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

1.1 Product identifier

Trade name/designation	1-Buten
Art-Nr(n).	2410, 70241
Substance name	but-1-ene
INDEX No.	601-012-00-4
EC No.	203-449-2
REACH No.	01-2119456615-34
CAS No.	106-98-9

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

* **Sector of uses [SU]**
SU3 Industrial uses
SU8 Manufacture of bulk, large scale chemicals (including petroleum products)
SU9 Manufacture of fine chemicals
SU10 Formulation [mixing] of preparations and/or re-packaging (excluding alloys)
SU21 Consumer uses: Private households (= general public = consumers)
SU22 Professional uses: Public domain (administration, education, entertainment, services, craftsmen)

* **Process categories [PROC]**
PROC1 Use in closed process, no likelihood of exposure
PROC2 Use in closed, continuous process with occasional controlled exposure
PROC3 Use in closed batch process (synthesis or formulation)
PROC4 Use in batch and other process (synthesis) where opportunity for exposure arises
PROC5 Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)
PROC6 Calendering operations
PROC8a Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities
PROC8b Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
PROC9 Transfer of substance or preparation into small containers (dedicated filling line, including weighing)
PROC13 Treatment of articles by dipping and pouring
PROC14 Production of preparations or articles by tabletting, compression, extrusion, pelletisation
PROC15 Use as laboratory reagent
PROC20 Use of functional fluids in small devices
PROC21 Low energy manipulation and handling of substances bound in/on materials or articles
PROC28 Manual maintenance (cleaning and repair) of machinery

* **Environmental release categories [ERC]**
ERC1 Manufacture of substances
ERC4 Industrial use of processing aids in processes and products, not becoming part of articles
ERC6a Industrial use resulting in manufacture of another substance (use of intermediates)
ERC7 Use of functional fluid at industrial site
ERC8d Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)
ERC9a Widespread use of functional fluid (indoor)
ERC9b Widespread use of functional fluid (outdoor)

* **Product Categories [PC]**
PC13 Fuels
PC16 Heat transfer fluids
PC17 Hydraulic fluids
PC19 Intermediate (precursor)

1.3 Details of the supplier of the safety data sheet

Supplier
GHC Gerling, Holz & Co. Handels GmbH
Ruhrstraße 113
D-22761 Hamburg
Telephone +49 40 853 123 0
E-mail hamburg@ghc.de
Website www.ghc.com

Department responsible for information:
GHC Gerling, Holz & Co. Handels GmbH
Telephone +49 40 853 123 0

E-mail (competent person):
msds@ghc.de

*** 1.4 Emergency telephone number**

EN: Poison Information Center Mainz +49 6131 19240

* SECTION 2: Hazards identification

*** 2.1 Classification of the substance or mixture**

Classification according to Regulation (EC) No 1272/2008 [CLP]	Classification procedure
Flam. Gas 1A, H220	
Press. Gas (Liq.), H280	

Hazard statements for physical hazards
H220 Extremely flammable gas.
H280 Contains gas under pressure; may explode if heated.

*** 2.2 Label elements**

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

Hazard pictograms

GHS02

Signal word
Danger

Hazard statements
H220 Extremely flammable gas.
H280 Contains gas under pressure; may explode if heated.

Precautionary statements
P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P377 Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381 In case of leakage, eliminate all ignition sources.
P403 Store in a well-ventilated place.

*** Supplemental hazard information**
EIGA0357 Asphyxiant in high concentrations.
Please return container with residual pressure.

*** 2.3 Other hazards**

*** Adverse human health effects and symptoms**
Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level.
The inhalation of gas / vapour in high concentrations may cause cardiac arrhythmia.
Contact with liquid may cause cold burns/frostbite.

*** Other adverse effects**
The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

*** Results of PBT and vPvB assessment**
The substance/mixture does not contain components meeting the PBT/vPvB criteria of the Reach Regulation, Annex XIII, at levels of 0.1% or higher.

* SECTION 3: Composition / information on ingredients

* 3.1 Substances

Substance name	but-1-ene
INDEX No.	601-012-00-4
EC No.	203-449-2
REACH No.	01-2119456615-34
CAS No.	106-98-9

* **Additional information**
Content: >= 99 %

* 3.2 Mixtures

not applicable

* SECTION 4: First aid measures

* 4.1 Description of first aid measures

* **General information**
Remove contaminated, saturated clothing immediately.
In the event of persistent symptoms obtain medical treatment.
First aider: Pay attention to self-protection!

