

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

#### 1.1. Product identifier

Chemical type	: Substance
Substance name	: Distillates (petroleum), C6-rich
Trade name	: Hexane
EC index no	: 601-037-00-0
EC no	: 296-903-4
CAS No.	: 93165-19-6
REACH registration No.	: Not available yet
Product code	: 687 SDS#PbR00036

#### 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 Formulation [mixing] of preparations and/or re-packaging Coatings Manufacture of rubber products. Fuels Cleaning agent
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##### 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
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### 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
Muta. 1B	H340
Carc. 1A	H350
Repr. 2	H361
STOT SE 3	H336
STOT RE 2	H373
Asp. Tox. 1	H304
Aquatic Chronic 2	H411

Full text of H-phrases: see section 16.

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

Carc.Cat.1; R45  
Muta.Cat.2; R46  
Repr.Cat.3; R62  
F; R11  
Xn; R65  
Xn; R48/20  
Xi; R38  
N; R51/53  
R67

Full text of R-phrases: see section 16.

# Hexane

## Safety Data Sheet

according to Regulation (EC) No. 453/2010

### Adverse physicochemical, human health and environmental effects

Highly flammable. Irritating to eyes and skin. May cause respiratory irritation. Pulmonary edema. Risk of pneumonia. Can occur: gastrointestinal disturbance. May cause cancer. May cause genetic defects. May damage fertility. Depression of the central nervous system. Death in extreme cases. Environmental hazards.

### 2.2. Label elements

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

Hazard pictograms (CLP) :



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  
 H340 - May cause genetic defects  
 H350 - May cause cancer  
 H361 - Suspected of damaging fertility. Suspected of damaging the unborn child.  
 H373 - May cause damage to organs through prolonged or repeated exposure  
 H411 - Toxic to aquatic life with long lasting effects

Precautionary statements (CLP) :

P201 - Obtain special instructions before use  
 P210 - Keep away from hot surfaces, open flames, sparks, heat. - No smoking.  
 P280 - Wear eye protection, face protection, protective clothing, protective gloves.  
 P301+P310 - If swallowed, immediately call a doctor.  
 P403+P233 - Store in a well-ventilated place. Keep container tightly closed  
 P501 - Dispose of contents/container to hazardous or special waste collection point.

### 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
Distillates (petroleum), C6-rich	(CAS No.) 93165-19-6 (EC no) 296-903-4 (EC index no) 649-388-00-9	100	Carc.Cat.2; R45 Muta.Cat.2; R46 Xn; R65
n-Hexane (Constituent)	(CAS No.) 110-54-3 (EC no) 203-777-6 (EC index no) 601-037-00-0	30 - 40	F; R11 Repr.Cat.3; R62 Xn; R65-48/20 Xi; R38 R67 N; R51-53
Benzene (Constituent)	(CAS No.) 71-43-2 (EC no) 200-753-7 (EC index no) 601-020-00-8	0.2	F; R11 Carc.Cat.1; R45 Muta.Cat.2; R46 T; R48/23/24/25 Xn; R65 Xi; R36/38
Name	Product identifier	%	Classification according to Regulation (EC) No. 1272/2008 [CLP]
Distillates (petroleum), C6-rich	(CAS No.) 93165-19-6 (EC no) 296-903-4 (EC index no) 649-388-00-9	100	Asp. Tox. 1, H304 Carc. 1B, H350 Muta. 1B, H340
n-Hexane (Constituent)	(CAS No.) 110-54-3 (EC no) 203-777-6 (EC index no) 601-037-00-0	30 - 40	Flam. Liq. 2, H225 Skin Irrit. 2, H315 Repr. 2, H361f STOT SE 3, H336 STOT RE 2, H373 Asp. Tox. 1, H304 Aquatic Chronic 2, H411
Benzene (Constituent)	(CAS No.) 71-43-2 (EC no) 200-753-7 (EC index no) 601-020-00-8	0.2	Flam. Liq. 2, H225 Skin Irrit. 2, H315 Eye Irrit. 2, H319 Muta. 1B, H340 Carc. 1A, H350 STOT RE 1, H372 Asp. Tox. 1, H304

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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 general	: Avoid any direct contact with the product. Keep victim warm and rested. Never give anything by mouth to an unconscious person.
First-aid measures after inhalation	: Remove victim to fresh air. In case of breathing difficulties administer oxygen. If breathing stops, give artificial respiration. Seek medical advice (show the label where possible).
First-aid measures after skin contact	: Remove contaminated clothing and shoes. Rinse immediately with plenty of water for 15 minutes. Wash contaminated clothing before reuse. Seek medical advice (show the label where possible).
First-aid measures after eye contact	: Rinse immediately and thoroughly, pulling the eyelids well away from the eye (15 minutes minimum). Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical advice (show the label where possible).
First-aid measures after ingestion	: If swallowed, rinse mouth with water (only if the person is conscious). Do not induce vomiting. Seek medical advice (show the label where possible).

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

Symptoms/injuries after inhalation	: May cause respiratory irritation. Risk of lungs oedema. Coughing, pneumonia, shortage of breath.
Symptoms/injuries after skin contact	: Irritating to skin. Repeated exposure may cause skin dryness or cracking.
Symptoms/injuries after eye contact	: Irritating to eyes. Redness of the eye tissue.
Symptoms/injuries after ingestion	: Depression of the central nervous system, headaches, dizziness, drowsiness, loss of co-ordination. May result in aspiration into the lungs, causing chemical pneumonia.

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

Treat symptomatically. Symptoms may be delayed.

## SECTION 5: Firefighting measures

### 5.1. Extinguishing media

Suitable extinguishing media:	: carbon dioxide (CO <sub>2</sub> ), dry chemical powder, foam. Water spray.
Unsuitable extinguishing media	: Do not use a water jet since it may cause the fire to spread.

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

Fire hazard	: Highly flammable. Hazardous combustion products. Carbon dioxide. Carbon monoxide. Nitrogen oxides (NO <sub>x</sub> ). hydrocarbons. Do not allow run-off from fire fighting to enter drains or water courses.
Explosion hazard	: Vapours can travel considerable distances to a source of ignition where they can ignite, flash back, or explode. In closed containers, pressure build up could result in distortion, blowing and in extreme cases bursting of the container. Prevent the product from entering drains (risk of explosion).
Reactivity	: None known.

### 5.3. Advice for firefighters

Firefighting instructions	: Cool adjacent tanks / containers / drums with water jet.
Protective equipment for firefighters	: In case of fire: Wear self-contained breathing apparatus. Refer to section 8.
Other information	: Do not allow run-off from fire fighting to enter drains or water courses.

## SECTION 6: Accidental release measures

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

#### 6.1.1. For non-emergency personnel

Protective equipment	: Wear suitable protective clothing, gloves and eye/face protection. Refer to section 8.
Emergency procedures	: This product is flammable. Remove all sources of ignition. No smoking. Evacuate unnecessary personnel.

#### 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	: This product is flammable. Remove all sources of ignition. No smoking. Evacuate unnecessary personnel. Avoid release to the environment.

### 6.2. Environmental precautions

Avoid release to the environment. Do not allow to enter into soil/subsoil. Do not empty into drains or the aquatic environment.

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

- For containment : Stop leak if safe to do so. Clean up any spills as soon as possible, using an absorbent material to collect it. Prevent spreading over great surfaces (e.g. by damming or installing oil booms).
- Methods for cleaning up : Wear suitable protective clothing. Collect up the product and place it in a spare container: - suitably labelled. Absorb remaining liquid with sand or inert absorbent and remove to safe place. Do not empty into drains or the aquatic environment. Place spent adsorbent in sealed packages and contact specialist waste disposal contractor.

### 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 : Provide local exhaust or general room ventilation to minimize vapour concentrations. Avoid contact with skin, eye and clothing. Do not eat, drink and do not smoke in areas where product is used. Wash hands thoroughly after handling. Wash contaminated clothing before reuse. Do not breathe the gas, fumes, vapour or spray.

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

- Technical measures: : Provide adequate ventilation. Floors should be impenetrable, resistant to liquids and easy to clean.
- Storage condition(s) : Keep in original containers closed. Keep out of direct sunlight. Keep container tightly closed. store in adequate storage tanks placed in containment basin to retain product in case of leakage.
- Incompatible materials : Strong oxidizing agents. Pure oxygen. Chlorides. dinitrogen tetraoxide.
- Storage area : store in adequate storage tanks placed in containment basin to retain product in case of leakage. The floor of the depot should be impermeable and designed to form a tight basin.

### 7.3. Specific end use(s)

No additional information available

## SECTION 8: Exposure controls/personal protection

### 8.1. Control parameters

n-Hexane (110-54-3)		
EU	IOELV TWA (mg/m <sup>3</sup> )	72 mg/m <sup>3</sup>
EU	IOELV TWA (ppm)	20 ppm
Austria	MAK (mg/m <sup>3</sup> )	180 mg/m <sup>3</sup>
Austria	MAK (ppm)	50 ppm
Austria	MAK Short time value (mg/m <sup>3</sup> )	720 mg/m <sup>3</sup>
Austria	MAK Short time value (ppm)	200 ppm
Belgium	Limit value (mg/m <sup>3</sup> )	72 mg/m <sup>3</sup>
Belgium	Limit value (ppm)	20 ppm
France	VME (mg/m <sup>3</sup> )	170 mg/m <sup>3</sup>
France	VME (ppm)	50 ppm
Germany	TRGS 900 Occupational exposure limit value (mg/m <sup>3</sup> )	180 mg/m <sup>3</sup>
Germany	TRGS 900 Occupational exposure limit value (ppm)	50 ppm
Germany	TRGS 903 (BGW)	5 mg/l
Germany	Remark (TRGS 903)	2,5-Hexandion + 4,5-Dihydroxy-2-hexanon (Urin; Expositionsende bzw. Schichtende)
Spain	VLA-ED (mg/m <sup>3</sup> )	72 mg/m <sup>3</sup>
Spain	VLA-ED (ppm)	20 ppm
The Netherlands	MAC TGG 8H (mg/m <sup>3</sup> )	72 mg/m <sup>3</sup>
The Netherlands	MAC TGG 15MIN (mg/m <sup>3</sup> )	144 mg/m <sup>3</sup>
United Kingdom	WEL TWA (mg/m <sup>3</sup> )	72 mg/m <sup>3</sup>
United Kingdom	WEL TWA (ppm)	20 ppm
Czech Republic	Expoziční limity (PEL) (mg/m <sup>3</sup> )	70 mg/m <sup>3</sup>
Czech Republic	Expoziční limity (PEL) (ppm)	19.88 ppm
Czech Republic	Expoziční limity (NPK-P) (mg/m <sup>3</sup> )	200 mg/m <sup>3</sup>
Czech Republic	Expoziční limity (NPK-P) (ppm)	56.8 ppm
Czech Republic	Remark (CZ)	D, P
Denmark	Grænseværdie (langvarig) (mg/m <sup>3</sup> )	90 mg/m <sup>3</sup>
Denmark	Grænseværdie (langvarig) (ppm)	25 ppm
Denmark	Grænseværdie (kortvarig) (mg/m <sup>3</sup> )	180 mg/m <sup>3</sup>

