

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

1.1. Product identifier

Chemical type	: Substance
Substance name	: Distillates (petroleum), light catalytic cracked
Trade name	: L.C.O. - Light Cycle Oil
EC index no	: 649-435-00-3
EC no	: 265-060-4
CAS No.	: 64741-59-9
REACH registration No.	: 01-2119489732-23-0040
Product code	: 261; SDS # PbR00266
Synonyms	: Bunker diluent / Light Industrial Oil – LCI / Light Recycle Oil – LCR

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 Release agent. Fuels Lubricant
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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]

Acute Tox. 4 (Inhalation)	H332
Skin Irrit. 2	H315
Carc. 1B	H350
STOT RE 2	H373
Asp. Tox. 1	H304
Aquatic Acute 1	H400
Aquatic Chronic 1	H410

Full text of H-phrases: see section 16.

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

Xn; R65
Xn; R20
Xn; R48/21
Xi; R38
Carc.Cat.2; R45
N; R50/53

Full text of R-phrases: see section 16.

Adverse physicochemical, human health and environmental effects

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

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2.2. Label elements

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

Hazard pictograms (CLP) :



Signal word (CLP) :

Danger

Hazard statements (CLP) :

H304 - May be fatal if swallowed and enters airways
H315 - Causes skin irritation
H332 - Harmful if inhaled
H350 - May cause cancer
H373 - May cause damage to organs through prolonged or repeated exposure
H400 - Very toxic to aquatic life
H410 - Very toxic to aquatic life with long lasting effects

Precautionary statements (CLP) :

P201 - Obtain special instructions before use
P210 - Keep away from heat, hot surfaces, open flames, sparks. - No smoking.
P280 - Wear eye protection, protective gloves, protective clothing.
P301+P310 - If swallowed, immediately call a doctor.
P331 - Do NOT induce vomiting
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

: Combustible liquid.

SECTION 3: Composition/information on ingredients

3.1. Substances

Name	Product identifier	%	Classification according to Directive 67/548/EEC
Distillates (petroleum), light catalytic cracked	(CAS No.) 64741-59-9 (EC no) 265-060-4 (EC index no) 649-435-00-3	100	Xn; R65 Xn; R20 Xn; R48/21 Xi; R38 Carc.Cat.2; R45 N; R50/53
Name	Product identifier	%	Classification according to Regulation (EC) No. 1272/2008 [CLP]
Distillates (petroleum), light catalytic cracked	(CAS No.) 64741-59-9 (EC no) 265-060-4 (EC index no) 649-435-00-3	100	Acute Tox. 4 (Inhalation), H332 Skin Irrit. 2, H315 Asp. Tox. 1, H304 Carc. 1B, H350 STOT RE 2, H373 Aquatic Chronic 1, H410 Aquatic Acute 1, H400

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

3.2. Mixtures

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures after inhalation : Move the affected person away from the contaminated area and into the fresh air. If not breathing, give artificial respiration. In case of breathing difficulties administer oxygen. Seek medical advice (show the label where possible).

First-aid measures after skin contact : Remove contaminated clothing and shoes. Rinse thoroughly with plenty of water for at least 20 minutes and take medical advice. Seek medical advice (show the label where possible).

First-aid measures after eye contact : Rinse immediately and plentifully with water, also under the eyelids, for at least 20 minutes. Seek medical advice (show the label where possible).

First-aid measures after ingestion : Do not induce vomiting. Rinse mouth immediately and drink large quantities of water. Seek medical advice (show the label where possible).

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

Symptoms/injuries after inhalation : Dizziness, headaches, nausea. May cause irritation to the respiratory tract.

Symptoms/injuries after skin contact : Can occur: skin irritation. Prolonged or repeated contacts with the skin may cause dermatitis.

Symptoms/injuries after eye contact : Conjunctival redness. Irritating to eyes.

Symptoms/injuries after ingestion : Risk of aspiration pneumonia.

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

Do not rub the skin and eyes after direct contact with the product.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media: : carbon dioxide (CO₂), dry chemical powder, foam.

5.2. Special hazards arising from the substance or mixture

Fire hazard : Combustible.

Reactivity : Hazardous combustion products. Carbon monoxide. Nitrogen oxides (NO_x). Sulfur oxides. Carbon dioxide (CO₂).

5.3. Advice for firefighters

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

Other information : Cool tanks/drums with water spray/remove them into safety. Remove product from area of fire.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Eliminate all ignition sources if safe to do so. Remove product from area of fire.

6.1.1. For non-emergency personnel

Protective equipment : Refer to section 8.

Emergency procedures : Do not smoke. No flames, No sparks. Eliminate all sources of ignition.

6.1.2. For emergency responders

Emergency procedures : Do not smoke. No flames, No sparks. Eliminate all sources of ignition.

6.2. Environmental precautions

Avoid release to the environment. Stop leak if safe to do so. Prevent entry to sewers and public waters. Prevent spreading over great surfaces (e.g. by damming or installing oil booms). Relevant water authorities should be notified of any large spillage to water course or drain.

6.3. Methods and material for containment and cleaning up

For containment : Collect in closed containers for disposal. Keep recovered product for subsequent disposal.

Methods for cleaning up : Do not empty into drains or the aquatic environment. Do not remove as household garbage. Collect in closed containers for disposal. Absorb with liquid-binding material (e.g. sand, diatomaceous earth, acid- or universal binding agents).

