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SECTION 1. SUBSTANCE/MIXTURE AND COMPANY/PLANT IDENTIFICATION

1.1. Product identifier

- Trading name: FCC butane
- Chemical name: Hydrocarbons C3 - C4
- Other names: Liquidized crude oil gases, LPG
- REACH registration number: 01-2119486557-22-0008
- Index number: 649-199-00-1
- CAS number: 68476-40-4
- ES number: 270-681-9
- UFI code: not relevant

1.2. Designated use of the substance or mixture and its unrecommended uses

1.2.1. Designated use

Intermediate product for the production of chemical substances, such as industrial heating media. Where such a mixture is sold to the public, the 1,3-butadiene content of this mixture shall not exceed 0,1%.

1.2.2. Unrecommended uses

No unrecommended uses were specified during the registration process; at the same time, the product must not be used in any other way than specified in Point 1.2.1 or Subsection 7.3. It is strictly forbidden to use FCC butane in devices that have not been approved for its use.

1.3. Detailed information about the safety data sheet supplier

1.3.1. Business name and identification number

ORLEN Unipetrol RPA s.r.o., Záluží 1, 436 70 Litvínov, Czech Republic

Business Identification Number: 275 97 075

☎: 420 476 161 111

fax: 420 476 619 553

unipetrolrpa@orlenunipetrol.cz

www.orlenunipetrolrpa.cz

1.3.2. Business location

Litvínov Refinery

Záluží 1

436 01 Litvínov

tel.: +420 476 163 567

fax: +420 476 165 086

Kralupy Refinery

O. Wichterleho 809

278 01 Kralupy n/Vlt.

+420 315 718 500

+420 315 718 640


1.3.3. Email address of the technically competent persons who is responsible for the safety data sheet:

reach.unirpa@orlenunipetrol.cz

1.4. Emergency phone number

- CONTROLroom of ORLEN Unipetrol RPA s.r.o. ☎: +420 476 163 111 (NON STOP)
- Toxicological information center (TIS) ☎: +420 224 919 293 (NON STOP)
 Na bojišti 1, 120 00 Prague 2, Czech Republic ☎: +420 224 915 402 (NON STOP)
 e-mail: tis@vfn.cz
- Transportation information and accident system (TRINS) ☎: +420 476 163 111 (NON STOP)

Note: Emergency phone numbers for the EU countries are included in section 16

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SECTION 2. HAZARD IDENTIFICATION

2.1. Substance or mixture classification

The product is classified as hazardous pursuant to Directive (EC) No. 1272/2008 CLP:

FLAMMABLE GAS, CATEGORY 1A; H220

GAS UNDER PRESSURE; H280

MUTAGENICITY IN REPRODUCTIVE CELLS, CATEGORY 1B; H340

CARCINOGENICITY, CATEGORY 1B; H350

Flam. gas. 1A, H220




Liquefied gas, H280

Muta. 1B, H340, GHS08, Dgr

Carc. 1B, H350

Notice: The full text of the H-statements marked with a code is given in Section 2.2.


2.2. Marking elements

<i>product identifiers</i>	FCC BUTANE HYDROCARBONS C3 – C4, LIQUIDIZED CRUDE OIL GASES, LPG index number: 649-199-00-1	
<i>warning hazard symbol</i>	  	
<i>signal word</i>	HAZARD	
<i>H-sentences (standard hazard sentences)</i>	H220 H280 H340 H350	Extremely flammable gas Contains gas under pressure: it can explode when heated May cause genetic defects May cause cancer
<i>P-instructions (safe handling instructions)</i>	P102 P202 P210 P281 P377 P381 P308+P313 P410+P403	Keep out of reach of children Do not handle until all safety precautions have been read and understood. Keep away from heat/sparks/open flames/hot surfaces. – No smoking. Use personal protective equipment as required. Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so. IF exposed or concerned: Get medical advice/attention. Protect from sunlight. Store in a well-ventilated place.
<i>additional information</i>	Where such a mixture is sold to the public, the 1,3-butadiene content of this mixture shall not exceed 0,1%.	
ORLEN Unipetrol RPA s.r.o. Záluží 1, 436 70 Litvínov, Czech Republic ☎: +420 476 161 111, +420 476 163 111		

2.3. Other hazards

Information if a given substance or mixture complies with the criteria set for PBT or vPvB substances is included in subsection 12.5.

FCC butane in its gaseous state is heavier than air and can thus accumulate in low places. It creates an explosive

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mixture when mixed with the air. FCC butane vapors in high concentrations can have narcotic effects, can cause headaches, nausea, eye and airways irritation. The product can accumulate static electricity. FCC butane is stored under pressure in butane bottles. When it enters areas exposed to atmospheric pressure, it starts evaporating due to boiling under temperatures of up to $-45\text{ }^{\circ}\text{C}$. That is why frostbites can occur when the liquidized gas comes into contact with skin.

Released gas displaces oxygen, thus creating a risk of suffocation. This explosion and suffocation risk is particularly present below the terrain level and in enclosed areas.

The substance is not included in the Candidate List according to Article 59 (1) of the REACH Regulation due to endocrine disrupting properties.

The meaning of abbreviations used in this section is given in Section 16.

SECTION 3. COMPOSITION / INFORMATION ABOUT INDIVIDUAL COMPONENTS

3.1. Substances

substance name:	HYDROCARBONS C3 - C4	
index number (index):	649-199-00-1	
CAS number:	68476-40-4	
ES number:	270-681-9	
<i>components included in this UVCB substance</i> <ul style="list-style-type: none"> • in a concentration of $\geq 0.1\%$ or • influencing classification of this substance: 	NAME:	IDENTIFIER:
	<i>1,3-butadiene</i>	<i>buta-1,3-diene (index 601-013-00-X, CAS 106-99-0, ES 203-450-8)</i>

NOTE: The substance does not contain nanoform

3.2. Mixtures

Not applicable, the product is a substance.

SECTION 4. FIRST AID INSTRUCTIONS

4.1. First aid description

4.1.1. General instructions


When administering first aid, observe your own safety.

Call for the ambulance (155 Czech Republic, 120 EU) and observe the provided instructions until its arrival. Secure vitally important functions of the victim. If the victim is not breathing normally even when you tilt his/her head back, conduct resuscitation by pressing his/her chest approximately 5 cm deep with a frequency of 100-120 pushes per minute. If you are trained in rescue breathing, execute 2 inhalations after every 30 pushes of the chest. Do not interrupt the heart massage until the ambulance personnel arrives.

Do not give anything to consume to people who are unconscious or who are experiencing cramps. Put them in the recovery position.

4.1.2. Upon inhalation

In order to ensure your own safety, transport the victim to fresh air, do not let him/her become cold and seek medical assistance.

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4.1.3. Upon contact with skin

Do not remove clothes in the case of frostbites. Do not rub the frostbitten spots. Cover them only with sterile dressing or a clean piece of fabric. Seek medical assistance.

4.1.4. If the products hits eyes

Should the victim wear contact lenses, remove them. Immediately seek professional medical assistance if the liquidize gas comes into contact with eyes since the eyes could become seriously damaged if frostbitten.

4.1.5. Upon ingestion

Ingestion does not represent a probable exposure manner. However mouth and lips can develop frostbites if they come into contact with the liquidize gas. In that case rinse your mouth with lukewarm water and seek professional medical assistance immediately.

4.2. The most important acute and delayed symptoms and effects

Depending on the exposure dose, the substance can cause headache, nausea, dizziness, breathing difficulties or even breathing stoppages, cramps and unconsciousness. Ingestion can cause vomiting and, as a result of that, the vomit can get into lungs (aspiration) and pulmonary edema can occur (chemical pneumonia), which can result in death. Direct contact with eyes or skin can cause their temporary irritation. Longer exposures of skin to the substance can degrease it.

4.3. Instructions related to immediate medical assistance and special treatment

Should the product hit eyes or enter airways, medical assistance has to be sought immediately.

SECTION 5. FIRE EXTINGUISHING MEASURES

5.1. Fire extinguishers

Suitable fire extinguishers: heavy foam, water spray or water mist.

Unsuitable fire extinguishers: direct water stream.

Extinguishing small fires: powder or snow (CO₂) fire extinguishers, dry sand or fire extinguishing foam.

5.2. Special hazards related to the given substance or mixture

Do not attempt to extinguish the fire if the leak source is not removed. If this is not possible, let the fire die out on its own and keep cooling containers in the fire surroundings using water. A strong reaction or explosion can occur otherwise. Vapors can spread quite far and, should they come in contact with an ignition source, can cause a reverse flare and subsequent explosion and/or fire. The gas is heavier than the air. It accumulates by the ground and in enclosed areas, where an explosion and suffocation can occur. Containers with the substance can explode when heated. Its burning can create toxic smokes that contain carbon monoxide, carbon dioxide and unburned carbohydrates.

5.3. Instructions for fire fighters

Limit penetration of the fire extinguishing liquid polluted with the given substance to the sewerage system, surface and underground water and soil to a minimum. When leaked into the sewerage system, there is a risk of an explosion and subsequent burning.

Cool the tanks containing the product with water spray because they can explode due to heat.


Do not use foam and water simultaneously since water decomposes the foam.

Protection equipment for the fire fighters: fully protective clothing and insulation breathing apparatus.

SECTION 6. ACCIDENTAL LEAK MEASURES

6.1. People protection measures, protective equipment and emergency procedures

Seal the accident location and prevent access to the endangered area. Stay on the windward side. Leaks of this product can cause fires. That is why you need to remove all possible ignition sources. Do not smoke and do not handle open flame. If possible, ensure adequate ventilation of the enclosed areas. Prevent contact with the substance and its vapors. When rectifying the given extraordinary event/accident consequences, use all the recommended personal protection equipment (see Subsection 8.2). Evacuate all people from the endangered area

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in the case of larger accidents. If initiated, the substance vapors below the terrain level and in enclosed areas (including the sewerage system space) can explode or suffocate people.

6.2. Measures for the protection of the environment

Eliminate any further leaks of the substance and fence off the location. Prevent penetration of leaking liquidized gas into the sewerage system.