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<b>n-Hexane (110-54-3)</b>		
Denmark	Grænseværdie (kortvarig) (ppm)	50 ppm
Finland	HTP-arvo (8h) (mg/m <sup>3</sup> )	72 mg/m <sup>3</sup>
Finland	HTP-arvo (8h) (ppm)	20 ppm
Finland	Huomautus (FI)	iho
Hungary	AK-érték	180 mg/m <sup>3</sup>
Hungary	CK-érték	720 mg/m <sup>3</sup>
Ireland	OEL (8 hours ref) (mg/m <sup>3</sup> )	70 mg/m <sup>3</sup>
Ireland	OEL (8 hours ref) (ppm)	20 ppm
Ireland	Notes (IE)	IOELV
Lithuania	IPRV (mg/m <sup>3</sup> )	90 mg/m <sup>3</sup>
Lithuania	IPRV (ppm)	25 ppm
Lithuania	TPRV (mg/m <sup>3</sup> )	180 mg/m <sup>3</sup>
Lithuania	TPRV (ppm)	50 ppm
Norway	Gjennomsnittsverdier (AN) (mg/m <sup>3</sup> )	72 mg/m <sup>3</sup>
Norway	Gjennomsnittsverdier (AN) (ppm)	20 ppm
Norway	Merknader (NO)	R
Canada (Quebec)	VEMP (mg/m <sup>3</sup> )	176 mg/m <sup>3</sup>
Canada (Quebec)	VEMP (ppm)	50 ppm
Australia	TWA (mg/m <sup>3</sup> )	72 mg/m <sup>3</sup>
Australia	TWA (ppm)	20 ppm

<b>Benzene (71-43-2)</b>		
EU	IOELV TWA (mg/m <sup>3</sup> )	3.25 mg/m <sup>3</sup>
EU	IOELV TWA (ppm)	1 ppm
EU	Notation	Skin
Austria	MAK (mg/m <sup>3</sup> )	3.2 mg/m <sup>3</sup>
Austria	MAK (ppm)	1 ppm
Austria	MAK Short time value (mg/m <sup>3</sup> )	12.8 mg/m <sup>3</sup>
Austria	MAK Short time value (ppm)	4 ppm
Belgium	Limit value (mg/m <sup>3</sup> )	3.25 mg/m <sup>3</sup>
Belgium	Limit value (ppm)	1 ppm
Belgium	Remark*	C, D
France	VME (mg/m <sup>3</sup> )	3.25 mg/m <sup>3</sup>
France	VME (ppm)	1 ppm
Italy - Portugal - USA ACGIH	ACGIH TWA (ppm)	0.5 ppm
Italy - Portugal - USA ACGIH	ACGIH STEL (ppm)	2.5 ppm
USA NIOSH	NIOSH REL (TWA) (ppm)	0.1 ppm
USA NIOSH	NIOSH REL (STEL) (ppm)	1 ppm
USA OSHA	OSHA PEL (TWA) (ppm)	1 ppm
USA OSHA	OSHA PEL (STEL) (ppm)	5 ppm
Spain	VLA-ED (mg/m <sup>3</sup> )	3.25 mg/m <sup>3</sup>
Spain	VLA-ED (ppm)	1 ppm
Switzerland	VME (mg/m <sup>3</sup> )	1.6 mg/m <sup>3</sup>
Switzerland	VME (ppm)	0.5 ppm
The Netherlands	MAC TGG 8H (mg/m <sup>3</sup> )	3.25 mg/m <sup>3</sup>
United Kingdom	WEL TWA (ppm)	1 ppm
Czech Republic	Expoziční limity (PEL) (mg/m <sup>3</sup> )	3 mg/m <sup>3</sup>
Czech Republic	Expoziční limity (PEL) (ppm)	0.939 ppm
Czech Republic	Expoziční limity (NPK-P) (mg/m <sup>3</sup> )	10 mg/m <sup>3</sup>
Czech Republic	Expoziční limity (NPK-P) (ppm)	3.13 ppm
Czech Republic	Remark (CZ)	D, P
Denmark	Grænseværdie (langvarig) (mg/m <sup>3</sup> )	1.6 mg/m <sup>3</sup>
Denmark	Grænseværdie (langvarig) (ppm)	0.5 ppm

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<b>Benzene (71-43-2)</b>		
Denmark	Grænseværdie (kortvarig) (mg/m3)	3.2 mg/m <sup>3</sup>
Denmark	Grænseværdie (kortvarig) (ppm)	1.0 ppm
Finland	HTP-arvo (8h) (mg/m3)	3.25 mg/m <sup>3</sup>
Finland	HTP-arvo (8h) (ppm)	1 ppm
Finland	Huomautus (FI)	iho, Kaikki työt
Hungary	CK-érték	3 mg/m <sup>3</sup>
Ireland	OEL (8 hours ref) (mg/m3)	3 mg/m <sup>3</sup>
Ireland	OEL (8 hours ref) (ppm)	1 ppm
Ireland	Notes (IE)	Sk, C1
Lithuania	IPRV (mg/m3)	3.25 mg/m <sup>3</sup>
Lithuania	IPRV (ppm)	1 ppm
Lithuania	TPRV (mg/m3)	19 mg/m <sup>3</sup>
Lithuania	TPRV (ppm)	6 ppm
Lithuania	Remark (LT)	K O; IPRV 3,25mg/m3 (1 ppm) galios nuo 2003 06 27 (pagal direktyvos 97/42 EC 2 str. 1 dalyje nurodytą datą).
Norway	Gjennomsnittsverdier (AN) (mg/m3)	3 mg/m <sup>3</sup>
Norway	Gjennomsnittsverdier (AN) (ppm)	1 ppm
Norway	Merknader (NO)	K
Poland	NDS (mg/m3)	1.6 mg/m <sup>3</sup>
Sweden	nivågränsvärde (NVG) (mg/m3)	1.5 mg/m <sup>3</sup> 0.5 mg/m <sup>3</sup> H, C
Sweden	nivågränsvärde (NVG) (ppm)	0.5 ppm 1.5 ppm H, C
Sweden	kortidsvärde (KTV) (mg/m3)	9 mg/m <sup>3</sup> 3 mg/m <sup>3</sup> H, C
Sweden	kortidsvärde (KTV) (ppm)	3 ppm 9 ppm H, C
Canada (Quebec)	VECD (mg/m <sup>3</sup> )	15.5 mg/m <sup>3</sup>
Canada (Quebec)	VECD (ppm)	5 ppm
Canada (Quebec)	VEMP (mg/m <sup>3</sup> )	3 mg/m <sup>3</sup>
Canada (Quebec)	VEMP (ppm)	1 ppm

<b>Distillates (petroleum), C6-rich (93165-19-6)</b>	
DNEL/DMEL (Workers)	
Acute - systemic effects, inhalation	1300 mg/m <sup>3</sup>
Acute - local effects, dermal	1100 mg/cm <sup>2</sup>
Long-term - local effects, inhalation	840 mg/m <sup>3</sup> /day
DNEL/DMEL (General population)	
Acute - systemic effects, inhalation	1200 mg/m <sup>3</sup>
Acute - local effects, inhalation	640 mg/m <sup>3</sup>
Long-term - local effects, inhalation	180 mg/m <sup>3</sup> /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 local exhaust or general room ventilation to minimize vapour concentrations.
- Personal protective equipment : High gas/vapour concentration: gas mask. Protective goggles. Gloves. Protective clothing.



- Hand protection : Protective gloves made of PVC.
- Eye protection : Protective goggles.
- Skin and body protection : Wear suitable protective clothing.

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Respiratory protection	: An approved organic vapour respirator/supplied air or self-contained breathing apparatus must be used when vapour concentration exceeds applicable exposure limits.
Environmental exposure controls	: Avoid release to the environment. Do not allow into drains or water courses or dispose of where ground or surface waters may be affected. Notify authorities if product enters sewers or public waters.

### SECTION 9: Physical and chemical properties

#### 9.1. Information on basic physical and chemical properties

Physical state	: Liquid
Appearance	: clear.
Colour	: colourless.
Odour	: Mild. Solvent. gasoline-like.
Odour threshold	: No data available
pH	: Not applicable
Melting point	: -96 °C
Solidification point	: No data available
Boiling point	: 64.1-73.2 °C
Flash point	: < 20 °C ASTM D56
Relat. evapor. rate comp. to butylacetate	: 6 (n-butyl acetate = 1)
Flammability (solid, gas)	: No data available
Explosive limits	: 1.2-6.9 vol %
Vapour pressure	: 411.88 mbar at 37.8°C
Relative vapour density at 20 °C	: 2.9
Relative density	: 0.672 g/cm <sup>3</sup>
Solubility	: insoluble in water. Soluble in alcohols. Soluble in chloroform.
Log Pow	: No data available
Self ignition temperature	: 225 °C (ASTM D5372)
Decomposition temperature	: No data available
Viscosity, kinematic	: 0.42 cSt (at 40 °C) ASTM D445
Viscosity, dynamic	: No data available
Explosive properties	: No data available
Oxidising properties	: No data available

#### 9.2. Other information

No additional information available

### SECTION 10: Stability and reactivity

#### 10.1. Reactivity

None known.

#### 10.2. Chemical stability

Stable in use and storage conditions as recommended in item 7.

#### 10.3. Possibility of hazardous reactions

Vapours may form explosive mixtures with air.

#### 10.4. Conditions to avoid

High temperature. ignition sources. Incompatible materials.

#### 10.5. Incompatible materials

Strong oxidizing agents. Pure oxygen. dinitrogen tetraoxide. Chlorides.

#### 10.6. Hazardous decomposition products

Toxic fumes may be released. carbon dioxide (CO<sub>2</sub>). Carbon monoxide. Nitrogen oxides (NO<sub>x</sub>). hydrocarbons. dinitrogen tetraoxide.

### SECTION 11: Toxicological information

#### 11.1. Information on toxicological effects

Acute toxicity : Not classified

<b>Distillates (petroleum), C6-rich (93165-19-6)</b>	
LD50 oral rat	> 5000 mg/kg
LD50 dermal rat	> 2000 mg/kg
LC50 inhalation rat (mg/l)	> 4.96 mg/l/4h

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Skin corrosion/irritation	: Causes skin irritation. pH: Not applicable
Serious eye damage/irritation	: Not classified pH: Not applicable
Respiratory or skin sensitisation	: Not classified
Germ cell mutagenicity	: May cause genetic defects.
Carcinogenicity	: May cause cancer.
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.

