

In accordance with ADR / RID / ADNR / IMDG / ICAO / IATA

14.1. UN number

UN-No. : 1294

14.2. UN proper shipping name

Proper shipping name : TOLUENE

Transport document description : UN 1294 TOLUENE, 3, II, (D/E)

14.3. Transport hazard class(es)

Class (UN) : 3

Hazard labels (UN) : 3

14.4. Packing group

Packing group (UN) : II

14.5. Environmental hazards

Other information : No supplementary information available.

14.6. Special precautions for user

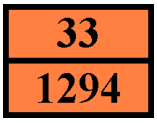
Special transport precautions : No data available.

14.6.1. Overland transport

Hazard identification number (Kemler No.) : 33

Classification code : F1

Orange plates :



Tunnel restriction code : D/E

Limited quantities (ADR) : LQ04

Excepted quantities (ADR) : E2

14.6.2. Transport by sea

Class : 3 - Flammable liquids

14.6.3. Air transport

Class : 3 - Flammable liquids

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

IBC code : No data available.

SECTION 15: Regulatory information

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

15.1.1. EU-Regulations

Other regulations, restrictions and prohibition regulations : Compliance with following regulations: Regulation (EC) 1907/2006 as amended. Regulation (EC) 1272/2008 as amended. Directive 67/548/EEC as amended. Directive 1999/45/EC as amended.

15.1.2. National regulations

Regional legislation : No data has been reported. In case of need contact our Product Safety office.

Hazard symbols :

F - Highly flammable Xn - Harmful

R-phrases : R11 - Highly flammable.
R38 - Irritating to skin.
R48/20 - Harmful: danger of serious damage to health by prolonged exposure through inhalation.
R63 - Possible risk of harm to the unborn child.
R65 - Harmful: may cause lung damage if swallowed.
R67 - Vapours may cause drowsiness and dizziness.

Classified dangerous in accordance with Directives 67/548/EEC and 1999/45/EC

S-phrases : S2 - Keep out of the reach of children.
Keep out of reach of children
S36/37 - Wear suitable protective clothing and gloves.
S62 - If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.

15.2. Chemical safety assessment

Chemical safety assessment has been established in the attachment.

SECTION 16: Other information

Sources of Key data : PETROBRAS. MSDS.

Abbreviations and acronyms : ASTM - American Society for Testing and Materials . CLP - Classification, Labelling and Packaging. CSR - Chemical Safety Report. EC - European Community. EEC - European Economic Community. GHS - Globally Harmonised System. SDS - Safety Data Sheet . REACH - Registration, Evaluation, Authorisation and Restriction of Chemicals.

Full text of R-, H- and EUH-phrases:

Asp. Tox. 1	Aspiration hazard Category 1
Flam. Liq. 2	flammable liquids Category 2
Repr. 2	Reproductive toxicity Category 2
Repr. 2	Reproductive toxicity Category 2
Skin Irrit. 2	skin corrosion/irritation Category 2
STOT RE 2	Specific target organ toxicity (repeated exposure) Category 2
STOT SE 3	Specific target organ toxicity (single exposure) Category 3
H225	Highly flammable liquid and vapour
H304	May be fatal if swallowed and enters airways
H315	Causes skin irritation
H336	May cause drowsiness or dizziness
H361	Suspected of damaging fertility or the unborn child
H361d	Suspected of damaging the unborn child.
H373	May cause damage to organs through prolonged or repeated exposure
R11	Highly flammable.
R38	Irritating to skin.
R48/20	Harmful: danger of serious damage to health by prolonged exposure through inhalation.
R63	Possible risk of harm to the unborn child.
R65	Harmful: may cause lung damage if swallowed.
R67	Vapours may cause drowsiness and dizziness.

The information presented in this Safety Data Sheet is based on current knowledge and is believed to be complete and accurate. It describes the product for the purposes of health, safety and environment requirements only and shall, therefore, be used only as a guide. The data refers to a specific product and may not be valid for combined uses with other products. It is the user´s obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. Petrobras shall not be responsible for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices.

Exposure Scenarios for: Toluene

Trade Name : Toluene
CAS Number : 108-88-3
EC Number : 203-625-9
SDS Reference : PbR0122

Table of Contents:

Summary of parameters used for assessing safe use:

DNEL: Worker - inhalation (long term): 192 mg/m^3/8 h
Worker - dermal (long term): 384 mg/kg bw/day
Consumer - dermal (long term): 226 mg/kg bw/day
Consumer - oral (long term): 8.13 mg/kg bw/day
Consumer - inhalation (long term): 56.5 mg/m^3/ 24 h

PNEC: In STP/ untreated wastewater: 13.61 mg/l
In local freshwater: 0.68 mg/l
In local soil: 2.89 mg/kg dw
In local marine water: 0.68 mg/l
In sediment freshwater: 16.39 mg/kg dw
In sediment marine water: 16.39 mg/kg dw

Acronyms:

CSA	:	Chemical safety assessment
DNEL	:	Derived no effect level
DU	:	Downstream user
ERC	:	Environmental release category
ES	:	Exposure scenario
PC	:	Product category
PEC	:	Predicted environmental concentration
PNEC	:	Predicted no effect concentration
PPE	:	Personal protection equipment
PROC	:	Process category
RCR	:	Risk characterisation ratio
STP	:	Sewage treatment plant
SU	:	Sector of use
WWTP	:	Wastewater treatment plant

Exposure Scenario (ES1):

Manufacture of toluene

9.1.1. Exposure scenario addressing uses carried out by workers **Manufacture of toluene**	
Use descriptors related to the life cycle stage	SU3 : Industrial uses: Uses of substances as such or in preparations at industrial sites SU8 : Manufacture of bulk, large scale chemicals (including petroleum products) SU9 : Manufacture of fine chemicals PROC1 : Use in closed process, no likelihood of exposure PROC2 : Use in closed, continuous process with occasional controlled exposure PROC3 : Use in closed batch process (synthesis or formulation) PROC4 : Use in batch and other process (synthesis) where opportunity for exposure arises PROC8a : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC15 : Use as laboratory reagent ERC1 : Manufacture of substances
Processes, tasks, activities covered	Manufacture of substance or use as an intermediate or process chemical or extraction agent.
Specific environmental release category	ESVOC SpERC 1.1.v1
9.1.2. Operational conditions and risk managment measures	
9.1.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	0.5 – 10kPa
Amounts used	
Annually at point sources	300,000 t/year (maximum in worst case)
Annually total	3,000,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	300
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m^3/day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.005
Release fraction to waste water from process	0.0001

before RMMs	
Release fraction to soil from process before RMMs	0.0001
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >90%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 93.3%
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	4,070,000
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
During manufacturing no waste of the substance is generated.	
9.1.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical conditions and measures to control dispersion from source towards the worker	
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) (PROC 8b) Operate activity away from sources of emissions or release (PROC 8b)	
Organisational measures to prevent /limit releases, dispersion and exposure	
Drain down system prior to equipment break-in or maintenance (PROC 8a)	
Conditions and measures related to personal protection, hygiene and health evaluation	
1. PPE: Wear a respirator conforming to EN140 with Type A filter or better (PROC8b – if technical measures not practicable)	

2. PPE: Wear gloves (Type EN374) if regular skin contact likely (PROC 8b)

9.1.3. Exposure information and reference to its source

9.1.3.1. Prediction of environmental exposure resulting from the conditions described above

Environmental exposure estimation is calculated with EUSES model v2.1.1..

For PNEC values, please refer to Page 1.

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	3.35	0.0852	0.0655	0.0336	0.446	0.176

9.1.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01	0.34
PROC 2	10	1.37
PROC 3	25	0.34
PROC 4	20	6.86
PROC 8a	10	0.14
PROC 8b	15	6.86
PROC 15	10	0.34

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 1	0	0	0
PROC 2	0.20	0	0.20
PROC 3	0.49	0	0.49
PROC 4	0.39	0.02	0.41
PROC 8a	0.20	0	0.20
PROC 8b	0.29	0	0.29
PROC 15	0.20	0	0.20

9.1.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES
The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.
9.1.5. Additional good practice advice beyond the REACH CSA
Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES2):

Distribution of toluene

9.2.1. Exposure scenario addressing uses carried out by workers **Distribution of toluene**	
Use descriptors related to the life cycle stage	SU3 : Industrial uses: Uses of substances as such or in preparations at industrial sites SU8 : Manufacture of bulk, large scale chemicals (including petroleum products) SU9 : Manufacture of fine chemicals PROC1 : Use in closed process, no likelihood of exposure PROC2 : Use in closed, continuous process with occasional controlled exposure PROC3 : Use in closed batch process (synthesis or formulation) PROC4 : Use in batch and other process (synthesis) where opportunity for exposure arises PROC8a : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC9 : Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC15 : Use as laboratory reagent ERC1 : Manufacture of substances
Specific environmental release category	ESVOC SpERC 1.1b.v1
9.2.2. Operational conditions and risk managment measures	
9.2.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	0.5 – 10kPa
Amounts used	
Annually at point sources	30,000 t/year (maximum in worst case)
Annually total	300,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	300
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m^3/day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.0001

Release fraction to waste water from process before RMMs	0.00001
Release fraction to soil from process before RMMs	0.00001
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >90%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 93.3%
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	13,600,000
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and/or national regulations.	
9.2.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical conditions and measures to control dispersion from source towards the worker	
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) (PROC 8a, 8b & 9) Operate activity away from sources of emissions or release (PROC 8b)	
Organisational measures to prevent /limit releases, dispersion and exposure	
Drain down system prior to equipment break-in or maintenance (PROC 2)	
Conditions and measures related to personal protection, hygiene and health evaluation	

1. PPE: Wear a respirator conforming to EN140 with Type A filter or better (PROC8a, 8b & 9 – if technical measures not practicable)
2. PPE: Wear gloves (Type EN374) if regular skin contact likely (PROC 8a, 8b & 9)

9.2.3. Exposure information and reference to its source

9.2.3.1. Prediction of environmental exposure resulting from the conditions described above

Environmental exposure estimation is calculated with EUSES model v2.1.1..