Other information : Comply with local regulations for disposal. Relevant water authorities should be notified of any large spillage to water course or drain.

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 : Handle in accordance with good industrial hygiene and safety procedures. Do not eat, drink and do not smoke in areas where product is used. Separate working clothes from town clothes. Launder separately. Handle in accordance with good industrial hygiene and safety procedures.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures: : Provide adequate ventilation. Ground equipment electrically. Only use anti-static equipped (spark-free) tools.

Storage condition(s) : Store in well ventilated area. Store at room temperature. standard pressure (101,3 kPa). Avoid ignition sources.

Incompatible products : Strong oxidizing agents.

Incompatible materials : Strong oxidizing agents.

Storage area : Floors should be impenetrable, resistant to liquids and easy to clean.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Distillates (petroleum), light catalytic cracked (64741-59-9)

Italy - Portugal - USA ACGIH	ACGIH TWA (mg/m ³)	100 mg/m ³ diesel fuel.
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Distillates (petroleum), light catalytic cracked (64741-59-9)

DNEL/DMEL (Workers)

Acute - local effects, inhalation	2230 mg/m ³
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Distillates (petroleum), light catalytic cracked (64741-59-9)	
Long-term - systemic effects, dermal	2.4 mg/kg bodyweight/day
Long-term - systemic effects, inhalation	30 mg/m ³ /day
DNEL/DMEL (General Population)	
Long-term - systemic effects, oral	1 mg/kg bodyweight/day

8.2. Exposure controls

Appropriate engineering controls	: Provide adequate ventilation.
Hand protection	: Protective gloves made of PVC. Impermeable protective nitrile gloves.
Eye protection	: Chemical goggles or face shield with safety glasses.
Respiratory protection	: In case of insufficient ventilation, wear suitable respiratory equipment. In case of fire: Wear self-contained breathing apparatus.
Environmental exposure controls	: Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Avoid contact with skin, eyes, or clothing.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	: Liquid
Colour	: reddish brown.
Odour	: Strong. characteristic. Kerosene.
Odour threshold	: No data available
pH	: No data available
Melting point	: -40-6 °C
Solidification point	: No data available
Boiling point	: 159-390 °C
Flash point	: 78 °C ASTM D93
Relat. evapor. rate comp. to butylacetate	: No data available
Flammability (solid, gas)	: No data available
Explosive limits	: not applicable vol %
Vapour pressure	: 0.4 kPa (at 40 °C)
Relative vapour density at 20 °C	: No data available
Relative density	: 0.93-0.98 g/cm ³ @ 20°C
Solubility	: Soluble in organic solvents. Water: not significant
Log Pow	: No data available
Self ignition temperature	: > 225 °C
Decomposition temperature	: 400 °C
Viscosity, kinematic	: No data available
Viscosity, dynamic	: 3.613 cSt @ 40°C (ASTM D445)
Explosive properties	: not explosive.
Oxidising properties	: Not oxidizing.

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

Hazardous combustion products. Carbon monoxide. Nitrogen oxides (NOx). Sulfur oxides. Carbon dioxide (CO₂).

10.2. Chemical stability

Stable at ambient temperature and under normal conditions of use.

10.3. Possibility of hazardous reactions

No data available.

10.4. Conditions to avoid

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

10.5. Incompatible materials

Oxidizing agents.

10.6. Hazardous decomposition products

hydrocarbon substances with low molecular weight and their oxidation products.

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SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Harmful if inhaled.

Distillates (petroleum), light catalytic cracked (64741-59-9)	
LD50 oral rat	3200 mg/kg
LD50 dermal rabbit	> 2000 mg/kg
LC50 inhalation rat (mg/l)	4.65 mg/l/4h

Skin corrosion/irritation : Causes skin irritation.
Serious eye damage/irritation : Not classified
Not irritating
Respiratory or skin sensitisation : Not classified
Not sensitizing
Germ cell mutagenicity : Not classified
Carcinogenicity : May cause cancer.
Reproductive toxicity : Not classified
Specific target organ toxicity (single exposure) : Not classified
Specific target organ toxicity (repeated exposure) : May cause damage to organs through prolonged or repeated exposure.

Distillates (petroleum), light catalytic cracked (64741-59-9)	
NOAEL (oral,rat,28 days)	500 mg/kg bodyweight/day
NOAEL (dermal,rat/rabbit,90 days)	> 30 mg/kg bodyweight/day

Aspiration hazard : May be fatal if swallowed and enters airways.
Potential Adverse human health effects and symptoms : Inhalation may affect the nervous system causing headache, possibly dizziness, nausea, weakness, loss of coordination and unconsciousness.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - water : In case of large spills the product may be hazardous to aquatic organisms due to possible formation of a film on the surface water which can diminish dissolved oxygen levels.

Distillates (petroleum), light catalytic cracked (64741-59-9)	
LC50 fishes	0.156 mg/l 96 hours
LC50 other aquatic organisms	1.954 mg/l 48 hours
EC50 Daphnia	0.319 mg/l 48 hours
NOEC (acute)	0.241 mg/l 21 days- microorganism
NOEC (chronic)	0.053 mg/l 21 days- daphnia
ErC50 (algae)	0.202 mg/l 72 hours

12.2. Persistence and degradability

L.C.O. - Light Cycle Oil (64741-59-9)	
Persistence and degradability	No data available.