Following inhalation
Remove casualty to fresh air and keep warm and at rest.
In case of respiratory standstill give artificial respiration by respiratory bag (Ambu bag) or respirator. Obtain medical assistance.

* **Following skin contact**
In case of skin contact rinse with warm water.
In case of frostbite, wash with plenty of water; do not remove clothing.
In case of frostbite rinse with lukewarm (not hot) water for at least 15 minutes. Do not remove clothing frozen to the skin.
Thaw with lukewarm water. Apply a sterile dressing. Obtain medical assistance.

After eye contact
Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Obtain medical assistance.

Following ingestion
Ingestion is not considered a potential route of exposure.

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

* **Symptoms**
The following symptoms may occur in case of strong exposition:
Unconsciousness
Cardiac arrhythmias
Respiratory tract irritation
Eye Irritation

4.3 Indication of any immediate medical attention and special treatment needed

Notes for the doctor
Treat symptomatically.
Do not apply drugs of the adrenaline ephedrine group.
To supervise the blood circulation.

* SECTION 5: Firefighting measures

* 5.1 Extinguishing media

* **Suitable extinguishing media**
Extinguishing powder
Water spray jet
Foam
Carbon dioxide (CO_2)

Unsuitable extinguishing media
Full water jet

* **5.2 Special hazards arising from the substance or mixture**

* **Hazardous combustion products**
In case of fire formation of dangerous gases possible.
Carbon monoxide
Carbon dioxide (CO_2)

* **5.3 Advice for firefighters**

* **Special protective equipment for firefighters**
Wear a self-contained breathing apparatus and chemical protective clothing.

* **Additional information**
If possible, shut off gas valves and move containers to a safe location.
Use water spray jet to protect personnel and to cool endangered containers.
Exposure to fire may cause rupture / explosion of the containers.
Do not extinguish a leaking gas flame unless absolutely necessary. Spontaneous/explosive re-ignition may occur. Extinguish any other fire.
Dispose of fire residues and contaminated extinguishing water in accordance with local, official regulations.

* SECTION 6: Accidental release measures

* **6.1 Personal precautions, protective equipment and emergency procedures**

* **For non-emergency personnel**
Use personal protection equipment.
Leave the danger area.
Keep people away and stay on the upwind side.

* **For emergency responders**
Personal protection by wearing close-fitting protective clothing and breathing apparatus.
Pay attention to extension of gas especially at ground (heavier than air) and in direction of the wind.
Eliminate all ignition sources if safe to do so.
Remove persons to safety.

* **6.2 Environmental precautions**

If possible, stop flow of product.
Do not allow to enter into surface water or drains.
Do not allow to enter into soil/subsoil.

* **6.3 Methods and material for containment and cleaning up**

* **For containment**
If necessary, secure leaky pressure receptacles using a salvage container.
Prevent the liquid from spreading over a wide area (set up barriers, cover sewage systems).
Limit expansion of the gas (water spray jet).

* **For cleaning up**
Leave to vapourize.
Provide adequate ventilation.

6.4 Reference to other sections

Disposal: see section 13
Personal protection equipment: see section 8

* SECTION 7: Handling and storage

* 7.1 Precautions for safe handling

* **Protective measures**
Use only in well-ventilated areas.
Transfer and handle product only in closed systems.
Usual measures for fire prevention.
Containers' temperature should not be increased above 50 °C.
The working pressure in the receptacle must not exceed the saturation vapour pressure of the pure product resulting at a temperature of 50 °C.
Take precautionary measures against static discharges. Ground barrels and installations. Use only antistatically equipped (spark-free) tools.
Use explosion-proof machinery, apparatus, ventilation facilities, tools etc.
Ensure valve protection device is correctly fitted.
Ensure valve outlet cap nut or plug (where provided) is correctly fitted.
Open valve slowly to avoid pressure shock.
Do not allow backflow into the container.
Entering of water into the container must be prevented.
No water to valves, flanges and other fittings.
Purging of pipes and valves with inert gases - to avoid: water, solvents.