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed exposures are not expected to exceed the predicted PNECs and the resulting risk characterization ratios are expected to be less than 1. For PNEC values, please refer to Page 1.

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	0.335	0.0349	0.166	0.00348	0.183	0.0182

9.2.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01	0.34
PROC 2	10	1.37
PROC 3	25	0.34
PROC 4	20	6.86
PROC 8a	5	13.71
PROC 8b	35	6.86
PROC 9	35	6.86
PROC 15	10	0.34

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 1	0	0	0
PROC 2	0.20	0	0.20
PROC 3	0.49	0	0.49
PROC 4	0.39	0.02	0.41
PROC 8a	0.10	0.04	0.13
PROC 8b	0.69	0.02	0.70
PROC 9	0.69	0.02	0.70
PROC 15	0.20	0	0.20

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

9.2.5. Additional good practice advice beyond the REACH CSA

Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES3):

Use of toluene as an intermediate

This scenario is covered by ES1, please refer to Page 3.

Exposure Scenario (ES4):

Use of toluene in roads and construction - Professional

9.4.1. Exposure scenario addressing uses carried out by workers Use of toluene in roads and construction - Professional	
Use descriptors related to the life cycle stage	SU22 : Professional uses: Public domain (administration, education, entertainment, services, craftsmen) PROC7 : Industrial spraying PROC8a : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC9 : Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC10 : Roller application or brushing PROC11 : Non industrial spraying PROC13 : Treatment of articles by dipping and pouring ERC8d : Wide dispersive outdoor use of processing aids in open systems ERC8f : Wide dispersive outdoor use resulting in inclusion into or onto a matrix
Specific environmental release category	ESVOC SpERC 8.15.v1
9.4.2. Operational conditions and risk managment measures	
9.4.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	0.5 – 10kPa
Amounts used	
Annually at point sources	3,000 t/year (maximum in worst case)
Annually total	30,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	365
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m^3/day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.95
Release fraction to waste water from process before RMMs	0.01
Release fraction to soil from process before RMMs	0.04

Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >0%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 93.3%
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	78,500
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and/or national regulations.	
9.4.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	
Technical conditions and measures at process level (source) to prevent release	
Ensure material transfers are under containment or extract ventilation (PROC 8b)	
Technical conditions and measures to control dispersion from source towards the worker	
Provide a good standard of general ventilation (not less than 10 to 15 air changes per hour) (PROC 8a) Ensure operation is undertaken outdoors (PROC 10, 11 & 13)	
Organisational measures to prevent /limit releases, dispersion and exposure	
Retain drain downs in sealed storage pending disposal or for subsequent recycle (PROC 8a)	
Conditions and measures related to personal protection, hygiene and health evaluation	
1. PPE: Wear a respirator conforming to EN140 with Type A filter or better (PROC11, PROC 8a & 8b if technical measures not practicable) 2. PPE: Wear gloves (Type EN374) if regular skin contact likely (PROC 8a & b)	
9.4.3. Exposure information and reference to its source	

9.4.3.1. Prediction of environmental exposure resulting from the conditions described above

Environmental exposure estimation is calculated with EUSES model v2.1.1..

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed exposures are not expected to exceed the predicted PNECs and the resulting risk characterization ratios are expected to be less than 1. For PNEC values, please refer to Page 1.

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	0.00536	0.00194	0.00301	0.000176	0.0102	0.000921

9.4.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 7	Not available	Not available
PROC 8a	30	0.03 – 13.71
PROC 8b	25	0.69
PROC 9	Not available	Not available
PROC 10	7	27.43
PROC 11	7	2.14
PROC 13	30	13.71

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 7	Not available	Not available	Not available
PROC 8a	0.59	0 – 0.04	0.59 – 0.62
PROC 8b	0.49	0	0.49
PROC 9	Not available	Not available	Not available
PROC 10	0.14	0.07	0.21
PROC 11	0.14	0.01	0.14
PROC 13	0.59	0.04	0.62

9.4.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES
The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.
9.4.5. Additional good practice advice beyond the REACH CSA
Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES5):

Use of toluene in cleaning agents - Industrial

9.5.1. Exposure scenario addressing uses carried out by workers Use of toluene in cleaning agents - Industrial		
Use descriptors related to the life cycle stage	SU3 :	Industrial uses: Uses of substances as such or in preparations at industrial sites
	SU10 :	Formulation [mixing] of preparations and/or re-packaging (excluding alloys)
	PROC2 :	Use in closed, continuous process with occasional controlled exposure
	PROC3 :	Use in closed, continuous process with occasional controlled exposure
	PROC4 :	Use in batch and other process (synthesis) where opportunity for exposure arises
	PROC7 :	Industrial spraying
	PROC8a :	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities
	PROC8b :	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
	PROC10 :	Roller application or brushing
	PROC13 :	Treatment of articles by dipping and pouring
	ERC4 :	Industrial use of processing aids in processes and products, not becoming part of articles
Specific environmental release category	ESVOC SpERC 4.4a.v1	
9.5.2. Operational conditions and risk managment measures		
9.5.2.1. Control of environmental exposure		
Product characteristic		
Physical state	Liquid	
Concentration of substance in product	Up to 100%	
Vapour pressure of substance	0.5 – 10kPa	
Amounts used		
Annually at point sources	1,500 t/year (maximum in worst case)	
Annually total	15,000 t/year total market	
Frequency and duration of use/exposure		
Emission days per year	300	
Environment factors not influenced by risk management		
Flow rate of receiving surface water	18,000 m^3/day (default)	
Other given operational conditions affecting environmental exposure		
Release fraction to air from process before RMMs	0.3	
Release fraction to waste water from process before RMMs	0.00003	
Release fraction to soil from process before	0	

RMMs	
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >70%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 93.3%
Soil emission controls are not applicable as there is no direct release to soil.	
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	1,770,000
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and/or national regulations.	
9.5.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	
Technical conditions and measures at process level (source) to prevent release	
No specific measured identified.	
Technical conditions and measures to control dispersion from source towards the worker	
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) (PROC 8a, 8b, 10 & 13) Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) (PROC 7) Provide extract ventilation to points where emissions occur (PROC 4) Limit the substance content in the product to 5% (PROC 7)	
Organisational measures to prevent /limit releases, dispersion and exposure	
Drain down system prior to equipment break-in or maintenance (PROC 8a)	
Conditions and measures related to personal protection, hygiene and health evaluation	

1. PPE: Wear a respirator conforming to EN140 with Type A filter or better (PROC 8b - if technical measures not practicable)
2. PPE: Wear gloves (Type EN374) if regular skin contact likely (PROC8b)

9.5.3. Exposure information and reference to its source

9.5.3.1. Prediction of environmental exposure resulting from the conditions described above

Environmental exposure estimation is calculated with EUSES model v2.1.1..

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed exposures are not expected to exceed the predicted PNECs and the resulting risk characterization ratios are expected to be less than 1. For PNEC values, please refer to Page 1.