12.3. Bioaccumulative potential

L.C.O. - Light Cycle Oil (64741-59-9)	
Bioaccumulative potential	No data available.

12.4. Mobility in soil

L.C.O. - Light Cycle Oil (64741-59-9)	
Ecology - soil	If product enters soil, it will be mobile and may contaminate groundwater.

12.5. Results of PBT and vPvB assessment

L.C.O. - Light Cycle Oil (64741-59-9)	
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. Dispose of this material and its container to hazardous or special waste collection point.

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SECTION 14: Transport information

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

14.1. UN number

UN-No. : 3082

14.2. UN proper shipping name

Proper shipping name : ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S.
Transport document description : UN 3082 ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S., 9, III, (E)

14.3. Transport hazard class(es)

Class (UN) : 9
Hazard labels (UN) : 9



14.4. Packing group

Packing group (UN) : III

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.) : 90
Classification code : M6
Orange plates :



Tunnel restriction code : E
Limited quantities (ADR) : LQ07
Excepted quantities (ADR) : E1

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

Chemical safety assessment has been established in the attachment.

SECTION 16: Other information

Sources of Key data : PETROBRAS. MSDS.

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Abbreviations and acronyms

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

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

Acute Tox. 4 (Inhalation)	Acute toxicity (inhalation) Category 4
Aquatic Acute 1	Hazardous to the aquatic environment - acute hazard Category 1
Aquatic Chronic 1	Hazardous to the aquatic environment - chronic hazard Category 1
Asp. Tox. 1	Aspiration hazard Category 1
Carc. 1B	Carcinogenicity Category 1B
Skin Irrit. 2	skin corrosion/irritation Category 2
STOT RE 2	Specific target organ toxicity (repeated exposure) Category 2
H304	May be fatal if swallowed and enters airways
H315	Causes skin irritation
H332	Harmful if inhaled
H350	May cause cancer
H373	May cause damage to organs through prolonged or repeated exposure
H400	Very toxic to aquatic life
H410	Very toxic to aquatic life with long lasting effects
R20	Harmful by inhalation.
R38	Irritating to skin.
R45	May cause cancer.
R48/21	Harmful: danger of serious damage to health by prolonged exposure in contact with skin.
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R65	Harmful: may cause lung damage if swallowed.

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.



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Exposure Scenarios for: Light Cycle Oil

Trade Name : Light Cycle Oil
CAS Number : 64741-59-9
EC Number : 265-060-4
SDS Reference : PbR000266

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Summary of parameters used for assessing safe use:

DNEL: Worker - inhalation (acute): 2230 mg/m³/15 min
Worker - inhalation (long term): 30 mg/m³/8 h
Worker - dermal (long term): 2.4 mg/kg bw/8 h

Acronyms:

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

Exposure Scenario (ES1):

Manufacture of Light Cycle Oil

9.1.1. Exposure scenario addressing uses carried out by workers	
Manufacture of Light Cycle Oil – Industrial	
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>SU8 : Manufacture of bulk, large scale chemicals (including petroleum products)</p> <p>SU9 : Manufacture of fine chemicals</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>ERC4 : Industrial use of processing aids in processes and products, not becoming part of articles</p>
Specific environmental release category	ESVOC SpERC 1.1.v1
9.1.2. Operational conditions and risk management measures	
9.1.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	<0.5 kPa at STP
Amounts used	
Daily at point sources	930,000 kg/day
Annually at point sources	280,000 t/year (maximum in worst case)
Annually total	280,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	300
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m ³ /day (default)
Other given operational conditions affecting environmental exposure	



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Release fraction to air from process before RMMs	0.01
Release fraction to waste water from process before RMMs	0.0003
Release fraction to soil from process before RMMs	0.0001
Technical conditions and measures at process level (source) to prevent release	
Common practices vary across sites thus conservative process release estimates are used.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >90%.
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 98.7%. If discharging to domestic STP, provide the required onsite wastewater removal efficiency of ≥83.6%.
Risk from environmental exposure is driven by freshwater sediment. Prevent discharge of undissolved substance to or recover from onsite wastewater. Onsite wastewater treatment required.	
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.	
Conditions and measures related to municipal sewage treatment plant	
Estimated substance removal from wastewater via domestic sewage treatment	92.3%
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs	98.7%
Maximum allowable site tonnage (M_{safe}) (kg/d)	930,000
Assumed domestic sewage treatment plant flow (m^3/d)	10,000
Conditions and measures related to treatment of waste	
During manufacturing no waste of the substance is generated to treat or recover.	
9.1.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable.	
Other given operational conditions affecting workers exposure	
Operation is carried out at elevated temperature (>20° above ambient temperature).	
Assumes a good basic standard of occupational hygiene is implemented.	
Technical conditions and measures at process level (source) to prevent release	
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) Store substance within a closed system (PROC 1 & 2) Ensure material transfers are under containment or extract ventilation (PROC 8b)	
Technical conditions and measures to control dispersion from source towards the worker	
Minimise exposure using measures such as closed systems, dedicated facilities and suitable genera/ local exhaust	



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ventilation (all PROCs)

Handle substance within a predominantly closed system provided with extract ventilation (PROC 1, 2 & 3)

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

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)

Deal with spills immediately (PROC 8a)

Sample via a closed loop or other system intended to avoid exposure (PROC 3)

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)

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 suitable gloves (tested to EN374) (PROC 2, 3, 8a, 8b & 15)

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

3. PPE: wear respiratory protection when its use is identified for certain contributing scenarios (all PROCs)

9.1.3. Exposure information and reference to its source

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

Substance is a complex 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	0.011	0.00066	0.33	0.000066

9.1.3.2. 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 1.