* **Advices on general occupational hygiene**
When using do not eat, drink, smoke, sniff.
Wash hands before breaks and after work.
Remove contaminated clothing and protective equipment before entering eating areas.

* 7.2 Conditions for safe storage, including any incompatibilities

* **Requirements for storage rooms and vessels**
All regulations and local requirements for the storage of containers have to be respected.
Keep container tightly closed and in a well-ventilated place.
Do not put any product-impregnated cleaning rags into your trouser pockets.
Prevent cylinders from falling over.
Only use containers specifically approved for the substance/product.
Information on suitable materials for receptacles and valves see ISO 11114.

Storage class
2A Gases (except aerosol dispensers and lighters)

* **Materials to avoid**
Do not store together with explosives.
Do not store together with flammable liquids.
Do not store together with flammable solids.
Do not store together with pyrophoric and self-heating substances.
Do not store together with oxidizing liquids or oxidizing solids.
Do not store together with toxic liquids or toxic solids.
Do not store together with infectious substances.
Do not store together with radioactive material.
Do not store together with food or feed.

* 7.3 Specific end use(s)

* **Recommendation**
See section 1.2
Exposure scenarios (ES) see annex to this safety data sheet.

* SECTION 8: Exposure controls/personal protection

* 8.1 Control parameters

Occupational exposure limit values

CAS No.	EC No.	Substance name	occupational exposure limit value
106-98-9	203-449-2	Butene, all isomers	250 [ml/m³(ppm)] (IE)

* 8.2 Exposure controls

Appropriate engineering controls

Technical measures to prevent exposure
Transfer and handle only in enclosed systems.

* **Personal protection equipment**

Eye/face protection
Protective goggles according to EN 166, in case of increased risk add protective face shield.

* **Hand protection**
Safety gloves according to EN 388:
Chromate-free leather

Body protection:
Safety shoes with steel toecap.
Body covering work clothing or chemical resistant suit at increased risk.

Respiratory protection
Keep self contained breathing apparatus readily available for emergency use.
Respiratory protection necessary at:
high concentrations
Respiratory protection complying with EN 137.
In case of low concentrations in the breathing air: short term: filter apparatus, filter AX.
In case of rescue and maintenance activities in storage containers use environment-independent breathing apparatus because of risk of suffocation due to displacement of oxygen.

* **Thermal hazards**
Use cold-resistant protective equipment.

* **Environmental exposure controls**

* **Remark**
Prevent release to the environment.

* SECTION 9: Physical and chemical properties

* 9.1 Information on basic physical and chemical properties

Physical state
Gaseous / liquefied under pressure.

Colour
colourless

Odour
mild aromatic

Safety relevant basis data

	Value	Method	Source, Remark
Odour threshold:			not determined
Melting point/freezing point			not applicable
Boiling point or initial boiling point and boiling range	-6.2 °C pressure 1013 hPa		
flammability			inflammable
Lower and upper explosion limit	Upper explosion limit 10.6 Vol-%		
Lower and upper explosion limit	Lower explosion limit 1.5 Vol-%		
Flash point			not applicable
Auto-ignition temperature	360 °C		
Decomposition temperature			No decomposition if used as directed.
pH			not applicable
Viscosity			not applicable
Solubility(ies)	Water solubility 221 mg/L (25°C)		

	Value	Method	Source, Remark
Partition coefficient n-octanol/water (log value)	2.4		
Vapour pressure	2500 hPa (20°C)		
Density and/or relative density			not applicable
Relative vapour density	2		Air = 1.
particle characteristics			not applicable

*** 9.2 Other information**

*** Information with regard to physical hazard classes**

*** Gases under pressure**

Safety characteristics

	Value	Method, Result	Source, Remark
Critical temperature	146.5 °C		

*** Other information**
Vapours are heavier than air.

* SECTION 10: Stability and reactivity

*** 10.1 Reactivity**

May form an explosive mixture with air.

*** 10.2 Chemical stability**

The substance is chemically stable under recommended conditions of storage, use and temperature.

10.3 Possibility of hazardous reactions

Reactions with strong acids.
Reactions with strong oxidising agents.
Danger of polymerisation

*** 10.4 Conditions to avoid**

Heat sources / heat - risk of bursting.
Ignition sources, open flames, glowing metal surfaces, etc.