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	0.00489	0.00190	0.00443	0.000171	0.00993	0.000897

9.5.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 2	10	1.37
PROC 3	25	0.34
PROC 4	10	0.69
PROC 7	7.50	42.86
PROC 8a	10 - 35	0.14 - 13.71
PROC 8b	35	0.69
PROC 10	35	27.43
PROC 13	35	13.71

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 2	0.20	0	0.20
PROC 3	0.49	0	0.49
PROC 4	0.20	0	0.20
PROC 7	0.15	0.11	0.26
PROC 8a	0.20 - 0.69	0 - 0.04	0.20 - 0.72
PROC 8b	0.69	0	0.69
PROC 10	0.69	0.07	0.76
PROC 13	0.69	0.04	0.72

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

9.5.5. Additional good practice advice beyond the REACH CSA

Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES6):

Use of toluene in cleaning agents - Professional

9.6.1. Exposure scenario addressing uses carried out by workers **Use of toluene in cleaning agents - Professional**	
Use descriptors related to the life cycle stage	SU22 : Professional uses: Public domain (administration, education, entertainment, services, craftsmen) PROC1 : Use in closed process, no likelihood of exposure PROC2 : Use in closed, continuous process with occasional controlled exposure PROC3 : Use in closed, continuous process with occasional controlled exposure PROC4 : Use in batch and other process (synthesis) where opportunity for exposure arises PROC8a : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC10 : Roller application or brushing PROC11 : Non industrial spraying PROC13 : Treatment of articles by dipping and pouring ERC8a : Wide dispersive indoor use of processing aids in open systems ERC8d : Wide dispersive outdoor use of processing aids in open systems
Specific environmental release category	ESVOC SpERC 8.4b.v1
9.6.2. Operational conditions and risk managment measures	
9.6.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	0.5 – 10kPa
Amounts used	
Annually at point sources	1,500 t/year (maximum in worst case)
Annually total	15,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	365
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m^3/day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.02
Release fraction to waste water from	0.000001

process before RMMs	
Release fraction to soil from process before RMMs	0
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >0%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 93.3%
Soil emission controls are not applicable as there is no direct release to soil.	
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	3,895
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and/or national regulations.	
9.6.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (PROC 1, 2, 3, 4, 8b, 10, 11 & 13) < 4 hours/day (PROC 8a)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	
Technical conditions and measures at process level (source) to prevent release	
No specific measure identified.	
Technical conditions and measures to control dispersion from source towards the worker	
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) (PROC 4, 10 & 11) Provide a good standard of general ventilation (not less than 10 to 15 air changes per hour) (PROC 8b &13) Avoid carrying out activities involving exposure for more than 4 hours (PROC 8a) Ensure operation is undertaken outdoors (PROC 8a) Natural ventilation is from windows and doors etc. Controlled ventilation means air is supplied or removed by a	

powered fan (PROC 10)
Provide extract ventilation to points where emissions occur (PROC 4 & 10)

Organisational measures to prevent /limit releases, dispersion and exposure

Drain down system prior to equipment break-in or maintenance (PROC 8a)

Conditions and measures related to personal protection, hygiene and health evaluation

1. PPE: Wear a respirator conforming to EN140 with Type A filter or better (PROC10 & 11)

9.6.3. Exposure information and reference to its source

9.6.3.1. Prediction of environmental exposure resulting from the conditions described above

Environmental exposure estimation is calculated with EUSES model v2.1.1..

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed exposures are not expected to exceed the predicted PNECs and the resulting risk characterization ratios are expected to be less than 1. For PNEC values, please refer to Page 1.

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	0.0000268	0.00141	0.000145	0.000123	0.00738	0.000642

9.6.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	Not available	Not available
PROC 2	20	1.37
PROC 3	25	0.34
PROC 4	10 - 35	0.69 - 6.86
PROC 8a	20 - 42	13.71
PROC 8b	15	6.86
PROC 10	7 - 20	1.37 - 27.43
PROC 11	35	107.14
PROC 13	30	13.71

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 1	Not available	Not available	Not available
PROC 2	0.39	0	0.40
PROC 3	0.49	0	0.49
PROC 4	0.20 - 0.69	0 - 0.02	0.20 - 0.70
PROC 8a	0.39 - 0.82	0.04	0.43 - 0.86
PROC 8b	0.29	0.02	0.31
PROC 10	0.14 – 0.39	0 - 0.07	0.21 – 0.40
PROC 11	0.69	0.28	0.97
PROC 13	0.59	0.04	0.62

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

9.6.5. Additional good practice advice beyond the REACH CSA

Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES7):

Use of toluene as a fuel - Industrial

9.7.1. Exposure scenario addressing uses carried out by workers **Use of toluene as a fuel - Industrial**	
Use descriptors related to the life cycle stage	SU3 : Industrial uses: Uses of substances as such or in preparations at industrial sites SU10 : Formulation [mixing] of preparations and/or re-packaging (excluding alloys) PROC1 : Use in closed process, no likelihood of exposure PROC2 : Use in closed, continuous process with occasional controlled exposure PROC3 : Use in closed, continuous process with occasional controlled exposure PROC4 : Use in batch and other process (synthesis) where opportunity for exposure arises PROC8a : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC16 : Using material as fuel sources, limited exposure to unburned product to be expected ERC7 : Industrial use of substances in closed systems
Specific environmental release category	ESVOC SpERC 7.12a.v1
9.7.2. Operational conditions and risk managment measures	
9.7.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	0.5 – 10kPa
Amounts used	
Annually at point sources	15,000 t/year (maximum in worst case)
Annually total	150,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	300
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m^3/day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.0025
Release fraction to waste water from process before RMMs	0.00001
Release fraction to soil from process before	0

RMMs	
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >95%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 93.3%
Soil emission controls are not applicable as there is no direct release to soil.	
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	11,100,000
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
This substance is consumed during use and no waste of the substance is generated.	
9.7.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	
Technical conditions and measures at process level (source) to prevent release	
No specific measured identified.	
Technical conditions and measures to control dispersion from source towards the worker	
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) (PROC 8a & 8b)	
Organisational measures to prevent /limit releases, dispersion and exposure	
Drain down system prior to equipment break-in or maintenance (PROC 8a)	
Conditions and measures related to personal protection, hygiene and health evaluation	
1. PPE: Wear suitable coveralls to prevent exposure to the skin (PROC 8a)	
9.7.3. Exposure information and reference to its source	
9.7.3.1. Prediction of environmental exposure resulting from the conditions described above	

Environmental exposure estimation is calculated with EUSES model v2.1.1..

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed exposures are not expected to exceed the predicted PNECs and the resulting risk characterization ratios are expected to be less than 1. For PNEC values, please refer to Page 1.

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	0.0163	0.00304	0.00973	0.000285	0.0159	0.00149

9.7.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01	0.03
PROC 2	10	1.37
PROC 3	25	0.34
PROC 4	20	6.86
PROC 8a	10 - 35	2.74 – 13.71
PROC 8b	35	6.86
PROC 16	5	0.34

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 1	0	0	0
PROC 2	0.20	0	0.20
PROC 3	0.49	0	0.49
PROC 4	0.39	0.02	0.41
PROC 8a	0.20 – 0.69	0.01 – 0.04	0.20 – 0.72
PROC 8b	0.69	0.02	0.70
PROC 16	0.10	0	0.10

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

9.7.5. Additional good practice advice beyond the REACH CSA

Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES8):

Use of toluene as a fuel - Professional

9.8.1. Exposure scenario addressing uses carried out by workers **Use of toluene as a fuel - Professional**	
Use descriptors related to the life cycle stage	SU22 : Professional uses: Public domain (administration, education, entertainment, services, craftsmen) PROC1 : Use in closed process, no likelihood of exposure PROC2 : Use in closed, continuous process with occasional controlled exposure PROC3 : Use in closed, continuous process with occasional controlled exposure PROC4 : Use in batch and other process (synthesis) where opportunity for exposure arises PROC8a : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC16 : Using material as fuel sources, limited exposure to unburned product to be expected ERC9a : Wide dispersive indoor use of substances in closed systems ERC9b : Wide dispersive outdoor use of substances in closed systems
Specific environmental release category	ESVOC SpERC 9.12b.v1
9.8.2. Operational conditions and risk managment measures	
9.8.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	0.5 – 10kPa
Amounts used	
Annually at point sources	15,000 t/year (maximum in worst case)
Annually total	150,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	365
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m^3/day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.001
Release fraction to waste water from process before RMMs	0.00001
Release fraction to soil from process before	0.00001

RMMs	
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >0%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 93.3%
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	3,895
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
This substance is consumed during use and no waste of the substance is generated.	
9.8.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	
Technical conditions and measures at process level (source) to prevent release	
Handle substance within a closed system (PROC 2) Store substance within a closed system (PROC 1)	
Technical conditions and measures to control dispersion from source towards the worker	
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) (PROC 8b) Provide a good standard of general ventilation (not less than 10 to 15 air changes per hour) (PROC 4)	
Organisational measures to prevent /limit releases, dispersion and exposure	
Drain down system prior to equipment break-in or maintenance (PROC 8a)	
Conditions and measures related to personal protection, hygiene and health evaluation	
No specific measures identified.	
9.8.3. Exposure information and reference to its source	

9.8.3.1. Prediction of environmental exposure resulting from the conditions described above

Environmental exposure estimation is calculated with EUSES model v2.1.1..

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed exposures are not expected to exceed the predicted PNECs and the resulting risk characterization ratios are expected to be less than 1. For PNEC values, please refer to Page 1.