6.3. Methods and material for leak limitation and for cleaning

When the liquidized gas leaks, its evaporation quickly increases without an efficient possibility to influence this process. Use water spray for reducing the vapors in the air. Increase ventilation intensity at the leak location, particularly in the case of enclosed areas, and monitor the gas concentration. In cold weather, when the product can remain in its liquid state due to low temperatures, pump the leaked substance into enclosed containers prior to its processing.

6.4. References to other sections

For recommended personal protection aids, see Subsection 8.2 (“Limiting exposure”).
 For recommended waste removal procedures, see Section 13 (“Removal instructions”).

SECTION 7. HANDLING AND STORAGE

7.1. Safe handling measures

General safety and hygienic measures: Use it only in well ventilated areas with no ignition sources. Adopt measures that eliminate any possible static electricity discharge. Do not use compressed air for filling, emptying or other handling of the tanks. Do not forget that even empty packages can contain residues of flammable vapors and do not conduct activities, such as welding, cutting, grinding, etc., in their proximity. When entering enclosed areas that are not ventilated, always use protection of your airways.

Observe the personal hygiene rules. Immediately take off polluted parts of your clothing. Do not smoke, drink or eat while working! Thoroughly wash your hands and uncovered parts of your body by water and soap and, if necessary, apply a suitable repairation cream after work and before eating. Do not bring polluted clothes, footwear and protection equipment to eating areas.

7.2. Safe storage conditions for substances and mixtures, including incompatible substances and mixtures

Storage packages have to be properly closed, marked and grounded. Do not store the product nearby incompatible materials, such as oxidation agents. Store it in well ventilated areas, away from the reach of ignition sources. Electric devices have to be implemented pursuant to the corresponding regulations. Protect the areas against static electricity. Smoking is prohibited.

7.3. Specific final use(s)

FCC butane is used as a heating medium, particularly for industrial heating purposes. It is also used as material for further processing. It can be used only for the purposes and in devices that have been approved for its use. Never pour the product into the sewerage system. Where such a mixture is sold to the public, the 1,3-butadiene content of this mixture shall not exceed 0,1%.

SECTION 8. LIMITING EXPOSURE / PERSONAL PROTECTION EQUIPMENT


8.1. Control parameters

8.1.1. Limit worksite exposure values

Government Directive No. 361/2007 Coll., which determines the occupational health protection condition, as amended, specifies the following acceptable exposure limits (PEL) and the highest acceptable concentrations (NPK-P) of chemical substances in the air in the Czech Republic:

Name	CAS number	PEL [mg.m ⁻³]	NPK-P [mg.m ⁻³]	Note
LPG	68476-85-7	1800	4000	
		Does not exist for FCC butane. The table shows values for propane-butane (LPG)		

Note 1: The meaning of the PEL and NPK-P abbreviations can be found in Section 16.

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Note 2: The limit exposure values for the worksites throughout the EU countries are stated in Section 16.

8.1.2. DNEL/DMEL values

DNEL values used for the evaluation:

Not specified

Note: The meaning of the DNEL and DMEL abbreviations can be found in Section 16.

8.1.3. PNEC values

PNEC (secondary exposure, oral): 20.3 mg/kg

Pursuant to Paragraph 2 of Appendix IX to the REACH Directive, no bioaccumulation study is necessary in water environments. The substance has a low bioaccumulation potential and since the octanol log partition coefficient of this category is lower than 3, it does not represent a secondary poisoning risk. Moreover, the substance is not classified as toxic.

Note: The meaning of the DNEL and DMEL abbreviations can be found in Section 16.

8.2. Limiting exposure

8.2.1. Technical protection measures for limiting exposure of people and of the environment

Employees have to have personal protective equipment available to them. These aids have to correspond to the character of the conducted activities. They have to be also equipped with a suitable protection of their airways when the used technical means cannot guarantee the exposure of their airways would not endanger health or life of people. When using the protective equipment continuously while working, appropriate safety breaks have to be included, provided the character of the given PPE requires it. All PPE has to be continuously maintained in a usable condition. Should it become damaged or polluted, it has to be replaced immediately.

8.2.2. Individual protective measures

Should there be a risk of an increased exposure while handling the product or should the exposure increase, for example, as a result of an accident or an extraordinary event, the employees have to have available personal protection equipment (PPE) for the protection of their airways, eyes, hands and skin, which correspond to the character of the conducted activities. They have to be also equipped with a suitable protection of their airways when the used technical means cannot guarantee compliance with the exposure limits specified for the given work environment or when the exposure of their airways could endanger their health. When using the protective equipment continuously while working, appropriate safety breaks have to be included, provided the character of the given PPE requires it. All PPE has to be continuously maintained in a usable condition. Should it become damaged or polluted, it has to be replaced immediately.


RECOMMENDED PERSONAL PROTECTION EQUIPMENT (PPE):

(particular types of the protective equipment have to be chosen based on the type of the conducted activity and based on the quantity and concentration of the given hazardous substance/mixture at the worksite)

- **airways protection:** insulation breathing apparatus when entering an area, atmosphere of which is not demonstrably safe;
- **eyes / face protection:** protective goggles/face shield that complies with EN 166 when handling devices under pressure;
- **hands protection:** protective gloves that protect against cold and possible frostbites when handling the liquidized product;
the following materials protect against the effects of the substance:

	<i>glove material</i>	<i>layer thickness</i>	<i>penetration time</i>
common work activities (staining possibility)	natural latex	1 mm	10 minutes
leak / accident repair	viton	0.7 mm	480 minutes

- **protection of other body parts:** antistatic and inflammable clothes and antistatic footwear

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• *heat hazard:* irrelevant when used as specified.

8.2.3. Limiting the exposure of the environment


Prevent product leaks to locations where its accumulation could be dangerous.

SECTION 9. PHYSICAL AND CHEMICAL CHARACTERISTICS

9.1. Information about the basic physical and chemical characteristics

The information has been adopted from the corresponding registration documentation, unless stated otherwise.

attribute	unit	value	source/method	note
state of matter		gas	CSR	at 20°C
colour		colorless	CSR	
odour		odorless		
melting point / freezing point	[°C]	-188 - -138	CSR	
initial boiling point / boiling point range	[°C]	-161 - -0,5	CSR	influence of variable composition of UVCB
flammability		extremely flammable	CSR	
upper explosive limit	%	15	CSR	
lower explosive limit	%	1,8	CSR	
flash point	[°C]	-104 - -60	CSR	
spontaneous ignition temperature	[°C]	287-537	CSR	
decomposition temperature		does not decompose at normal operating temperatures		CSR does not state
pH		not relevant (non-polar substances)		CSR does not state
viscosity kinematic	[mm ² .s ⁻¹]	data not available		
solubility in water	[mg.l ⁻¹]	24,4-60,4		CSR does not state

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attribute	unit	value	source/method	note
relative density	water=1	0,423-0,589	CSR	at 15°C
distributive coefficient: n-octanol/water	[log Koc]	1,09-2,8	CSR	
vapour pressure	[Pa]	it is not necessary to perform a vapor pressure study as this substance has a boiling point lower than 30 ° C	CSR	RVP
relative vapour density	air=1	2,59	Thermopedia	CSR does not state
particle characteristics		-		not applicable - it is a gas

9.2. Other information

9.2.1. Information concerning physical hazard classes

Extremely flammable gas

9.2.2. Other security features

They are not available.

SECTION 10. STABILITY AND REACTIVITY

10.1. Reactivity

The product is stable under normal conditions.

10.2. Chemical stability

The product is stable under normal conditions.

10.3. Possibility of hazardous chemical reactions

It can release carbon monoxide when burning in an environment with a lack of oxygen.

10.4. Conditions that have to be avoided

Concentrations within the explosion limits, presence of ignition sources, contact with open flame.

10.5. Incompatible materials

Oxidation agents.


10.6. Hazardous disintegration products

None under normal conditions; carbon monoxide and soot can be created when burning in an environment with a lack of oxygen.

SECTION 11. TOXICOLOGICAL INFORMATION

11.1. Information about toxicological effects

11.1.1. Toxicological effects of the substance/mixture

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HAZARD CLASS	DATA FROM THE REGISTRATION DOCUMENTATION		EVALUATION
	DESCRIPTION	RESULT	
Acute toxicity	oral and dermal: inhalation:	unfeasible (Dw/nf) LC ₅₀ > 10,000 ppm	it does not comply with the classification criteria
Causticity / irritant effect for skin		no negative effects have been recorded	it does not comply with the classification criteria
Serious damage / eye irritation		no negative effects have been recorded	it does not comply with the classification criteria
Sensibility		scientifically unjustifiable (Dw/su)	it does not comply with the classification criteria
Mutagenicity in reproductive cells		positive test results; conclusion: the product containing ≥0.1% of 1.3-Butadiene can cause unfavorable genotoxic effects	it complies with the classification criteria
Carcinogenicity		positive test results; conclusion: the product containing ≥0.1% of 1.3-Butadiene can cause cancer	it complies with the classification criteria
Toxic for reproduction		no negative reproduction or development effects have been recorded	it does not comply with the classification criteria
STOT – one-time exposure	1/ oral and dermal: 2/ inhalation:	1/ unfeasible (Dw/nf) 2/ no toxic effects for up to 10,000 ppm	it does not comply with the classification criteria
STOT – repeated exposure	1/ oral OECD 407: 2/ inhalation: 3/ dermal:	1/ NOAEL(rat)=148.6 mg/kg 2/ NOAEC(rat)=1,000 ppm 3/ scientifically unjustifiable	it does not comply with the classification criteria
Inhalation hazard		when the product is ingested or when it enters the airways, it does not damage lungs and does not cause death	it does not comply with the classification criteria

11.1.2. Information about probable exposure ways

The exposure can occur by inhalation or penetration of individual components through skin.

11.1.3. Symptoms and effects (acute, delayed and chronic after short-term as well as long-term exposure)

The product displaces oxygen. Lack of oxygen causes fatigue, sleepiness, faintness, dizziness, nausea, vomiting, loss of coordination, attention disorder, judgment errors, confusion. The victim does not have

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to be aware of the fact he/she is suffocating and can quickly fall unconscious and suffocate. Frostbites can occur upon contact with the cooled liquidized gas. Should frostbites occur, the frostbitten spots are pale, cold and insensitive; later on, they can redden, get swollen and the victim can feel tingling, burning and pain. The substance can cause hereditary genetic changes and it can also cause or support the origin of cancer in humans.

