SAFETY DATA SHEET
in accordance with the Regulation EU 453/2010 and
Rule book on the content of safety data sheet ("Sl. glasnik RS",100/11)

1,3 - BUTADIENE

Version: 6 – this version replaces all previous
Revision: 1 Date: 01.06.2015.

1. IDENTIFICATION OF CHEMICAL AND INFORMATION ABOUT THE PERSON WHO PUTS THE CHEMICAL ON THE MARKET

Chemical name	
Chemical name	Buta-1,3-diene
Index number	601-013-00-X
CAS number	106-99-0
EC number	203-450-8
Trade name	1,3 - butadiene
REACH registration no.	01-2119471988-16-0088

1.1 IDENTIFIED WAYS OF USAGE OF CHEMICALS AND WAYS OF USAGE THAT ARE NOT RECOMMENDED

Ways of usage of chemicals	The raw material for the production of synthetic rubber (SBR) latex production (industrial carpet, paint), plastic materials (ABS) and the product of the liquid rubber (R30990)

1.2 INFORMATION ON SUPPLIER

Producer name	„HIP-Petrohemija" Pančevo
Address and telephone number	Spoljnostarčevačka 82 26000 Pančevo Republic of Serbia +381 13 30 70 00
E-mail of the person responsible for safety data sheet	iboja.rasa@hip-petrohemija.rs
Only Representative	REACHLaw, Finland; info@reachlaw.fi

1.3 TELEPHONE NUMBER FOR EMERGENCIES

Emergency Contact (24h)	See Section 16. for the list of telephone numbers of poison centers in the European Economic Area

2. HAZARD IDENTIFICATION

2.1 CHEMICAL CLASSIFICATION

Rule book on classification, packaging, signing and advertising of the chemical and certain product in accordance with Global harmonized system for classification and signing of UN („Sl.glasnik RS" No. 105/13)	Flam.gas. 1; H220 Gas. under pres. (*liquid gas*) Carc. 1A; H350 Mut. germ. 1B; H340

For the total name of the hazard classes and notification on hazard, see Chapter 16

Adverse effect on the environment	The product is not classified as dangerous for the environment. The product is highly volatile.
Adverse physical-chemical effects	At outlets or locations of fire flames in storage tanks vapor can form polymers and lead to clogging of the openings. The product can, under certain conditions (exposure to air) initiate the polymerization of an explosive character. Product may polymerize due to fire or explosion. The product decomposes explosively when the rapid rise of temperature under pressure.

2.2 LABEL ELEMENTS

Hazard pictogram	
Word of warning	DANGER!
Information on hazards	H220; H340; H350
Information on precautious measures	P210; P243; P377; P381; P308+P313, P403

For the total name of information on precautious measurements see Chapter 16

2.3 OTHER HAZARDS

1,3- butadiene does not meet the criteria for identification as persistent - bioaccumulative - toxic (PBT) or sporadically persistent - very bioaccumulative (vPvB).

3. CONTENT / INFORMATION ON COMPONENTS

3.1 INFORMATION ON SUPSTANCE COMPONENTS

Name of chemical	Index number	Concentration (%(m/m))
1,3-butadiene	601-013-00-X	min 99,5

4. FIRST AID MEASURES

4.1 DESCRIPTION OF FIRST AID MEASURES

General advice	Stop the influence of the substance on the human body. Check basic vital functions (blood circulation, breathing, conscious state). In case of unconsciousness, with spontaneous breathing and blood circulation, stabilize the situation. In the case of breathing and blood circulation stopped immediately apply cardio - pulmonary revival (heart-lung resuscitation, heart massage, artificial respiration). Immediately seek medical attention. Take the necessary precautions to protect their own health before rescue and providing first aid.
Inhalation	Move to fresh air and keep at rest in a comfortable position comfortable for breathing. Seek medical attention. If it is necessary give him oxygen. If breathing has stopped, qualified person to give him artificial respiration. Keep it under medical supervision.
Contact with skin	In case of skin contact with the liquid caused frostbite. Immediately remove all contaminated clothing. Wash skin immediately with plenty of water. Frostbite should be treated as burns. In case of serious contamination, the affected immediately taken to hospital treatment.
Contact with eyes	Rinse eyes thoroughly with plenty of water for at least 15 minutes, also under the eyelids to make sure that it is washed the entire surface of the eye. Use warm water. Immediately seek medical attention. Consult a physician. Do not wear lenses when you are working.
Ingestion	Swallowing during the handling is unlikely. If the affected person has spasms, is unconscious or fainting, do not induce vomiting. If the person is conscious should be given to drink about ¼ l water. Repeat after spontaneous vomiting.

4.2 MOST IMPORTANT SYMPTOMS AND EFFECTS, BOTH ACUTE AND DELAYED

Inhalation	May cause irritation to the respiratory system, cough, sore throat, dizziness, headache, drowsiness, nausea and vomiting. The loss of oxygen can cause unconsciousness, and in extreme cases, coma and death. It can cause loss of sense of balance, fatigue. High concentrations can cause irregular heartbeat and possible sensitization of the heart.
Contact with skin	May cause irritation and redness. It can be absorbed through the skin. May cause swellings. Liquefied form may cause frostbites.
Contact with eyes	Gas is a mild irritant and can cause redness, pain and blurred vision. The liquid can cause frostbite, irritation, watery eyes, redness.
Ingestion	Ingestion is not considered a potential route of exposure to this product. It can cause frostbite tissues of the mouth and throat.

4.3 IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT

There is no specific antidote, to treat the symptoms.
Standard methods to treat sleepiness, frostbite, nausea, decreased blood pressure and cardiac arrhythmias. Sympathomimetic and catecholamines should be avoided or used with caution (even small doses can have an impact) because it can cause cardiac sensitization. Provide oxygen mask if there is a disruption in breathing. Treatment of consequences from exposure should be directed at establishing control of symptoms and the clinical picture of the patient. After initial assistance there is no need for further treatment if symptoms do not happen again.

5. FIREFIGHTING MEASURES

5.1 EXTINGUISHING MEDIA

Suitable extinguishing media	Small fire - a dry powder (ABC), carbon dioxide; Great Fire - Water spray or possibly water spray.
Unsuitable extinguishing media:	Do not use foam.

5.2 SPECIAL HAZARDS ARISING FROM THE SUBSTANCE OR MIXTURE

During the complete combustion, carbon dioxide and water vapor are made. In the incomplete combustion product emitts carbon monoxide, carbon dioxide and / or low molecular weight hydrocarbons: aldehydes and ketones.

5.3 ADVICE FOR FIREFIGHTERS

Special measures of protection during fire fighting:	Fight fire from protected location of the maximum possible distance. Avoid breathing smoke or burnt material. Keep away in a case of fire at the opening of the container, or when changing the color of the tank caused by heat. Gas is heavier than air, spreads to the ground and can reach to the source of ignition.
Special protective equipment for firefighters:	A set of protective equipment for firefighters by ref. Standard SRPS EN 469, protective gloves for firefighters (ref. standard EN 659) and boots in conjunction with the appropriate respiratory protection devices (ref. standard SRPS EN 137).

6. MEASURES IN CASE OF ACCIDENT

6.1 PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES

Be sure that wearing full personal protective equipment, including gloves, goggles or face shields. Wear breathing apparatus if there is a risk of exposure to vapor.

6.2 PRECAUTIONS RELATED TO THE ENVIRONMENT

Ensure that it does not get into the drains and the environment. If it comes to the excessive spillage notify the local authorities.
It should be covered entering drains and prevent vapor / liquid to reach the drains and waste water systems. Vapors are heavier than air and explosive mixtures can accumulate in low areas, and work in places remote from the place of expiration - there is a danger of explosion. There is a danger of

polymerization after heating and after the impact of oxygen from the air - the explosive character of the polymerization. Warn the population in residential and industrial areas.