Since the DNEL for dermal irritation cannot be calculated, risk management measures (RMM) are derived from a qualitative risk assessment, reflecting industry standards for this class of substances.

Process category	Inhalatory worker exposure (mg/m ³)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01 – 0.5	0.34 – 1.37
PROC 2	0.5	1.37
PROC 3	1	0.34
PROC 8a	0.5	1.37
PROC 8b	5	1.37
PROC 15	0.05	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 – 0.02	0.14 – 0.57	0.14 – 0.59
PROC 2	0.02	0.57	0.59
PROC 3	0.04	0.14	0.18
PROC 8a	0.02	0.57	0.59
PROC 8b	0.18	0.57	0.75
PROC 15	0	0.01	0.01

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool 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 (ES2):

Use of Light Cycle Oil as intermediate – Industrial

9.2.1. Exposure scenario addressing uses carried out by workers	
Use of Light Cycle Oil as Intermediate - Industrial	
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>SU8 : Manufacture of bulk, large scale chemicals (including petroleum products)</p> <p>SU9 : Manufacture of fine chemicals</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>ERC6a : Industrial use resulting in manufacture of another substance (use of intermediates)</p>
Specific environmental release category	ESVOC SpERC 6.1a.v1
9.2.2. Operational conditions and risk management measures	
9.2.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	<0.5 kPa at STP
Amounts used	
Daily at point sources	50,000 kg/day
Annually at point sources	15,000 t/year (maximum in worst case)
Annually total	51,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	300
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m ³ /day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMS	0.001



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Release fraction to waste water from process before RMMs	0.00017
Release fraction to soil from process before RMMs	0.001
Technical conditions and measures at process level (source) to prevent release	
Common practices vary across sites thus conservative process release estimates are used.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >80%.
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 95.3%. If discharging to domestic STP, provide the required onsite wastewater removal efficiency of ≥38.8%.
Risk from environmental exposure is driven by freshwater sediment. Prevent discharge of undissolved substance to or recover from onsite wastewater. Onsite wastewater treatment required.	
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.	
Conditions and measures related to municipal sewage treatment plant	
Estimated substance removal from wastewater via domestic sewage treatment	92.3%
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs	95.3%
Maximum allowable site tonnage (M_{safe}) (kg/d)	50,000
Assumed domestic sewage treatment plant flow (m^3/d)	2,000
Conditions and measures related to treatment of waste	
During manufacturing no waste of the substance is generated to treat or recover.	
9.2.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable.	
Other given operational conditions affecting workers exposure	
Operation is carried out at elevated temperature (>20° above ambient temperature).	
Assumes a good basic standard of occupational hygiene is implemented.	
Technical conditions and measures at process level (source) to prevent release	
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) Store substance within a closed system (PROC 1 & 2) Ensure material transfers are under containment or extract ventilation (PROC 8b)	
Technical conditions and measures to control dispersion from source towards the worker	
Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/ local exhaust ventilation (all PROCs)	



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Handle substance within a predominantly closed system provided with extract ventilation (PROC 1, 2 & 3)
Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure (PROC 15)

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)
Deal with spills immediately (PROC 8a)
Sample via a closed loop or other system intended to avoid exposure (PROC 3)
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)
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 suitable gloves (tested to EN374) (PROC 2, 3, 8a, 8b & 15)
2. PPE: wear suitable coveralls to prevent exposure to the skin (PROC 8a & 15)
3. PPE: wear respiratory protection when its use is identified for certain contributing scenarios (all PROCs)

9.2.3. Exposure information and reference to its source

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

Substance is a complex 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 characterization 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	0.011	0.00066	0.33	0.000066

9.2.3.2. 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 1.
Since the DNEL for dermal irritation cannot be calculated, risk management measures (RMM) are derived from a qualitative risk assessment, reflecting industry standards for this class of substances.

Process category	Inhalatory worker exposure (mg/m ³)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01 – 0.5	0.34 – 1.37
PROC 2	0.5	1.37
PROC 3	1	0.34
PROC 8a	0.5	1.37
PROC 8b	5	1.37
PROC 15	0.05	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 – 0.02	0.14 – 0.57	0.14 – 0.59
PROC 2	0.02	0.57	0.59
PROC 3	0.04	0.14	0.18
PROC 8a	0.02	0.57	0.59
PROC 8b	0.18	0.57	0.75
PROC 15	0	0.01	0.01

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool 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 (ES3):

Distribution of Light Cycle Oil – Industrial

9.3.1. Exposure scenario addressing uses carried out by workers	
Distribution of Light Cycle Oil – Industrial	
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>ERC7a : Industrial use of substances in closed systems</p>
Specific environmental release category	ESVOC SpERC 1.1b.v1
9.3.2. Operational conditions and risk management measures	
9.3.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	<0.5 kPa at STP