10.5 Incompatible materials

Acetylene
Chlorine
Hydrochloric gas
Fluorine
Nitrogen oxides (NOx)

10.6 Hazardous decomposition products

When handled and stored appropriately, no dangerous decomposition products are known.

* SECTION 11: Toxicological information

11.1 Information on hazard classes as defined in Regulation (EC) No 1272/2008

*** Acute toxicity**

*** Animal data**

	Effective dose	Method,Evaluation	Source, Remark
Acute oral toxicity			Study technically not feasible.
Acute dermal toxicity			Study technically not feasible.

	Effective dose	Method,Evaluation	Source, Remark
Acute inhalation toxicity	Acute inhalation toxicity (gas) LC50: > 10000 ppm Species Rat Exposure time 4 h	OECD 403	Analogous to a similar product.

* **Assessment/classification**
Based on available data, the classification criteria are not met.

* **Skin corrosion/irritation**

* **Other information**
Study technically not feasible.

* **Serious eye damage/irritation**

* **Other information**
Study technically not feasible.

* **Sensitisation to the respiratory tract**

* **Other information**
No data available

* **Skin sensitisation**

* **Other information**
Study technically not feasible.

* **Germ cell mutagenicity**

	Value	Method	Result / Evaluation	Remark
In vitro mutagenicity/genotoxicity			negative	
In vivo mutagenicity/genotoxicity	Species Mouse	OECD 474	negative	Analogous to a similar product.

* **Assessment/classification**
Based on available data, the classification criteria are not met.

* **Carcinogenicity**

Animal data

	Value	Method	Result / Evaluation	Remark
Carcinogenicity	inhalative NOAEC 4589 mg/kg Species Rat			

* **Assessment/classification**
Based on available data, the classification criteria are not met.

* **Reproductive toxicity**

Animal data

	Value	Method	Result / Evaluation	Remark
Reproductive toxicity	inhalative NOAEC 8000 ppm	OECD 422		

* **Assessment/classification**
Based on available data, the classification criteria are not met.

* **STOT-single exposure**

* **STOT SE 1 and 2**

* **Assessment/classification**
No data available

* **STOT-repeated exposure**

* **Animal data**

	Effective dose	Method	Specific effects:	Organs affected:	Source, Remark
Inhalative specific target organ toxicity (repeated exposure)	NOAEL(C): 8000 ppm Species Rat (male / female)	OECD 422			

* **Assessment/classification**
Based on available data, the classification criteria are not met.

* **Aspiration hazard**

* **Assessment/classification**
Study technically not feasible.

11.2 Information on other hazards

Symptoms related to the physical, chemical and toxicological characteristics

* **Additional information**
The inhalation of gas / vapour in high concentrations may cause cardiac arrhythmia.
Inhalation causes narcotic effects/intoxication.

* SECTION 12: Ecological information

* **12.1 Toxicity**

* **Aquatic toxicity**

	Effective dose	Method,Evaluation	Source, Remark
Acute (short-term) fish toxicity	LC50: 29- 38 mg/L Test duration 96 h	QSAR	
Chronic (long-term) fish toxicity	not determined		
Acute (short-term) toxicity to crustacea	LC50 16.8- 21.8 mg/L Test duration 48 h	QSAR	
Chronic (long-term) toxicity to aquatic invertebrate	not determined		
Acute (short-term) toxicity to algae and cyanobacteria	EC50 13.6- 16.9 mg/L Test duration 96 h	QSAR	
Chronic (long-term) toxicity to aquatic algae and cyanobacteria	not determined		
Toxicity to other aquatic plants/organisms	not determined		
Toxicity to microorganisms	not determined		

* **12.2 Persistence and degradability**

	Value	Method	Source, Remark
Biodegradation	Degradation rate 50 % Test duration 2.8 d	QSAR	

* **Assessment/classification**
Readily biodegradable (according to OECD criteria).

* **12.3 Bioaccumulative potential**

	Value	Method	Source, Remark
Bioconcentration factor (BCF)	Bioconcentration factor (BCF) 17.8		

* 12.4 Mobility in soil

	Value	Distribution	Transport type	Method	Remark
Half-life time in soil	108.3			KOC value	Calculated

* 12.5 Results of PBT and vPvB assessment

The substance/mixture does not contain components meeting the PBT/vPvB criteria of the Reach Regulation, Annex XIII, at levels of 0.1% or higher.