6.3 MEASURES TO BE TAKEN AND MATERIALS FOR CONTAINMENT AND CLEANING UP

Allow that the product "under control" burns in the presence of fire-fighters if necessary. The product evaporates easily. In case of cold weather (low temperature) to cover the substance of combustible material to absorb (sand, universal binders) and place in closed containers. Dispose of contaminated material in accordance with Chapter 13. Use water spray to reduce the concentration in the air.

6.4 REFERENCE TO OTHER SECTIONS

See chapters 8. and 13.

7. HANDLING AND STORAGE

7.1 PRECAUTIONS FOR SAFETY HANDLING

Use antistatic personal protective equipment when handling. Ensure good ventilation in work areas. Eliminate all possible sources of ignition in the work environment. You must take all precautions to prevent the accumulation of static electricity. Prevent leakage of product into drains and water systems. Do not use an open flame near the product.

7.2 CONDITIONS FOR SAFE STORAGE, INCLUDING INCOMPATIBILITY

Storage area should be cool, dry, well-ventilated place, away from all sources of ignition. In the reaction of the product with substances, rich in oxygen and rusted iron, may form unstable peroxides. Peroxides, acids, alkaline solid metals, and various metal compounds (aluminum, iron and antimony chloride) catalyst - can cause the polymerization of 1,3-butadiene. Suitable materials for the manufacture of tanks - steel, stainless steel and nickel. Copper and its alloys can be damaged.

7.3 SPECIAL WAY OF USAGE

No information.

8. EXPOSURE CONTROL

8.1 PARAMETERS OF EXPOSURE CONTROL

The maximum allowable concentration

1,3-butadiene	ACGIH	TLV: 2 ppm (TWA)
	OSHA	1 ppm (8 hours TWA) 5 ppm (15 minutes STEL)

8.2 EXPOSURE CONTROL AND PERSONAL PROTECTIVE EQUIPMENT

Protection of eyes/face	Face masks, goggles or in combination with breathing apparatus. Do not wear contact lenses when working with 1,3 butadiene (ref.standard SRPS EN 166).
Protection of skin (hands/other body parts)	Protective gloves resistant to cold, from chloroprene, butilnitrila and other materials resistant to 1,3-butadiene. Antistatic protective work clothing, antistatic shoes, in case of need for chemical protective clothing in case of fire, use a non-flammable clothing (ref.standard SRPS EN 374).
Respiratory protection	Use a dust mask AX at lower concentrations, a breathing apparatus at higher concentrations (ref.standard SRPS EN 137).
Control of environmental exposure	Control exposure of the environment conducted in accordance with applicable regulations

9. PHYSICAL AND CHEMICAL PROPERTIES [1]

9.1 INFORMATION ON BASIC PHYSICAL AND CHEMICAL PROPERTIES

Aggregate state	Gas on 20°C and 1013 hPa
Colour	Colourless
Odour	Weak smell of aromatics
Odour threshold	1,0 – 4.,0 mg/m^3
pH	Not applicable
Melting point / freezing point	- 108,9 °C
Initial boiling point (boiling range)	- 4,4 °C (760 mm Hg)
Flash point	-76°C
Evaporation rate	Immediate on 20°C
Flammability	Very easily flammable
The lower limit of flammability (explosive)	2%
The upper limit of flammability (explosive)	12%
Vapour pressure	2110 mm Hg on 25°C
Vapour density (air=1)	1,87
The relative density	0,6149 g/cm^3 (25°C)
Solubility	735 mg/l (20°C)
Coef.of partition n-oktanol/water (Log Pow)	1,99
Autoignition temperature	420°C
Decomposition temperature	>200°C
Viscosity	No information
Explosive properties	A mixture of steam and air is explosive
Oxidising properties	When exposed to air it forms explosive peroxides

9.2 OTHER INFORMATION

Soluble in organic solvents - an ether, ethanol, very soluble in acetone. When it is heated to decomposition it emits smoke and fumes.

10. STABILITY AND REACTIVITY

10.1 REACTIVITY

Contact 1,3-butadiene with strong oxidizing agents may cause fire and explosions.

10.2 CHEMICAL STABILITY

Stability was dependent on the content of an inhibitor in the product, on the temperature during storage, and on the duration of storage.

10.3 POSSIBILITY OF HAZARDOUS REACTIONS

Avoid contact with water and oxygen. Heating under pressure, the mixing with the phenols, the crotonaldehyde can cause an explosion. Peroxides, acids, solid alkaline metals and different metal compounds (aluminum, iron and antimony chloride) catalysts - the possibility of polymerization with explosive character. Risk of polymerization after heating and after the impact of the oxygen from the air - polymerization of explosive character. Due to the possibility of polymerization the product during storage and transportation is stabilized.

10.4 CONDITIONS WHICH SHOULD BE AVOID

Heat, sparks, open flames and other ignition sources.

10.5 INCOMPATIBLE MATERIAL

Oxidizing agent, water, phenols, acids, alkali metals.

10.6 HAZARDOUS DECOMPOSITION PRODUCTS

Dangerous degradation products, which may arise from the carbon monoxide and carbon dioxide.

11. TOXICOLOGICAL INFORMATION [(1)]

11.1 INFORMATION ON TOXICOLOGICAL EFFECTS OF A SUBSTANCE

Accute toxicity	LD_{50} orally, rat	5480 mg/kg
	LC_{50} inhalling, rats, for gases and vapours	285 mg/l (4h)
Skin corrosion / irritation	It does not cause skin damage / irritation.	
Serious eye damage / eye irritation	It does not cause eye damage / irritation.	
Respiratory or skin sensitization	No sensitizing of respitary organs and skin.	
Germ cell mutagenicity	Mutagenicity of germ cell, category 1B *The positive results of in vivo tests in mice bone marrow.*	
Carcinogenicity	Carcinogenicity, category 1A *There is evidence on carcinogenicity for rodents, route of exposure, inhalation.*	
Reproductive toxicity	*Ima dokaza ali su nedovoljni za klasifikaciju. Toksičan za reproduktivne organe oba pola kod miševa. There is evidence, but there are insufficient for classification. Toxic to the reproductive organs of both sexes for mice.*	
Specific toxicity for target organ - JI	No information	
Specific toxicity for target organ - VI	*Low toxicity for rats by inhalation, with minimal effects upon exposure to a concentration of 8000 ppm (17701 g/m3) for 2 years. For humans, there is no chronic neoplastic effects. The mouse is the most sensitive species whose target organs are the bone marrow and the sex glands of both sexes.*	
Risk of aspiration	No information.	

12. ECOTOXICAL INFORMATION [(1)]

12.1 TOXICITY

Accute toxicity	96 h LC_{50} (for fish)	38,99 mg/l
	48 h LC_{50} (for crabs)	22,1 mg/l
	96 h EC_{50} (for algae)	10,64 mg/l
	M – factor	/
Chronic toxicity	96 h LC_{50} (for fish)	Information not available
	48 h LC_{50} (for crabs)	Information not available
	96 h EC_{50} (for algae)	Information not available
	M - factor	/

12.2 PERSISTENCE AND DEGRADABILITY

Biodegradation	Product is easily biodegradable in the environment.

12.3 BIOACCUMULATION POTENTIAL

Bioaccumulation	The ability to bioaccumulate was determined by the octanol / water log Kow = 1.99 and log bioconcentration factor BCF = 0.98. Based on the data it can be concluded that the substance has no potential to bioconcentrate.

12.4 MOBILITY IN SOIL	
Adsorption/desorption	log Koc = 1,72 (calculated value). Indicates a low potential for mobility in soil.