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Amounts used	
Daily at point sources	28,000 kg/day
Annually at point sources	560 t/year (maximum in worst case)
Annually total	280,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	20
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m ³ /day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.001
Release fraction to waste water from process before RMMs	0.00001
Release fraction to soil from process before RMMs	0.00001
Technical conditions and measures at process level (source) to prevent release	
Common practices vary across sites thus conservative process release estimates are used.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >90%.
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 0%. If discharging to domestic STP, provide the required onsite wastewater removal efficiency of ≥0%.
Risk from environmental exposure is driven by freshwater sediment. No wastewater treatment required.	
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.	
Conditions and measures related to municipal sewage treatment plant	
Estimated substance removal from wastewater via domestic sewage treatment	92.3%
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs	92.3%
Maximum allowable site tonnage (M _{safe}) (kg/d)	920,000
Assumed domestic sewage treatment plant flow (m ³ /d)	2,000
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling should comply with application regulations.	
9.3.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable.	
Other given operational conditions affecting workers exposure	

Assumes use at not more than 20° above ambient temperature.						
Assumes a good basic standard of occupational hygiene is implemented.						
Technical conditions and measures at process level (source) to prevent release						
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) Store substance within a closed system (PROC 1 & 2) Ensure material transfers are under containment or extract ventilation (PROC 8b)						
Technical conditions and measures to control dispersion from source towards the worker						
Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/ local exhaust ventilation (all PROCs) Handle substance within a predominantly closed system provided with extract ventilation (PROC 1, 2 & 3) Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure (PROC 15)						
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) Deal with spills immediately (PROC 8a) Sample via a closed loop or other system intended to avoid exposure (PROC 3) 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) 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 suitable gloves (tested to EN374) (PROC 2, 3, 8a, 8b & 15) 2. PPE: wear suitable coveralls to prevent exposure to the skin (PROC 8a & 15) 3. PPE: wear respiratory protection when its use is identified for certain contributing scenarios (all PROCs)						
9.3.3. Exposure information and reference to its source						
9.3.3.1. Prediction of environmental exposure resulting from the conditions described above						
Substance is a complex 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	0.011	0.00066	0.33	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 1.

Since the DNEL for dermal irritation cannot be calculated, risk management measures (RMM) are derived from a qualitative risk assessment, reflecting industry standards for this class of substances.

Process category	Inhalatory worker exposure (mg/m ³)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01 – 0.5	0.34 -1.37
PROC 2	0.5	1.37
PROC 3	0.1 - 1	0.03 - 0.34
PROC 8a	0.5	1.37
PROC 8b	5	1.37
PROC 15	0.05	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 – 0.02	0.14 – 0.57	0.14 – 0.59
PROC 2	0.02	0.57	0.59
PROC 3	0 - 0.04	0.01 - 0.14	0.02 - 0.18
PROC 8a	0.02	0.57	0.59
PROC 8b	0.18	0.57	0.75
PROC 15	0	0.01	0.01

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 (ES4):

Formulation & (Re)packing of Light Cycle Oil – Industrial

9.4.1. Exposure scenario addressing uses carried out by workers	
Formulation & (Re)packing of Light Cycle Oil - Industrial	
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>SU10 : Formulation [mixing] of preparations and/or re-packaging (excluding alloys)</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>ERC2 : Formulation of preparations</p>
Specific environmental release category	ESVOC SpERC 2.2.v1
9.4.2. Operational conditions and risk management measures	
9.4.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	<0.5 kPa at STP
Amounts used	
Daily at point sources	100,000 kg/day
Annually at point sources	30,000 t/year (maximum in worst case)
Annually total	240,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	300
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m ³ /day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.01
Release fraction to waste water from process before RMMs	0.000083
Release fraction to soil from process before RMMs	0.0001

Technical conditions and measures at process level (source) to prevent release	
Common practices vary across sites thus conservative process release estimates are used.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >0%.
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 96.5%. If discharging to domestic STP, provide the required onsite wastewater removal efficiency of ≥54.1%.
Risk from environmental exposure is driven by freshwater sediment. Onsite wastewater treatment required.	
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.	
Conditions and measures related to municipal sewage treatment plant	
Estimated substance removal from wastewater via domestic sewage treatment	92.3%
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs	96.5 %
Maximum allowable site tonnage (M_{safe}) (kg/d)	100,000
Assumed domestic sewage treatment plant flow (m^3/d)	2,000
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling waste should comply with applicable regulations.	
9.4.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable.	
Other given operational conditions affecting workers exposure	
Assumes use at not more than 20° above ambient temperature.	
Assumes a good basic standard of occupational hygiene is implemented.	
Technical conditions and measures at process level (source) to prevent release	
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) Store substance within a closed system (PROC 1 & 2) Ensure material transfers are under containment or extract ventilation (PROC 8b)	
Technical conditions and measures to control dispersion from source towards the worker	
Minimise exposure using measures such as closed systems, dedicated facilities and suitable genera/ local exhaust ventilation (all PROCs) Handle substance within a predominantly closed system provided with extract ventilation (PROC 1, 2 & 3) Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure (PROC 15)	
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)
Deal with spills immediately (PROC 8a)
Sample via a closed loop or other system intended to avoid exposure (PROC 3)
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)
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 suitable gloves (tested to EN374) (PROC 2, 3, 8a, 8b & 15)
2. PPE: wear suitable coveralls to prevent exposure to the skin (PROC 8a & 15)
3. PPE: wear respiratory protection when its use is identified for certain contributing scenarios (all PROCs)

9.4.3. Exposure information and reference to its source

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

Substance is a complex 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	0.011	0.00066	0.33	0.000066

9.4.3.2. 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 1.