<b>Distillates (petroleum), C6-rich (93165-19-6)</b>	
NOAEL (oral,rat,28 days)	< 500 mg/kg bodyweight
NOAEL (dermal,rat/rabbit,90 days)	> 5 mg/kg bodyweight/day
NOAEL (inhalation,rat,gas,90 days)	292 ppmV/6h/day
NOAEL (inhalation,rat,vapour,90 days)	> 10 mg/l/6h/day

Aspiration hazard	: May be fatal if swallowed and enters airways.
Potential Adverse human health effects and symptoms	: Depression of the central nervous system. Repeated exposure may cause skin dryness or cracking. May result in aspiration into the lungs, causing chemical pneumonia.

## SECTION 12: Ecological information

### 12.1. Toxicity

<b>Distillates (petroleum), C6-rich (93165-19-6)</b>	
LC50 fishes	> 4.2 mg/l 96 hours
EC50 Daphnia	> 4.5 mg/l 48 hours
NOEC (acute)	0.5 mg/l 48 hours- daphnia
NOEC (chronic)	2.6 mg/l 21 days- daphnia
ErC50 (algae)	> 3.1 mg/l 72 hours

### 12.2. Persistence and degradability

<b>Distillates (petroleum), C6-rich (93165-19-6)</b>	
Persistence and degradability	Rapidly degradable. low persistence.

### 12.3. Bioaccumulative potential

<b>Distillates (petroleum), C6-rich (93165-19-6)</b>	
BCF other aquatic organisms	200
Log Kow	3.9
Bioaccumulative potential	Bioaccumulative potential.

### 12.4. Mobility in soil

<b>Distillates (petroleum), C6-rich (93165-19-6)</b>	
Mobility in soil	High

### 12.5. Results of PBT and vPvB assessment

<b>Distillates (petroleum), C6-rich (93165-19-6)</b>	
This substance/mixture does not meet the PBT/vPvB criteria of REACH, annex XIII.	

### 12.6. Other adverse effects

No additional information available

## SECTION 13: Disposal considerations

### 13.1. Waste treatment methods

Regional legislation (waste)	: Disposal must be done according to official regulations.
Waste treatment methods	: Keep the product residues in their original containers and properly sealed inside metallic drums according to legislation. Disposal should be carried out as established for the product, recommending routes of co-processing in cement kilns and incineration.
Waste disposal recommendations	: Can be deposited in landfills, sent to an incineration or other appropriate means of disposal provided they meet the requirements of local laws. Do not re-use empty containers. These may contain residues of the product and must be kept closed and sent for proper disposal. In this case, it is recommended shipping routes for recovery or incineration of drums.

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according to Regulation (EC) No. 453/2010

### SECTION 14: Transport information

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

#### 14.1. UN number

UN-No. : 1268

#### 14.2. UN proper shipping name

Proper shipping name : PETROLEUM DISTILLATES, N.O.S. / PETROLEUM PRODUCTS, N.O.S.  
Transport document description : UN 1268 PETROLEUM DISTILLATES, N.O.S. / PETROLEUM PRODUCTS, N.O.S., 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

Marine pollutant :



Other information : No supplementary information available.

#### 14.6. Special precautions for user

##### 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  
EAC code : 3YE

##### 14.6.2. Transport by sea

No additional information available

##### 14.6.3. Air transport

No additional information available

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

Not applicable

### SECTION 15: Regulatory information

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

##### 15.1.1. EU-Regulations

No ingredients included in the REACH Candidate list

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

##### 15.1.2. National regulations

No additional information available

#### 15.2. Chemical safety assessment

CSA has been carried out

### SECTION 16: Other information

Sources of Key data : PETROBRAS. MSDS.

# Hexane

## Safety Data Sheet

according to Regulation (EC) No. 453/2010

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. REACH - Registration, Evaluation, Authorisation and Restriction of Chemicals. SDS - Safety Data Sheet.

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

Aquatic Chronic 2	Hazardous to the aquatic environment - chronic hazard Category 2
Asp. Tox. 1	Aspiration hazard Category 1
Carc. 1A	Carcinogenicity Category 1A
Carc. 1B	Carcinogenicity Category 1B
Eye Irrit. 2	Serious Eye Damage/Irritation Category 2
Flam. Liq. 2	flammable liquids Category 2
Muta. 1B	flammable liquids Category 1 flammable liquids Category 3
Repr. 2	Reproductive toxicity Category 2
Repr. 2	Reproductive toxicity Category 2
Skin Irrit. 2	skin corrosion/irritation Category 2
STOT RE 1	Specific target organ toxicity (repeated exposure) Category 1
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
H319	Causes serious eye irritation
H336	May cause drowsiness or dizziness
H340	May cause genetic defects
H350	May cause cancer
H361	Suspected of damaging fertility or the unborn child
H361f	Suspected of damaging fertility.
H372	Causes damage to organs through prolonged or repeated exposure
H373	May cause damage to organs through prolonged or repeated exposure
H411	Toxic to aquatic life with long lasting effects
R11	Highly flammable.
R36/38	Irritating to eyes and skin.
R38	Irritating to skin.
R45	May cause cancer.
R46	May cause heritable genetic damage.
R48/20	Harmful: danger of serious damage to health by prolonged exposure through inhalation.
R48/23/24/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.
R51	Toxic to aquatic organisms.

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R51/53	Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R53	May cause long-term adverse effects in the aquatic environment.
R62	Possible risk of impaired fertility.
R65	Harmful: may cause lung damage if swallowed.
R67	Vapours may cause drowsiness and dizziness.

### SDS PETROBRAS USES

*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: Hexane

Trade Name : Hexane  
 CAS Number : 93165-19-6  
 EC Number : 296-903-4  
 SDS Reference : PbR0036

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### Summary of parameters used for assessing safe use:

DNEL: Worker - inhalation (acute): 1100-1300 ppm/15 min  
 Worker - inhalation (long term): 840 ppm/8 h  
 Consumer - inhalation (acute): 640-1200 ppm/15 min  
 Consumer - inhalation (long term): 180 ppm/24 h

### Acronyms:

CSA : Chemical safety assessment  
 DNEL : Derived no effect level  
 DU : Downstream user  
 ERC : Environmental release category  
 ES : Exposure scenario  
 PC : Product category

# Hexane

## Annex to the Safety Data Sheet

according to Regulation (EC) No. 453/2010  
Revision date: September 8, 2011

Supersedes:

Version: 1.0

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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 (ES1b):

Manufacture of Substances (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))

<b>9.1.1. Exposure scenario addressing uses carried out by workers</b>	
<b>Manufacture of Substances (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))</b>	
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) 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 ERC4 : Industrial use of processing aids in processes and products, not becoming part of articles
Specific environmental release category	ESVOC SpERC 1.1.v1
<b>9.1.2. Operational conditions and risk management measures</b>	
<b>9.1.2.1. Control of environmental exposure</b>	
<b>Product characteristic</b>	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	>10 kPa at STP
<b>Amounts used</b>	
Daily at point sources	2,000,000 kg/day (maximum in worst case)
Annually at point sources	600,000 t/year (maximum in worst case)
Annually total	18,700,000 t/year total market
<b>Frequency and duration of use/exposure</b>	
Emission days per year	300
<b>Environment factors not influenced by risk management</b>	
Flow rate of receiving surface water	18,000 m <sup>3</sup> /day (default)
<b>Other given operational conditions affecting environmental exposure</b>	
Release fraction to air from process before RMMs	0.05

Release fraction to waste water from process before RMMs	0.003
Release fraction to soil from process before RMMs	0.0001
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Prevent discharge of undissolved substance to or recover from wastewater. Risk from environmental exposure is driven by humans via indirect exposure (primarily inhalation). Onsite wastewater treatment required.	
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>	
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 $\geq 99\%$
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency $\geq 95.2\%$  If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of $\geq 80.4\%$
<b>Organizational measures to prevent/limit release from site</b>	
Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.	
<b>Conditions and measures related to municipal sewage treatment plant</b>	
Estimated substance removal from wastewater via domestic sewage treatment	95.5%
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs	99.1%
Maximum allowable site tonnage ( $M_{safe}$ ) (kg/d)	2,000,000
Assumed domestic sewage treatment plant flow ( $m^3/d$ )	10,000
<b>Conditions and measures related to treatment of waste</b>	
During manufacturing no waste of the substance is generated.	
<b>9.1.2.2. Control of worker exposure</b>	
<b>Frequency and duration of use/exposure</b>	
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)
<b>Human factors not influenced by risk management</b>	
Not applicable	
<b>Other given operational conditions affecting workers exposure</b>	
Operation is carried out at elevated temperature ( $>20^\circ C$ above ambient temperature).	
Assumes a good basic standard of occupational hygiene is implemented.	
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Consider technical advances and process upgrades (including automation) for the elimination of releases (all PROCs) Regularly inspect, test and maintain all control measures (all PROCs) Handle substance within closed systems (PROC 1, 2 & 3) Store substance within a closed system (PROC 2)	