12.5 RESULTS PBT I vPvB ASSESSMENT	
PBT I vPvB	The substance does not meet the criteria for identification as persistent-bioaccumulative - toxic or very persistent- very bioaccumulative.

12.6 OTHER ADVERSE EFFECTS	
Effects on the environment	Information not available
Photochemical ozone creation	Information not available
Disorders of the endocrine system	Information not available

13. DISPOSAL

13.1 WASTE TREATMENT METHODS	
Disposal of unused product and packaging	Disposal of unused product is made in accordance with the regulations on waste management - the rest of the unused product shall be delivered to the authorized operator or the place designated for hazardous waste. This product is not packaged in a container.

14. INFORMATION ON TRANSPORT

Road* (ADR) / *Rail* (RID)/ *Water* (ADN) *transport

Proper shipping name	BUTADIENES, STABILIZED
UN number	1010
Class of danger in transport	2.1 (Flammable gas)
Classification code	2F
Hazard identification number	239
Packing group	/

Signing

International maritime transport (IMDG)

Proper shipping name	BUTADIENES, STABILIZED
UN number	1010
IMDG class	2.1 (Flammable gas)
EmS classification	F-D, S-U
Packing group	/

Signing

International airline transport (IATA/ICAO)

Proper shipping name	BUTADIENES, STABILIZED
UN number	1010
ICAO/IATA class	2.1 (Flammable gas)
Packing group	/

Signing

14.1 UN NUMBER
UN 1010

14.2 UN NAME OF BURDEN IN TRANSPORT
BUTADIENES, STABILIZED

14.3 HAZARD CLASSES IN TRANSPORT
2.1 (Flammable gas)

14.4 PACKAGE GROUP

/

14.5 HAZARD FOR THE ENVIRONMENT

ADR	Yes
RID	Yes
ADN	Yes
IMDG	Yes

14.6 SPECIAL PRECAUTIONS FOR USER

Adhere to the same measures as described in Section 7 Handling and Storage

14.7 TRANSPORT IN BULK

Not applicable.

15. REGULATORY INFORMATION

15.1 REGULATIONS RELATED TO SECURITY, HEALTH AND ENVIRONMENT

Rule book on the List of hazardous substances and their amounts and the criteria for determining the types of documents drawn up by the operator Seveso facility i.e. complex. („Sl.gl. RS“, No. 89/10, 71/11 and 90/11):

Number of limits and restrictions 28 and 29 1,3-butadiene CAS NO. 106-99-0 EC NO. 270-691-3
"1 It shall not be placed on the market or use:

- *as substance;*
- *as a component of other substances or in mixtures intended for general use, and their individual concentrations equal to or greater than:*
- *specific limit concentration given in the List of Classified Substances*
- *relevant concentrations given in the Regulation on the classification, packaging, labeling and marketing of chemicals and certain products („Službeni glasnik RS“, number 59/10).*

The supplier shall ensure that the packaging of such substance or mixture, in addition to labeling in accordance with the regulations on the classification, packaging and labeling of chemicals, shall be visible and indelibly marked as follows: "It is intended for professional use."

2. The prohibition from Section 1 shall not apply to:
a) medical or veterinary products as defined by special regulations;
b) cosmetic products that are regulated by specific regulations;
v) motor fuels which are regulated by special regulations, and to:

- *mineral oils used as fuel in engines or power plants;*
- *mineral fuels sold in closed systems (eg, bottles with liquid gas);*

g) painting color.*“*

Rule book on the List of Hazardous Substances and their amounts and the criteria for determining the types of documents drawn up by the operator Seveso facility or complex. („Sl.gl. RS.“ No.41/10)

A list of the hazard classes and limit the amount of hazardous substances Rb. 8 threshold quantity in tons: 10-50

15.2 CHEMICAL SAFETY ASSESSMENT

It is undertaken an assessment of chemical safety. Exposure scenario is given in Annex Safety Data Sheet

16. OTHER INFORMATION

Advice on training	Personnel handling the product must be familiar with its hazardous properties, the principles of health and environmental protection related to the product and the principles of first aid.	
Recommendation for use	The product is intended for professional use only. Use only in industry.	
The text of hazard classes, Hazard and Precautionary Information	Flam.gas. 1	Flammable gases, category 1
	Gas. under pres.	Gases under pressure
	Karc. 1A	Carcinogenicity category 1B
	Mut. germ. 1B	Germ cell mutagenicity, category 1B
	H220	Very flammable gas
	H340	May cause genetic defects
	H350	May cause cancer
	P210	Keep away from heat / sparks / open flames / hot surfaces. - No smoking
	P243	Take precautions to avoid creating static electricity
	P377	Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
	P381	Remove all sources of ignition, if it can be done safely
	P308+P313	If it comes to exposure or it is suspected of having been exposed: Get medical advice
	P403	Store in a well-ventilated places
Changes and additions to the SDS	Changes were made in subsection 2.1 and section 16 for the purpose of classification and labeling only with the "Regulation on classification, packaging, labeling and advertising chemicals and certain products in accordance with the Globally Harmonized System for classification and labeling UN" („Sl.glasnik RS“ No. 105/13)	
The sources used for critical information in making safety data sheet	[(1)] ECHA – European Agency for chemicals (http://echa.europa.eu/) ESIS - European chemical Substances Information System (http://esis.jrc.ec.europa.eu/)	

Spisak skraćenica

ACGIH	American Conference of Governmental Industrial Hygienists
ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road
CAS	Chemical Abstract Service
ErC_{50}	Half maximal effective concentration
EU	European Union
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IMDG	International Maritime Dangerous Goods
LC_{50}	Lethal Concentration
LD_{50}	Lethal Dose
M-faktor	M-factor is a coefficient which is multiplied by the concentration of substances classified as hazardous to the aquatic environment, acute, category 1 or chronic, category 1, which is used in a method of summarizing the classification of a mixture containing that substance
OSHA	Occupational Safety and Healt Administration
RID	International Rule for Transport of Dangerous Substances by Railway
TLV	Treshold Limit Value
TWA	Time Weighted Averages

LIST OF TELEPHONE NUMBERS OF POISON CENTRES IN THE EUROPEAN ECONOMIC AREA	
AUSTRIA (Vienna Wien)	+43 1 40 400 2222
BELGIUM (Brussels Bruxelles)	+32 70 245 245
BULGARIA (Sofia)	+359 2 9154 409 / +359 887 435 325
CZECH REPUBLIC (Prague Praha)	+42 2 2491 9293 or +42 2 2491 5402
DENMARK (Copenhagen)	+45 35 31 54 04
FINLAND (Helsinki)	+358 9 471 977
FRANCE (Paris)	+33 1 40 05 48 48
GERMANY (Berlin)	+49 30 450 653565
GREECE (Athens Athinai)	+30 10 779 3777
HUNGARY (Budapest)	+36 80 20 11 99
ICELAND (Reykjavik)	+354 525 111, +354 543 2222
IRELAND (Dublin)	+353 1 8379964
ITALY (Rome)	+39 06 305 4343
LATVIA (Riga)	+371 704 2468
LITHUANIA (Vilnius)	+370 2 36 20 52, +370 2 36 20 92
NETHERLANDS (Bilthoven)	+31 30 274 88 88
NORWAY (Oslo)	+47 22 591300
POLAND (Gdansk)	+48 58 301 65 16 or +48 58 349 2831
PORTUGAL (Lisbon Lisboa)	808 250 143 (for use only in Portugal), +351 21 330 3284
ROMANIA (Bucharest)	+40 21 230 8000;
SLOVAKIA (Bratislava)	+421 2 54 77 4 166
SLOVENIA (Ljubljana)	+ 386 41 650 500
SPAIN (Barcelona)	+34 93 227 98 33 or +34 93 227 54 00 bleep 190
SWEDEN (Stockholm)	+46 8 33 12 31 (International) 112 (National)
UNITED KINGDOM (London)	0870 243 2241

ANEX OF SAFETY DATA SHEET

EXPOSURE SCENARIO

Exposure scenario is entirely taken from Chapter 9. EXPOSURE ASSESSMENT, „CHEMICAL SAFETY REPORT“, Part B“ for 1,3-butadiene.