Since the DNEL for dermal irritation cannot be calculated, risk management measures (RMM) are derived from a qualitative risk assessment, reflecting industry standards for this class of substances.

Process category	Inhalatory worker exposure (mg/m ³)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01 – 0.5	0.03 -1.37
PROC 2	0.5	1.37
PROC 3	0.1 – 1	0.03 - 0.34
PROC 8a	0.5	1.37
PROC 8b	0.5	0.69
PROC 15	0.05	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 – 0.02	0.01 – 0.57	0.01 – 0.59
PROC 2	0.02	0.57	0.59
PROC 3	0 - 0.04	0.01 - 0.14	0.02 - 0.18
PROC 8a	0.02	0.57	0.59
PROC 8b	0.02	0.29	0.31
PROC 15	0	0.01	0.01

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool 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 (ES5):

Light Cycle Oil Lubricants – Industrial

9.5.1. Exposure scenario addressing uses carried out by workers	
Light Cycle Oil Lubricants - Industrial	
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>PROC9 : Transfer of substance or preparation into small containers (dedicated filling line, including weighing)</p> <p>ERC4 : Industrial use of processing aids in processes and products, not becoming part of articles</p> <p>ERC7 : Industrial use of substances in closed systems</p>
Specific environmental release category	ESVOC SpERC 4.6a.v1
9.5.2. Operational conditions and risk management measures	
9.5.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	<0.5 kPa at STP
Amounts used	
Daily at point sources	5,000 kg/day
Annually at point sources	100 t/year (maximum in worst case)
Annually total	500 t/year total market
Frequency and duration of use/exposure	
Emission days per year	20
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m ³ /day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.005



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Release fraction to waste water from process before RMMs	0.00005
Release fraction to soil from process before RMMs	0.001
Technical conditions and measures at process level (source) to prevent release	
Common practices vary across sites thus conservative process release estimates are used.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >70%.
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 0%. If discharging to domestic STP, provide the required onsite wastewater removal efficiency of ≥ 0%.
Risk from environmental exposure is driven by freshwater sediment. No wastewater treatment required.	
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.	
Conditions and measures related to municipal sewage treatment plant	
Estimated substance removal from wastewater via domestic sewage treatment	92.3%
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs	92.3 %
Maximum allowable site tonnage (M_{safe}) (kg/d)	310,000
Assumed domestic sewage treatment plant flow (m^3/d)	2,000
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling waste should comply with applicable regulations.	
9.5.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable.	
Other given operational conditions affecting workers exposure	
Assumes use at not more than 20° above ambient temperature.	
Assumes a good basic standard of occupational hygiene is implemented.	
Technical conditions and measures at process level (source) to prevent release	
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) Store substance within a closed system (PROC 1 & 2) Ensure material transfers are under containment or extract ventilation (PROC 8b & 9)	
Technical conditions and measures to control dispersion from source towards the worker	
Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/ local exhaust ventilation (all PROCs)	

Handle substance within a predominantly closed system provided with extract ventilation (PROC 2 & 3)

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)
Deal with spills immediately (PROC 8a)
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)
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 suitable gloves (tested to EN374) (PROC 3, 8a, 8b & 9)
2. PPE: wear suitable coveralls to prevent exposure to the skin (recommended for carcinogens)
3. PPE: wear respiratory protection when its use is identified for certain contributing scenarios (all PROCs)

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 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	0.011	0.00066	0.33	0.000066

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

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 1.

Since the DNEL for dermal irritation cannot be calculated, risk management measures (RMM) are derived from a qualitative risk assessment, reflecting industry standards for this class of substances.

Process category	Inhalatory worker exposure (mg/m ³)	Dermal worker exposure (mg/kg/day)
PROC 1	0.5	1.37
PROC 2	0.5	1.37
PROC 3	0.1	0.34
PROC 8a	5	1.37
PROC 8b	0.5 – 0.75	0.69
PROC 9	5	1.37

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	0.02	0.57	0.59
PROC 2	0.02	0.57	0.59
PROC 3	0	0.14	0.15
PROC 8a	0.18	0.57	0.75
PROC 8b	0.02 – 0.03	0.29	0.31
PROC 9	0.18	0.57	0.75

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

The workers exposure and environmental emissions have been evaluated using Ecetoc TRA integrated tool 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 (ES6):

Use of Light Cycle Oil as release agents or binders – Professional

9.6.1. Exposure scenario addressing uses carried out by workers	
Use of Light Cycle Oil as release agents or binders - Industrial	
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) 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 4.10a.v1
9.6.2. Operational conditions and risk management measures	
9.6.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	<0.5 kPa at STP
Amounts used	
Daily at point sources	620 kg/day
Annually at point sources	12 t/year (maximum in worst case)
Annually total	12 t/year total market
Frequency and duration of use/exposure	
Emission days per year	20
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m ³ /day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	1.0
Release fraction to waste water from process before RMMs	0.000003
Release fraction to soil from process before RMMs	0
Technical conditions and measures at process level (source) to prevent release	
Common practices vary across sites thus conservative process release estimates are used.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases	Treat air emissions to provide a typical removal