Ensure material transfers are under containment or extract ventilation (PROC 8b)														
<b>Technical conditions and measures to control dispersion from source towards the worker</b>														
<p>Minimise exposure using measures such as closed systems, dedicated facilities and suitable genera/ local exhaust ventilation (all PROCs)</p> <p>Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure (PROC 15)</p> <p>Drain down systems and clear transfer lines prior to breaking containment. Clean/ flush equipment, where possible, prior to maintenance (PROC 8a)</p> <p>Retain drain downs in sealed storage pending disposal or for subsequent recycle (PROC 8a)</p>														
<b>Organisational measures to prevent /limit releases, dispersion and exposure</b>														
<p>Avoid direct skin contact with product (all PROCs)</p> <p>Identify potential areas for indirect skin contact (all PROCs)</p> <p>Wash off skin contamination immediately (all PROCs)</p> <p>Clean up contamination/spills as soon as they occur (PROC 8a)</p> <p>Sample via a closed loop or other system intended to avoid exposure (PROC 2)</p> <p>Ensure operation is undertaken outdoors (PROC 2 &amp; 3)</p> <p>Provide basic employee training to prevent/minimise exposures and to report and skin effects that may develop (all PROCs)</p>														
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>														
<p>Restrict access to authorized staff; provide specific activity training to operators to minimise exposures; clean up spills immediately and dispose of wastes safely (all PROCs)</p> <p>Consider the need for risk based health surveillance (all PROCs)</p> <ol style="list-style-type: none"> <li>1. PPE: Wear gloves (Type EN374) if regular skin contact likely (PROC 2, 8a, 8b &amp; 15)</li> <li>2. PPE: Wear suitable coveralls to prevent exposure to the skin (PROC 8a &amp; 15)</li> </ol>														
<b>9.1.3. Exposure information and reference to its source</b>														
<b>9.1.3.1. Prediction of environmental exposure resulting from the conditions described above</b>														
<p>Substance is a complex hydrocarbon UVCB. Predominantly hydrophobic.</p> <p>The Hydrocarbon Block Method with the Petrorisk model is used for environmental risk assessment.</p> <p>When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed the resulting risk characterisation ratios are expected to be less than 1.</p> <p>PNECs have been derived using HC5 statistical extrapolation method and the target lipid model using representative structures. For more detailed information contact supplier - see Product Library tab in Petrorisk spreadsheet.</p>														
<table border="1"> <thead> <tr> <th>Environmental exposure</th> <th>In STP/ untreated wastewater (mg/l)</th> <th>In local freshwater (mg/l)</th> <th>In local soil (mg/kg dw)</th> <th>In local marine water (mg/l)</th> <th>In sediment freshwater (mg/kg dw)</th> <th>In sediment marine water (mg/kg dw)</th> </tr> </thead> <tbody> <tr> <td>PEC</td> <td>0.066</td> <td>0.0066</td> <td>0.00143</td> <td>0.00066</td> <td>0.034</td> <td>0.000066</td> </tr> </tbody> </table>	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	0.066	0.0066	0.00143	0.00066	0.034	0.000066
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	0.066	0.0066	0.00143	0.00066	0.034	0.000066								
<b>9.1.3.2. Prediction of workers exposure resulting from the conditions described above</b>														
<p>Workers exposure estimation is calculated with Ecetoc TRA model. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 2.</p>														

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0	0.03
PROC 2	0.35 - 0.50	0.03 – 0.14
PROC 3	0.70	0.03
PROC 8a	0.25	0.14
PROC 8b	0.15	0.07
PROC 15	0.05	0

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	0.145	0.145
PROC 2	0.350 - 0.500	0.117 – 0.585	0.617 – 0.935
PROC 3	0.700	0.145	0.845
PROC 8a	0.250	0.586	0.836
PROC 8b	0.150	0.295	0.445
PROC 15	0.050	0.013	0.063

**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 Ecectoc TRA integrated tool and Hydrocarbon Block Method with the Petrorisk model 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 (ES2b):**

Use of substance as intermediate (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))

<b>9.2.1. Exposure scenario addressing uses carried out by workers</b>	
<b>Use of substance as intermediate (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))</b>	
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) 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 ERC6a : Industrial use resulting in manufacture of another substance (use of intermediates)
Specific environmental release category	ESVOC SpERC 6.1a.v1
<b>9.2.2. Operational conditions and risk management measures</b>	
<b>9.2.2.1. Control of environmental exposure</b>	
<b>Product characteristic</b>	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	>10 kPa at STP
<b>Amounts used</b>	
Daily at point sources	50,000 kg/day (maximum in worst case)
Annually at point sources	15,000 t/year (maximum in worst case)
Annually total	2,210,000 t/year total market
<b>Frequency and duration of use/exposure</b>	
Emission days per year	300
<b>Environment factors not influenced by risk management</b>	
Flow rate of receiving surface water	18,000 m <sup>3</sup> /day (default)
<b>Other given operational conditions affecting environmental exposure</b>	
Release fraction to air from process before RMMs	0.025
Release fraction to waste water from	0.003

process before RMMs	
Release fraction to soil from process before RMMs	0.001
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Prevent discharge of undissolved substance to or recover from wastewater. Risk from environmental exposure is driven by freshwater sediment. If discharging to domestic sewage treatment plant, no onsite wastewater treatment required.	
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>	
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))	Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency $\geq 92.9\%$  If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of $\geq 0\%$
<b>Organizational measures to prevent/limit release from site</b>	
Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.	
<b>Conditions and measures related to municipal sewage treatment plant</b>	
Estimated substance removal from wastewater via domestic sewage treatment	95.5%
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs	95.5%
Maximum allowable site tonnage ( $M_{safe}$ ) (kg/d)	78,000
Assumed domestic sewage treatment plant flow ( $m^3/d$ )	2,000
<b>Conditions and measures related to treatment of waste</b>	
This substance is consumed during use and no waste of the substance is generated.	
<b>9.2.2.2. Control of worker exposure</b>	
<b>Frequency and duration of use/exposure</b>	
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)
<b>Human factors not influenced by risk management</b>	
Not applicable	
<b>Other given operational conditions affecting workers exposure</b>	
Operation is carried out at elevated temperature ( $>20^\circ C$ above ambient temperature).	
Assumes a good basic standard of occupational hygiene is implemented.	
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Consider technical advances and process upgrades (including automation) for the elimination of releases (all PROCs) Regularly inspect, test and maintain all control measures (all PROCs) Handle substance within closed systems (PROC 1, 2 & 3) Store substance within a closed system (PROC 2)	

Ensure material transfers are under containment or extract ventilation (PROC 8b)														
<b>Technical conditions and measures to control dispersion from source towards the worker</b>														
<p>Minimise exposure using measures such as closed systems, dedicated facilities and suitable genera/ local exhaust ventilation (all PROCs)</p> <p>Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure (PROC 15)</p> <p>Drain down systems and clear transfer lines prior to breaking containment. Clean/ flush equipment, where possible, prior to maintenance (PROC 8a)</p> <p>Retain drain downs in sealed storage pending disposal or for subsequent recycle (PROC 8a)</p>														
<b>Organisational measures to prevent /limit releases, dispersion and exposure</b>														
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<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>														
<p>Restrict access to authorized staff; provide specific activity training to operators to minimise exposures; clean up spills immediately and dispose of wastes safely (all PROCs)</p> <p>Consider the need for risk based health surveillance (all PROCs)</p> <ol style="list-style-type: none"> <li>1. PPE: Wear gloves (Type EN374) if regular skin contact likely (PROC 2, 3, 8a, 8b &amp; 15)</li> <li>2. PPE: Wear coveralls to prevent exposure to the skin (PROC 8a &amp; 15)</li> </ol>														
<b>9.2.3. Exposure information and reference to its source</b>														
<b>9.2.3.1. Prediction of environmental exposure resulting from the conditions described above</b>														
<p>Substance is a complex hydrocarbon UVCB. Predominantly hydrophobic.</p> <p>The Hydrocarbon Block Method with the Petrorisk model is used for environmental risk assessment.</p> <p>When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed the resulting risk characterisation ratios are expected to be less than 1.</p> <p>PNECs have been derived using HC5 statistical extrapolation method and the target lipid model using representative structures. For more detailed information contact supplier - see Product Library tab in Petrorisk spreadsheet.</p>														
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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	0.066	0.0066	0.00143	0.00066	0.034	0.000066								
<b>9.2.3.2. Prediction of workers exposure resulting from the conditions described above</b>														
<p>Workers exposure estimation is calculated with Ecetoc TRA model. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 2.</p>														

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0	0.03
PROC 2	0.35 – 0.50	0.03 – 0.14
PROC 3	0.70	0.03
PROC 8a	0.25	0.14
PROC 8b	0.15	0.07
PROC 15	0.05	0

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	0.145	0.145
PROC 2	0.350 - 0.500	0.117 – 0.585	0.617 – 0.935
PROC 3	0.700	0.145	0.845
PROC 8a	0.250	0.586	0.836
PROC 8b	0.150	0.295	0.445
PROC 15	0.050	0.013	0.063

### **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 Ecectoc TRA integrated tool and Hydrocarbon Block Method with the Petrorisk model 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 (ES3b):**

Distribution of substance (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))

<b>9.3.1. Exposure scenario addressing uses carried out by workers</b>	
<b>Distribution of substance (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))</b>	
Use descriptors related to the life cycle stage	<p>SU3 : Industrial uses: Uses of substances as such or in preparations at industrial sites</p> <p>PROC1 : Use in closed process, no likelihood of exposure</p> <p>PROC2 : Use in closed, continuous process with occasional controlled exposure</p> <p>PROC3 : Use in closed batch process (synthesis or formulation)</p> <p>PROC8a : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities</p> <p>PROC8b : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities</p> <p>PROC15 : Use as laboratory reagent</p> <p>ERC1 : Manufacture of substances</p> <p>ERC2 : Formulation of preparations</p> <p>ERC3 : Formulation in materials</p> <p>ERC4 : Industrial use of processing aids in processes and products, not becoming part of articles</p> <p>ERC5 : Industrial use resulting in inclusion into or onto a matrix</p> <p>ERC6a : Industrial use resulting in manufacture of another substance (use of intermediates)</p> <p>ERC6b : Industrial use of reactive processing aids</p> <p>ERC6c : Industrial use of monomers for manufacture of thermo-plastics</p> <p>ERC6d : Industrial use of process regulators for polymerisation processes in production of resins, rubbers, polymers</p> <p>ERC7 : Industrial use of substances in closed systems</p>
Specific environmental release category	ESVOC SpERC 1.1b.v1
<b>9.3.2. Operational conditions and risk management measures</b>	
<b>9.3.2.1. Control of environmental exposure</b>	
<b>Product characteristic</b>	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	>10 kPa at STP
<b>Amounts used</b>	
Daily at point sources	120,000 kg/day (maximum in worst case)
Annually at point sources	37,500 t/year (maximum in worst case)
Annually total	18,700,000 t/year total market

<b>Frequency and duration of use/exposure</b>	
Emission days per year	300
<b>Environment factors not influenced by risk management</b>	
Flow rate of receiving surface water	18,000 m <sup>3</sup> /day (default)
<b>Other given operational conditions affecting environmental exposure</b>	
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 RMMs	0.00001
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Risk from environmental exposure is driven by humans via indirect exposure (primarily inhalation). If discharging to domestic sewage treatment plant, no onsite wastewater treatment required.	
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>	
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))	Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency ≥12%  If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of ≥ 0%
<b>Organizational measures to prevent/limit release from site</b>	
Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.	
<b>Conditions and measures related to municipal sewage treatment plant</b>	
Estimated substance removal from wastewater via domestic sewage treatment	95.5%
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs	95.5%
Maximum allowable site tonnage (M <sub>safe</sub> ) (kg/d)	1,100,000
Assumed domestic sewage treatment plant flow (m <sup>3</sup> /d)	2,000
<b>Conditions and measures related to treatment of waste</b>	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and/or national regulations.	
<b>9.3.2.2. Control of worker exposure</b>	
<b>Frequency and duration of use/exposure</b>	
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)
<b>Human factors not influenced by risk management</b>	