* 12.6 Endocrine disrupting properties

	Effective dose	Method,Evaluation	Source, Remark
Endocrine disrupting properties			See section 2.3

12.7 Other adverse effects

No data available

* SECTION 13: Disposal considerations

* 13.1 Waste treatment methods

Waste codes/waste designations according to EWC/AVV

Waste code product	Waste name
160504 *	gases in pressure containers (including halons) containing hazardous substances

* **Appropriate disposal / Product**
Waste disposal according to directive 2008/98/EC, covering waste and dangerous waste.
Prevent release to the environment. No disposal via the sewage.

Appropriate disposal / Package
Transportable pressure equipment (empty, residual pressure): Return to supplier / manufacturer.

* SECTION 14: Transport information

	Land transport (ADR/RID)	Sea transport (IMDG)	Air transport (ICAO-TI / IATA-DGR)
14.1 UN number or ID number	UN 1012	UN 1012	UN 1012
14.2 UN proper shipping name	BUTYLENE (1-Butylene)	BUTYLENE	Butylene
14.3 Transport hazard class(es)	2.1	2.1	2.1
14.4 Packing group	-	-	-
14.5 Environmental hazards	No	No	No

14.6 Special precautions for user

The protective measures listed in Sections 6, 7 and 8 of the Safety Data Sheet have to be considered.

14.7 Maritime transport in bulk according to IMO instruments

No carriage in bulk.

Land transport (ADR/RID)

UN number or ID number	UN 1012
UN proper shipping name	BUTYLENE (1-Butylene)
Transport hazard class(es)	2.1
Hazard label(s)	2.1
Classification code	2F
Packing group	-
Environmental hazards	No
Limited quantity (LQ)	0

Special provisions	662
Tunnel restriction code	B/D

* **Sea transport (IMDG)**

UN number or ID number	UN 1012
UN proper shipping name	BUTYLENE
Transport hazard class(es)	2.1
Packing group	-
Environmental hazards	No
Limited quantity (LQ)	0
Marine pollutant	No
EmS	F-D, S-U

Air transport (ICAO-TI / IATA-DGR)

UN number or ID number	UN 1012
UN proper shipping name	Butylene
Transport hazard class(es)	2.1
Packing group	-
Environmental hazards	No

* SECTION 15: Regulatory information

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

* **EU legislation**

* **Restrictions of occupation**
Observe employment restrictions under the Maternity Protection Directive (92/85/EEC) for expectant or nursing mothers.
Observe restrictions to employment for juvenils according to the 'juvenile work protection guideline' (94/33/EC).

* **Other regulations (EU)**

* **To follow:**
Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), Annex XVII No 40.
Directive 2012/18/EU on the control of major-accident hazards involving dangerous substances.
National and local regulations concerning chemicals shall be observed.

* **Directive 2010/75/EU on industrial emissions [Industrial Emissions Directive] VOC**
VOC-value ≥ 99 %

15.2 Chemical Safety Assessment

* **National regulations**

For this substance a chemical safety assessment has been carried out.

* SECTION 16: Other information

Key literature references and sources for data
Information from our suppliers and data from the "GESTIS Substances Database" and the "Registered Substances" database of the European Chemicals Agency (ECHA) were used to create this safety data sheet.

* **Additional information**
The information contained herein is based on the state of our knowledge. It characterizes the product with regard to the appropriate safety precautions. It does not represent a guarantee of the properties of the product.

Relevant H- and EUH-phrases (Number and full text)

H220	Extremely flammable gas.
H280	Contains gas under pressure; may explode if heated.

Indication of changes
* Data changed compared with the previous version

Annex to the extended Safety Data Sheet (eSDS)

Content

Exposure Scenario I.

Exposure scenario worker

1.Manufacture

List of use descriptors	
Life Cycle Stage	Manufacture
Sector(s) of use	SU3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Product categories [PC]:	PC19: Intermediate (precursor)

Name of contributing environmental scenario and corresponding ERC	Manufacture: ERC1: Manufacture of the substance

List of names of contributing worker scenarios and corresponding PROCs	Manufacture: PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC3: Use in closed batch process (synthesis or formulation) PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities : Use as laboratory reagent

Further explanations	
Other Process or activity:	Manufacture of the substance or use as a process chemical or extraction agent. Includes recycling/ recovery, material transfers, storage, maintenance and loading (including marine vessel/barge, road/rail car and bulk container), sampling and associated laboratory activities.