11.1.4. Interactive effects

No interactions occur if the product is used appropriately.

11.2. Information on other hazards

The Substance is not included in the Candidate List under Article 59 (1) of the REACH (due to endocrine disrupting properties or for any other reason).

SECTION 12. ENVIRONMENTAL INFORMATION

12.1. Toxicity

Water environment	fish	LC ₅₀ (96 h, fish) = 24.11 – 147.54 mg/l	(Q)SAR
	invertebrates	LC ₅₀ (96 h, invertebrates) = 7.02 – 69.43 mg/l	(Q)SAR
	seaweed	EC ₅₀ (96 h, seaweed) = 7.71 – 16.5 mg/l	(Q)SAR
Microbiological activity (waste water treatment plant)	activated sludge	In compliance with Column 2 of Appendix X, no long-term toxicity study related to sediment organisms needs to be conducted since the assessment of chemical safety pursuant to Appendix I did not indicate any need for further examination of the substance effects	

Note: Significance of the LC₅₀, EL₅₀ and LL₅₀ abbreviations is included in Section 16.

12.2. Persistence and degradability

Since the product is a gas under normal pressure and temperature, the standard biodegradability tests are technically difficult to conduct and the results may not be relevant. Application of the (Q)SAR method resulted in a conclusion that the product is not easily biodegradable..

12.3. Bioaccumulation potential

Since the value of the partition coefficient n-octanol/water (log Kow) is smaller than 3 (1.09 – 2.8), no bioaccumulation of the product is expected.

12.4. Mobility in the soil

Because of the value of the partition coefficient n-octanol/water (log Kow < 3), no product sorption to a sediment or soil is expected.

12.5. PBT and vPvB assessment results

The substance is not PBT / vPvB.


12.6. Endocrine disrupting properties

The Substance is not included in the Candidate List under Article 59 (1) of the REACH due to endocrine disrupting properties.

12.7. Other negative impacts

Pursuant to Appendix 1 to Water Act No. 254/2001 Coll., the product is not considered hazardous and harmful substance.

It does not contain ozone-harming substances pursuant to the Montreal Protocol and its Copenhagen Amendment.

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SECTION 13. REMOVAL INSTRUCTIONS

13.1. Waste management methods

When product residues need to be removed (for example, unused or leaked product), the valid European Union legislature, national legislature and valid local regulations have to be observed. Hand the waste over for removal to an appropriately qualified person with the appropriate authorization.

Recommended waste classification pursuant Decision 2000/532 / EC on the list of wastes covered by Directive of the European Parliament and of the Council (Waste Catalogue)

13.1.1. Catalogue number

The gases that are supplied in pressure bottles can not be included among waste and thus cannot be assigned a catalogue number.

13.1.2. Recommended waste removal method

Incinerate the product residues designated for removal using a suitable burner and protection against reverse flare of the flame.

13.1.3. Contaminated packaging liquidation methods

Irrelevant. If not packaged, it is transported by road tankers.

13.1.4. Measures for limiting exposure when handling waste

Never discharge the unusable product residues to the environment. Doing so could create an explosive mixture with the air. Do not flash the liquidized product that leaked during an extraordinary event or accident to the sewerage system. Proceed in compliance with the instructions stated in Section 6 (“Accidental leak measures”) and in Subsection 8.2 (“Limiting exposure”) and comply with all valid legal regulations related to the protection of people, the air and water.

NOTE: the stated information applies to the delivered, still unused material. Should an already used material become waste, it is up to the waste originator to assign a code to it pursuant to the given field and usage process and to determine its liquidation method.

SECTION 14. TRANSPORT INFORMATION

14.1. UN number or ID-number

1965

14.2. Official (UN) transport name

GASEOUS HYDROCARBONS, MIXTURE, LIQUIDIZED, J.N (mixture A – butane).

14.3. Transport hazard class/classes

2

14.4. Packaging group

14.5. Environmental hazard


14.6. Special safety measures for the users

None.

14.7. Maritime bulk transport according to IMO instruments

Irrelevant. The product is transported in railway tankers or road tankers.



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14.8. Other information

Hazard number:	23
Classification code:	2F
Safety symbol:	2

SECTION 15. REGULATION INFORMATION

15.1. Regulations related to safety, health and the environment / specific legal regulations related to the given substance or mixture

15.1.1. European Union

EP and Council (EC) Directive No. 1907/2006 (REACH) as amended

REGISTRATION (HEAD II OF THE REACH DIRECTIVE):

the product has been fully registered as a substance

APPROVAL PROCESS (HEAD VII OF THE REACH DIRECTIVE)

the product is not listed on the list of substances included in Appendix XIV of Directive (EC) No. 1907/2006 REACH and the approval obligation thus does not apply to it

LIMITATIONS (HEAD VIII OF THE REACH DIRECTIVE):

the product must not be placed on the market for being sold to the public, with the exception of cosmetic products, medicines and fuels defined in more detail in record 28 of Appendix XVII of Directive (EC) No. 1907/2006 REACH

EP and Council (EC) Directive No. 1272/2008 (CLP), as amended

the product has been classified in compliance with the above stated directive; the obligations related to packaging and package marking of hazardous chemical substances apply to the product only if it is put on the market in packages that are subject to the marking obligation pursuant to Directive CLP

EP and Council (EC) Directive No. 649/2012 on exporting and importing hazardous chemical substances, as amended

the product is not subject to any special export or import limitations

Decision 2000/532 / EC on the list of wastes covered by Directive of the European Parliament and of the Council

15.1.2. Czech Republic

Act No. 350/2011 Coll. on chemical substances and chemical mixtures, as amended

the CHLAP system notification obligation does not apply to the product

Act No. 258/2000 Coll., on Protection of Public Health, as amended

the obligation to prepare corresponding Handling Rules apply to the product

Act No. 254/2001 Coll., on Waters, as amended

Act No. 201/2012 Coll., on Air Protection, as amended


Act No. 541/2020 Coll., on Waste, as amended

Government Directive No. 361/2007 Coll., which determines occupational health protection conditions, as amended

Act No. 224/2015 Coll., on prevention of serious accidents caused by selected dangerous chemicals or chemical mixtures, as amended

15.2. Chemical safety assessment

A chemical safety assessment was performed at substance registration. Substance meets the criteria for classification as dangerous according to Regulation (EC) No 1272/2008 CLP. The exposure assessment and the subsequent risk characterization step have been carried out.

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SECTION 16. OTHER INFORMATION


Changes made during the revision

Changes in this version of the safety data sheet are indicated by a black and red vertical line to the left of the text.

24.4.2023 In section 9, the term “ignition point” was replaced by the term “flash point”.

Abbreviated words and abbreviations used in the text

ADR	European Agreement Concerning the International Carriage of Dangerous Goods by Road
CAS	Registration number assigned by the “Chemical Abstracts Service“ of the ”American Chemical Society“
CLP	Directive (EC) No. 1272/2008 on Classification, Labelling and Packaging of Chemical Substances and Mixtures, implemented into the European legislature by GHS (United Nations’ Globally Harmonized System)
CMR	Carcinogenic, mutagenic or toxic for reproduction
ČSN EN (ISO)	European standard incorporated into the system of the Czech technical standards
CSR	Chemical Safety Report
DMEL	Exposure level that corresponds to a low and possibly theoretical risk, which should be considered an acceptable risk (for threshold-less effects, i.e. no exposure level without an effect exists)
DNEL	Exposure level derived from toxicological data, during which no negative impacts on the health of people occur
DW	Data waiving
EC ₅₀	Effect concentration that results in immobilization of 50% of individuals
ErC ₅₀	Effect concentration that results in a 50% reduction of the seaweed growth speed
ECHA	European Chemicals Agency
EL ₅₀	Effective loading speed that is necessary for a 50% immobilization
ES	Official number of the chemical substance in the European Union: EINECS from the European Inventory of Existing Commercial Substances, or ELINCS from the European List of Notified Chemical Substances, or NLP from the “No Longer Polymer“ list of substances
HSDB	Hazardous Substances Data Bank
IATA	International Air Transport Association
IBC	International regulation for the construction and equipment of boats that transport hazardous chemicals in bulk (“Intermediate Bulk Container”)
IC ₅₀	Inhibition concentration that results in inhibition of 50% of individuals
ICAO	International Civil Aviation Organization
ICE	“Intervention in Chemical Transport Emergencies” program
IMDG	International Maritime Dangerous Goods
IMO	International Maritime Organisation
ISO	International Organization for Standardization
LC ₅₀ /LD ₅₀	Lethal concentration/level that results in death of 50% of individuals
LL ₅₀	Introduction speed of the tested substance that results in a 50% mortality rate

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LOEC/LOEL	Lowest Observed Effect Concentration/Level
log Koc	Logarithm for the partition coefficient of carbon and water in soil
log Kow	Logarithm for the n-octanol/water partition coefficient
MARPOL	International convention on preventing pollution from boats
nf	Not feasible
NOAEC/NOAEL	Highest “no observed adverse effect concentration/level”
NOEC/NOEL	Highest “no observed effect concentration/level”
NPK-P	Highest acceptable chemical substance concentration in the air (substance concentration that employees can be exposed for a maximum of 15 minutes; nevertheless, this concentration must never be exceeded)
OECD	Organization for Economic Co-operation and Development
PPA	Personal protective aids
UN	United Nations
(Q)SAR	Theoretical mathematic model, using of which can be used for determining the given substance characteristics based on the chemical substance structure and activity (“Quantitative Structure-Activity Relationship”)
PBT, vPvB	Persistent, bioaccumulative and toxic, highly persistent and highly bioaccumulative
PEL	Acceptable exposure limit of a given chemical substance in the air (exposure value that employees can be exposed to during the entire shift time (8 hours) even all their lives without endangering their health)
PNEC	Estimated concentration, during which hazardous effects in the given environmental component do not occur
REACH	Directive (EC) No. 1907/2006 on the Registration, Evaluation and Authorisation of Chemicals
RID	Regulation Concerning the International Carriage of Dangerous Goods by Rail
SDS	Safety Data Sheet
STOT	Specific Target Organ Toxicity
SU	Scientifically Unjustified
TRINS	Transportation information and accident system
UACRON	Chemical database (The University of Akron).
UN number	Four-digit substance or item identification number adopted from the UN ample regulations
UVCB	Substances of Unknown or Variable composition, Complex reaction products or Biological materials

Data sources used for preparing safety data sheets

Appendixes I, IV, VI and VII to Directive (EC) No. 1272/2008 CLP, as amended


First aid principles upon exposure to chemical substances (doc. MUDr. Daniela Pelclová and col.)