Not applicable
<b>Other given operational conditions affecting workers exposure</b>
Assumes use not > 20°C above ambient temperature, unless stated differently.
Assumes a good basic standard of occupational hygiene is implemented.
<b>Technical conditions and measures at process level (source) to prevent release</b>
Consider technical advances and process upgrades (including automation) for the elimination of releases (all PROCs) Regularly inspect, test and maintain all control measures (all PROCs) Handle substance within closed systems (PROC 1, 2 & 3) Store substance within a closed system (PROC 2) Ensure material transfers are under containment or extract ventilation (PROC 8b)
<b>Technical conditions and measures to control dispersion from source towards the worker</b>
Minimise exposure using measures such as closed systems, dedicated facilities and suitable genera/ local exhaust ventilation (all PROCs) Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure (PROC 15) Drain down systems and clear transfer lines prior to breaking containment. Clean/ flush equipment, where possible, prior to maintenance (PROC 8a) Retain drain downs in sealed storage pending disposal or for subsequent recycle (PROC 8a)
<b>Organisational measures to prevent /limit releases, dispersion and exposure</b>
Avoid direct skin contact with product (all PROCs) Identify potential areas for indirect skin contact (all PROCs) Wash off skin contamination immediately (all PROCs) Clean up contamination/spills as soon as they occur (PROC 8a) Sample via a closed loop or other system intended to avoid exposure (PROC 2 & 3) Ensure operation is undertaken outdoors (PROC 2) Provide basic employee training to prevent/minimise exposures and to report and skin effects that may develop (all PROCs)
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>
Restrict access to authorized staff; provide specific activity training to operators to minimise exposures; clean up spills immediately and dispose of wastes safely (all PROCs) Consider the need for risk based health surveillance (all PROCs) 1. PPE: Wear gloves (Type EN374) if regular skin contact likely (PROC 2, 3, 8a, 8b & 15) 2. PPE: Wear suitable coveralls to prevent exposure to the skin (PROC 8a & 15)
<b>9.3.3. Exposure information and reference to its source</b>
<b>9.3.3.1. Prediction of environmental exposure resulting from the conditions described above</b>
Substance is a complex hydrocarbon UVCB. Predominantly hydrophobic. The Hydrocarbon Block Method with the Petrorisk model is used for environmental risk assessment.
When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed the resulting risk characterisation ratios are expected to be less than 1. PNECs have been derived using HC5statistical extrapolation method and the target lipid model using representative structures. For more detailed information contact supplier - see Product Library tab in Petrorisk spreadsheet.

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	0.066	0.0066	0.00143	0.00066	0.034	0.000066

### 9.3.3.2. Prediction of workers exposure resulting from the conditions described above

Workers exposure estimation is calculated with Ecetoc TRA model. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 2.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0	0.03
PROC 2	0.35 - 0.50	0.03 – 0.14
PROC 3	0.05 - 0.70	0.03
PROC 4	10	0.69
PROC 8a	0.25	0.14
PROC 8b	0.15	0.07
PROC 9	20	0.69
PROC 15	0.05	0

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	0.145	0.145
PROC 2	0.350 - 0.500	0.117 – 0.585	0.617 – 0.935
PROC 3	0.050 - 0.700	0.145	0.195 - 0.845
PROC 4	0.038	0	0.038
PROC 8a	0.250	0.586	0.836
PROC 8b	0.150	0.295	0.445
PROC 9	0.076	0	0.076
PROC 15	0.050	0.013	0.063

### 9.3.4. 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 and Hydrocarbon Block Method with the Petrorisk model respectively.

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

### 9.3.5. 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 (ES4b):

Formulation & (re)packing of substances and mixtures (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))

<b>9.4.1. Exposure scenario addressing uses carried out by workers</b>	
<b>Formulation &amp; (re)packing of substances and mixtures (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))</b>	
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 batch process (synthesis or formulation) 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 ERC2 : Formulation of preparations
Specific environmental release category	ESVOC SpERC 2.2.v1
<b>9.4.2. Operational conditions and risk management measures</b>	
<b>9.4.2.1. Control of environmental exposure</b>	
<b>Product characteristic</b>	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	>10 kPa at STP
<b>Amounts used</b>	
Daily at point sources	100,000 kg/day (maximum in worst case)
Annually at point sources	30,000 t/year (maximum in worst case)
Annually total	16,500,000 t/year total market
<b>Frequency and duration of use/exposure</b>	
Emission days per year	300
<b>Environment factors not influenced by risk management</b>	
Flow rate of receiving surface water	18,000 m <sup>3</sup> /day (default)
<b>Other given operational conditions affecting environmental exposure</b>	
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	0.0001

RMMs	
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Prevent discharge of undissolved substance to or recover from wastewater. Risk from environmental exposure is driven by humans via indirect exposure (primarily inhalation). If discharging to domestic sewage treatment plant, no onsite wastewater treatment required.	
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>	
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 56.5%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency $\geq 94.7\%$  If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of $\geq 0\%$
<b>Organizational measures to prevent/limit release from site</b>	
Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.	
<b>Conditions and measures related to municipal sewage treatment plant</b>	
Estimated substance removal from wastewater via domestic sewage treatment	95.5%
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs	95.5%
Maximum allowable site tonnage ( $M_{safe}$ ) (kg/d)	100,000
Assumed domestic sewage treatment plant flow ( $m^3/d$ )	2,000
<b>Conditions and measures related to treatment of waste</b>	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and/or national regulations.	
<b>9.4.2.2. Control of worker exposure</b>	
<b>Frequency and duration of use/exposure</b>	
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)
<b>Human factors not influenced by risk management</b>	
Not applicable	
<b>Other given operational conditions affecting workers exposure</b>	
Assumes use not $> 20^\circ C$ above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Consider technical advances and process upgrades (including automation) for the elimination of releases (all PROCs) Regularly inspect, test and maintain all control measures (all PROCs) Handle substance within closed systems (PROC 1, 2 & 3) Store substance within a closed system (PROC 2) Ensure material transfers are under containment or extract ventilation (PROC 8b)	

<b>Technical conditions and measures to control dispersion from source towards the worker</b>						
<p>Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/ local exhaust ventilation (all PROCs)</p> <p>Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure (PROC 15)</p> <p>Drain down systems and clear transfer lines prior to breaking containment. Clean/ flush equipment, where possible, prior to maintenance (PROC 8a)</p> <p>Retain drain downs in sealed storage pending disposal or for subsequent recycle (PROC 8a)</p>						
<b>Organisational measures to prevent /limit releases, dispersion and exposure</b>						
<p>Avoid direct skin contact with product (all PROCs)</p> <p>Identify potential areas for indirect skin contact (all PROCs)</p> <p>Wash off skin contamination immediately (all PROCs)</p> <p>Clean up contamination/spills as soon as they occur (PROC 8a)</p> <p>Sample via a closed loop or other system intended to avoid exposure (PROC 2 &amp; 3)</p> <p>Provide basic employee training to prevent/minimise exposures and to report and skin effects that may develop (all PROCs)</p>						
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>						
<p>Restrict access to authorized staff; provide specific activity training to operators to minimise exposures; clean up spills immediately and dispose of wastes safely (all PROCs)</p> <p>Consider the need for risk based health surveillance (all PROCs)</p> <ol style="list-style-type: none"> <li>1. PPE: Wear gloves (Type EN374) if regular skin contact likely (PROC 2, 3, 8a, 8b &amp; 15)</li> <li>2. PPE: Wear suitable coveralls to prevent exposure to the skin (PROC 8a &amp; 15)</li> </ol>						
<b>9.4.3. Exposure information and reference to its source</b>						
<b>9.4.3.1. Prediction of environmental exposure resulting from the conditions described above</b>						
<p>Substance is a complex hydrocarbon UVCB. Predominantly hydrophobic</p> <p>The Hydrocarbon Block Method with the Petrorisk model is used for environmental risk assessment.</p> <p>When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed the resulting risk characterisation ratios are expected to be less than 1.</p> <p>PNECs have been derived using HC5 statistical extrapolation method and the target lipid model using representative structures. For more detailed information contact supplier - see Product Library tab in Petrorisk spreadsheet.</p>						
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)
<b>PEC</b>	0.066	0.0066	0.00143	0.00066	0.034	0.000066
<b>9.4.3.2. Prediction of workers exposure resulting from the conditions described above</b>						
<p>Workers exposure estimation is calculated with Ecetoc TRA model. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 2.</p>						

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0	0.03
PROC 2	0.50	0.03
PROC 3	0.05 - 0.70	0.03
PROC 8a	0.25	0.14
PROC 8b	0.05	0.07
PROC 15	0.05	0

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	0.145	0.145
PROC 2	0.500	0.117	0.617
PROC 3	0.050 – 0.700	0.145	0.195 – 0.845
PROC 8a	0.250	0.586	0.836
PROC 8b	0.045	0.295	0.340
PROC 15	0.050	0.013	0.063

**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 Ecectoc TRA integrated tool and Hydrocarbon Block Method with the Petrorisk model 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 (ES5b):**

Uses in Coatings: Industrial (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))

<b>9.5.1. Exposure scenario addressing uses carried out by workers</b>	
<b>Uses in Coatings: Industrial (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))</b>	
Use descriptors related to the life cycle stage	SU3 : Industrial uses: Uses of substances as such or in preparations at industrial sites 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) 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 ERC4 : Industrial use of processing aids in processes and products, not becoming part of articles
Specific environmental release category	ESVOC SpERC 4.3a.v1
<b>9.5.2. Operational conditions and risk management measures</b>	
<b>9.5.2.1. Control of environmental exposure</b>	
<b>Product characteristic</b>	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	>10 kPa at STP
<b>Amounts used</b>	
Daily at point sources	21,000 kg/day (maximum in worst case)
Annually at point sources	6,200 t/year (maximum in worst case)
Annually total	6,200 t/year total market
<b>Frequency and duration of use/exposure</b>	
Emission days per year	300
<b>Environment factors not influenced by risk management</b>	
Flow rate of receiving surface water	18,000 m <sup>3</sup> /day (default)
<b>Other given operational conditions affecting environmental exposure</b>	
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
<b>Technical conditions and measures at process level (source) to prevent release</b>	

Prevent discharge of undissolved substance to or recover from wastewater. Risk from environmental exposure is driven by humans via indirect exposure (primarily inhalation). If discharging to domestic sewage treatment plant, no onsite wastewater treatment required.	
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>	
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 94.1%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency $\geq 92.6\%$  If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of $\geq 0\%$
<b>Organizational measures to prevent/limit release from site</b>	
Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.	
<b>Conditions and measures related to municipal sewage treatment plant</b>	
Estimated substance removal from wastewater via domestic sewage treatment	95.5%
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs	95.5%
Maximum allowable site tonnage ( $M_{safe}$ ) (kg/d)	21,000
Assumed domestic sewage treatment plant flow ( $m^3/d$ )	2,000
<b>Conditions and measures related to treatment of waste</b>	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and/or national regulations.	
<b>9.5.2.2. Control of worker exposure</b>	
<b>Frequency and duration of use/exposure</b>	
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)
<b>Human factors not influenced by risk management</b>	
Not applicable	
<b>Other given operational conditions affecting workers exposure</b>	
Assumes use not $> 20^\circ C$ above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Consider technical advances and process upgrades (including automation) for the elimination of releases (all PROCs) Regularly inspect, test and maintain all control measures (all PROCs) Handle substance within closed systems (PROC 3) Store substance within a closed system (PROC 1) Ensure material transfers are under containment or extract ventilation (PROC 8b)	
<b>Technical conditions and measures to control dispersion from source towards the worker</b>	
Minimise exposure using measures such as closed systems, dedicated facilities and suitable genera/ local exhaust	

ventilation (all PROCs)

Provide a good standard of ventilation. Natural ventilation is from doors, window, etc. Controlled ventilation means air is supplied or removed by a powered fan.

Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure (PROC 15)

Drain down systems and clear transfer lines prior to breaking containment. Clean/ flush equipment, where possible, prior to maintenance (PROC 8a)

Retain drain downs in sealed storage pending disposal or for subsequent recycle (PROC 8a)

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid direct skin contact with product (all PROCs)

Identify potential areas for indirect skin contact (all PROCs)

Wash off skin contamination immediately (all PROCs)

Clean up contamination/spills as soon as they occur (PROC 8a)

Provide basic employee training to prevent/minimise exposures and to report and skin effects that may develop (all PROCs)

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

Restrict access to authorized staff; provide specific activity training to operators to minimise exposures; clean up spills immediately and dispose of wastes safely (all PROCs)

Consider the need for risk based health surveillance (all PROCs)

1. PPE: Wear gloves (Type EN374) if regular skin contact likely (PROC 3, 8a, 8b & 15)

2. PPE: Wear suitable coveralls to prevent exposure to the skin (PROC 8a & 15)

### 9.5.3. Exposure information and reference to its source

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

Substance is a complex hydrocarbon UVCB. Predominantly hydrophobic

The Hydrocarbon Block Method with the Petrorisk model is used for environmental risk assessment.

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed the resulting risk characterisation ratios are expected to be less than 1.

PNECs have been derived using HC5 statistical extrapolation method and the target lipid model using representative structures. For more detailed information contact supplier - see Product Library tab in Petrorisk spreadsheet.

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	0.066	0.0066	0.00143	0.00066	0.034	0.000066

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

Workers exposure estimation is calculated with Ecetoc TRA model. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 2.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0	0.03
PROC 2	0.05	0.01
PROC 3	0.70	0.03
PROC 8a	0.25	0.14
PROC 8b	0.05	0.07
PROC 15	0.05	0

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	0.145	0.145
PROC 2	0.050	0.060	0.110
PROC 3	0.700	0.145	0.845
PROC 8a	0.250	0.586	0.836
PROC 8b	0.045	0.295	0.340
PROC 15	0.050	0.013	0.063

**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 Ecectoc TRA integrated tool and Hydrocarbon Block Method with the Petrorisk model 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 (ES7b):**

Use in Cleaning Agents: Industrial (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))

<b>9.6.1. Exposure scenario addressing uses carried out by workers</b>	
<b>Use in Cleaning Agents: Industrial (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))</b>	
Use descriptors related to the life cycle stage	SU3 : Industrial uses: Uses of substances as such or in preparations at industrial sites 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) 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	ESVOC SpERC 4.4a.v1
<b>9.6.2. Operational conditions and risk management measures</b>	
<b>9.6.2.1. Control of environmental exposure</b>	
<b>Product characteristic</b>	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	>10 kPa at STP
<b>Amounts used</b>	
Daily at point sources	5,000 kg/day (maximum in worst case)
Annually at point sources	100 t/year (maximum in worst case)
Annually total	512 t/year total market
<b>Frequency and duration of use/exposure</b>	
Emission days per year	300
<b>Environment factors not influenced by risk management</b>	
Flow rate of receiving surface water	18,000 m <sup>3</sup> /day (default)
<b>Other given operational conditions affecting environmental exposure</b>	
Release fraction to air from process before RMMs	1.0
Release fraction to waste water from process before RMMs	0.00003
Release fraction to soil from process before RMMs	0
<b>Technical conditions and measures at process level (source) to prevent release</b>	

Prevent discharge of undissolved substance to or recover from wastewater. Risk from environmental exposure is driven by humans via indirect exposure (primarily inhalation). If discharging to domestic sewage treatment plant, no onsite wastewater treatment required.	
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>	
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))	Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency $\geq 4.4\%$  If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of $\geq 0\%$
<b>Organizational measures to prevent/limit release from site</b>	
Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.	
<b>Conditions and measures related to municipal sewage treatment plant</b>	
Estimated substance removal from wastewater via domestic sewage treatment	95.5%
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs	95.5%
Maximum allowable site tonnage ( $M_{safe}$ ) (kg/d)	29,000
Assumed domestic sewage treatment plant flow ( $m^3/d$ )	2,000
<b>Conditions and measures related to treatment of waste</b>	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and/or national regulations.	
<b>9.6.2.2. Control of worker exposure</b>	
<b>Frequency and duration of use/exposure</b>	
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)
<b>Human factors not influenced by risk management</b>	
Not applicable	
<b>Other given operational conditions affecting workers exposure</b>	
Assumes use not $> 20^\circ C$ above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Consider technical advances and process upgrades (including automation) for the elimination of releases (all PROCs) Regularly inspect, test and maintain all control measures (all PROCs) Handle substance within closed systems (PROC 2) Store substance within a closed system (PROC 1) Ensure material transfers are under containment or extract ventilation (PROC 3 & 8b)	
<b>Technical conditions and measures to control dispersion from source towards the worker</b>	
Minimise exposure using measures such as closed systems, dedicated facilities and suitable genera/ local exhaust	

ventilation (all PROCs)

Drain down systems and clear transfer lines prior to breaking containment. Clean/ flush equipment, where possible, prior to maintenance (PROC 8a)

Retain drain downs in sealed storage pending disposal or for subsequent recycle (PROC 8a)

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid direct skin contact with product (all PROCs)

Identify potential areas for indirect skin contact (all PROCs)

Wash off skin contamination immediately (all PROCs)

Clean up contamination/spills as soon as they occur (PROC 8a)

Provide basic employee training to prevent/minimise exposures and to report and skin effects that may develop (all PROCs)

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

Restrict access to authorized staff; provide specific activity training to operators to minimise exposures; clean up spills immediately and dispose of wastes safely (all PROCs)

Consider the need for risk based health surveillance (all PROCs)

1. PPE: Wear gloves (Type EN374) if regular skin contact likely (PROC 2, 3, 8a & 8b)

2. PPE: Wear suitable coveralls to prevent exposure to the skin (PROC 8a)

### 9.6.3. Exposure information and reference to its source

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

Substance is a complex hydrocarbon UVCB. Predominantly hydrophobic.

The Hydrocarbon Block Method with the Petrorisk model is used for environmental risk assessment.

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed the resulting risk characterisation ratios are expected to be less than 1.

PNECs have been derived using HC5 statistical extrapolation method and the target lipid model using representative structures. For more detailed information contact supplier - see Product Library tab in Petrorisk spreadsheet.

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	0.066	0.0066	0.00143	0.00066	0.034	0.000066

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

Workers exposure estimation is calculated with Ecetoc TRA model. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 2.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0	0.03
PROC 2	0.50	0.03
PROC 3	0.10	0.03
PROC 8a	0.25	0.14
PROC 8b	0.05	0.07

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	0.145	0.145
PROC 2	0.500	0.117	0.617
PROC 3	0.100	0.145	0.245
PROC 8a	0.250	0.586	0.836
PROC 8b	0.045	0.295	0.340

**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 and Hydrocarbon Block Method with the Petrorisk model 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 (ES10b):**

Use as a fuel: Industrial (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))

<b>9.7.1. Exposure scenario addressing uses carried out by workers</b>	
<b>Use as a fuel: Industrial (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))</b>	
Use descriptors related to the life cycle stage	SU3 : Industrial uses: Uses of substances as such or in preparations at industrial sites 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) 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
<b>9.7.2. Operational conditions and risk management measures</b>	
<b>9.7.2.1. Control of environmental exposure</b>	
<b>Product characteristic</b>	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	>10 kPa at STP
<b>Amounts used</b>	
Daily at point sources	4,600,000 kg/day (maximum in worst case)
Annually at point sources	1,400,000 t/year (maximum in worst case)
Annually total	1,400,000 t/year total market
<b>Frequency and duration of use/exposure</b>	
Emission days per year	300
<b>Environment factors not influenced by risk management</b>	
Flow rate of receiving surface water	18,000 m <sup>3</sup> /day (default)
<b>Other given operational conditions affecting environmental exposure</b>	
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 RMMs	0

<b>Technical conditions and measures at process level (source) to prevent release</b>	
Risk from environmental exposure is driven by humans via indirect exposure (primarily inhalation). If discharging to domestic sewage treatment plant, no onsite wastewater treatment required.	
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>	
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 99.4%
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency $\geq 76.9\%$  If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of $\geq 0\%$
<b>Organizational measures to prevent/limit release from site</b>	
Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.	
<b>Conditions and measures related to municipal sewage treatment plant</b>	
Estimated substance removal from wastewater via domestic sewage treatment	95.5%
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs	95.5%
Maximum allowable site tonnage ( $M_{safe}$ ) (kg/d)	4,600,000
Assumed domestic sewage treatment plant flow ( $m^3/d$ )	2,000
<b>Conditions and measures related to treatment of waste for disposal</b>	
Combustion emissions limited by required exhaust emission controls. Combustion emissions considered in regional exposure assessment.	
<b>Conditions and measures related to recovery of waste</b>	
This substance is consumed during use and no waste of the substance is generated.	
<b>9.7.2.2. Control of worker exposure</b>	
<b>Frequency and duration of use/exposure</b>	
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)
<b>Human factors not influenced by risk management</b>	
Not applicable	
<b>Other given operational conditions affecting workers exposure</b>	
Assumes use not > 20°C above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Consider technical advances and process upgrades (including automation) for the elimination of releases (all PROCs) Regularly inspect, test and maintain all control measures (all PROCs) Handle substance within closed systems (PROC 1, 2, 3 & 16) Store substance within a closed system (PROC 2) Ensure material transfers are under containment or extract ventilation (PROC 8b)	