to air (containment by preference or catalytic or thermal gas oxidation)	efficiency of >80%.
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 0%. If discharging to domestic STP, provide the required onsite wastewater removal efficiency of $\geq 0\%$.
Risk from environmental exposure is driven by freshwater sediment. No wastewater treatment required.	
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.	
Conditions and measures related to municipal sewage treatment plant	
Estimated substance removal from wastewater via domestic sewage treatment	92.3%
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs	92.3 %
Maximum allowable site tonnage (M_{safe}) (kg/d)	340,000
Assumed domestic sewage treatment plant flow (m^3/d)	2,000
Conditions and measures related to treatment of waste	
External treatment, disposal, recovery and recycling waste should comply with applicable regulations.	
9.6.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable.	
Other given operational conditions affecting workers exposure	
Assumes use at not more than 20° above ambient temperature.	
Assumes a good basic standard of occupational hygiene is implemented.	
Technical conditions and measures at process level (source) to prevent release	
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) Store substance within a closed system (PROC 1 & 2) Ensure material transfers are under containment or extract ventilation (PROC 8b) Provide extract ventilation to points where emissions occur (PROC 3)	
Technical conditions and measures to control dispersion from source towards the worker	
Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/ local exhaust ventilation (all PROCs) Handle substance within a closed system (PROC 3)	
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) 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 suitable gloves (tested to EN374) (PROC 3 & 8b)
2. PPE: wear suitable coveralls to prevent exposure to the skin (recommended for carcinogens)
3. PPE: wear respiratory protection when its use is identified for certain contributing scenarios (all PROCs)

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 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	0.011	0.00066	0.33	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 1.

Since the DNEL for dermal irritation cannot be calculated, risk management measures (RMM) are derived from a qualitative risk assessment, reflecting industry standards for this class of substances.

Process category	Inhalatory worker exposure (mg/m ³)	Dermal worker exposure (mg/kg/day)
PROC 1	0.5	1.37
PROC 2	0.5	1.37
PROC 3	0.1	0.37
PROC 8b	0.5	0.69

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	0.02	0.57	0.59
PROC 2	0.02	0.57	0.59
PROC 3	0	0.15	0.16
PROC 8b	0.02	0.29	0.31



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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 (ES7):

Use of Light Cycle Oil as a fuel – Industrial

9.7.1. Exposure scenario addressing uses carried out by workers	
Use of Light Cycle Oil as a fuel - Industrial	
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>PROC16 : Using material as fuel sources, limited exposure to unburned product to be expected</p> <p>ERC7 : Industrial use of substances in closed systems</p>
Specific environmental release category	ESVOC SpERC 7.12a.v1
9.7.2. Operational conditions and risk management measures	
9.7.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	<0.5 kPa at STP
Amounts used	
Daily at point sources	680,000 kg/day
Annually at point sources	200,000 t/year (maximum in worst case)
Annually total	200,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	300
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m ³ /day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	0.005
Release fraction to waste water from process before RMMs	0.00001

Release fraction to soil from process before RMMs	0
Technical conditions and measures at process level (source) to prevent release	
Common practices vary across sites thus conservative process release estimates are used.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of >95%.
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 88.9%. If discharging to domestic STP, provide the required onsite wastewater removal efficiency of $\geq 0\%$.
Risk from environmental exposure is driven by freshwater sediment. If discharging from domestic STP, no onsite wastewater treatment required.	
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.	
Conditions and measures related to municipal sewage treatment plant	
Estimated substance removal from wastewater via domestic sewage treatment	92.3%
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs	92.3 %
Maximum allowable site tonnage (M_{safe}) (kg/d)	920,000
Assumed domestic sewage treatment plant flow (m^3/d)	2,000
Conditions and measures related to treatment of waste for disposal	
Combustion emissions limited by required exhaust emission controls. Combustion emissions considered in regional exposure assessment.	
Conditions and measures related to external recovery of waste	
This substance is consumed during use and no waste of the substance is generated to recover.	
9.7.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable.	
Other given operational conditions affecting workers exposure	
Assumes use at not more than 20° above ambient temperature.	
Assumes a good basic standard of occupational hygiene is implemented.	
Technical conditions and measures at process level (source) to prevent release	
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) Store substance within a closed system (PROC 1 & 2) Ensure material transfers are under containment or extract ventilation (PROC 8b)	
Technical conditions and measures to control dispersion from source towards the worker	
Minimise exposure using measures such as closed systems, dedicated facilities and suitable genera/ local exhaust	



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ventilation (all PROCs) Handle substance within a closed system (PROC 1, 2 & 16)						
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) 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) 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 suitable gloves (tested to EN374) (PROC 8a & 8b) 2. PPE: wear suitable coveralls to prevent exposure to the skin (PROC 8a) 3. PPE: wear respiratory protection when its use is identified for certain contributing scenarios (all PROCs)						
9.7.3. Exposure information and reference to its source						
9.7.3.1. Prediction of environmental exposure resulting from the conditions described above						
Substance is a complex 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	0.011	0.00066	0.33	0.000066
9.7.3.2. Prediction of workers exposure resulting from the conditions described above						
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 1. Since the DNEL for dermal irritation cannot be calculated, risk management measures (RMM) are derived from a qualitative risk assessment, reflecting industry standards for this class of substances.						