Registration documentation of the substances pursuant to Directive (EC) No. 1907/2006 REACH

Decision of the European Agency for Chemical Substances ECHA No. SUB-D-2114160418-49-01/F on the registration pursuant to Directive (EC) No. 1907/2006 REACH

Training instructions

People who handle the product have to be acquainted with the related handling risks and with the requirements related to the protection of health and of the environment (see the corresponding stipulations of the Labor Code).

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Access to information

Pursuant to Article 35 of Directive (EC) No. 1907/2006 REACH, all employers have to allow access to the information stated on the safety data sheets to all employees who use the given product or who are exposed to its effects while working, as well as to representatives of these employees.

Limit worksite exposure values for the EU countries (see Point 8.1.1)

FCC butane data (CAS number 68476-40-4)

Name	Country	8-hour limit [mg.m ⁻³]	short-term limit [mg.m ⁻³]
FCC butane	European Union (Regulation 2000/39/ES)	no limit values for the given substances have been defined	
	Hungary		
	Germany		
	Poland		

8-hour limit: measured and calculated value in relation to an eight-hour reference period as a time-weighted average
 short-term limit: exposure limit value, which should not be exceeded and which corresponds to 15 minutes

Emergency phone numbers for the EU countries (see Section 1.4)

National centers (NON STOP)		TOXICOLOGY (first aid information)	ICE (SDS information)	
Belgium		☎+32/70245245	Belintra	☎+32/35699232
Bulgaria		☎+359/29154378		
Croatia		☎+385/12348342		
Czech Republic		☎+420/224-919293; 915402	TRINS	☎+420/47 6163111; 6163267
Denmark		☎+45/82121212	PIBF/RVK	☎+45/45906000
Estonia		☎+372/6269379		
Finland		☎+358/9471977		
France		☎+33/(0)140054848	Transaid	☎+33/298331010
Ireland		☎+353/18092566		

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National centers (NON STOP)		TOXICOLOGY (first aid information)	ICE (SDS information)	
Italy		+39/063054343	SET	+39/0362512868
Cyprus		+357/1401		
Lithuania		+370/52362052		
Latvia		+371/67042473		
Luxembourg		+32/70245245 (see Belgium)		
Hungary		+36/80201199	VERIK	+36/23552205
Malta		+356/21450000		
Germany		+49/3019240	TUIS	+49/6216043333
Holland		+31/302748888	TRC	+31/102468642
Poland		+48/226196654	SPOT	+48/243657032
Portugal		+351/808250143		
Austria		+43/14064343	TUIS	+49/6216043333
Greece		+30/2107793777		
Romania		+40/212106282		
Slovakia		+421/254774166	DINS	+421/317754112; 2771
Slovenia		+386/41635500		
Spain		+34/915620420	CERET	+34 915373 248; 238
Sweden		+46/(0)104566700	KEMIAKUTEN	+46/8337043; 170970
Great Britain		8448920111	Chemsafe	+44/123 5836002; 5753363


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Declaration: The safety data sheet has been prepared in compliance with Directive (EC) No. 1907/2006 REACH. It contains information that is necessary for ensuring occupational health and safety and protection of the environment. This information has been stated in good spirits, it corresponds to the current level of knowledge and experience and complies with our valid legal regulations. The stated information does not replace the corresponding qualitative specification and it cannot be considered a guarantee of suitability and usability of this product for a particular application. It is the responsibility of the product user to assess accuracy of the information for particular applications, during which the product characteristics can be influenced by various factors. The consumer is responsible for complying with the valid regional legal regulations.

APPENDIX TO THE SAFETY DATA SHEET

EXPOSURE SCENARIO PURSUANT TO ARTICLE 31 OF DIRECTIVE OF THE EUROPEAN PARLIAMENT AND COUNCIL (EC) NO. 1907/2006 (REACH)

The appendix includes exposure scenarios applied from Chapter 9 of the Chemical Safety Report submitted as a part of the kerosene registration process, which have been prepared for hydrocarbons C₃-C₄ production and its identified uses.

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9. EXPOSURE ASSESSMENT

For the effects on human health, a chemical safety assessment (HCHB) has been carried out by reference to the constituents on which the substance is labeled (as described in section 5.11 of this Chemical Safety Report). In the chemical safety assessment (CSA), where the phrase “Limit the substance content in the product to 5% (OC17) *” regularly appears, this applies to the upper limit of the key component identifying the product and does not apply to any restriction applied to a substance of the UVCB nature (unknown or variable composition, complex reaction products or biological materials) UVCB). As such, it is not intended to be communicated as part of the exposure scenario (SE) for the substance but is included in the HCHB for transparency purposes.

* - does not apply to consumer uses where the 1,3-butadiene content must always be less than 0.1% by weight.



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Table 1

Table of local exposure results and risk characterization PETRORISK	local output - production	local output - use as a semi-product	local output - formulation	local output - use as fuel	local output - use as fuel	local output - use as fuel	local output - production of polymers	local output - processing of polymers	local output - polymer processing
Section 9 - Exposure Scenarios	9.1	9.2	9.3	9.5	9.6	9.7	9.10	9.11	9.12
Annual amount used on site (T / y)	2.0E+05	1.5E+04	3.0E+04	5.0E+04	2.5E+01	2.5E+01	1.0E+04	1.0E+04	5.0E+00
Daily amount used on site (kg / d)	6.7E+05	5.0E+04	1.0E+05	1.7E+05	6.8E+01	6.8E+01	3.3E+04	3.3E+04	1.4E+01
Number of emission days (d / y)	300	300	300	300	365	365	3.0E+02	3.0E+02	3.7E+02
On-site removal efficiency - air (%)	90.0	80.0	0.0	95.0	0.0	0.0	80.0	80.0	0.0
Inhalation dose (µg / kg / d)	2.2E+02	1.7E+01	1.6E+02	2.7E+01	3.6E-01	3.6E-01	4.7E+00	3.3E+02	3.6E-01
DNEL: 19 µg / kg / d (by inhalation)	0.577	0.044	0.432	0.072	0.001	0.001	0.012	0.860	0.001
RCR by inhalation (adjusted to 5% content of 1,3-butadiene)									

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The following generic uses were evaluated in the exposure assessment of Other Petroleum Gases.

Identified use	Process category (PROC)	Product Category (PC)	Sector of Use (SU)	Article category (AC)	Environmental Release Category (ERC)
Manufacture	PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC15	NA	3, 8, 9	NA	1,4
Distribution	PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9, PROC15	NA	3, 8, 9	NA	1 7
Formulation	PROC1, PROC2, PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC9, PROC14, PROC15	NA	3, 10	NA	2
Blowing agents (Industrial)	PROC1, PROC2, PROC3, PROC8b, PROC9, PROC12	NA	3	NA	4
Use as a fuel (Industrial)	PROC1, PROC2, PROC3, PROC8a, PROC8b, PROC16	NA	3	NA	7
Use as a fuel (Professional)	PROC1, PROC2, PROC3, PROC8a, PROC8b, PROC16	NA	22	NA	9A, 9B
Use in functional fluids (Industrial)	PROC1, PROC2, PROC3, PROC4, PROC 8a, PROC 8b, PROC9	NA	3	NA	7
Use in functional fluids (Industrial)	NA	13	21	NA	NA
Use in functional fluids (Professional)	PROC1, PROC2, PROC3, PROC 8a, PROC9, PROC20	NA	22	NA	9A, 9B
Use in polymer production (Industrial)	PROC1, PROC2, PROC3, PROC4, PROC5, PROC6, PROC8a, PROC8b, PROC9, PROC14, PROC21	NA	3, 8, 9	NA	6A, 6C
Use in polymer processing	PROC1, PROC2, PROC3, PROC4, PROC5, PROC6,	NA	3, 10	NA	4

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Identified use	Process category (PROC)	Product Category (PC)	Sector of Use (SU)	Article category (AC)	Environmental Release Category (ERC)
(Industrial)	PROC8a, PROC8b, PROC9, PROC13, PROC14, PROC21				
Use in polymer processing (Professional)	PROC1, PROC2, PROC6, PROC8a, PROC8b, PROC14, PROC21	NA	22	NA	8A, 8D

A qualitative risk characterisation is required for the environmental assessment (See because this substance is not classified as "Dangerous for the environment". The purpose of the

Section 7) qualitative risk characterisation is to assess:

"...the likelihood that effects are avoided when implementing the exposure scenario..." (REACH


Annex 1, Section 6.5).

The general approach aims to reduce/avoid contact or incidents with the substance. However, implementation of risk management measures (RMMs) and operational conditions (OCs) needs to be proportional to the degree of concern for the environmental hazard presented by the substance.

Exposures should be controlled to at least the levels that represent an acceptable level of risk, i.e. implementation of the chosen RMMs will ensure that the likelihood of an event occurring due to the hazard of the substance is negligible, and the risk is considered to be controlled to a level of no concern.

The exposure of aquatic, terrestrial, sediment and sewage treatment microorganisms is considered to be negligible because the substance partitions primarily to air when emitted to the environment.

Emission of butadiene to the air compartment is regulated by the VOC directive and the carcinogen directive. The limits in place of both of these directives would also limit exposure to ecological receptors. Hence the risks are considered to be controlled for ecological receptors.