<b>Technical conditions and measures to control dispersion from source towards the worker</b>						
<p>Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/ local exhaust ventilation (all PROCs)</p> <p>Provide a good standard of general ventilation. Natural ventilation is from doors, windows, etc. Controlled ventilation means air is supplied or removed by a powered fan.</p> <p>Drain down systems and clear transfer lines prior to breaking containment. Clean/ flush equipment, where possible, prior to maintenance (PROC 8a)</p> <p>Retain drain downs in sealed storage pending disposal or for subsequent recycle (PROC 8a)</p>						
<b>Organisational measures to prevent /limit releases, dispersion and exposure</b>						
<p>Avoid direct skin contact with product (all PROCs)</p> <p>Identify potential areas for indirect skin contact (all PROCs)</p> <p>Wash off skin contamination immediately (all PROCs)</p> <p>Clean up contamination/spills as soon as they occur (PROC 8a)</p> <p>Provide basic employee training to prevent/minimise exposures and to report and skin effects that may develop (all PROCs)</p>						
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>						
<p>Restrict access to authorized staff; provide specific activity training to operators to minimise exposures; clean up spills immediately and dispose of wastes safely (all PROCs)</p> <p>Consider the need for risk based health surveillance (all PROCs)</p> <ol style="list-style-type: none"> <li>1. PPE: Wear gloves (Type EN374) if regular skin contact likely (PROC 2, 3, 8a &amp; 8b)</li> <li>2. PPE: Wear suitable coveralls to prevent exposure to the skin (PROC 8a)</li> </ol>						
<b>9.7.3. Exposure information and reference to its source</b>						
<b>9.7.3.1. Prediction of environmental exposure resulting from the conditions described above</b>						
<p>Substance is a complex hydrocarbon UVCB. Predominantly hydrophobic.</p> <p>The Hydrocarbon Block Method with the Petrorisk model is used for environmental risk assessment.</p> <p>When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed the resulting risk characterisation ratios are expected to be less than 1.</p> <p>PNECs have been derived using HC5 statistical extrapolation method and the target lipid model using representative structures. For more detailed information contact supplier - see Product Library tab in Petrorisk spreadsheet.</p>						
<b>Environmental exposure</b>	<b>In STP/ untreated wastewater (mg/l)</b>	<b>In local freshwater (mg/l)</b>	<b>In local soil (mg/kg dw)</b>	<b>In local marine water (mg/l)</b>	<b>In sediment freshwater (mg/kg dw)</b>	<b>In sediment marine water (mg/kg dw)</b>
<b>PEC</b>	0.066	0.0066	0.00143	0.00066	0.034	0.000066
<b>9.7.3.2. Prediction of workers exposure resulting from the conditions described above</b>						
<p>Workers exposure estimation is calculated with Ectoc TRA model. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 2.</p>						

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0	0.03
PROC 2	0.35 - 0.50	0.03 – 0.14
PROC 3	0.70	0.03
PROC 8a	0.35	0.14
PROC 8b	0.09 – 0.15	0.07
PROC 16	0.25	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 1	0	0.145	0.145
PROC 2	0.350 - 0.500	0.117 – 0.585	0.617 – 0.935
PROC 3	0.700	0.145	0.845
PROC 8a	0.350	0.586	0.936
PROC 8b	0.090 – 0.150	0.295	0.385 – 0.445
PROC 16	0.250	0.145	0.395

**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 and Hydrocarbon Block Method with the Petrorisk model 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 (ES11b):**

Use as a fuel: Professional (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))

<b>9.8.1. Exposure scenario addressing uses carried out by workers</b>	
<b>Use as a fuel: Professional (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))</b>	
Use descriptors related to the life cycle stage	<p>SU22 : Professional uses: Public domain (administration, education, entertainment, services, craftsmen)</p> <p>PROC1 : Use in closed process, no likelihood of exposure</p> <p>PROC2 : Use in closed, continuous process with occasional controlled exposure</p> <p>PROC3 : Use in closed batch process (synthesis or formulation)</p> <p>PROC8a : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities</p> <p>PROC8b : Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities</p> <p>PROC16 : Using material as fuel sources, limited exposure to unburned product to be expected</p> <p>ERC9a : Wide dispersive indoor use of substances in closed systems</p> <p>ERC9b : Wide dispersive outdoor use of substances in closed systems</p>
Specific environmental release category	ESVOC SpERC 9.12b.v1
<b>9.8.2. Operational conditions and risk management measures</b>	
<b>9.8.2.1. Control of environmental exposure</b>	
<b>Product characteristic</b>	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	>10 kPa at STP
<b>Amounts used</b>	
Daily at point sources	160 kg/day (maximum in worst case)
Annually at point sources	590 t/year (maximum in worst case)
Annually total	1,190,000 t/year total market
<b>Frequency and duration of use/exposure</b>	
Emission days per year	365
<b>Environment factors not influenced by risk management</b>	
Flow rate of receiving surface water	18,000 m <sup>3</sup> /day (default)
<b>Other given operational conditions affecting environmental exposure</b>	
Release fraction to air from process before RMMs	0.01

Release fraction to waste water from process before RMMs	0.00001
Release fraction to soil from process before RMMs	0.00001
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Risk from environmental exposure is driven by humans via indirect exposure (primarily inhalation). If discharging to domestic sewage treatment plant, no onsite wastewater treatment required.	
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>	
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))	Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency $\geq 3.4\%$  If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of $\geq 0\%$
<b>Organizational measures to prevent/limit release from site</b>	
Prevent discharge of undissolved substance to or recover from wastewater. Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.	
<b>Conditions and measures related to municipal sewage treatment plant</b>	
Estimated substance removal from wastewater via domestic sewage treatment	95.5%
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs	95.5%
Maximum allowable site tonnage ( $M_{safe}$ ) (kg/d)	15,000
Assumed domestic sewage treatment plant flow ( $m^3/d$ )	2,000
<b>Conditions and measures related to treatment of waste for disposal</b>	
Combustion emissions limited by required exhaust emission controls. Combustion emissions considered in regular exposure assessment.	
<b>Conditions and measures related to recovery of waste</b>	
This substance is consumed during use and no waste of the substance is generated.	
<b>9.8.2.2. Control of worker exposure</b>	
<b>Frequency and duration of use/exposure</b>	
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)
<b>Human factors not influenced by risk management</b>	
Not applicable	
<b>Other given operational conditions affecting workers exposure</b>	
Assumes use not $> 20^\circ C$ above ambient temperature, unless stated differently.	
Assumes a good basic standard of occupational hygiene is implemented.	
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Consider technical advances and process upgrades (including automation) for the elimination of releases (all	

<p>PROCs)</p> <p>Regularly inspect, test and maintain all control measures (all PROCs)</p> <p>Handle substance within closed systems (PROC 1 &amp; 16)</p> <p>Store substance within a closed system (PROC 2)</p> <p>Ensure material transfers are under containment or extract ventilation (PROC 8b)</p>																				
<p><b>Technical conditions and measures to control dispersion from source towards the worker</b></p> <p>Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/ local exhaust ventilation (all PROCs)</p> <p>Provide a good standard of general ventilation. Natural ventilation is from doors, windows, etc. Controlled ventilation means air is supplied or removed by a powered fan.</p> <p>Drain down systems and clear transfer lines prior to breaking containment. Clean/ flush equipment, where possible, prior to maintenance (PROC 8a)</p> <p>Retain drain downs in sealed storage pending disposal or for subsequent recycle (PROC 8a)</p> <p>Ensure operatives are trained to minimise exposures.</p>																				
<p><b>Organisational measures to prevent /limit releases, dispersion and exposure</b></p> <p>Avoid direct skin contact with product (all PROCs)</p> <p>Identify potential areas for indirect skin contact (all PROCs)</p> <p>Wash off skin contamination immediately (all PROCs)</p> <p>Clean up contamination/spills as soon as they occur (PROC 8a)</p> <p>Provide basic employee training to prevent/minimise exposures and to report and skin effects that may develop (all PROCs)</p>																				
<p><b>Conditions and measures related to personal protection, hygiene and health evaluation</b></p> <p>Restrict access to authorized staff; provide specific activity training to operators to minimise exposures; clean up spills immediately and dispose of wastes safely (all PROCs)</p> <p>Consider the need for risk based health surveillance (all PROCs)</p> <ol style="list-style-type: none"> <li>1. PPE: Wear gloves (Type EN374) if regular skin contact likely (PROC 2, 3, 8a &amp; 8b)</li> <li>2. PPE: Wear suitable coveralls to prevent exposure to the skin (PROC 8a)</li> </ol>																				
<p><b>9.8.3. Exposure information and reference to its source</b></p>																				
<p><b>9.8.3.1. Prediction of environmental exposure resulting from the conditions described above</b></p> <p>Substance is a complex hydrocarbon UVCB. Predominantly hydrophobic.</p> <p>The Hydrocarbon Block Method with the Petrorisk model is used for environmental risk assessment.</p> <p>When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed the resulting risk characterisation ratios are expected to be less than 1.</p> <p>PNECs have been derived using HC5 statistical extrapolation method and the target lipid model using representative structures. For more detailed information contact supplier - see Product Library tab in Petrorisk spreadsheet.</p>																				
<table border="1"> <thead> <tr> <th>Environmental exposure</th> <th>In STP/ untreated wastewater (mg/l)</th> <th>In local freshwater (mg/l)</th> <th>In local soil (mg/kg dw)</th> <th>In local marine water (mg/l)</th> <th>In sediment freshwater (mg/kg dw)</th> <th>In sediment marine water (mg/kg dw)</th> </tr> </thead> <tbody> <tr> <td>PEC</td> <td>0.066</td> <td>0.0066</td> <td>0.00143</td> <td>0.00066</td> <td>0.034</td> <td>0.000066</td> </tr> </tbody> </table>							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	0.066	0.0066	0.00143	0.00066	0.034	0.000066
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	0.066	0.0066	0.00143	0.00066	0.034	0.000066														
<p><b>9.8.3.2. Prediction of workers exposure resulting from the conditions described above</b></p> <p>Workers exposure estimation is calculated with Ecetoc TRA model. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 2.</p>																				

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0	0.03
PROC 2	0.35 - 0.50	0.03 – 0.14
PROC 3	0.70	0.03
PROC 8a	0.85	0.03
PROC 8b	0.25	0.07
PROC 16	0.50	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 1	0.001	0.145	0.146
PROC 2	0.350 - 0.500	0.117 – 0.585	0.617 – 0.935
PROC 3	0.700	0.145	0.845
PROC 8a	0.850	0.117	0.967
PROC 8b	0.250	0.295	0.545
PROC 16	0.500	0.145	0.645