Process category	Inhalatory worker exposure (mg/m ³)	Dermal worker exposure (mg/kg/day)
PROC 1	0.5	1.37
PROC 2	0.5	1.37
PROC 3	1	0.34
PROC 8a	0.5	1.37
PROC 8b	0.5	0.69
PROC 16	5	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	0.02	0.57	0.59
PROC 2	0.02	0.57	0.59
PROC 3	0.04	0.14	0.18
PROC 8a	0.02	0.57	0.59
PROC 8b	0.02	0.29	0.31
PROC 16	0.18	0.01	0.20

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 (ES8):

Use of Light Cycle Oil as a fuel – Professional

9.8.1. Exposure scenario addressing uses carried out by workers	
Use of Light Cycle Oil as a fuel – Professional	
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
9.8.2. Operational conditions and risk management measures	
9.8.2.1. Control of environmental exposure	
Product characteristic	
Physical state	Liquid
Concentration of substance in product	Up to 100%
Vapour pressure of substance	<0.5 kPa at STP
Amounts used	
Daily at point sources	52 kg/day
Annually at point sources	19 t/year (maximum in worst case)
Annually total	38,000 t/year total market
Frequency and duration of use/exposure	
Emission days per year	365
Environment factors not influenced by risk management	
Flow rate of receiving surface water	18,000 m ³ /day (default)
Other given operational conditions affecting environmental exposure	
Release fraction to air from process before RMMs	10,000
Release fraction to waste water from process before	0.00001

RMMs	
Release fraction to soil from process before RMMs	0.0001
Technical conditions and measures at process level (source) to prevent release	
Common practices vary across sites thus conservative process release estimates are used.	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Apply technical measures aiming at reducing releases to air (containment by preference or catalytic or thermal gas oxidation)	Treat air emissions to provide a typical removal efficiency of % N/A
Apply technical measures aiming at reduction and cleaning of waste water (WWTP /local STP (e.g. biological treatment))	Typical onsite wastewater treatment technology provides removal efficiency of 0%. If discharging to domestic STP, provide the required onsite wastewater removal efficiency of $\geq 0\%$.
Risk from environmental exposure is driven by freshwater. No wastewater treatment required.	
Organizational measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils. Sludge should be incinerated, contained or reclaimed.	
Conditions and measures related to municipal sewage treatment plant	
Estimated substance removal from wastewater via domestic sewage treatment	92.3%
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs	92.3 %
Maximum allowable site tonnage (M_{safe}) (kg/d)	31,000
Assumed domestic sewage treatment plant flow (m^3/d)	2,000
Conditions and measures related to treatment of waste for disposal	
Combustion emissions limited by required exhaust emission controls. Combustion emissions considered in regional exposure assessment.	
Conditions and measures related to external recovery of waste	
This substance is consumed during use and no waste of the substance is generated to recover.	
9.8.2.2. Control of worker exposure	
Frequency and duration of use/exposure	
Frequency of use for which the ES ensures control of risk	days/year: not restricted
Duration of use for which the ES ensures control of risk	8 hours/day (all PROCs)
Human factors not influenced by risk management	
Not applicable.	
Other given operational conditions affecting workers exposure	
Assumes use at not more than 20° above ambient temperature.	
Assumes a good basic standard of occupational hygiene is implemented.	
Technical conditions and measures at process level (source) to prevent release	
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) Store substance within a closed system (PROC 1 & 2) Ensure material transfers are under containment or extract ventilation (PROC 8b)	
Technical conditions and measures to control dispersion from source towards the worker	
Minimise exposure using measures such as closed systems, dedicated facilities and suitable genera/ local exhaust	



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ventilation (all PROCs) Handle substance within a closed system (PROC 16)														
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) 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) 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 suitable gloves (tested to EN374) (PROC 8a & 8b) 2. PPE: wear suitable coveralls to prevent exposure to the skin (PROC 8a) 3. PPE: wear respiratory protection when its use is identified for certain contributing scenarios (all PROCs)														
9.8.3. Exposure information and reference to its source														
9.8.3.1. Prediction of environmental exposure resulting from the conditions described above														
Substance is a complex 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.														
<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>0.011</td> <td>0.00066</td> <td>0.33</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	0.011	0.00066	0.33	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	0.011	0.00066	0.33	0.000066								
9.8.3.2. Prediction of workers exposure resulting from the conditions described above														
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 1. Since the DNEL for dermal irritation cannot be calculated, risk management measures (RMM) are derived from a qualitative risk assessment, reflecting industry standards for this class of substances.														

Process category	Inhalatory worker exposure (mg/m ³)	Dermal worker exposure (mg/kg/day)
PROC 1	0.01 - 1	0.34 - 1.37
PROC 2	0.01 - 1	0.34 - 1.37
PROC 3	1	0.34
PROC 8a	0.5 - 5	1.37
PROC 8b	1-5	0.69 – 1.37
PROC 16	20	0.34

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

Risk characterization:

Process category	RCR (inhalation)	RCR (dermal)	RCR (all routes)
PROC 1	0 - 0.04	0.14 - 0.57	0.14 - 0.61
PROC 2	0 - 0.04	0.14 - 0.57	0.14 - 0.61
PROC 3	0.04	0.14	0.18
PROC 8a	0.02 - 0.18	0.57	0.59 - 0.75
PROC 8b	0.04 – 0.18	0.29 – 0.57	0.32 – 0.75
PROC 16	0.73	0.14	0.87

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.