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9a Carcinogenicity (R45) and Mutagenicity (R46) Hazard Qualitative Risk Assessment

A qualitative risk characterisation is required for the human health assessment

"...the likelihood that effects are avoided when implementing the exposure scenario..."

(See Section 5). The purpose of the qualitative risk characterisation is to assess:

(REACH Annex 1, Section 6.5).

The general approach aims to reduce/avoid contact or incidents with the substance. However, implementation of risk management measures (RMMs) and operational conditions (OCs) needs to be proportional to the degree of concern for the health hazard presented by the substance. Exposures should be controlled to at least the levels that represent an acceptable level of risk, i.e. implementation of the chosen RMMs will ensure that the likelihood of an event occurring due to the hazard of the substance is negligible, and the risk is considered to be controlled to a level of no concern.

For carcinogenic and mutagenic hazards a qualitative risk assessment was conducted and handling and storage risk management measures that are generally identified to control potential risks are outlined in Appendix C. A review of these RMMs indicates that if the user complies with the following generic statement, risks due to carcinogenic and mutagenic hazards are considered to be controlled:

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- *Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance.*
- *Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely.*
- *Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider*
- *the need for risk based health surveillance. [G20]*

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9.1. Exposure scenario 1: Manufacture of petroleum gases streams in Other Petroleum Gases

9.1.1. Exposure scenario


Section 1	Exposure Scenario Title
Title	Manufacture of Other Petroleum Gases
Use Descriptor	Sector of Use: Industrial (SU3, SU8, SU9)
	Process Categories: PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC15
	Environmental Release Categories: ERC1, ERC4
Processes, tasks, activities covered	Manufacture of the Substance or use as an intermediate or process chemical or extraction agent. Includes recycling/ recovery, material transfers, storage, sampling, associated laboratory activities, maintenance and loading (including marine vessel/barge, road/rail car and bulk container).
Section 2	Operational conditions and risk management measures
<i>Field for additional statements to explain scenario if required.</i>	
Section 2.1	Control of worker exposure
Product characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa [OC5].
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) [G13].
Amounts used	<i>Not applicable</i>
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Human factors not influenced by risk management	<i>Not applicable</i>
Other Operational Conditions affecting worker exposure	Assumes use at not > 20°C above ambient [G15]; Assumes a maximum Butadiene content of 1% and a maximum Benzene content of 1%. Assumes a good basic standard of occupational hygiene is implemented [G1].

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Contributing Scenarios	Risk Management Measures <i>Note: list RMM standard phrases according to the control hierarchy indicated in the ECHA template: 1. Technical measures to prevent release, 2. Technical measures to prevent dispersion, 3. Organisational measures, 4. Personal protection. Phrases between brackets are good practice advice only, beyond REACH Chemical Safety Assessment and may be communicated in Section 5 of the ES or within the main sections of the SDS.</i>
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General measures (carcinogens) [G18].	<p>Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance.</p> <p>Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely.</p> <p>Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures.</p> <p>Consider the need for risk based health surveillance. [G20].</p>
General exposures (closed systems) [CS15].	Handle substance within a closed system [E47].
General exposures (closed systems) [CS15]. With sample collection [CS56]. With occasional controlled exposure [CS140].	Handle substance within a closed system [E47].
General exposures (closed systems) [CS15]. Use in contained batch processes [CS37].	Handle substance within a closed system [E47].
General exposures (open systems) [CS16]. Batch process [CS55]. With sample collection [CS56].	Handle substance within a predominantly closed system provided with extract ventilation [E49]. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11], OR [G9] Ensure activity is undertaken outdoor [69]. Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Process sampling [CS2].	Handle substance within a closed system [E47]. Use a sampling system designed to control exposure [E89]. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11], OR [G9] Ensure activity is undertaken outdoor [69].
Laboratory activities [CS36].	Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure [E12].
Bulk transfers [CS14]. (open systems) [CS108].	Handle substance within a closed system [E47]. Ensure material transfers are under containment or extract ventilation [E66].
Bulk transfers [CS14]. (closed systems) [CS107].	Ensure material transfers are under containment or extract ventilation [E66].


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Equipment cleaning and maintenance [CS39].	Drain down system prior to equipment break-in or maintenance [E65]. Provide extract ventilation to points where emissions occur [E54].
Storage [CS67]. With occasional controlled exposure [CS140].	Ensure material transfers are under containment or extract ventilation [E66]. Store substance within a closed system [E84].

Section 2.2	Control of environmental exposure
Substance is not classified environmental exposure assessment not required	
Section 3	Exposure Estimation
3.1. Health	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise

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	indicated. G21 <i>When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed, exposures are not expected to exceed the predicted DNELs and the resulting risk characterisation ratios are expected to be less than 1 as indicated in Appendix A.</i>
3.2. Environment	Qualitative approach used to conclude safe use.[EE8]
Section 4	Guidance to check compliance with the Exposure Scenario
4.1. Health	<i>Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and OC.</i>
4.2. Environment	No additional risk management measures required.[DSU7]
Section 5	Additional good practice advice beyond the REACH Chemical Safety Assessment - (Section Optional)
Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH.	
Control of Worker Exposure	
<i>Selection of relevant Contributing Scenario phrases</i>	<i>Good practice RMM phrases may be incorporated in this section or consolidated into the main sections of the SDS, depending on the preference of the Registrant and functionality of the available e-SDS system.</i>
Control of environmental exposure	

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	Not applicable
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9.1.2. Exposure estimation

9.1.2.1. Workers exposure

The worker exposure estimates for the activities associated with the manufacturing of petroleum gases streams in Other Petroleum Gases were assessed using ECETOC TRAv2 (See Appendix A). Appendix A contains Tables 1 and 2 used to model the worker exposures. These tables contain all the operating conditions, and the efficiencies of the exposure modifiers including RPE, PPE and LEV. A separate table (also in Appendix A) contains the associated RMMs.



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9.1.2.2. Consumer exposure

Not applicable.


9.1.2.3. Indirect exposure of humans via the environment (oral)

See Table 1

9.1.2.4. Environmental exposure

Not applicable


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9.2. Exposure scenario 2: Distribution of Other Petroleum Gases

9.2.1. Exposure scenario


Section 1	Exposure Scenario Title
Title	Distribution of Other Petroleum Gases
Use Descriptor	Sector of Use: Industrial (SU3, SU8, SU9)
	Process Categories: PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9, PROC15
	Environmental Release Categories: ERC1 - 7
Processes, tasks, activities covered	Loading (including marine vessel/barge, rail/road car and IBC loading) and repacking (including drums and small packs) of substance, including its distribution and associated laboratory activities
Section 2	Operational conditions and risk management measures
<i>Field for additional statements to explain scenario if required.</i>	
Section 2.1	Control of worker exposure
Product characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa [OC5].
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) [G13].
Amounts used	<i>Not applicable</i>
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Human factors not influenced by risk management	<i>Not applicable</i>
Other Operational Conditions affecting worker exposure	Assumes use at not > 20°C above ambient [G15]; Assumes Butadiene content 1% and Benzene content 1% Assumes a good basic standard of occupational hygiene is implemented [G1].

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Contributing Scenarios	Risk Management Measures <i>Note: list RMM standard phrases according to the control hierarchy indicated in the ECHA template: 1. Technical measures to prevent release, 2. Technical measures to prevent dispersion, 3. Organisational measures, 4. Personal protection. Phrases between brackets are good practice advice only, beyond REACH Chemical Safety Assessment and may be communicated in Section 5 of the ES or within the main sections of the SDS.</i>
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General measures (carcinogens) [G18]	<p>Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance.</p> <p>Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely.</p> <p>Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures.</p> <p>Consider the need for risk based health surveillance. [G20].</p>
General exposures (closed systems) [CS15].	Handle substance within a closed system [E47].
General exposures (closed systems) [CS15]. With sample collection [CS56]. With occasional controlled exposure [CS140].	Handle substance within a closed system [E47]. Sample via a closed loop or other system to avoid exposure [E8]
General exposures (closed systems) [CS15]. Use in contained batch processes [CS37].	Handle substance within a closed system [E47]. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Ensure material transfers are under containment or extract ventilation [E66].
General exposures (open systems) [CS16]. Batch process [CS55]. With sample collection [CS56].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Sample via a closed loop or other system to avoid exposure [E8]
Process sampling [CS2].	Sample via a closed loop or other system to avoid exposure [E8].
Laboratory activities [CS36].	Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure [E12].
Bulk transfers [CS14]. (closed systems) [CS107].	Handle substance within a closed system [E47]. Ensure material transfers are under containment or extract ventilation [E66].
Drum and small package filling [CS6].	Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40]. Ensure material transfers are under containment or extract ventilation [E66].


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Equipment cleaning and maintenance [CS39].	Drain down and flush system prior to equipment break-in or maintenance [E55]. Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].
Storage [CS67]. With occasional controlled exposure [CS140].	Store substance within a closed system [E84]. Ensure operation is undertaken outdoors [E69].

Section 2.2	Control of environmental exposure
Substance is not classified environmental exposure assessment not required	
Section 3	Exposure Estimation

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3.1. Health	<p>The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21</p> <p><i>When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed, exposures are not expected to exceed the predicted DNELs and the resulting risk characterisation ratios are expected to be less than 1 as indicated in Appendix A.</i></p>
3.2. Environment	Qualitative approach used to conclude safe use.[EE8]
Section 4	Guidance to check compliance with the Exposure Scenario
4.1. Health	<i>Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and OC.</i>
4.2. Environment	No additional risk management measures required.[DSU7]
Section 5	Additional good practice advice beyond the REACH Chemical Safety Assessment - (Section Optional)
Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH.	
Control of Worker Exposure	
<i>Selection of relevant Contributing Scenario phrases</i>	<i>Good practice RMM phrases may be incorporated in this section or consolidated into the main sections of the SDS, depending on the preference of the Registrant and functionality of the available e-SDS system.</i>
Control of environmental exposure	

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	Not applicable
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9.2.2. Exposure estimation

9.2.2.1. Workers exposure

The worker exposure estimates for the activities associated with the distribution of petroleum gases streams in Other Petroleum Gases were assessed using ECETOC TRAv2 (See Appendix A). Appendix A contains Tables 1 and 2 used to model the worker exposures. These tables contain all the operating conditions, and the efficiencies of the exposure modifiers including RPE, PPE and LEV. A separate table (also in Appendix A) contains the associated RMMs.