9. EXPOSURE ASSESSMENT

The following generic uses were evaluated in the exposure assessment of 1,3-butadiene.

Exposure scenario	Identified use	Process category (PROC)	Product Category (PC)	Sector of Use (SU)	Article category (AC)	Environmental	Release Category (ERC)	EU tonnage Regional fraction
1	Manufacture (Industrial)	PROC 1, PROC 2, PROC 3, PROC 4, PROC 8a, PROC 8b, PROC 15	NA	3, 8, 9,	NA	1, 4	5000000	0.4
2	Distribution (Industrial)	PROC 1, PROC 2, PROC 3, PROC 4, PROC 8a, PROC 8b, PROC 9, PROC 15	NA	3, 8, 9	NA	1-7	5000000	0.1
3	Use as an intermediate	PROC 1, PROC 2, PROC 3, PROC 4, PROC 8a, PROC 8b, PROC 15	NA	3, 8, 9,	NA	6a	250000	0.4
4	Formulation	PROC 1, PROC 2, PROC 3, PROC 4, PROC 5, PROC 8a, PROC 8b, PROC 9, PROC 14, PROC 15	NA	3, 10	NA	2	750000	0.1
5	Uses in Fuels (Industrial)	PROC 1, PROC 2, PROC 3, PROC 8a, PROC 8b, PROC 16	NA	3	NA	7	500000	0.1
6	Uses in Laboratory reagents (Industrial)	PROC 10, PROC 15	NA	3	NA	2, 4	1000	0.1

7	Uses in Rubber production and processing (Industrial)	PROC 1, PROC 2, PROC 3, PROC 4, PROC 5, PROC 6, PROC 7, PROC 8a, PROC 8b, PROC 13, PROC 14, PROC 21	NA	3, 10	NA	4, 6D	3000000	0.1
8	Use in polymer production (Industrial)	PROC 1, PROC 2, PROC 3, PROC 4, PROC 5, PROC 6, PROC 8a, PROC 8b, PROC 9, PROC 14, PROC 21	NA	3, 8, 9, 22	NA	4, 6C	1000000	0.1
9	Use in polymer processing (Industrial)	PROC 1, PROC 2, PROC 3, PROC 4, PROC 5, PROC 6, PROC 8a, PROC 8b, PROC 9, PROC 13, PROC 14, PROC 21	NA	3, 10	NA	4	250000	0.1
10	Use in polymer processing (Professional)	PROC 1, PROC 2, PROC 8a, PROC 8b, PROC 14, PROC 21	NA	22	NA	8A, 8D	25000	0.1

The following information was used for the exposure assessments:

Substance specific information			
Substance	1,3-butadiene	**MOLW**	54.09 g/mol
CAS RN	106-99-0	**MP**	-108.9 °C
Vapour pressure	151 kPa at 12 °C	**BP**	-4.41 °C
TRA volatility range	High	**SOL**	0.735 g/l
Log KOW	1.99		

Qualitative risk characterisation is required for the environmental assessment (See Section 7) because this substance is a gas. The purpose of the 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 found in 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.

However, as 1,3-butadiene is classified R48, an environmental exposure assessment is conducted in order to assess the risk of indirect exposure of man via the environment.

9.1. Exposure scenario 1: Manufacture of 1,3-butadiene

9.1.1. Exposure scenario

Section 1	**Exposure Scenario Title**
Title	**Manufacture of 1,3-butadiene;CAS RN106-99-0**
Use Descriptor	Sector of Use: Industrial (SU3)
	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**
Field for additional statements to explain scenario if required	
Section 2.1 **Product characteristics**	**Control of worker exposure**
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	*Not applicable*
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Human factors not influenced by risk management	*Not applicable*
Other Operational Conditions affecting worker exposure	Assumes use at not > 20°C above ambient [G15]; Assumes a good basic standard of occupational hygiene is implemented [G1].
Contributing Scenarios	**Risk Management Measures** *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.
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 [CS137]	Handle substance within a predominantly closed system provided with extract ventilation [E49].; Sample via a closed loop or other system to avoid exposure [E8]Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11].Avoid carrying out activities involving exposure for more than 1 hour [OC27].
General exposures (closed systems) [CS15]. Use in contained batch processes [CS37].	Handle substance within a predominantly closed system provided with extract ventilation [E49].; Sample via a closed loop or other system to avoid exposure [E8]Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11].Avoid carrying out activities involving exposure for more than 15 minutes [OC26].
General exposures (open systems) [CS16]. Batch process [CS55]. With sample collection [CS56].	Handle substance within a predominantly closed system provided with extract ventilation [E49].; Sample via a closed loop or other system to avoid exposure [E8]Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11]. Avoid carrying out activities involving exposure for more than 15 minutes [OC26].
Process sampling [CS2].	Sample via a closed loop or other system to avoid exposure [E8]Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11]. Avoid carrying out activities involving exposure for more than 15 minutes [OC26].
Laboratory activities [CS36].	Use a high performance fume cupboard [E86], or [G9] alternatively [G10], Handle within a fume cupboard or implement equivalent measures to minimise exposures [E12], Wear a full face respirator conforming to EN140 with Type A filter or better [PPE24]
Bulk transfers [CS14]. (open systems) [CS108] With potential for aerosol generation [CS138].	Use dry break couplings for material transfer [E75].Ensure material transfers are under containment or extract ventilation [E66]. ; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11]. Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Bulk transfers [CS14]. (closed systems) [CS107];	Use dry break couplings for material transfer [E75].Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Equipment cleaning and maintenance [CS39].	Drain down and flush system prior to equipment break-in or maintenance [E55].Provide extract ventilation to points where emissions occur [E54]. ; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11].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 [CS137]	Sample via a closed loop or other system to avoid exposure [E8]Provide extract ventilation to material transfer points and other openings [E82].; Store substance within a closed system [E84].
Section 2.2	**Control of environmental exposure**
The exposure of aquatic, terrestrial, sediment and sewage treatment microorganisms is considered to be negligible because the substance partitions primarily to air when found in 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 limitexposure to ecological receptors. Hence the risks are considered to be controlled for ecological receptors.	
Section 3	**Exposure Estimation**
3.1. Health	*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.*
3.2. Environment	
Section 4	**Guidance to check compliance with the Exposure Scenario**
4.1. Health	*Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and OC*
4.2. Environment	
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	
Selection of relevant Contributing Scenario phrases	*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.*
Control of environmental exposure	
Selection of relevant RMM Core Phrases	*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.*

9.1.2. Exposure estimation

9.1.2.1. Workers exposure

The worker exposure estimates for the activities associated with the manufacturing of 1,3-butadiene 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.

9.1.2.2. Consumer exposure

Not applicable.

9.1.2.3. Indirect exposure of humans via the environment

See section 9.11.