**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 and Hydrocarbon Block Method with the Petrorisk model 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 (ES12b):**

Use as a fuel: Consumer (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))

<b>9.9.1. Use as a fuel: Consumer (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))</b>	
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
<b>9.9.2. Operational conditions and risk management measures</b>	
<b>9.9.2.1. Control of environmental exposure</b>	
<b>Product characteristic</b>	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	>10 kPa at STP
<b>Amounts used</b>	
Annually at point sources	7,000 t/year (maximum in worst case)
Regional tonnage	13,900,000 t/year
Fraction of regional tonnage used locally	0.0005
<b>Frequency and duration of use/exposure</b>	
Emission days per year	365
<b>Environment factors not influenced by risk management</b>	
Local Freshwater dilution factor	10
Local marine water dilution factor	100
<b>Other given operational conditions affecting environmental exposure</b>	
Release fraction to air from wide dispersive use (regional only)	0.01
Release fraction to wastewater from wide dispersive use	0.00001
Release fraction to soil from wide dispersive use (regional only)	0.00001
<b>Conditions and measures related to municipal sewage treatment plant</b>	
Risk from environmental exposure is driven by humans via indirect exposure (primarily inhalation)	
Estimated substance removal from wastewater via domestic sewage treatment	95.5%
Maximum allowable site tonnage ( $M_{safe}$ ) (kg/d)	180,000
Assumed domestic sewage treatment plant flow ( $m^3/d$ )	2,000

<b>Conditions and measures related to external treatment of waste for disposal</b>						
Combustion emissions limited by required exhaust emission controls. Combustion emissions considered in regional exposure assessment.						
<b>Conditions and measures related to external recovery of waste</b>						
This substance is consumed during use and no waste of the substance is generated.						
<b>9.9.2.2. Control of consumer exposure</b>						
<b>Substance content in the product</b>	Up to 100%					
<b>Amounts of product used / applied per event</b>	Up to 37,500 g					
<b>Frequency and duration of use/exposure</b>	Covers use frequency up to 0.143 times per day					
	Duration of exposure: up to 2 hours per event					
<b>Consumer related measures</b>	<p>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<sup>2</sup> for each use event;  Covers use amounts 750 - 37,500 g;  Covers use in room size of 20m<sup>3</sup>;  For each use event, covers exposure up to 0.03 - 2.00hr/event;</p> <p>RMM: No specific RMMs identified beyond those OCs stated</p>					
<b>Other Operational Conditions affecting exposure</b>	Assumes use at ambient temperatures; assumes use in a 20m <sup>3</sup> room; assumes use with typical ventilation.					
<b>9.9.3. Exposure information and reference to its source</b>						
<b>9.9.3.1. Prediction of environmental exposure resulting from the conditions described above</b>						
Substance is a complex hydrocarbon UVCB. Predominantly hydrophobic. The Hydrocarbon Block Method with the Petrorisk model is used for environmental risk assessment.						
When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed the resulting risk characterisation ratios are expected to be less than 1. PNECs have been derived using HC5statistical extrapolation method and the target lipid model using representative structures. For more detailed information contact supplier - see Product Library tab in Petrorisk spreadsheet.						
<b>Environmental exposure</b>	<b>In STP/ untreated wastewater (mg/l)</b>	<b>In local freshwater (mg/l)</b>	<b>In local soil (mg/kg dw)</b>	<b>In local marine water (mg/l)</b>	<b>In sediment freshwater (mg/kg dw)</b>	<b>In sediment marine water (mg/kg dw)</b>
<b>PEC</b>	0.066	0.0066	0.00143	0.00066	0.034	0.000066
<b>9.9.3.2. Prediction of consumer exposure resulting from the conditions described above</b>						
The ECETOC TRA tool has been used to estimate consumer exposures, consistent with the content of ECETOC Report #107 and the Chapter R15 of the IR&CSA TGD. 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.						
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 2.						

# Hexane

## Annex to the Safety Data Sheet

according to Regulation (EC) No. 453/2010  
 Revision date: September 8, 2011

Supersedes:

Version: 1.0

Consumers exposure	Dermal (mg/kg/day)	Oral (mg/kg/day)	Inhalation (mg/kg for 24hr day)	All routes systematic (mg/kg/day)
Exposure estimates	71.50	0	11416.70	11488

### Risk characterization:

Process category	RCR (dermal)	RCR (oral)	RCR (inhalation)	RCR (all routes)
All PROCs	305.38	Not available	Not available	Not available

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

### 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 (ES13b):**

Rubber production and processing: Industrial (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))

<b>9.10.1. Exposure scenario addressing uses carried out by workers</b>	
<b>Rubber production and processing: Industrial (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))</b>	
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) SU11 : Manufacture of rubber products 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) 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 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 19
<b>9.10.2. Operational conditions and risk management measures</b>	
<b>9.10.2.1. Control of environmental exposure</b>	
<b>Product characteristic</b>	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	>10 kPa at STP
<b>Amounts used</b>	
Daily at point sources	4,700 kg/day (maximum in worst case)
Annually at point sources	94 t/year (maximum in worst case)
Annually total	94 t/year total market
<b>Frequency and duration of use/exposure</b>	
Emission days per year	20

<b>Environment factors not influenced by risk management</b>	
Flow rate of receiving surface water	18,000 m <sup>3</sup> /day (default)
<b>Other given operational conditions affecting environmental exposure</b>	
Release fraction to air from process before RMMs	0.003
Release fraction to waste water from process before RMMs	0.01
Release fraction to soil from process before RMMs	0.0001
<b>Technical conditions and measures at process level (source) to prevent release</b>	
Prevent discharge of undissolved substance to or recover from wastewater. Risk from environmental exposure is driven by humans via indirect exposure (primarily inhalation). If discharging to domestic sewage treatment plant, no onsite wastewater treatment required.	
<b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>	
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))	Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency $\geq 23.9\%$  If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of $\geq 0\%$
<b>Organizational measures to prevent/limit release from site</b>	
Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.	
<b>Conditions and measures related to municipal sewage treatment plant</b>	
Estimated substance removal from wastewater via domestic sewage treatment	95.5%
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs	95.5%
Maximum allowable site tonnage ( $M_{safe}$ ) (kg/d)	42,000
Assumed domestic sewage treatment plant flow (m <sup>3</sup> /d)	2,000
<b>Conditions and measures related to treatment of waste</b>	
External treatment, disposal, recovery and recycling of waste should comply with applicable local and/or national regulations.	
<b>9.10.2.2. Control of worker exposure</b>	
<b>Frequency and duration of use/exposure</b>	
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)
<b>Human factors not influenced by risk management</b>	
Not applicable	
<b>Other given operational conditions affecting workers exposure</b>	
Operation is carried out at elevated temperature ( $>20^{\circ}\text{C}$ above ambient temperature).	

Assumes a good basic standard of occupational hygiene is implemented.						
<b>Technical conditions and measures at process level (source) to prevent release</b>						
Consider technical advances and process upgrades (including automation) for the elimination of releases (all PROCs) Regularly inspect, test and maintain all control measures (all PROCs) Handle substance within closed systems (PROC 2) Store substance within a closed system (PROC 2) Ensure material transfers are under containment or extract ventilation (PROC 2 & 8b)						
<b>Technical conditions and measures to control dispersion from source towards the worker</b>						
Minimise exposure using measures such as closed systems, dedicated facilities and suitable genera/ local exhaust ventilation (all PROCs) Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure (PROC 15) Drain down systems and clear transfer lines prior to breaking containment. Clean/ flush equipment, where possible, prior to maintenance (PROC 8a) Retain drain downs in sealed storage pending disposal or for subsequent recycle (PROC 8a) Carry out in a vented booth or extracted enclosure (PROC 9)						
<b>Organisational measures to prevent /limit releases, dispersion and exposure</b>						
Avoid direct skin contact with product (all PROCs) Identify potential areas for indirect skin contact (all PROCs) Wash off skin contamination immediately (all PROCs) Clean up contamination/spills as soon as they occur (PROC 8a) Provide basic employee training to prevent/minimise exposures and to report and skin effects that may develop (all PROCs)						
<b>Conditions and measures related to personal protection, hygiene and health evaluation</b>						
Restrict access to authorized staff; provide specific activity training to operators to minimise exposures; clean up spills immediately and dispose of wastes safely (all PROCs) Consider the need for risk based health surveillance (all PROCs) 1. PPE: Wear gloves (Type EN374) if regular skin contact likely (PROC 2, 3, 8a, 8b, 9 & 15) 2. PPE: Wear suitable coveralls to prevent exposure to the skin (PROC 15)						
<b>9.10.3. Exposure information and reference to its source</b>						
<b>9.10.3.1. Prediction of environmental exposure resulting from the conditions described above</b>						
Substance is a complex hydrocarbon UVCB. Predominantly hydrophobic. The Hydrocarbon Block Method with the Petrorisk model is used for environmental risk assessment.						
When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed the resulting risk characterisation ratios are expected to be less than 1. PNECs have been derived using HC5statistical extrapolation method and the target lipid model using representative structures. For more detailed information contact supplier - see Product Library tab in Petrorisk spreadsheet.						
<b>Environmental exposure</b>	<b>In STP/ untreated wastewater (mg/l)</b>	<b>In local freshwater (mg/l)</b>	<b>In local soil (mg/kg dw)</b>	<b>In local marine water (mg/l)</b>	<b>In sediment freshwater (mg/kg dw)</b>	<b>In sediment marine water (mg/kg dw)</b>
<b>PEC</b>	0.066	0.0066	0.00143	0.00066	0.034	0.000066

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

Workers exposure estimation is calculated with Ecetoc TRA model. Where applicable, predicted exposures and RCR values are reported as ranges. For DNEL values, please refer to Page 2.

Process category	Inhalatory worker exposure (ppm)	Dermal worker exposure (mg/kg/day)
PROC 1	0	0.03
PROC 2	0.05 – 0.50	0.01 – 0.03
PROC 3	0.70	0.03
PROC 8a	0.35	0.14
PROC 8b	0.05	0.07
PROC 9	0.20	0.07
PROC 15	0.05	0

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	0.145	0.145
PROC 2	0.050 – 0.500	0.060 – 0.585	0.110 – 0.935
PROC 3	0.700	0.145	0.845
PROC 8a	0.350	0.586	0.936
PROC 8b	0.045	0.295	0.340
PROC 9	0.200	0.295	0.495
PROC 15	0.050	0.013	0.063

### 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 and Hydrocarbon Block Method with the Petrorisk model 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.