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9.2.2.2. Consumer exposure


Not applicable.

9.2.2.3. Indirect exposure of humans via the environment (oral)

See Table 1.

9.2.2.4. Environmental exposure

Not applicable.

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9.3. Exposure scenario 3: Formulation of Other Petroleum Gases

9.3.1. Exposure scenario

Section 1	Exposure Scenario Title
Title	Formulation & (re)packaging of substances and mixtures of Other Petroleum Gases
Use Descriptor	Sector of Use: Industrial (SU3, SU10)
	Process Categories: PROC1, PROC2, PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC9, PROC14, PROC15
	Environmental Release Categories: ERC2
Processes, tasks, activities covered	Formulation, packing and re-packing of the substance and its mixtures in batch or continuous operations, including storage, materials transfers, mixing, large and small scale packing, maintenance and associated laboratory activities
Section 2	Operational conditions and risk management measures
Section 2.1	Control of worker exposure
Product characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa [OC5].
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) [G13].
Amounts used	<i>Not applicable</i>
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Human factors not influenced by risk management	<i>Not applicable</i>
Other Operational Conditions affecting worker exposure	Assumes use at not > 20°C above ambient [G15]; Assumes butadiene content 1% and benzene content 1% Assumes a good basic standard of occupational hygiene is implemented [G1].



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Contributing Scenarios

Risk Management Measures

Phrases between brackets are good practice advice only, beyond REACH Chemical Safety Assessment and may be communicated in Section 5 of the ES or within the main sections of the SDS.



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General measures (carcinogens) [G18]	Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].
General exposures (closed systems) [CS15].	Handle substance within a closed system [E47].
General exposures (closed systems) [CS15]. With sample collection [CS56]. With occasional controlled exposure [CS140].	Handle substance within a closed system [E47]. Sample via a closed loop or other system to avoid exposure [E8]
General exposures (closed systems) [CS15]. Use in contained batch processes [CS37].	Handle substance within a closed system [E47]. Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings [E60].
General exposures (open systems) [CS16]. Batch process [CS55]. With sample collection	Sample via a closed loop or other system to avoid exposure [E8]
Process sampling [CS2].	Sample via a closed loop or other system to avoid exposure [E8].
Laboratory activities [CS36].	Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure [E12].
Bulk transfers [CS14].	Ensure material transfers are under containment or extract ventilation [E66].
Mixing operations (open systems) [CS30].	Provide extract ventilation to points where emissions occur [E54]. Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].



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Drum and small package filling [CS6].	Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings [E60]. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11].
Equipment cleaning and maintenance [CS39].	Drain down and flush system prior to equipment break-in or maintenance [E55]. Clear spills immediately [C&H13]. Wear a respirator conforming to EN140 with Type A filter or better [PPE22]. Retain drain downs in sealed storage pending disposal or for subsequent recycle [ENVT4].
Storage [CS67]. With occasional controlled exposure [CS140].	Ensure material transfers are under containment or extract ventilation [E66]. Store substance within a closed system [E84].


Section 2.2

Control of environmental exposure


Substance is not classified – environmental exposure assessment not required

Section 3

Exposure Estimation

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3.1. Health	<p>The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21</p> <p><i>When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed, exposures are not expected to exceed the predicted DNELs and the resulting risk characterisation ratios are expected to be less than 1 as indicated in Appendix A.</i></p>
3.2. Environment	Qualitative approach used to conclude safe use.[EE8]
Section 4	Guidance to check compliance with the Exposure Scenario
4.1. Health	<i>Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and OC.</i>
4.2. Environment	No additional risk management measures required.[DSU7]
Section 5	Additional good practice advice beyond the REACH Chemical Safety Assessment - (Section Optional)
Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH.	
Control of Worker Exposure	
<i>Selection of relevant Contributing Scenario phrases</i>	<i>Good practice RMM phrases may be incorporated in this section or consolidated into the main sections of the SDS, depending on the preference of the Registrant and functionality of the available e-SDS system.</i>
Control of environmental exposure	
	Not applicable

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9.3.2. Exposure estimation

9.3.2.1. Workers exposure

The worker exposure estimates for the activities associated with the use in of streams in Other Petroleum Gases in formulation were assessed using ECETOC TRAv2.

9.3.2.2. Consumer exposure


Not applicable.

9.3.2.3. Indirect exposure of humans via the environment (oral)

See Table 1.

9.3.2.4. Environmental exposure

Not applicable.

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9.5. Exposure scenario 5: Use of Other Petroleum Gases in fuels - Industrial

9.5.1. Exposure scenario

Section 1	Exposure Scenario Title
Title	Use in Fuels of Other Petroleum Gases
Use Descriptor	Sector of Use: Industrial (SU3)
	Process Categories: PROC1, PROC2, PROC3, PROC8a, PROC8b, PROC16
	Environmental Release Categories: ERC7
Processes, tasks, activities covered	Covers the use as a fuel (or fuel additive) and includes activities associated with its transfer, use, equipment maintenance and handling of waste.
Section 2	Operational conditions and risk management measures
Section 2.1	Control of worker exposure
Product characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa [OC5].
Concentration of substance in product	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Amounts used	<i>Not applicable</i>
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Human factors not influenced by risk management	<i>Not applicable</i>
Other Operational Conditions affecting worker exposure	Assumes use at not > 20°C above ambient [G15]; Assumes Butadiene content 1% and Benzene content 1% Assumes a good basic standard of occupational hygiene is implemented [G1].
Contributing Scenarios	Risk Management Measures
	<i>Phrases between brackets are good practice advice only, beyond REACH Chemical Safety Assessment and may be communicated in Section 5 of the ES or within the main sections of the SDS.</i>



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<p>General measures (carcinogens) [G18].</p>	<p>Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. [G20].</p>
<p>Bulk transfers [CS14].</p>	<p>Provide a good of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Ensure material transfers are under containment or extract ventilation [E66].</p>
<p>Drum/batch transfers [CS8].</p>	<p>Ensure material transfers are under containment or extract ventilation [E66]. {Wear suitable gloves tested to EN374 [PPE15]}.</p>
<p>General exposures (closed systems) [CS15].</p>	<p>Handle substance within a closed system [E47].{Wear suitable gloves tested to EN374 [PPE15]}.</p>
<p>General exposures (closed systems) [CS15]. With occasional controlled exposure [CS140].</p>	<p>Handle substance within a predominantly closed system provided with extract ventilation [E49].</p>
<p>General exposures (closed systems) [CS15]. Batch process [CS55].</p>	<p>Handle substance within a predominantly closed system provided with extract ventilation [E49]. Provide a good of general ventilation (not less than 3 to 5 air changes per hour) [E11].</p>
<p>General exposures (open systems) [CS16].</p>	<p>Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].</p>



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General exposures (open systems) [CS16]. (closed systems) [CS107]. Batch process [CS55].	Handle substance within a predominantly closed system provided with extract ventilation [E49]. Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].
Equipment maintenance [CS5].	Drain down and flush system prior to equipment break-in or maintenance [E55]. Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].
Vessel and container cleaning [CS103].	Drain down and flush system prior to equipment break-in or maintenance [E55]. Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40]. Only allow access to authorised persons [AP1] Apply vessel entry procedures including use of forced supplied air. [AP15]
Storage [CS67].	Store substance within a closed system [E84].
Storage [CS67]. With occasional controlled exposure [CS140].	Provide extract ventilation to points where emissions occur [E54]. Store substance within a closed system [E84].


Section 2.2

Control of environmental exposure

Substance is not classified – environmental exposure assessment not required

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Section 3	Exposure Estimation
3.1. Health	<p>The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21</p> <p><i>When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed, exposures are not expected to exceed the predicted DNELs and the resulting risk characterisation ratios are expected to be less than 1 as indicated in Appendix A.</i></p>
3.2. Environment	Qualitative approach used to conclude safe use.[EE8]
Section 4	Guidance to check compliance with the Exposure Scenario
4.1. Health	<i>Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and OC.</i>
4.2. Environment	No additional risk management measures required.[DSU7]
Section 5	Additional good practice advice beyond the REACH Chemical Safety Assessment - (Section Optional)
Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH.	
Control of Worker Exposure	
<i>Selection of relevant Contributing Scenario phrases</i>	<i>Good practice RMM phrases may be incorporated in this section or consolidated into the main sections of the SDS, depending on the preference of the Registrant and functionality of the available e-SDS system.</i>

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Control of environmental exposure	
	Not applicable

9.5.2. Exposure estimation

9.5.2.1. Workers exposure

The worker exposure estimates for the activities associated with the industrial use of petroleum gases streams in Other Petroleum Gases in fuels were assessed using ECETOC TRAv2.

9.5.2.2. Consumer exposure


See exposure scenario 9.7 for consumer exposure, use as a fuel

9.5.2.3. Indirect exposure of humans via the environment (oral)

See Table 1.

9.5.2.4. Environmental exposure

Not applicable

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9.6. Exposure scenario 6: Use of Other Petroleum Gases in fuels – Professional

9.6.1. Exposure scenario

Section 1	Exposure Scenario Title
Title	Use in Fuels of Other Petroleum Gases
Use Descriptor	Sector of Use: Professional (SU22)
	Process Categories: PROC1, PROC2, PROC3, PROC8a, PROC8b, PROC16
	Environmental Release Categories: ERC 9A, ERC 9B
Processes, tasks, activities covered	Covers the use as a fuel (or fuel additive) and includes activities associated with its transfer, use, equipment maintenance and handling of waste.
Section 2	Operational conditions and risk management measures
Section 2.1	Control of worker exposure
Product characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa [OC5].
Concentration of substance in product	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Amounts used	<i>Not applicable</i>
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Human factors not influenced by risk management	<i>Not applicable</i>
Other Operational Conditions affecting worker exposure	Assumes use at not > 20°C above ambient [G15]; Assumes Butadiene content 1% and Benzene content 1% Assumes a good basic standard of occupational hygiene is implemented [G1].