9.1.2.4. Environmental exposure

Not applicable

9.2. Exposure scenario 2: Distribution of 1,3-butadiene

9.2.1. Exposure scenario

Section 1	**Exposure Scenario Title**
Title	**Distribution of 1,3-butadiene;CAS RN106-99-0**
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**
Field for additional statements to explain scenario if required.	
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	*Not applicable*
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Human factors not influenced by risk management	*Not applicable*
Other Operational Conditions affecting worker exposure	Assumes use at not > 20°C above ambient [G15]; Assumes a good basic standard of occupational hygiene is implemented [G1].
Contributing Scenarios	**Risk Management Measures** *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.
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 [CS137]	Handle substance within a closed system [E47]. Ensure material transfers are under containment or extract ventilation [E66]. ; Sample via a closed loop or other system to avoid exposure [E8]Avoid carrying out activities involving exposure for more than 1 hour [OC27].
General exposures (closed systems) [CS15]. Use in contained batch processes [CS37].	Handle substance within a closed system [E47]. Ensure material transfers are under containment or extract ventilation [E66]. ; Sample via a closed loop or other system to avoid exposure [E8]Avoid carrying out activities involving exposure for more than 1 hour [OC27].
General exposures (open systems) [CS16]. Batch process [CS55]. ; With sample collection [CS56].	Handle substance within a closed system [E47]. Ensure material transfers are under containment or extract ventilation [E66]. ; Sample via a closed loop or other system to avoid exposure [E8]Avoid carrying out activities involving exposure for more than 4 hours [OC28]Clear transfer lines prior to de-coupling [E39].; Transfer via enclosed lines [E52].
Process sampling [CS2].	Handle substance within a closed system [E47].Sample via a closed loop or other system to avoid exposure [E8]
Laboratory activities [CS36].	Use a high performance fume cupboard [E86], or [G9] alternatively [G10], Handle within a fume cupboard or implement equivalent measures to minimise exposures [E12], and, Wear a full face respirator conforming to EN140 with Type A filter or better [PPE24]; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11].
Bulk transfers [CS14]. ; (closed systems) [CS107]	Clear transfer lines prior to de-coupling [E39].; Transfer via enclosed lines [E52].Ensure material transfers are under containment or extract ventilation [E66]. Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Bulk transfers [CS14]. ; (open systems) [CS108]	Clear transfer lines prior to de-coupling [E39].; Transfer via enclosed lines [E52].Ensure material transfers are

	under containment or extract ventilation [E66]. Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Drum and small package filling [CS6].	Transfer via enclosed lines [E52]. Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].; Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings [E60]. Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Equipment cleaning and maintenance [CS39].	Drain down and flush system prior to equipment break-in or maintenance [E55]. Provide extract ventilation to points where emissions occur [E54]. ; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11].Clear spills immediately [C&H13]. Retain drain downs in sealed storage pending disposal or for subsequent recycle [ENVT4].
Storage [CS67] With occasional controlled exposure [CS137]	Transfer via enclosed lines [E52]. Provide extract ventilation to points where emissions occur [E54]. Avoid carrying out activities involving exposure for more than 4 hours [OC28]
Section 2.2	Control of environmental exposure
The exposure of aquatic, terrestrial, sediment and sewage treatment microorganisms is considered to be negligible because the substance partitions primarily to air when found in 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 limitexposure to ecological receptors. Hence the risks are considered to be controlled for ecological receptors.	
Section 3	**Exposure Estimation**
3.1. Health	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.
3.2. Environment	
Section 4	**Guidance to check compliance with the Exposure Scenario**
4.1. Health	*Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and OC.*
4.2. Environment	
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	
Selection of relevant Contributing Scenario phrase	*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.*
Control of environmental exposure	
Selection of relevant RMM Core Phrases	*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*

9.2.2. Exposure estimation

9.2.2.1. Workers exposure

The worker exposure estimates for the activities associated with the distribution of 1,3-butadiene 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.

9.2.2.2. Consumer exposure

Not applicable.

9.2.2.3. Indirect exposure of humans via the environment

See section 9.11.

9.2.2.4. Environmental exposure

Not applicable.

9.3. Exposure scenario 3: Use of 1,3-butadiene as an Intermediate.

Human health assessment is not required for this use, use as an intermediate is included in the manufacture of 1,3-butadiene see section 9.1.

9.3.2. Exposure estimation

9.3.2.1. Workers exposure

Human health assessment is not required for this use, use as an intermediate is included in the manufacture of 1,3-butadiene see section 9.1.

9.3.2.2. Consumer exposure

Not applicable.

9.3.2.3. Indirect exposure of humans via the environment

See section 9.11.

9.3.2.4. Environmental exposure

Not applicable.

9.4 Formulation of 1,3-butadiene

9.4.1. Exposure scenario

Section 1	Exposure Scenario Title
Title	**Formulation & (re)packaging of substances and mixtures of 1,3-butadiene;CAS RN106-99-0**
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	*Not applicable*
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Human factors not influenced by risk management	*Not applicable*
Other Operational Conditions affecting worker exposure	Assumes use at not > 20°C above ambient [G15]; Assumes a good basic standard of occupational hygiene is implemented [G1].
Contributing Scenarios	**Risk Management Measures** *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.
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 [CS137]	Handle substance within a closed system [E47]. Provide extract ventilation to points where emissions occur [E54].; 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] Avoid carrying out activities involving exposure for more than 1 hour [OC27].
General exposures (closed systems) [CS15]. Use in contained batch processes [CS37].	Handle substance within a closed system [E47]. Provide extract ventilation to points where emissions occur [E54].; 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] Avoid carrying out activities involving exposure for more than 1 hour [OC27].
General exposures (open systems) [CS16]. Batch process [CS55]. ; With sample collection [CS56]. ; With potential for aerosol generation [CS138].	Formulate in enclosed or ventilated mixing vessels [E46]. Provide extract ventilation to points where emissions occur [E54]. ; 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] Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Batch processes at elevated temperatures [CS136].	Handle substance within a closed system [E47]. Provide extract ventilation to points where emissions occur [E54].; 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] Avoid carrying out activities involving exposure for more than 1 hour [OC27]
Process sampling [CS2].	Handle substance within a closed system [E47]. Provide extract ventilation to points where emissions occur [E54].; 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] Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Laboratory activities [CS36].	Use High Performance fumecupboard [E86]; Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].
Bulk transfers [CS14].	Clear transfer lines prior to de-coupling [E39].; Transfer via enclosed lines [E52].Ensure material transfers are under containment or extract ventilation [E66].
Mixing operations (open systems) [CS30]. With potential for aerosol generation [CS138]	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].Wear a respirator conforming to EN140 with Type A filter or better. [PPE22]
Manual [CS34]. ; Transfer from/pouring from containers [CS22].	Use drum pumps or carefully pour from container [E64]. 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].Avoid spillage when withdrawing pump [C&H16].

	Avoid carrying out activities involving exposure for more than 4 hours [OC28]
Drum/batch transfers [CS8].	Use drum pumps or carefully pour from container [E64]. 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].
Production or preparation or articles by tabletting, compression, extrusion or pelletisation [CS100]	Limit the substance content in the product to 1% [OC16]. 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]
Drum and small package filling [CS6].	Clear transfer lines prior to de-coupling [E39].; Transfer via enclosed lines [E52]. Ensure material transfers are under containment or extract ventilation [E66]. ; Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].
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].Apply vessel entry procedures including use of forced supplied air [AP15]. Wear a respirator conforming to EN140 with Type A filter or better. [PPE22]
Storage [CS67] With occasional controlled exposure [CS137]	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]. ; Store substance within a closed system [E84].Avoid carrying out activities involving exposure for more than 4 hours [OC28]
Section 2.2	**Control of environmental exposure**
The exposure of aquatic, terrestrial, sediment and sewage treatment microorganisms is considered to be negligible because the substance partitions primarily to air when found in 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.	
Section 3	**Exposure Estimation**
3.1. Health	*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.
3.2. Environment	
Section 4	**Guidance to check compliance with the Exposure Scenario**
4.1. Health	**Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and OC.**
4.2. Environment	
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	

Selection of relevant Contributing Scenario phrases	*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.*
Control of environmental exposure	
Selection of relevant RMM Core Phrases	*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.*

9.4.2. Exposure estimation

9.4.2.1. Workers exposure

The worker exposure estimates for the activities associated with the use in formulation using 1,3-butadiene 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.