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	0.0000268	0.00141	0.000144	0.000123	0.00738	0.000642

9.8.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01	0.34
PROC 2	20	1.37
PROC 3	25	0.34
PROC 4	15	6.86
PROC 8a	20	13.71
PROC 8b	35	3.43
PROC 16	10	0.34

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 1	0	0	0
PROC 2	0.39	0	0.40
PROC 3	0.49	0	0.49
PROC 4	0.29	0.02	0.31
PROC 8a	0.39	0.04	0.43
PROC 8b	0.69	0.01	0.70
PROC 16	0.20	0	0.20

9.8.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES
The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.
9.8.5. Additional good practice advice beyond the REACH CSA
Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES9):

Consumer use of toluene as a fuel

9.9.1. Exposure Scenario for Consumer use of toluene as a fuel	
Use descriptors related to the life cycle stage	SU21 : Consumer uses: Private households (= general public = consumers) PC13 : Fuels ERC9a : Wide dispersive indoor use of substances in closed systems ERC9b : Wide dispersive outdoor use of substances in closed systems
Specific environmental release category	ESVOC SpERC 9.12c.v1
9.9.2. Operational conditions and risk management measures	
9.9.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	3089
Amounts used	
EU tonnage	150,000 t/year
Regional tonnage	15,000 t/year
Fraction of main local source	0.002
Frequency and duration of use/exposure	
Emission days per year	365
Environment factors not influenced by risk management	
Local Freshwater dilution factor	10
Local marine water dilution factor	100
Other given operational conditions affecting environmental exposure	
Release fraction to air from wide dispersive use (regional only)	0.001
Release fraction to wastewater from wide dispersive use	0.00001
Release fraction to soil from wide dispersive use (regional only)	0.00001
Conditions and measures related to municipal sewage treatment plant	
Assumed domestic sewage treatment plant flow	2000 m^3/day
Maximum allowable site tonnage (M_{safe}) (kg/d)	3,895
Estimated substance removal from wastewater via domestic sewage treatment 93.3%	
Soil emission controls are not applicable as there is no direct release to soil.	
Conditions and measures related to external treatment of waste for disposal	
External treatment and disposal of waste should comply with applicable local and/or national regulations.	
Conditions and measures related to external recovery of waste	
External recovery and recycling of waste should comply with applicable local and/or national regulations.	

9.9.2.2. Control of consumer exposure	
Substance content in the product	Up to 100%
Amounts of product used / applied per event	Up to 37,500 g
Frequency and duration of use/exposure	Covers use frequency up to 0.143 times per day
	Duration of exposure: up to 2 hours per event
Consumer related measures	Covers concentrations up to 100%; Covers use 1- 365 days/year; Covers use up to 1 time/on day of use; Covers skin contact area 210 – 420 cm^2 for each use event; Covers use amounts 100 – 37,500 g; Covers use in room size of 20m^3; For each use event, covers exposure up to 0.01 - 2.00hr/event; RMM: No specific RMMs identified beyond those OCs stated
Other Operational Conditions affecting exposure	Assumes use at ambient temperatures; assumes use in a 20m^3 room; assumes use with typical ventilation.

9.9.3. Exposure information and reference to its source

9.9.3.1. Prediction of environmental exposure resulting from the conditions described above

Environmental exposure estimation is based on EUSES v2.1.1.

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed exposures are not expected to exceed the predicted PNECs and the resulting risk characterisation ratios are expected to be less than 1. For PNEC values, please refer to Page 1.

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	0.0000268	0.00144	0.000145	0.000125	0.00753	0.000654

9.9.3.2. Prediction of consumer exposure resulting from the conditions described above

Consumer exposure estimation is based on ECETOC TRAv2.

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided below) when the operational conditions/risk management measures described above are implemented.

Ranges for exposure estimates and RCR are listed below. For more information contact the supplier or refer to the CSR. For DNEL values, please refer to Page 1.

Consumers exposure	Dermal (mg/kg/day)	Oral (mg/kg/day)	Inhalation (mg/m^3 for 24hr day)	All routes systematic (mg/kg/day)
Exposure estimates	71.5	0	12,500	1,213

Risk characterization:

Process category	RCR (dermal)	RCR (oral)	RCR (inhalation)	RCR (all routes)
All PROCs	0.02	0	0	0 – 0.02

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

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

9.9.5. Additional good practice advice beyond the REACH CSA

Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES10):

Use of toluene in coatings - Industrial

9.10.1. Exposure scenario addressing uses carried out by workers **Use of toluene in coatings - Industrial**	
Use descriptors related to the life cycle stage	SU3 : Industrial uses: Uses of substances as such or in preparations at industrial sites SU10 : Formulation [mixing] of preparations and/or re-packaging (excluding alloys) PROC1 : Use in closed process, no likelihood of exposure PROC2 : Use in closed, continuous process with occasional controlled exposure PROC3 : Use in closed, continuous process with occasional controlled exposure PROC4 : Use in batch and other process (synthesis) where opportunity for exposure arises PROC5 : Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact) PROC7 : Industrial spraying PROC8a : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC9 : Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC10 : Roller application or brushing PROC13 : Treatment of articles by dipping and pouring PROC15 : Use as laboratory reagent ERC4 : Industrial use of processing aids in processes and products, not becoming part of articles
Specific environmental release category	ESVOC SpERC 4.3a.v1
9.10.2. Operational conditions and risk managment measures	
9.10.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	0.5 – 10kPa
Amounts used	
Annually at point sources	4,500 t/year (maximum in worst case)
Annually total	150,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	300
Environment factors not influenced by risk management	

Flow rate of receiving surface water	18,000 m^3/day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.98
Release fraction to waste water from process before RMMs	0.007
Release fraction to soil from process before RMMs	0
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >90%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 93.3%
Soil emission controls are not applicable as there is no direct release to soil.	
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	19,900
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and / or national regulations.	
9.10.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical conditions and measures to control dispersion from source towards the worker	

Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) (PROC 5, 8a, 8b, 9, 10, 13, 14 & 15)
Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) (PROC 7)
Carry out in a vented booth or extracted enclosure (PROC 7)

Organisational measures to prevent /limit releases, dispersion and exposure

Drain down system prior to equipment break-in or maintenance (PROC 8a)

Conditions and measures related to personal protection, hygiene and health evaluation

1. PPE: Wear a respirator conforming to EN140 with Type A filter or better. (PROC 7 – if technical measures not practicable

9.10.3. Exposure information and reference to its source

9.10.3.1. Prediction of environmental exposure resulting from the conditions described above

Environmental exposure estimation is calculated with EUSES model v2.1.1..

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed exposures are not expected to exceed the predicted PNECs and the resulting risk characterization ratios are expected to be less than 1. For PNEC values, please refer to Page 1.

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	3.42	0.344	1.70	0.0343	1.80	0.180

9.10.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01	0.34
PROC 2	10	1.37
PROC 3	25	0.34
PROC 4	20	6.86
PROC 5	35	13.71
PROC 7	2.50 – 7.50	2.14 – 42.86
PROC 8a	10 - 35	0.14 - 13.71
PROC 8b	35	6.86
PROC 9	35	6.86
PROC 10	35	27.43
PROC 13	35	13.71
PROC 15	10	0.34

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 1	0	0	0
PROC 2	0.20	0	0.20
PROC 3	0.49	0	0.49
PROC 4	0.39	0.02	0.41
PROC 5	0.69	0.04	0.72
PROC 7	0.05 – 0.15	0.01 – 0.11	0.05 – 0.26
PROC 8a	0.20 - 0.69	0 - 0.04	0.20 - 0.72
PROC 8b	0.69	0.02	0.70
PROC 9	0.69	0.02	0.70
PROC 10	0.69	0.07	0.76
PROC 13	0.69	0.04	0.72
PROC 15	0.20	0.02	0.20

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

9.10.5. Additional good practice advice beyond the REACH CSA

Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES11):

Use of toluene in coatings - Professional

9.11.1. Exposure scenario addressing uses carried out by workers **Use of toluene in coatings - Professional**	
Use descriptors related to the life cycle stage	SU22 : Professional uses: Public domain (administration, education, entertainment, services, craftsmen) PROC1 : Use in closed process, no likelihood of exposure PROC2 : Use in closed, continuous process with occasional controlled exposure PROC3 : Use in closed, continuous process with occasional controlled exposure PROC4 : Use in batch and other process (synthesis) where opportunity for exposure arises PROC5 : Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact) PROC8a : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC10 : Roller application or brushing PROC11 : Non industrial spraying PROC13 : Treatment of articles by dipping and pouring PROC15 : Use as laboratory reagent PROC19 : Hand-mixing with intimate contact and only PPE available ERC8a : Wide dispersive indoor use of processing aids in open systems ERC8d : Wide dispersive outdoor use of processing aids in open systems
Specific environmental release category	ESVOC SpERC 8.3b.v1
9.11.2. Operational conditions and risk managment measures	
9.11.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	0.5 – 10kPa
Amounts used	
Annually at point sources	15,000 t/year (maximum in worst case)
Annually total	150,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	365
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m^3/day (default)

Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.98
Release fraction to waste water from process before RMMs	0.01
Release fraction to soil from process before RMMs	0.01
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >0%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 93.3%
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	12,700
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and / or national regulations.	
9.11.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (PROC 1, 2, 3, 4, 8a, 8b, 10, 11, 13, 15 & 19) < 4 hours/day (PROC 5)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	
Technical conditions and measures at process level (source) to prevent release	
Use drum pumps or carefully pour from container (PROC 8a & 8b) Use container to collect drips (PROC 8b)	
Technical conditions and measures to control dispersion from source towards the worker	
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) (PROC 5)	

Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) (PROC 4, 5, 10 & 19)
Avoid carrying out activities involving exposure for more than 4 hours (PROC 5)
Ensure operation is undertaken outdoors (PROC 4, 5, 10, 11, 13 & 19)
Carry out in a vented booth or extracted enclosure (PROC 11)
Ensure doors and windows are opened (PROC 19)

Organisational measures to prevent /limit releases, dispersion and exposure

Drain down system prior to equipment break-in or maintenance (PROC 8a)

Conditions and measures related to personal protection, hygiene and health evaluation

1. PPE: Wear a respirator conforming to EN140 with Type A filter or better. (PROC10, 11,13 & 19 – outdoor)
2. PPE: Wear gloves (type EN374) if regular skin contact likely (PROC 13 & 19 – outdoor)

9.11.3. Exposure information and reference to its source

9.11.3.1. Prediction of environmental exposure resulting from the conditions described above

Environmental exposure estimation is calculated with EUSES model v2.1.1..

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed exposures are not expected to exceed the predicted PNECs and the resulting risk characterization ratios are expected to be less than 1. For PNEC values, please refer to Page 1.

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	0.0268	0.00409	0.0146	0.000390	0.0214	0.00204

9.11.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01	0.34
PROC 2	20	1.37
PROC 3	25	0.34
PROC 4	15 - 35	6.86
PROC 5	30 – 42	13.71
PROC 8a	20	1.37 – 13.71
PROC 8b	10	0.69
PROC 10	7 - 30	27.43
PROC 11	35 – 50	2.14 – 107.14
PROC 13	7 – 20	0.69 – 13.71
PROC 15	10	0.34
PROC 19	7 - 30	141.43

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 1	0	0	0
PROC 2	0.39	0	0.40
PROC 3	0.29 - 0.49	0 – 0.02	0.31 - 0.49
PROC 4	0.69	0.02	0.70
PROC 5	0.59 – 0.82	0.04	0.62 – 0.86
PROC 8a	0.39	0 – 0.04	0.40 – 0.43
PROC 8b	0.20	0	0.20
PROC 10	0.14 – 0.59	0.07	0.21 – 0.66
PROC 11	0.69 – 0.98	0.01 – 0.28	0.97 – 0.99
PROC 13	0.14 – 0.39	0 – 0.04	0.17 – 0..39
PROC 15	0.20	0	0.20
PROC 19	0.14 – 0.59	0.37	0.51 – 0.96

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

9.11.5. Additional good practice advice beyond the REACH CSA

Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES12):

Consumer use of toluene in coatings

9.12.1. Exposure Scenario for Consumer use of toluene in coatings	
Use descriptors related to the life cycle stage	SU21 : Consumer uses: Private households (= general public = consumers) PC1 : Adhesives, sealants PC4 : Anti-Freeze and de-icing products PC5 : Artists Supply and Hobby preparations PC8 : Biocidal products (e.g. Disinfectants, pest control) PC9a : Coatings, paints, thinners, removers PC9b : Fillers, putties, plasters, model-ling clay PC9c : Finger paints PC10 : Building and construction preparations not covered elsewhere PC15 : Non-metal-surface treatment products PC18 : Ink and toners PC23 : Leather tanning, dye, finishing, impregnation and care products PC24 : Lubricants, greases, release products PC31 : Polishes and wax blends PC34 : Textile dyes, finishing and impregnating products; including bleaches and other processing aids ERC9a : Wide dispersive indoor use of substances in closed systems ERC9b : Wide dispersive outdoor use of substances in closed systems
Specific environmental release category	ESVOC SpERC 8.3c.v1
9.12.2. Operational conditions and risk management measures	
9.12.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	3089
Amounts used	
EU tonnage	150,000 t/year
Regional tonnage	15,000 t/year
Fraction of main local source	0.002
Frequency and duration of use/exposure	
Emission days per year	365
Environment factors not influenced by risk management	
Local Freshwater dilution factor	10
Local marine water dilution factor	100
Other given operational conditions affecting environmental exposure	

Release fraction to air from wide dispersive use (regional only)	0.985
Release fraction to wastewater from wide dispersive use	0.01
Release fraction to soil from wide dispersive use (regional only)	0.005
Conditions and measures related to municipal sewage treatment plant	
Assumed domestic sewage treatment plant flow	2000 m^3/day
Maximum allowable site tonnage (M_{safe}) (kg/d)	13,600
Estimated substance removal from wastewater via domestic sewage treatment 93.3%	
Prevent environmental discharge consistent with regulatory requirements.	
Conditions and measures related to external treatment of waste for disposal	
External treatment and disposal of waste should comply with applicable local and/or national regulations.	
Conditions and measures related to external recovery of waste	
External recovery and recycling of waste should comply with applicable local and/or national regulations.	
9.12.2.2. Control of consumer exposure	
Substance content in the product	Up to 100%
Amounts of product used / applied per event	Up to 13,800 g
Frequency and duration of use/exposure	Covers use frequency up to 1 times per day
	Duration of exposure: up to 6 hours per event
Consumer related measures	Covers concentrations of 0.1 – 100%; Covers use 1- 365 days/year; Covers use up to 1 time/on day of use; Covers skin contact area 210 – 420 cm^2 for each use event; Covers use amounts 35.73 – 857.50 g; Covers use in room size of 20m^3; For each use event, covers exposure up to 0.02 – 6.00hr/event; RMM: No specific RMMs identified beyond those Ocs stated
Other Operational Conditions affecting exposure	Assumes use at ambient temperatures ; assumes use in a 20m^3 room ; assumes use with typical ventilation.
9.12.3. Exposure information and reference to its source	
9.12.3.1. Prediction of environmental exposure resulting from the conditions described above	
Environmental exposure estimation is based on EUSES v2.1.1.	
When the recommended risk management measures (RMMs) and operational conditions (Ocs) are observed exposures are not expected to exceed the predicted PNECs and the resulting risk haracterization ratios are expected to be less than 1. For PNEC values, please refer to Page 1.	

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	0.0268	0.00409	0.000218	0.000390	0.0214	0.00204

9.12.3.2. Prediction of consumer exposure resulting from the conditions described above

Consumer exposure estimation is based on ECETOC TRAv2.

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided below) when the operational conditions/risk management measures described above are implemented.

Ranges for exposure estimates and RCR are listed below. For more information contact the supplier or refer to the CSR. For DNEL values, please refer to Page 1.

Consumers exposure	Dermal (mg/kg/day)	Oral (mg/kg/day)	Inhalation (mg/m^3 for 24hr day)	All routes systematic (mg/kg/day)
Exposure estimates	0 – 123.9	0 – 68	0 – 1,250,000	0 – 58,457

Risk characterization:

Process category	RCR (dermal)	RCR (oral)	RCR (inhalation)	RCR (all routes)
All PROCs	0 – 0.7	0 – 0.12	0 – 0.18	0 – 0.18

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

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

9.12.5. Additional good practice advice beyond the REACH CSA

Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES13):

Use of toluene in oilfield drilling and production operations – Industrial

9.13.1. Exposure scenario addressing uses carried out by workers Use of toluene in oilfield drilling and production operations – Industrial	
Use descriptors related to the life cycle stage	SU3 : Industrial uses: Uses of substances as such or in preparations at industrial sites SU10 : Formulation [mixing] of preparations and/or re-packaging (excluding alloys) PROC1 : Use in closed process, no likelihood of exposure PROC2 : Use in closed, continuous process with occasional controlled exposure PROC3 : Use in closed, continuous process with occasional controlled exposure PROC4 : Use in batch and other process (synthesis) where opportunity for exposure arises PROC8a : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities ERC4 : Industrial use of processing aids in processes and products, not becoming part of articles
Specific environmental release category	Not applicable
9.13.2. Operational conditions and risk managment measures	
9.13.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	0.5 – 10kPa
Amounts used	
Annually at point sources	3,000 t/year (maximum in worst case)
Annually total	30,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	n.a.
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m^3/day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	n.a.
Release fraction to waste water from process before RMMs	n.a.
Release fraction to soil from process before RMMs	n.a.
Technical conditions and measures at process level (source) to prevent release	