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Contributing Scenarios

Risk Management Measures

Phrases between brackets are good practice advice only, beyond REACH Chemical Safety Assessment and may be communicated in Section 5 of the ES or within the main sections of the SDS.



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General measures (carcinogens) [G18]	<p>Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance.</p> <p>Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely.</p> <p>Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures.</p> <p>Consider the need for risk based health surveillance. [G20].</p>
Bulk transfers [CS14].	Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40]. Ensure material transfers are under containment or extract ventilation [E66]. Avoid carrying out activities involving exposure for more than 4 hours [OC28].
Drum/batch transfers [CS8].	Ensure material transfers are under containment or extract ventilation [E66]. Ensure operation is undertaken outdoors [E69]; or [G9]; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Avoid carrying out operation involving exposure for more than 15 minutes [OC26].
General exposures (closed systems) [CS15].	Handle substance within a closed system [E47].
General exposures (closed systems) [CS15]. With occasional controlled exposure [CS140].	Ensure material transfers are under containment or extract ventilation [E66]. Ensure operation is undertaken outdoors [E69]; or [G9]; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11].
General exposures (open systems) [CS16]. (closed systems) [CS107]. Batch process [CS55].	Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40]. Ensure material transfers are under containment or extract ventilation [E66].



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General exposures (open systems) [CS16].	Ensure operation is undertaken outdoors [E69]; or [G9]; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11].
Equipment cleaning and maintenance [CS39].	Drain down and flush system prior to equipment break-in or maintenance [E55]. Ensure material transfers are under containment or extract ventilation [E66]. Ensure operation is undertaken outdoors [E69]; or [G9]; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Wear a respirator conforming to EN140 with Type A filter or better [PPE22].
Vessel and container cleaning [CS103]	Drain down and flush system prior to equipment break-in or maintenance [E55]. Ensure material transfers are under containment or extract ventilation [E66]. Ensure operation is undertaken outdoors [E69]; or [G9]; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Wear a respirator conforming to EN140 with Type A filter or better [PPE22].
Storage [CS67].	Store substance within a closed system [E84].

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Section 2.2	Control of environmental exposure
Substance is not classified – environmental exposure assessment not required	
Section 3	Exposure Estimation
3.1. Health	<p>The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21</p> <p><i>When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed, exposures are not expected to exceed the predicted DNELs and the resulting risk characterisation ratios are expected to be less than 1 as indicated in Appendix A.</i></p>
3.2. Environment	Qualitative approach used to conclude safe use.[EE8]
Section 4	Guidance to check compliance with the Exposure Scenario
4.1. Health	<i>Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and OC.</i>
4.2. Environment	No additional risk management measures required.[DSU7]
Section 5	Additional good practice advice beyond the REACH Chemical Safety Assessment - (Section Optional)
Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH.	
Control of Worker Exposure	

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<i>Selection of relevant Contributing Scenario phrases</i>	<i>Good practice RMM phrases may be incorporated in this section or consolidated into the main sections of the SDS, depending on the preference of the Registrant and functionality of the available e-SDS system.</i>
Control of environmental exposure	Not applicable

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9.6.2. Exposure estimation

9.6.2.1. Workers exposure

The worker exposure estimates for the activities associated with the professional use of petroleum streams in Other Petroleum Gases in fuels were assessed using ECETOC TRAv2. See

9.6.2.2. Consumer exposure


See exposure scenario 9.7 for consumer use as a fuel

9.6.2.3. Indirect exposure of humans via the environment (oral)

See Table 1

9.6.2.4. Environmental exposure


Not applicable

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9.7. Exposure scenario 7: Use of Other Petroleum Gases in fuels – Consumer

9.7.1. Exposure scenario


Section 1		Exposure Scenario Title
Title		Fuels
Sector of Use (SU code)		21
Use Descriptor (PC codes)		PC13
Processes, tasks, activities covered		Covers consumer uses in liquid fuels
Environmental Release Category		
Specific Environmental Release Category		
Section 2		Operational conditions and risk management measures
Section 2.1		Control of consumer exposure
Product characteristics		
Physical form of product		liquid
Vapour pressure		255000
Concentration of substance in product		Unless otherwise stated, cover concentrations up to 5% [ConsOC1]
Amounts used		Unless otherwise stated, covers use amounts up to 45000g [ConsOC2]; covers skin contact area up to 0cm ² [ConsOC5]

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Frequency and duration of use/exposure		Unless otherwise stated, covers use frequency up to 0.143 times per day [ConsOC4]; covers exposure up to 0.05 hours per event [ConsOC14]
Other Operational Conditions affecting exposure		Unless otherwise stated assumes use at ambient temperatures [ConsOC15]; assumes use in a 20 m3 room [ConsOC11]; assumes use with typical ventilation [ConsOC8].
Section 2.1.1		Product categories
PC13:Fuels--Liquid - subcategories added: Automotive Refuelling	OC	Unless otherwise stated, covers concentrations up to 5% [ConsOC1]; covers use up to 52 days/year[ConsOC3]; covers use up to 1 time/on day of use[ConsOC4]; for each use event, covers use amounts up to 45000g [ConsOC2]; covers outdoor use [ConsOC12]; covers use in room size of 100m3[ConsOC11]; for each use event, covers exposure up to
		0.05hr/event[ConsOC14];
	RMM	No specific RMMs developed beyond those OCs stated

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PC13:Fuels--Domestic use of LPG cylinders uses in heating and cooking	OC	Unless otherwise stated, covers concentrations up to 5% [ConsOC1]; covers use up to 26 days/year[ConsOC3]; covers use up to 1 time/on day of use[ConsOC4]; for each use event, covers use amounts up to 13000g [ConsOC2]; covers use in room size of 20m3[ConsOC11]; for each use event, covers exposure up to 0.03hr/event[ConsOC14];
	RMM	No specific RMMs developed beyond those OCs stated
Section 2.2		Control of environmental exposure
Substance is not classified – environmental exposure assessment not required		
Section 3		Exposure Estimation
3.1. Health		<p>The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21</p> <p><i>When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed, exposures are not expected to exceed the predicted DNELs and the resulting risk characterisation ratios are expected to be less than 1 as indicated in Appendix A.</i></p>
3.2. Environment		Qualitative approach used to conclude safe use.[EE8]
Section 4		Guidance to check compliance with the Exposure Scenario
4.1. Health		<i>Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and OC.</i>
4.2. Environment		No additional risk management measures required.[DSU7]

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Section 5	Additional good practice advice beyond the REACH Chemical Safety Assessment - (Section Optional)
Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH.	

Control of Worker Exposure	
<i>Selection of relevant Contributing Scenario phrases</i>	<i>Good practice RMM phrases may be incorporated in this section or consolidated into the main sections of the SDS, depending on the preference of the Registrant and functionality of the available e-SDS system.</i>
Control of environmental exposure	
	Not applicable

9.7.2. Exposure estimation

9.7.2.1. Workers exposure


Not applicable.

9.7.2.3. Indirect exposure of humans via the environment (oral)

See Table 1.

9.7.2.3. Environmental exposure


Not applicable

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9.10. Exposure scenario 10: Use of Other Petroleum Gases in polymer production Industrial


9.10.1. Exposure scenario

Section 1	Exposure Scenario Title
Title	Use in polymer production of Other Petroleum Gases
Use Descriptor	Sector of Use: Industrial (SU3, SU8, SU9)
	Process Categories: PROC1, PROC2, PROC3, PROC4, PROC5, PROC6, PROC8a, PROC8b, PROC9, PROC14, PROC21
	Environmental Release Categories: ERC6A, ERC6C
Processes, tasks, activities covered	Manufacture of polymers from monomers in continuous and batch processes, include sparging, discharging, and reactor maintenance and immediate polymer product formation (i.e. compounding, pelletisation, product off-gassing).
Section 2	Operational conditions and risk management measures
<i>Field for additional statements to explain scenario if required.</i>	
Section 2.1	Control of worker exposure
Product characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa [OC5].
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) [G13].
Amounts used	<i>Not applicable</i>
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Human factors not influenced by risk management	<i>Not applicable</i>
Other Operational Conditions affecting worker exposure	Assumes use at not > 20°C above ambient [G15]; Assumes Butadiene content 1% and Benzene content 1% Assumes a good basic standard of occupational hygiene is implemented [G1].
Contributing Scenarios	Risk Management Measures <i>Note: list RMM standard phrases according to the control hierarchy indicated in the ECHA template: 1. Technical measures to prevent release, 2. Technical measures to prevent dispersion, 3. Organisational measures, 4. Personal protection. Phrases between brackets are good practice advice only, beyond REACH Chemical Safety Assessment and may be communicated in Section 5 of the ES or within the main sections of the SDS.</i>


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General measures (carcinogens) [G18]	<p>Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance.</p> <p>Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely.</p> <p>Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures.</p> <p>Consider the need for risk based health surveillance [G20].</p>
General exposures (closed systems) [CS15]. Continuous process [CS54]. No sampling [CS57].	Handle substance within a closed system [E47]. No specific measures identified [E118].
Bulk transfers [CS14]. With sample collection [CS56].	Ensure material transfers are under containment or extract ventilation [E66]. Provide a good standard of general or controlled ventilation (not less than 3 to 5 air changes per hour) [E11].
Equipment maintenance [CS5].	Drain down system prior to equipment break-in or maintenance [E65]. Clear spills immediately [C&H13]. Wear a respirator conforming to EN140 with Type A filter or better [PPE22]. Retain drain downs in sealed storage pending disposal or for subsequent recycle [ENVT4].
Storage [CS67]. With occasional controlled exposure [CS140].	Provide a good standard of general or controlled ventilation (not less than 3 to 5 air changes per hour) [E11]. Store substance within a closed system [E84]. Avoid carrying out activities involving exposure for more than 1 hour [OC 27].