9.4.2.2. Consumer exposure

Not applicable.

9.4.2.3. Indirect exposure of humans via the environment

See section 9.11.

9.4.2.4. Environmental exposure

Not applicable

9.5. Exposure scenario 4: Use of 1,3-butadiene in fuels -Industrial

9.5.1. Exposure scenario

Section 1	**Exposure Scenario Title**
Title	**Use in Fuels of 1,3-butadiene;CAS RN106-99-0**
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 percentage substance in the product up to 100 % (unless stated differently) [G13].

Amounts used	*Not applicable*
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Human factors not influenced by risk management	*Not applicable*
Other Operational Conditions affecting worker exposure	Assumes use at not > 20°C above ambient [G15]; Assumes a good basic standard of occupational hygiene is implemented [G1].
Contributing Scenarios	**Risk Management Measures** *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
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].
Bulk transfers [CS14].	Transfer via enclosed lines [E52].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].
Drum/batch transfers [CS8].	Use drum pumps [E53]. Provide extract ventilation to material transfer points and other openings [E82].; Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].
General exposures (closed systems) [CS15].	Handle substance within a closed system [E47].
General exposures (closed systems) [CS15]. With occasional controlled exposure [CS137]	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].Avoid carrying out activities involvingexposure for more than 4 hours [OC28]
General exposures (closed systems) [CS15]. Batch process [CS55].	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].Avoid carrying out activities involving exposure for more than 1 hour [OC27].
General exposures (open systems) [CS16]. ; (closed systems) [CS107]	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].Avoid carrying out activities involving exposure for more than 1 hour [OC27].
General exposures (open systems) [CS16]. ; (closed systems) [CS107] Batch process [CS55].	Handle substance within a predominantly closed system provided with extract ventilation [E49].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].Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Equipment maintenance [CS5].	Drain down and flush system prior to equipment break-in or maintenance [E55]. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11]. Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Storage [CS67]	Handle substance within a closed system [E47]. No specific measures identified [EI18].
Storage [CS67] With occasional controlled exposure [CS137]	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]. Avoid carrying out activities involving exposure for more than 4 hours [OC28]
Disposal of wastes [CS28].	Transfer via enclosed lines [E52].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].
Section 2.2	**Control of environmental exposure**
The exposure of aquatic, terrestrial, sediment and sewage treatment microorganisms is considered to be negligible because the substance partitions primarily to air when found in 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.	
Section 3	**Exposure Estimation**
3.1. Health	*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.*
3.2. Environment	
Section 4	**Guidance to check compliance with the Exposure Scenario**
4.1. Health	*Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and OC.*
4.2. Environment	
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	
Selection of relevant Contributing Scenario phrases	*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.*
Control of environmental exposure	
Selection of relevant RMM Core Phrases	*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.*

9.5.2. Exposure estimation

9.5.2.1. Workers exposure

The worker exposure estimates for the activities associated with the industrial use in fuels of 1,3 butadiene 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.

9.5.2.2. Consumer exposure

Not applicable.

9.5.2.3. Indirect exposure of humans via the environment

See section 9.11.

9.5.2.4. Environmental exposure

Not applicable

9.6. Exposure scenario 5: Use of 1,3-butadiene in laboratory reagents – Industrial

9.6.1. Exposure scenario

Section 1	Exposure Scenario Title
Title	**Use in laboratory reagents of 1,3-butadiene; CAS RN106-99-0**
Use Descriptor	Sector of Use: Industrial (SU3) Process Categories: PROC10, PROC15 Environmental Release Categories: ERC 2, ERC 4
Processes, tasks, activities covered	Use of the substance within laboratory settings, including material transfers and equipment cleaning
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	*Not applicable*
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Human factors not influenced by risk management	*Not applicable*
Other Operational Conditions affecting worker exposure	Assumes use at not > 20 ^{0}C above ambient [G15]; Assumes a good basic standard of occupational hygiene is implemented [G1].
Contributing Scenarios	**Risk Management Measures** *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.
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].
Laboratory activities [CS36]. Small scale [CS61]. Handling small quantities (<1000ml) for more than 4 hours/day - inside fume cupboard.	Use high-performance fume cupboard [E86].
Cleaning [CS47]. Rolling, Brushing [CS51]. ; Vessel and container cleaning [CS103] Cleaning equiment, glassware etc under general ventilation for 15 min - 1 hour/day	Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].; Use high-performance fume cupboard [E86]
Section 2.2	**Control of environmental exposure**
The exposure of aquatic, terrestrial, sediment and sewage treatment microorganisms is considered to be negligible because the substance partitions primarily to air when found in 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.	
Section 3	**Exposure Estimation**
3.1. Health	*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*
3.2. Environment	
Section 4	**Guidance to check compliance with the Exposure Scenario**
4.1. Health	*Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and OC.*
4.2. Environment	
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	
Selection of relevant Contributing Scenario phrases	*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.*
Control of environmental exposure	
Selection of relevant RMM Core Phrases	*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.*

9.6.2. Exposure estimation

9.6.2.1. Workers exposure

The worker exposure estimates for activities associated with the use of 1,3-butadiene as laboratory reagents 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.

9.6.2.2. Consumer exposure

Not applicable.

9.6.2.3. Indirect exposure of humans via the environment

See section 9.11.

9.6.2.4. Environmental exposure

Not applicable

9.7. Exposure scenario 6: Use of 1,3-butadiene in rubber manufacture and processing – Industrial

9.7.1. Exposure scenario

Section 1	**Exposure Scenario Title**
Title	**Use in rubber manufacturing and processing of 1,3-butadiene; CAS RN 106-99-0**
Use Descriptor	Sector of Use: Industrial (SU3, SU10)
	Process Categories: PROC1, PROC2, PROC3, PROC4, PROC5, PROC6, PROC7, PROC8a, PROC8b, PROC13, PROC14, PROC21
	Environmental Release Categories: ERC 4, ERC 6D
Processes, tasks, activities covered	Manufacture of tyres and general rubber articles, including processing of raw (uncured) rubber, handling and mixing of rubber additives, vulcanising, cooling and finishing.
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	*Not applicable*
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Human factors not influenced by risk management	*Not applicable*
Other Operational Conditions affecting worker exposure	Assumes use at not > 20°C above ambient [G15]; Assumes a good basic standard of occupational hygiene is implemented [G1].
Contributing Scenarios	**Risk Management Measures**

	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
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].
Material transfers [CS3].	Handle substance within a closed system [E47]
Material transfers [CS3]. With occasional controlled exposure [CS137]	Transfer via enclosed lines [E52].Ensure material transfers are under containment or extract ventilation [E66]. ; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11].
Material transfers [CS3]. Dedicated facility [CS81]. Large Containers	Use drum pumps [E53].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].
Bulk weighing [CS91](closed systems) [CS107].	Handle substance within a closed system [E47].
Bulk weighing [CS91]With occasional controlled exposure [CS137]	Ensure material transfers are under containment or extract ventilation [E66]. ; Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].Avoid carrying out activities involving exposure for more than 4 hours [OC28]
Small scale weighing [CS90] Dedicated facility [CS81].	Transfer via enclosed lines [E52].Ensure material transfers are under containment or extract ventilation [E66]. ; Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].Avoid carrying out activities involving exposure for more than 4 hours [OC28]
Additive premixing [CS92] Batch process [CS55]. ; (closed systems) [CS107].	Formulate in enclosed or ventilated mixing vessels [E46]. Ensure material transfers are under containment or extract ventilation [E66]. ; Minimise exposure by partial enclosure of the operation or equipment and provide