No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Discharge to aquatic environment is restricted.	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of % N/A
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of % N/A
Organizational measures to prevent/limit release from site	
Prevent environmental discharge consistent with regulatory requirements.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and / or national regulations.	
9.13.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	
Technical conditions and measures at process level (source) to prevent release	
Ensure material transfers are under containment or extract ventilation (PROC 4)	
Technical conditions and measures to control dispersion from source towards the worker	
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) (PROC 8a & 8b) Provide extract ventilation to points where emissions occur (PROC 2) Ensure operation is undertaken outdoors (PROC 4) Operate activity away from sources of emissions or release (PROC 8b)	
Organisational measures to prevent /limit releases, dispersion and exposure	
No specific measures identified.	
Conditions and measures related to personal protection, hygiene and health evaluation	
1. PPE: Wear a respirator conforming to EN140 with Type A filter or better. (PROC 8b - if technical measures not practicable) 2. PPE: Wear gloves (type EN374) if regular skin contact likely(PROC 8b - if technical measures not practicable & PROC 8a)	

9.13.3. Exposure information and reference to its source

9.13.3.1. Prediction of environmental exposure resulting from the conditions described above

Quantitative exposure and risk assessment not possible due to lack of emissions to aquatic environment. Qualitative approach used to conclude safe use. For more detailed information refer to supplier or CSR.

9.13.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01	0.03 - 0.34
PROC 2	10	1.37
PROC 3	25	0.34
PROC 4	14 - 20	6.86
PROC 8a	35	13.71
PROC 8b	35	6.86

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 1	0	0	0
PROC 2	0.20	0	0.20
PROC 3	0.49	0	0.49
PROC 4	0.39 – 0.69	0.02 – 0.04	0.41 – 0.72
PROC 8a	0.69	0.04	0.72
PROC 8b	0.69	0.02	0.70

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

9.13.5. Additional good practice advice beyond the REACH CSA

Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES14):

Use of toluene in binders and release agents - Industrial

9.14.1. Exposure scenario addressing uses carried out by workers **Use of toluene in binders and release agents - Industrial**	
Use descriptors related to the life cycle stage	SU3 : Industrial uses: Uses of substances as such or in preparations at industrial sites SU8 : Manufacture of bulk, large scale chemicals (including petroleum products) SU9 : Manufacture of fine chemicals PROC1 : Use in closed process, no likelihood of exposure PROC2 : Use in closed, continuous process with occasional controlled exposure PROC3 : Use in closed, continuous process with occasional controlled exposure PROC4 : Use in batch and other process (synthesis) where opportunity for exposure arises PROC6 : Calendering operations PROC7 : Industrial spraying PROC8b : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC10 : Roller application or brushing PROC13 : Treatment of articles by dipping and pouring PROC14 : Production of preparations or articles by tabletting, compression, extrusion, pelletisation ERC5 : Industrial use resulting in inclusion into or onto a matrix
Specific environmental release category	ESVOC SpERC 4.10a.v1
9.14.2. Operational conditions and risk managment measures	
9.14.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	0.5 – 10kPa
Amounts used	
Annually at point sources	1,500 t/year (maximum in worst case)
Annually total	15,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	300
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m^3/day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.2

Release fraction to waste water from process before RMMs	0.00003
Release fraction to soil from process before RMMs	0
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >80%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 93.3%
Soil emission controls are not applicable as there is no direct release to soil.	
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	744,000
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and / or national regulations.	
9.14.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	
Technical conditions and measures at process level (source) to prevent release	
No specific measured identified.	
Technical conditions and measures to control dispersion from source towards the worker	
Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) (PROC 7, 8b & 14) Provide extract ventilation to points where emissions occur (PROC 6) Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings (PROC 7)	

Organisational measures to prevent /limit releases, dispersion and exposure
No specific measured identified.
Conditions and measures related to personal protection, hygiene and health evaluation
No specific measured identified.

9.14.3. Exposure information and reference to its source

9.14.3.1. Prediction of environmental exposure resulting from the conditions described above

Environmental exposure estimation is calculated with EUSES model v2.1.1..

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed exposures are not expected to exceed the predicted PNECs and the resulting risk characterization ratios are expected to be less than 1. For PNEC values, please refer to Page 1.

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	0.00489	0.00190	0.0152	0.000171	0.00993	0.000897

9.14.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01	0.03 - 0.34
PROC 2	10	0.14 - 1.37
PROC 3	25	0.34
PROC 4	20	6.86
PROC 6	25	1.37
PROC 7	2.50 - 12.50	2.14 – 42.86
PROC 8b	15	6.86
PROC 10	15	27.43
PROC 13	Not available	Not available
PROC 14	15	3.43

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 1	0	0	0
PROC 2	0.20	0	0.20
PROC 3	0.49	0	0.49
PROC 4	0.39	0.02	0.41
PROC 6	0.49	0	0.49
PROC 7	0.05 – 0.25	0.01 – 0.11	0.16 – 0.25
PROC 8b	0.29	0.02	0.31
PROC 10	0.29	0.07	0.37
PROC 13	Not available	Not available	Not available
PROC 14	0.29	0.01	0.30

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

9.14.5. Additional good practice advice beyond the REACH CSA

Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES15):

Use of toluene in binders and release agents - Professional

9.15.1. Exposure scenario addressing uses carried out by workers **Use of toluene in binders and release agents - Professional**	
Use descriptors related to the life cycle stage	SU22 : Professional uses: Public domain (administration, education, entertainment, services, craftsmen) PROC1 : Use in closed process, no likelihood of exposure PROC2 : Use in closed, continuous process with occasional controlled exposure PROC3 : Use in closed, continuous process with occasional controlled exposure PROC4 : Use in batch and other process (synthesis) where opportunity for exposure arises PROC6 : Calendering operations PROC8a : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC10 : Roller application or brushing PROC11 : Non industrial spraying PROC14 : Production of preparations or articles by tabletting, compression, extrusion, pelletisation ERC8a : Wide dispersive indoor use of processing aids in open systems ERC8b : Wide dispersive indoor use of reactive substances in open systems ERC8c : Wide dispersive indoor use resulting in inclusion into or onto a matrix ERC8d : Wide dispersive outdoor use of processing aids in open systems ERC8e : Wide dispersive outdoor use of reactive substances in open systems ERC8f : Wide dispersive outdoor use resulting in inclusion into or onto a matrix
Specific environmental release category	ESVOC SpERC 8.10b.v1
9.15.2. Operational conditions and risk managment measures	
9.15.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	0.5 – 10kPa
Amounts used	
Annually at point sources	1,500 t/year (maximum in worst case)
Annually total	15,000 t/year total market

Frequency and duration of use/exposure	
Emission days per year	365
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m^3/day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.95
Release fraction to waste water from process before RMMs	0.025
Release fraction to soil from process before RMMs	0.025
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >0%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 93.3%
Organizational measures to prevent/limit release from site	
Not applicable.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	2,660
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and / or national regulations.	
9.15.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	
Technical conditions and measures at process level (source) to prevent release	
Transfer materials directly to mixing vessels (PROC 8b)	

Technical conditions and measures to control dispersion from source towards the worker
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) (PROC 4 & 11) Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) (PROC 6, 10, 11 & 14) Carry out in a vented booth or extracted enclosure (PROC 11)
Organisational measures to prevent /limit releases, dispersion and exposure
No specific measures identified.
Conditions and measures related to personal protection, hygiene and health evaluation
1. PPE: Wear a respirator conforming to EN140 with Type A filter or better. (PROC 11 - if technical measures not practicable)

9.15.3. Exposure information and reference to its source

9.15.3.1. Prediction of environmental exposure resulting from the conditions described above

Environmental exposure estimation is calculated with EUSES model v2.1.1..

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed exposures are not expected to exceed the predicted PNECs and the resulting risk characterization ratios are expected to be less than 1.For PNEC values, please refer to Page 1.