Section 2.2	Control of environmental exposure
Substance is not classified environmental exposure assessment not required	
Section 3	Exposure Estimation

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3.1. Health	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21 <i>When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed, exposures are not expected to exceed the predicted DNELs and the resulting risk characterisation ratios are expected to be less than 1 as indicated in Appendix A.</i>
3.2. Environment	Qualitative approach used to conclude safe use.[EE8]
Section 4	Guidance to check compliance with the Exposure Scenario
4.1. Health	<i>Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and OC.</i>


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4.2. Environment	No additional risk management measures required.[DSU7]
Section 5	Additional good practice advice beyond the REACH Chemical Safety Assessment - (Section Optional)
Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH.	
Control of Worker Exposure	
<i>Selection of relevant Contributing Scenario phrases</i>	<i>Good practice RMM phrases may be incorporated in this section or consolidated into the main sections of the SDS, depending on the preference of the Registrant and functionality of the available e-SDS system.</i>
Control of environmental exposure	
	Not applicable

9.10.2. Exposure estimation

9.10.2.1. Workers exposure

The worker exposure estimates for the activities associated with the industrial use of petroleum gases streams in Other Petroleum Gases in polymer production were assessed using ECETOC TRAv2. See Appendix A). Appendix A contains Tables 1 and 2, used

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to model the worker exposures. These tables contain all the operating conditions, and the efficiencies of the exposure modifiers including RPE, PPE and LEV. A separate table (also in Appendix A) contains the associated RMMs.

9.10.2.2. Consumer exposure

Not applicable.

9.10.2.3. Indirect exposure of humans via the environment (oral)

See Table 1.



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9.10.2.4. Environmental exposure


Not applicable

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9.11. Exposure scenario 11: Use of Other Petroleum Gases in polymer processing Industrial

9.11.1. Exposure scenario

Section 1	Exposure Scenario Title
Title	Use in polymer processing of Other Petroleum Gases
Use Descriptor	Sector of Use: Industrial (SU3, SU10)
	Process Categories: PROC1, PROC2, PROC3, PROC4, PROC5, PROC6, PROC8a, PROC8b, PROC9, PROC13, PROC14, PROC21
	Environmental Release Categories: ERC 4
Processes, tasks, activities covered	Processing of formulated polymers including material transfers, additives handling (e.g. pigments, stabilisers, fillers, plasticisers, etc.), moulding, curing and forming activities, material re-works, storage and associated maintenance.
Section 2	Operational conditions and risk management measures
<i>Field for additional statements to explain scenario if required.</i>	
Section 2.1	Control of worker exposure
Product characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa [OC5].
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) [G13].
Amounts used	<i>Not applicable</i>
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Human factors not influenced by risk management	<i>Not applicable</i>
Other Operational Conditions affecting worker exposure	Assumes use at not > 20°C above ambient [G15]; Assumes Butadiene content 1% and Benzene content 1% Assumes a good basic standard of occupational hygiene is implemented [G1].

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Contributing Scenarios	Risk Management Measures <i>Note: list RMM standard phrases according to the control hierarchy indicated in the ECHA template: 1. Technical measures to prevent release, 2. Technical measures to prevent dispersion, 3. Organisational measures, 4. Personal protection. Phrases between brackets are good practice advice only, beyond REACH Chemical Safety Assessment and may be communicated in Section 5 of the ES or within the main sections of the SDS.</i>
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General measures (carcinogens) [G18]	<p>Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance.</p> <p>Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely.</p> <p>Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures.</p> <p>Consider the need for risk based health surveillance [G20].</p>
Bulk transfers [CS14]. (closed systems) [CS107].	Handle substance within a closed system [E47].
Bulk transfers [CS14]. (closed systems) [CS107]. With occasional controlled exposure [CS140].	Handle substance within a closed system [E47]. Ensure material transfers are under containment or extract ventilation [E66].
Bulk transfers [CS14]. Dedicated facility [CS81].	Ensure material transfers are under containment or extract ventilation [E66].
Bulk transfers [CS14]. Drum/batch transfers [CS8].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Ensure material transfers are under containment or extract ventilation [E66].
Bulk transfers [CS14]. Small package filling [CS7].	Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40]. Ensure material transfers are under containment or extract ventilation [E66].
Equipment maintenance [CS5].	Drain down and flush system prior to equipment break-in or maintenance [E55]. Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].
Storage [CS67]. With occasional controlled exposure [CS140].	Handle substance within a closed system [E47]. Provide extract ventilation to points where emissions occur [E54]. Store substance within a closed system [E84].

Section 2.2	Control of environmental exposure
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Substance is not classified environmental exposure assessment not required
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Section 3	Exposure Estimation
3.1. Health	<p>The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21</p> <p><i>When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed, exposures are not expected to exceed the predicted DNELs and the resulting risk characterisation ratios are expected to be less than 1 as indicated in Appendix A.</i></p>
3.2. Environment	Qualitative approach used to conclude safe use.[EE8]


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Section 4	Guidance to check compliance with the Exposure Scenario
4.1. Health	<i>Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and OC.</i>
4.2. Environment	No additional risk management measures required.[DSU7]
Section 5	Additional good practice advice beyond the REACH Chemical Safety Assessment - (Section Optional)
Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH.	
Control of Worker Exposure	
<i>Selection of relevant Contributing Scenario phrases</i>	<i>Good practice RMM phrases may be incorporated in this section or consolidated into the main sections of the SDS, depending on the preference of the Registrant and functionality of the available e-SDS system.</i>
Control of environmental exposure	
	Not applicable

9.11.2. Exposure estimation

9.11.2.1. Workers exposure

The worker exposure estimates for the activities associated with the industrial use of petroleum gases streams in Other Petroleum

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Gases in polymer processing were assessed using ECETOC TRAv2. See Appendix A). Appendix A contains Tables 1 and 2, used to model the worker exposures. These tables contain all the operating conditions, and the efficiencies of the exposure modifiers including RPE, PPE and LEV. A separate table (also in Appendix A) contains the associated RMMs.

9.11.2.2. Consumer exposure

Not applicable.

9.11.2.3. Indirect exposure of humans via the environment (oral)



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See Table 1.

9.11.2.4. Environmental exposure


Not applicable

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9.12. Exposure scenario 12: Use of Other Petroleum Gases in polymer processing Professional

9.12.1. Exposure scenario

Section 1	Exposure Scenario Title
Title	Use in polymer processing of Other Petroleum Gases
Use Descriptor	Sector of Use: Professional (SU22)
	Process Categories: PROC1, PROC2, PROC6, PROC8a, PROC8b, PROC14, PROC21
	Environmental Release Categories: ERC 8A, ERC 8D
Processes, tasks, activities covered	Processing of formulated polymers including material transfers, moulding and forming activities, material re-works and associated maintenance.
Section 2	Operational conditions and risk management measures
<i>Field for additional statements to explain scenario if required.</i>	
Section 2.1	Control of worker exposure
Product characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa [OC5].
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) [G13].
Amounts used	<i>Not applicable</i>
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Human factors not influenced by risk management	<i>Not applicable</i>
Other Operational Conditions affecting worker exposure	Assumes use at not > 20°C above ambient [G15]; Assumes Butadiene content 1% and Benzene content 1% Assumes a good basic standard of occupational hygiene is implemented [G1].


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Contributing Scenarios	Risk Management Measures <i>Note: list RMM standard phrases according to the control hierarchy indicated in the ECHA template: 1. Technical measures to prevent release, 2. Technical measures to prevent dispersion, 3. Organisational measures, 4. Personal protection. Phrases between brackets are good practice advice only, beyond REACH Chemical Safety Assessment and may be communicated in Section 5 of the ES or within the main sections of the SDS.</i>
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General measures (carcinogens) [G18]	<p>Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance.</p> <p>Where there is potential for exposure: Restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely.</p> <p>Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures.</p> <p>Consider the need for risk based health surveillance. [G20].</p>
Bulk transfers [CS14]. (closed systems) [CS107].	Handle substance within a closed system [E47].
Bulk transfers [CS14]. (closed systems) [CS107]. With occasional controlled exposure [CS140].	Handle substance within a closed system [E47]. Provide extract ventilation to points where emissions occur [E54]. Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].
Material transfers [CS3].	Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40]. Ensure material transfers are under containment or extract ventilation [E66]. Avoid carrying out operation for more than 4 hours [OC12].
Equipment maintenance [CS5]. -	Drain down system prior to equipment break-in or maintenance [E65]. Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40]. Wear a respirator conforming to EN140 with Type A filter or better [PPE22].
Storage [CS67].	Store substance within a closed system [E84].
Storage [CS67]. With occasional controlled exposure [CS140].	Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40]. Provide extract ventilation to points where emissions occur [E54]. Store substance within a closed system [E84].

Section 2.2	Control of environmental exposure
Substance is not classified environmental exposure assessment not required	
Section 3	Exposure Estimation


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3.1. Health	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21 <i>When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed, exposures are not expected to exceed the predicted DNELs and the resulting risk characterisation ratios are expected to be less than 1 as indicated in Appendix A.</i>
3.2. Environment	Qualitative approach used to conclude safe use.[EE8]
Section 4	Guidance to check compliance with the Exposure Scenario
4.1. Health	<i>Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and</i>

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	OC.
4.2. Environment	No additional risk management measures required.[DSU7]
Section 5	Additional good practice advice beyond the REACH Chemical Safety Assessment - (Section Optional)
Note: The measures reported in this section have not been taken into account in the exposure estimates related to the exposure scenario above. They are not subject to obligation laid down in Article 37 (4) of REACH.	
Control of Worker Exposure	
<i>Selection of relevant Contributing Scenario phrases</i>	<i>Good practice RMM phrases may be incorporated in this section or consolidated into the main sections of the SDS, depending on the preference of the Registrant and functionality of the available e-SDS system.</i>
Control of environmental exposure	
	Not applicable

9.12.2. Exposure estimation

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9.12.2.1. Workers exposure

The worker exposure estimates for the activities associated with the professional use petroleum gases streams in Other Petroleum Gases in polymer processing were assessed using ECETOC TRAv2. See Appendix A). Appendix A contains Tables 1 and 2, used to model the worker exposures. These tables contain all the operating conditions, and the efficiencies of the exposure modifiers including RPE, PPE and LEV. A separate table (also in Appendix A) contains the associated RMMs.

9.12.2.2. Consumer exposure

Not applicable.



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9.12.2.3. Indirect exposure of humans via the environment (oral)

See Table 1

9.12.2.4. Environmental exposure

Not applicable