2.1.Contributing exposure scenario controlling environmental exposure for: Manufacture

Environmental Release Category (ERC)	ERC1: Manufacture of the substance

Further explanations	
Other Process or activity:	As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

Product characteristics

Concentration of the substance in a mixture:	

Physical state	Gas

Viscosity:	
Kinematic viscosity:	This information is not available.
Dynamic viscosity:	This information is not available.

Amounts used

Frequency and duration of use

Batch process:	not relevant
Continuous process:	not relevant

Environment factors not influenced by risk management

Flow rate of receiving surface water (m^3/d):	not relevant
Local freshwater dilution factor	not relevant
Local marine water dilution factor	not relevant

Other given operational conditions affecting environmental exposure

Other relevant operational conditions	not relevant

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See chapter 8 of the safety data sheet (Environmental exposure controls).

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Air	not relevant
Soil	not relevant
Water	not relevant
Sediment:	not relevant

Remarks:	not relevant

Organisational measures to prevent/limit release from site:

none

Conditions and measures related to sewage treatment plant

Conditions and measures related to external treatment of waste for disposal

This information is not available.

Conditions and measures related to external recovery of waste

This information is not available.

Additional good practice advice beyond the REACH CSA

This information is not available.

2.2. Contributing exposure scenario controlling worker exposure for: Manufacture

Process Categories:	PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC3: Use in closed batch process (synthesis or formulation) PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities : Use as laboratory reagent

Further explanations:	
Other Process or activity:	Other General exposures (closed systems) General exposures (open systems) Equipment cleaning and maintenance Process sampling Laboratory activities Bulk transfers Closed systems , or: Open systems Storage

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.

Physical form of the product:	gaseous
Vapour pressure:	not relevant
Process temperature:	not relevant

Remarks	not relevant

Amounts used

Frequency and duration of use

Covers daily exposures up to 8 hours

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting workers exposure

Area of use	Room size:	Temperature :	Ventilation rate	Remarks
Indoor use				

Other relevant operational conditions:	not relevant

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See chapter 7 of the safety data sheet

Technical conditions and measures to control dispersion from source towards the worker

Application	Route of Exposure	Protective Measures	Effectiveness	Remarks
Industrial:	Inhalation exposure	Provide a basic standard of general ventilation (1 to 3 air changes per hour)., Provide extract ventilation to points where emissions occur.		

Organisational measures to prevent/limit releases, dispersion and exposure

Application	Route of Exposure	Protective Measures	Remarks
Industrial:	Dermal exposure	Assumes a good basic standard of occupational hygiene is implemented., Supervision in place to check that the RMMs (Risk Management Measures) in place are being used correctly and OCs (Operational Conditions) followed., Take precautionary measures against static discharges., Keep away from sources of ignition - No smoking., Keep away from heat/sparks/open flames. - No smoking.	

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

Application	Route of Exposure	Protective Measures	Effectiveness	Remarks
Industrial:	Dermal exposure	For personal protection see section 8.		

Additional good practice advice beyond the REACH CSA

This information is not available.

3. Exposure estimation

Environment:

Manufacture:

ERC1:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Humans via the environment		< 1	Qualitative approach used to conclude safe use.	Risk checked

Health:

Manufacture:

PROC1:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
Worker - all relevant routes			< 1	Qualitative approach used to conclude safe use.	Risk checked

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required. The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. Measured data could be used to confirm exposure levels are within the boundaries of the exposure scenario.

Exposure Scenario II.

Exposure scenario worker

1.Industrial uses, Distribution of substance

List of use descriptors	
Life Cycle Stage	Use at industrial sites
Sector(s) of use	SU3: Industrial uses: Uses of substances as such or in preparations at industrial sites
Product categories [PC]:	PC19: Intermediate (precursor)

Name of contributing environmental scenario and corresponding ERC	Industrial uses: ERC7: Industrial use of substances in closed systems

List of names of contributing worker scenarios and corresponding PROCs	Industrial uses: PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC3: Use in closed batch process (synthesis or formulation) PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises

	PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities PROC9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) PROC15: Use as laboratory reagent

Further explanations	
Other Process or activity:	Loading (including marine vessel/barge, rail/road car and IBC loading) and repacking (including drums and small packs) of substance, including its sampling, storage, unloading, distribution and associated laboratory activities.