	extract ventilation at openings [E60]. ; Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40]. Avoid carrying out activities involving exposure for more than 4 hours [OC28]
Additive premixing [CS92]	Ensure material transfers are under containment or extract ventilation [E66]. ; Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40]. Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Material transfers [CS3]. Dedicated facility [CS81].	Transfer via enclosed lines [E52].Ensure material transfers are under containment or extract ventilation [E66].
Material transfers [CS3]. Small Containers	Transfer via enclosed lines [E52]. Ensure material transfers are under containment or extract ventilation [E66]. ; Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40]. Avoid carrying out activities involving exposure for more than 4 hours [OC28]
Additive premixing [CS92] 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]. Avoid carrying out activities involving exposure for more than 15 minutes [OC26] or Wear a respirator conforming to EN140 with Type A filter or better [PPE20].
Calendering (including Banburys) [CS64]	Limit the substance content in the product to 1% [OC16]. 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].
Pressing uncured rubber blanks [CS73]	Limit the substance content in the product to 1% [OC16]. Ensure material transfers are under containment or extract ventilation [E66]. ; Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].
Vulcanisation [CS70]	Limit the substance content in the product to 1% [OC16]. 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].
Cooling cured articles [CS71]	Limit the substance content in the product to 1% [OC16]. 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].
Laboratory activities [CS36].	Use high-performance fume cupboard [E86].
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]. Wear a respirator conforming to EN140 with Type A filter or better. [PPE22].
Section 2.2	**Control of environmental exposure**

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

Section 3	**Exposure Estimation**
3.1. Health	*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.*
3.2. Environment	
Section 4	**Guidance to check compliance with the Exposure Scenario**
4.1. Health	*Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and OC.*
4.2. Environment	
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	
Selection of relevant Contributing Scenario phrases	*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.*
Control of environmental exposure	
Selection of relevant RMM Core Phrases	*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.*

9.7.2. Exposure estimation

9.7.2.1. Workers exposure

The worker exposure estimates for the activities associated with the rubber manufacture using 1,3-butadiene 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.

9.7.2.2. Consumer exposure

Not applicable

9.7.2.3. Indirect exposure of humans via the environment

See section 9.11.

9.7.2.4. Environmental exposure

Not applicable

9.8. Exposure scenario 7: Use of 1,3-butadiene in polymer production – Industrial

9.8.1. Exposure scenario

Section 1	Exposure Scenario Title
Title	**Use in polymer production of 1,3-butadiene; CAS RN 106-99-0**
Use Descriptor	Sector of Use: Industrial (SU3, SU10)
	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**
Field for additional statements to explain scenario if required.	
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	*Not applicable*
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Human factors not influenced by risk management	*Not applicable*
Other Operational Conditions affecting worker exposure	Assumes use at not > 20°C above ambient [G15]; Assumes a good basic standard of occupational hygiene is implemented [G1].
Contributing Scenarios	**Risk Management Measures** *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.
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]. Continuous process [CS54]. ; No sampling [CS57].	Handle substance within a closed system [E47].
Bulk transfers [CS14]. Transport [CS58]. ; With sample collection [CS56].	Ensure material transfers are under containment or extract ventilation [E66]. ; Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].; Sample via a closed loop or other system to avoid exposure [E8]Avoid carrying out activities involving exposure for more than 4 hours [OC28]
Polymerisation (bulk and batch) [CS65]Continuous process [CS54]. ; With sample collection [CS56].	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].; Provide extract ventilation to points where emissions occur [E54]. ; Sample via a closed loop or other system to avoid exposure [E8]Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Polymerisation (bulk and batch) [CS65]Batch process [CS55]. ; With sample collection [CS56]. Elevated Temperature	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].; Provide extract ventilation to points where emissions occur [E54]. ; Sample via a closed loop or other system to avoid exposure [E8]Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Finishing operations [CS102]Batch process [CS55]. ; With sample collection [CS56].	Limit the substance content in the product to 5% [OC17].; 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].; Provide extract ventilation to points where emissions occur [E54]. ; Sample via a closed loop or other system to avoid exposure [E8]
Intermediate polymer storage [CS66]	Limit the substance content in the product to 5% [OC17].; 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]. ; Sample via a closed loop or other system to avoid exposure [E8]
Additivation and stabilisation [CS69]	Limit the substance content in the product to 5% [OC17].; 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]. ; Sample via a closed loop or other system to avoid exposure [E8]

Mixing in containers [CS23]. Batch process [CS55].	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]. ; Sample via a closed loop or other system to avoid exposure [E8]
Pelletizing [CS53]. Extrusion and masterbatching [CS88]	Limit the substance content in the product to 1% [OC16]. Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings [E60]. ; Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].
Pelletizing [CS53].	Limit the substance content in the product to 1% [OC16]. 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].
Pelletisation and pellet screening [CS68] (open systems) [CS108]	Limit the substance content in the product to 1% [OC16]. Ensure material transfers are under containment or extract ventilation [E66].
Bulk transfers [CS14]. Continuous process [CS54]. ; With sample collection [CS56].	Handle substance within a closed system [E47].Ensure material transfers are under containment or extract ventilation [E66]. ; Sample via a closed loop or other system to avoid exposure [E8]; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11]. Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Transport [CS58]. With sample collection [CS56].	Ensure material transfers are under containment or extract ventilation [E66]. Avoid carrying out activities involving exposure for more than 1 hour [OC27].
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]. Clear spills immediately [C&H13]. Avoid carrying out activities involving exposure for more than 4 hours [OC28] 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 [CS137]	Provide extract ventilation to points where emissions occur [E54]. ; Sample via a closed loop or other system to avoid exposure [E8]; Store substance within a closed system [E84].Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Section 2.2	**Control of environmental exposure**
The exposure of aquatic, terrestrial, sediment and sewage treatment microorganisms is considered to be negligible because the substance partitions primarily to air when found in 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.	
Section 3	**Exposure Estimation**
3.1. Health	*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.
3.2. Environment	
Section 4	**Guidance to check compliance with the Exposure Scenario**
4.1. Health	*Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and OC.*
4.2. Environment	
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	
Selection of relevant Contributing Scenario phrases	*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.*
Control of environmental exposure	
Selection of relevant RMM Core Phrases	*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.*

9.8.2. Exposure estimation

9.8.2.1. Workers exposure

The worker exposure estimates for the activities associated with the polymer production using 1,3-butadiene 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.

9.8.2.2. Consumer exposure

Not applicable.

9.8.2.3. Indirect exposure of humans via the environment

See section 9.11.

9.8.2.4. Environmental exposure

Not applicable

9.9. Exposure scenario 8: Use of 1,3-butadiene in polymer processing – Industrial

Applicable only where there is a residual 1,3 butadiene concentration of between 0.1 and 1%. Below 0.1% no specific application of RMM / OC is required.