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	0.00670	0.00208	0.00355	0.000189	0.0109	0.000992

9.15.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01	0.03 - 0.34
PROC 2	20	0.14 - 1.37
PROC 3	25	0.34
PROC 4	35	6.86
PROC 6	30	27.43
PROC 8a		
PROC 8b	30	6.86
PROC 10	30	27.43
PROC 11	30 - 35	2.14 – 107.14
PROC 14	30	3.43

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 1	0	0	0
PROC 2	0.39	0	0. 39 - 0.40
PROC 3	0.49	0	0.49
PROC 4	0.69	0.02	0.70
PROC 6	0.59	0.07	0.66
PROC 8a			
PROC 8b	0.59	0.02	0.61
PROC 10	0.59	0.01	0.59
PROC 11	0.59 – 0.69	0.01 – 0.28	0.59 – 0.97
PROC 14	0.59	0.01	0.60

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

9.15.5. Additional good practice advice beyond the REACH CSA

Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES16):

Use of toluene as a laboratory reagent - Industrial

9.16.1. Exposure scenario addressing uses carried out by workers **Use of toluene as a laboratory reagent - Industrial**	
Use descriptors related to the life cycle stage	SU3 : Industrial uses: Uses of substances as such or in preparations at industrial sites SU10 : Formulation [mixing] of preparations and/or re-packaging (excluding alloys) PROC10 : Roller application or brushing PROC15 : Use as laboratory reagent ERC2 : Formulation of preparations ESC4 : Industrial use of processing aids in processes and products, not becoming part of articles
Specific environmental release category	SpERC proposes to assess using ERC 2
9.16.2. Operational conditions and risk managment measures	
9.16.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	0.5 – 10kPa
Amounts used	
Annually at point sources	1,500 t/year (maximum in worst case)
Annually total	15,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	300
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m^3/day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.025
Release fraction to waste water from process before RMMs	0.02
Release fraction to soil from process before RMMs	0.0001
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >0%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 93.3%
Organizational measures to prevent/limit release from site	

Do not apply industrial sludge to natural soils.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	7,020
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and / or national regulations.	
9.16.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	
Technical conditions and measures at process level (source) to prevent release	
No specific measured identified.	
Technical conditions and measures to control dispersion from source towards the worker	
Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) (PROC 10)	
Organisational measures to prevent /limit releases, dispersion and exposure	
No specific measured identified.	
Conditions and measures related to personal protection, hygiene and health evaluation	
No specific measured identified.	
9.16.3. Exposure information and reference to its source	
9.16.3.1. Prediction of environmental exposure resulting from the conditions described above	
Environmental exposure estimation is calculated with EUSES model v2.1.1..	
When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed exposures are not expected to exceed the predicted PNECs and the resulting risk characterization ratios are expected to be less than 1. For PNEC values, please refer to Page 1.	

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	3.26	0.327	1.61	0.0327	1.71	0.171

9.16.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 10	15	27.43
PROC 15	10	0.03

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 10	0.29	0.07	0.37
PROC 15	0.20	0	0.20

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

9.16.5. Additional good practice advice beyond the REACH CSA

Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES17):

Use of toluene as a laboratory reagent - Professional

9.17.1. Exposure scenario addressing uses carried out by workers Use of toluene as a laboratory reagent - Professional	
Use descriptors related to the life cycle stage	SU22 : Professional uses: Public domain (administration, education, entertainment, services, craftsmen) PROC10 : Roller application or brushing PROC15 : Use as laboratory reagent ERC4 : Industrial use of processing aids in processes and products, not becoming part of articles
Specific environmental release category	ESVOC SpERC 8.17.v1
9.17.2. Operational conditions and risk managment measures	
9.17.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	0.5 – 10kPa
Amounts used	
Annually at point sources	1,500 t/year (maximum in worst case)
Annually total	15,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	365
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m^3/day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.5
Release fraction to waste water from process before RMMs	0.5
Release fraction to soil from process before RMMs	0
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >0%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 93.3%
Soil emission controls are not applicable as there is no direct release to soil.	

Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	280
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and / or national regulations.	
9.17.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	
Technical conditions and measures at process level (source) to prevent release	
No specific measured identified.	
Technical conditions and measures to control dispersion from source towards the worker	
Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) (PROC 10)	
Organisational measures to prevent /limit releases, dispersion and exposure	
No specific measured identified.	
Conditions and measures related to personal protection, hygiene and health evaluation	
No specific measured identified.	
9.17.3. Exposure information and reference to its source	
9.17.3.1. Prediction of environmental exposure resulting from the conditions described above	
Environmental exposure estimation is calculated with EUSES model v2.1.1..	
When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed exposures are not expected to exceed the predicted PNECs and the resulting risk characterization ratios are expected to be less than 1. For PNEC values, please refer to Page 1.	

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	0.134	0.0148	0.0662	0.00146	0.0775	0.00766

9.17.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 10	30	27.43
PROC 15	10	0.03

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 10	0.59	0.07	0.66
PROC 15	0.20	0	0.20

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

9.17.5. Additional good practice advice beyond the REACH CSA

Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES18):

Use of toluene in functional fluids - Industrial

9.18.1. Exposure scenario addressing uses carried out by workers Use of toluene in functional fluids - Industrial	
Use descriptors related to the life cycle stage	SU3 : Industrial uses: Uses of substances as such or in preparations at industrial sites SU8 : Manufacture of bulk, large scale chemicals (including petroleum products) SU9 : Manufacture of fine chemicals PROC1 : Use in closed process, no likelihood of exposure PROC2 : Use in closed, continuous process with occasional controlled exposure PROC3 : Use in closed, continuous process with occasional controlled exposure PROC4 : Use in batch and other process (synthesis) where opportunity for exposure arises PROC8a : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC9 : Transfer of substance or preparation into small containers (dedicated filling line, including weighing) ERC7 : Industrial use of substances in closed systems
Specific environmental release category	ESVOC SpERC 7.13a.v1
9.18.2. Operational conditions and risk managment measures	
9.18.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	0.5 – 10kPa
Amounts used	
Annually at point sources	1,500 t/year (maximum in worst case)
Annually total	15,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	300
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m^3/day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.01
Release fraction to waste water from process before RMMs	0.0003

Release fraction to soil from process before RMMs	0.001
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >0%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 93.3%
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	455,000
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and / or national regulations.	
9.18.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	
Technical conditions and measures at process level (source) to prevent release	
No specific measured identified.	
Technical conditions and measures to control dispersion from source towards the worker	
Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings (PROC 8a, 8b & 9)	
Organisational measures to prevent /limit releases, dispersion and exposure	
Drain down system prior to equipment break-in or maintenance (PROC 8a & 9)	
Conditions and measures related to personal protection, hygiene and health evaluation	
No specific measured identified.	

9.18.3. Exposure information and reference to its source

9.18.3.1. Prediction of environmental exposure resulting from the conditions described above

Environmental exposure estimation is calculated with EUSES model v2.1.1..

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed exposures are not expected to exceed the predicted PNECs and the resulting risk characterization ratios are expected to be less than 1. For PNEC values, please refer to Page 1.

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	0.0489	0.00630	0.0248	0.000611	0.0330	0.00320

9.18.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01	0.03
PROC 2	10	0.14 – 1.37
PROC 3	25	0.03
PROC 4	20	6.86
PROC 8a	5 - 10	0.14 - 1.37
PROC 8b	1.50	0.69
PROC 9	5 - 10	0.69 – 6.86

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 1	0	0	0
PROC 2	0.20 – 0.39	0 – 0.02	0.20 – 0.41
PROC 3	0.49	0	0.49
PROC 4	0.39	0.02	0.41
PROC 8a	0.10 – 0.20	0	0.10 – 0.20
PROC 8b	0.69	0	0.03
PROC 9	0.20 - 0.69	0 – 0.02	0.10 – 0.21

9.18.4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES
The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.
9.18.5. Additional good practice advice beyond the REACH CSA
Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES19):

Use of toluene in functional fluids – Professional

9.19.1. Exposure scenario addressing uses carried out by workers **Use of toluene in functional fluids – Professional**	
Use descriptors related to the life cycle stage	SU22 : Professional uses: Public domain (administration, education, entertainment, services, craftsmen) PROC1 : Use in closed process, no likelihood of exposure PROC2 : Use in closed, continuous process with occasional controlled exposure PROC3 : Use in closed, continuous process with occasional controlled exposure PROC8a : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC9 : Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC20 : Heat and pressure transfer fluids in dispersive, professional use but closed systems ERC9a : Wide dispersive indoor use of substances in closed systems ERC9b : Wide dispersive outdoor use of substances in closed systems
Specific environmental release category	ESVOC SpERC 9.13b.v1
9.19.2. Operational conditions and risk managment measures	
9.19.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	0.5 – 10kPa
Amounts used	
Annually at point sources	1,500 t/year (maximum in worst case)
Annually total	15,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	365
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m^3/day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.05
Release fraction to waste water from process before RMMs	0.025
Release fraction to soil from process before RMMs	0.025
Technical conditions and measures at process level (source) to prevent release	

No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >0%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 93.3%
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	2,660
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and / or national regulations.	
9.19.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	
Technical conditions and measures at process level (source) to prevent release	
Use drum pumps or carefully pour from container (PROC 8a & 9)	
Technical conditions and measures to control dispersion from source towards the worker	
Handle substance within a predominantly closed system provided with extract ventilation (PROC 2)	
Organisational measures to prevent /limit releases, dispersion and exposure	
Drain down system prior to equipment break-in or maintenance (PROC 8a &9)	
Conditions and measures related to personal protection, hygiene and health evaluation	
No specific measured identified.	
9.19.3. Exposure information and reference to its source	
9.19.3.1. Prediction of environmental exposure resulting from the conditions described above	
Environmental exposure estimation is calculated with EUSES model v2.1.1..	
When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed	

exposures are not expected to exceed the predicted PNECs and the resulting risk characterization ratios are expected to be less than 1. For PNEC values, please refer to Page 1.