9.9.1. Exposure scenario

Section 1	Exposure Scenario Title
Title	**Use in polymer processing of 1,3-butadiene;CAS RN106-99-0**
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**
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	*Not applicable*
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Human factors not influenced by risk management	*Not applicable*
Other Operational Conditions affecting worker exposure	Assumes use at not > 20°C above ambient [G15]; Assumes a good basic standard of occupational hygiene is implemented [G1].
Contributing Scenarios	**Risk Management Measures** *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.
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].
Bulk transfers [CS14]. ; (closed systems) [CS107]	Handle substance within a closed system [E47].
Bulk transfers [CS14]. ; (closed systems) [CS107] With occasional controlled exposure [CS137]	Limit the substance content in the product to 1% [OC16].; Handle substance within a closed system [E47]. Ensure material transfers are under containment or extract ventilation [E66].
Bulk transfers [CS14]. Dedicated facility [CS81].	Limit the substance content in the product to 1% [OC16]. Ensure material transfers are under containment or extract ventilation [E66]
Bulk weighing [CS91] (closed systems) [CS107].	Handle substance within a closed system [E47].
Bulk weighing [CS91]With occasional controlled exposure [CS137]	Limit the substance content in the product to 1% [OC16]. Provide extract ventilation to points where emissions occur [E54]. ; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11].
Small scale weighing [CS90]	Limit the substance content in the product to 1% [OC16]. Ensure material transfers are under containment or extract ventilation [E66]. ; Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].
Additive premixing [CS92] (closed systems) [CS107]	Limit the substance content in the product to 1% [OC16].; Handle substance within a closed system [E47]. Ensure material transfers are under containment or extract ventilation [E66]. ; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11].
Additive premixing [CS92](open systems) [CS108]; With sample collection [CS56].	Limit the substance content in the product to 1% [OC16]. Ensure material transfers are under containment or extract ventilation [E66]. ; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11].
Additive premixing [CS92]General exposures (open systems) [CS16].	Limit the substance content in the product to 1% [OC16]. Ensure material transfers are under containment or extract ventilation [E66]. ; Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].
Bulk transfers [CS14]. Drum/batch transfers [CS8].	Limit the substance content in the product to 1% [OC16]. Ensure material transfers are under containment or extract ventilation [E66]. ; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11].
Bulk transfers [CS14]. Small package filling [CS7].	Transfer via enclosed lines [E52].; Limit the substance content in the product to 1% [OC16]. Ensure material transfers are under containment or extract ventilation [E66]. ; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11].

Calendering (including Banburys) [CS64]	Limit the substance content in the product to 1% [OC16]. 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].
Production of articles by dipping and pouring [CS113].	Limit the substance content in the product to 1% [OC16]. 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].
Extrusion and masterbatching [CS88]	Limit the substance content in the product to 1% [OC16]. 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].
Injection moulding of articles [CS89]	Restrict area of openings to equipment [E68]. 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 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].
Storage [CS67] With occasional controlled exposure [CS137]	Limit the substance content in the product to 1% [OC16]. Store substance within a closed system [E84].; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11]. Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Section 2.2	**Control of environmental exposure**

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

Section 3	**Exposure Estimation**
3.1. Health	*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.*
3.2. Environment	
Section 4	**Guidance to check compliance with the Exposure Scenario**
4.1. Health	*Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and OC.*
4.2. Environment	
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	
Selection of relevant Contributing Scenario phrases	*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.*
Control of environmental exposure	
Selection of relevant RMM Core Phrases	*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.*

9.9.2. Exposure estimation

9.9.2.1. Workers exposure

The worker exposure estimates for the activities associated with the polymer processing using 1,3-butadiene 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.

9.9.2.2. Consumer exposure

Not applicable.

9.9.2.3. Indirect exposure of humans via the environment

See section 9.11.

9.9.2.4. Environmental exposure

Not applicable

9.10. Exposure scenario 9: Use of 1,3-butadiene in polymer processing – Professional

Applicable only where there is a residual 1,3 butadiene concentration of between 0.1 and 1%. Below 0.1% no specific application of RMM / OC is required.

9.10.1. Exposure scenario

Section 1	**Exposure Scenario Title**
Title	**Use in polymer processing of 1,3-butadiene;CAS RN 106-99-0**
Use Descriptor	Sector of Use: Professional (SU22)
	Process Categories: PROC1, PROC2, 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**
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	*Not applicable*
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently) [G2]
Human factors not influenced by risk management	*Not applicable*
Other Operational Conditions affecting worker exposure	Assumes use at not > 20°C above ambient [G15]; Assumes a good basic standard of occupational hygiene is implemented [G1].
Contributing Scenarios	**Risk Management Measures** *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
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].
Bulk transfers [CS14]. ; (closed systems) [CS107]	Handle substance within a closed system [E47].
Bulk transfers [CS14]. ; (closed systems) [CS107]With occasional controlled exposure [CS137]	Limit the substance content in the product to 1% [OC16]. 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]. Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Material transfers [CS3].	Limit the substance content in the product to 1% [OC16]. 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]. Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Injection moulding of articles [CS89]	Limit the substance content in the product to 1% [OC16]. Minimiseexposure by partial enclosure of the operation or equipment and provide extract ventilation at openings [E60]. ; Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour) [E40].Avoid carrying out activities involving exposure for more than 1 hour [OC27]
Rework of articles [CS86]	No specific measures identified [EI18].
Equipment maintenance [CS5].	Drain down and flush system prior to equipment break-in or maintenance [E55].; Limit the substance content in the product to 1% [OC16]. 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]	Handle substance within a closed system [E47].; Limit the substance content in the product to 1% [OC16].
Storage [CS67] With occasional controlled exposure [CS137]	Limit the substance content in the product to 1% [OC16]. Store substance within a closed system [E84].; Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). [E11].
Section 2.2	**Control of environmental exposure**
The exposure of aquatic, terrestrial, sediment and sewage treatment microorganisms is considered to be negligible because the substance partitions primarily to air when found in 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	
Section 3	**Exposure Estimation**
3.1. Health	*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.
3.2. Environment	
Section 4	**Guidance to check compliance with the Exposure Scenario**
4.1. Health	*Confirm that RMMs and OCs are as described or of equivalent efficiency. See Appendix A for details of efficiencies and OC*
4.2. Environment	
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	
Selection of relevant Contributing Scenario phrases	*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.*
Control of environmental exposure	
Selection of relevant RMM Core Phrases	*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.*

9.10.2. Exposure estimation

9.9.2.1. Workers exposure

The worker exposure estimates for the activities associated with the polymer processing using 1,3-butadiene 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.

9.10.2.2. Consumer exposure

Not applicable.

9.10.2.3. Indirect exposure of humans via the environment

See section 9.11.

9.10.2.4. Environmental exposure

Not applicable

9.11 Indirect exposure of humans via the environment

An assessment of the risk posed by indirect exposure of man via the environment was made for each ES in EUSES. Emissions values were taken from the appropriate SpERC. Further details on scaling and control technologies are provided in SpERC factsheet). The SpERC emissions to air, and/or water, have first been amend (http://cefic.org/en/reach-for industrieslibraries.html) ed to reflect those reported in the EU risk assessment report on 1,3-butadiene (EU, 2002), and then (if safe use was not achieved) further reduced to ensure safe working conditions. The usual scaling factors can be amended to avoid the use of these emissions. The emission values used in the modelling are reported below.

ES	Site tonnage/yr	SpERC reference	Modelled emissions to air	Modelled emissions to water	Substance characteristics
1 Manufacture	2000000	1.1.v1	2.00E-04*	1.00E-03*	Water solubility is 735mg/l. Vapour pressure is 151kPa at 12°C. Log Kow is 1.99. Not considered to be readily biodegradable.
2 Distribution	500000	1.1b.v1	1.00E-02	1.00E-03	
3 Use as an intermediate	100000	6.1a.v1	3.00E-02*	5.00E-02*	
4 Formulation	75000	2.2.v1	1.00E-02*	1.00E-03*	
5 Uses in Fuels (Industrial)	50000	7.12a.v1	1.25E-03*	5.00E-06*	
6 Uses in Laboratory reagents (Industrial)	10	ERC 2, 4	2.50E+00	2.00E+00	
7 Uses in Rubber production and processing (Industrial)	100000	4.19.v1	1.00E-02*	5.00E-02*	
8 Use in polymer production (Industrial)	100000	4.20.v1	1.00E-02*	5.00E-02*	
9 Use in polymer processing (Industrial)	10000	4.21a.v1	5.00E-01*	0.00E+00	
10 Use in polymer processing (Professional)	2500	8.21b.v1	1.00E+00*	1.00E+00	

* SpERC Emissions modified

9.12 Regional Exposure Concentrations

Environmental exposure assessment is not required for this substance. Regional exposure concentrations based on the ES described above were used in the assessment of indirect exposure of man via the environment.