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	0.00670	0.00208	0.00343	0.000189	0.0109	0.000992

9.19.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01	0.03 - 1.37
PROC 2	20	0.14 - 1.37
PROC 3	Not available	Not available
PROC 8a	20	0.14 - 13.71
PROC 9	20	0.69 - 6.86
PROC 20	10	0.17

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 1	0	0	0
PROC 2	0.39	0	0.39 - 0.40
PROC 3	Not available	Not available	Not available
PROC 8a	0.39	0.04	0.43
PROC 9	0.39	0.02	0.41
PROC 20	0.20	0	0.20

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

9.19.5. Additional good practice advice beyond the REACH CSA

Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES20):

Use of toluene in rubber production and processing - Industrial

9.20.1. Exposure scenario addressing uses carried out by workers **Use of toluene in rubber production and processing - Industrial**	
Use descriptors related to the life cycle stage	SU3 : Industrial uses: Uses of substances as such or in preparations at industrial sites SU8 : Manufacture of bulk, large scale chemicals (including petroleum products) SU9 : Manufacture of fine chemicals PROC1 : Use in closed process, no likelihood of exposure PROC2 : Use in closed, continuous process with occasional controlled exposure PROC3 : Use in closed, continuous process with occasional controlled exposure PROC4 : Use in batch and other process (synthesis) where opportunity for exposure arises PROC5 : Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact) PROC6 : Calendering operations PROC7 : Industrial spraying PROC8a : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC13 : Treatment of articles by dipping and pouring PROC14 : Production of preparations or articles by tabletting, compression, extrusion, pelletisation PROC15 : Use as laboratory reagent PROC21 : Low energy manipulation of substances bound in materials and/or articles ERC4 : Industrial use of processing aids in processes and products, not becoming part of articles ERC6d : Industrial use of process regulators for polymerisation processes in production of resins, rubbers, polymers
Specific environmental release category	ESVOC SpERC 4.19.v1
9.20.2. Operational conditions and risk managment measures	
9.20.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	0.5 – 10kPa
Amounts used	
Annually at point sources	6,000 t/year (maximum in worst case)

Annually total	60,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	300
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m^3/day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.01
Release fraction to waste water from process before RMMs	0.003
Release fraction to soil from process before RMMs	0.0001
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >0%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 93.3%
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	467,000
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and / or national regulations.	
9.20.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	

Technical conditions and measures at process level (source) to prevent release
No specific measured identified.
Technical conditions and measures to control dispersion from source towards the worker
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) (PROC 5, 6, 8b & 9) Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) (PROC 6 & 14) Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings (PROC 6)
Organisational measures to prevent /limit releases, dispersion and exposure
Drain down system prior to equipment break-in or maintenance (PROC 8a)
Conditions and measures related to personal protection, hygiene and health evaluation
No specific measured identified.

9.20.3. Exposure information and reference to its source

9.20.3.1. Prediction of environmental exposure resulting from the conditions described above

Environmental exposure estimation is calculated with EUSES model v2.1.1..

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed exposures are not expected to exceed the predicted PNECs and the resulting risk characterization ratios are expected to be less than 1. For PNEC values, please refer to Page 1.

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	1.96	0.197	0.966	0.0197	1.03	0.103

9.20.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01	0.03
PROC 2	10	0.14
PROC 3	25	0.34
PROC 4	20	6.86
PROC 5	35	13.71
PROC 6	25 - 35	1.37 – 27.43
PROC 7	Not available	Not available
PROC 8a	5	13.71
PROC 8b	35	6.86
PROC 13	Not available	Not available
PROC 14	15	3.43
PROC 15	10	0.34
PROC 21	Not available	Not available

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 1	0	0	0
PROC 2	0.20	0	0.20
PROC 3	0.49	0	0.41
PROC 4	0.39	0.02	0.70
PROC 5	0.69	0.04	0.72
PROC 6	0.49 – 0.69	0 – 0.07	0.49 – 0.76
PROC 7	Not available	Not available	Not available
PROC 8a	0.10	0.04	0.13
PROC 8b	0.69	0.02	0.70
PROC 13	Not available	Not available	Not available
PROC 14	0.29	0.01	0.30
PROC 15	0.20	0	0.20
PROC 21	Not available	Not available	Not available

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

9.20.5. Additional good practice advice beyond the REACH CSA

Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.

Exposure Scenario (ES21):

Formulation of toluene

9.21.1. Exposure scenario addressing uses carried out by workers **Formulation of toluene**	
Use descriptors related to the life cycle stage	SU3 : Industrial uses: Uses of substances as such or in preparations at industrial sites SU10 : Formulation [mixing] of preparations and/or re-packaging (excluding alloys) PROC1 : Use in closed process, no likelihood of exposure PROC2 : Use in closed, continuous process with occasional controlled exposure PROC3 : Use in closed, continuous process with occasional controlled exposure PROC4 : Use in batch and other process (synthesis) where opportunity for exposure arises PROC5 : Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact) PROC8a : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC9 : Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC14 : Production of preparations or articles by tabletting, compression, extrusion, pelletisation PROC15 : Use as laboratory reagent ERC2 : Formulation of preparations
Specific environmental release category	ESVOC SpERC 2.2.v1
9.21.2. Operational conditions and risk managment measures	
9.21.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	0.5 – 10kPa
Amounts used	
Annually at point sources	1,500 t/year (maximum in worst case)
Annually total	15,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	300
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m^3/day (default)

Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.025
Release fraction to waste water from process before RMMs	0.002
Release fraction to soil from process before RMMs	0.0001
Technical conditions and measures at process level (source) to prevent release	
No specific measures identified.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >0%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 93.3%
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils.	
Conditions and measures related to municipal sewage treatment plant	
Size of STP	>= 2000 m^3/day
Degradation efficacy	93.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	67,800
Sludge treatment	Disposal or recovery
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and / or national regulations.	
9.21.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable	
Other given operational conditions affecting workers exposure	
Assumes use not > 20ºC above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
Users are advised to consider national Occupational Exposure Limits or other equivalent values.	
Technical conditions and measures at process level (source) to prevent release	
No specific measured identified.	
Technical conditions and measures to control dispersion from source towards the worker	
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) (PROC 5, 8a, 8b, 9 & 14) Ensure material transfers are under containment or extract ventilation (PROC 3)	

Provide extract ventilation to points where emissions occur (PROC 3)
Operate activity away from sources of emissions or release (PROC 8b)

Organisational measures to prevent /limit releases, dispersion and exposure

Drain down system prior to equipment break-in or maintenance (PROC 8a)

Conditions and measures related to personal protection, hygiene and health evaluation

1. PPE: Wear suitable respiratory protection (conforming to EN140 with Type A filter or better) (PROC 8b - if technical measures not practicable
2. PPE: Wear gloves (Type EN374) if regular skin contact likely (PROC 8b)

9.21.3. Exposure information and reference to its source

9.21.3.1. Prediction of environmental exposure resulting from the conditions described above

Environmental exposure estimation is calculated with EUSES model v2.1.1..

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed exposures are not expected to exceed the predicted PNECs and the resulting risk characterization ratios are expected to be less than 1. For PNEC values, please refer to Page 1.

Environmental exposure	In STP/ untreated wastewater (mg/l)	In local freshwater (mg/l)	In local soil (mg/kg dw)	In local marine water (mg/l)	In sediment freshwater (mg/kg dw)	In sediment marine water (mg/kg dw)
PEC	3.35	0.336	1.67	0.0336	1.76	0.176

9.21.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model v2.. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 1.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01	0.34
PROC 2	10	1.37
PROC 3	10 - 25	0.03 - 0.34
PROC 4	20	6.86
PROC 5	35	13.71
PROC 8a	5 - 35	1.37 - 13.71
PROC 8b	35	6.86
PROC 9	35	6.86
PROC 14	25	3.43
PROC 15	10	0.34

Predicted exposures are not expected to exceed the applicable exposure limits (DNEL as provided above) when the operational conditions/risk management measures described above are implemented

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 1	0	0	0
PROC 2	0.20	0	0.20
PROC 3	0.20 - 0.49	0	0.20 - 0.49
PROC 4	0.39	0	0.41
PROC 5	0.69	0.04	0.72
PROC 8a	0.10 - 0.69	0 - 0.04	0.10 - 0.72
PROC 8b	0.69	0.02	0.70
PROC 9	0.69	0.02	0.70
PROC 14	0.69	0.01	0.70
PROC 15	0.20	0	0.20

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool version 2 and EUSES v2.1.1. respectively.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

9.21.5. Additional good practice advice beyond the REACH CSA

Use specific measures expected to reduce the predicted exposure beyond the level estimated based on the exposure scenario when possible.