2.1.Contributing exposure scenario controlling environmental exposure for: Industrial uses, Distribution of substance

Environmental Release Category (ERC)	ERC7: Industrial use of substances in closed systems

Further explanations	
Other Process or activity:	As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

Product characteristics

Concentration of the substance in a mixture:	

Physical state	Gas

Viscosity:	
Kinematic viscosity:	This information is not available.
Dynamic viscosity:	This information is not available.

Amounts used

Frequency and duration of use

Batch process:	not relevant
Continuous process:	not relevant

Environment factors not influenced by risk management

Flow rate of receiving surface water (m^3/d):	not relevant
Local freshwater dilution factor	not relevant

Local marine water dilution factor	not relevant

Other given operational conditions affecting environmental exposure

Other relevant operational conditions	not relevant

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See chapter 8 of the safety data sheet (Environmental exposure controls).

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Air	not relevant
Soil	not relevant
Water	not relevant
Sediment:	not relevant
Remarks:	not relevant

Organisational measures to prevent/limit release from site:

none

Conditions and measures related to sewage treatment plant

Conditions and measures related to external treatment of waste for disposal

This information is not available.

Conditions and measures related to external recovery of waste

This information is not available.

Additional good practice advice beyond the REACH CSA

This information is not available.

2.2. Contributing exposure scenario controlling worker exposure for: Industrial uses, Distribution of substance

Process Categories:	PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC3: Use in closed batch process (synthesis or formulation) PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities PROC9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) PROC15: Use as laboratory reagent

Further explanations:	
Other Process or activity:	Other General exposures (closed systems) General exposures (open systems) Process sampling Laboratory activities Bulk transfers Closed systems , or: Open systems Drum and small package filling Equipment cleaning and maintenance Storage

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.

Physical form of the product:	gaseous
Vapour pressure:	not relevant
Process temperature:	not relevant
Remarks	not relevant

Amounts used

Frequency and duration of use

Covers daily exposures up to 8 hours

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting workers exposure

Area of use	Room size:	Temperature :	Ventilation rate	Remarks
Indoor use				

Other relevant operational conditions:	not relevant

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See chapter 7 of the safety data sheet

Technical conditions and measures to control dispersion from source towards the worker

Application	Route of Exposure	Protective Measures	Effectiveness	Remarks
Industrial:	Inhalation exposure	Provide a basic standard of general ventilation (1 to 3 air changes per hour)., Provide extract ventilation to points where emissions occur.		

Organisational measures to prevent/limit releases, dispersion and exposure

Application	Route of Exposure	Protective Measures	Remarks
Industrial:	Dermal exposure	Assumes a good basic standard of occupational hygiene is implemented., Supervision in place to check that the RMMs (Risk Management Measures) in place are being used correctly and OCs (Operational Conditions) followed., Take precautionary measures against static discharges., Keep away from sources of ignition - No smoking., Keep away from heat/sparks/open flames. - No smoking.	

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

Application	Route of Exposure	Protective Measures	Effectiveness	Remarks
Industrial:	Dermal exposure	For personal protection see section 8.		

Additional good practice advice beyond the REACH CSA

This information is not available.

3. Exposure estimation

Environment:

Industrial uses, Distribution of substance:

ERC7:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Humans via the environment		< 1	Qualitative approach used to conclude safe use.	Risk checked

Health:

Industrial uses, Distribution of substance:

PROC1:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
Worker - all relevant routes			< 1	Qualitative approach used to conclude safe use.	Risk checked

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required. The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. Measured data could be used to confirm exposure levels are within the boundaries of the exposure scenario.

Exposure Scenario III.

Exposure scenario worker

1.Industrial uses, Use as an intermediate

List of use descriptors	
Life Cycle Stage	Use at industrial sites
Sector(s) of use	SU3: Industrial uses: Uses of substances as such or in preparations at industrial sites

	SU8: Manufacture of bulk, large scale chemicals (including petroleum products) SU9: Manufacture of fine chemicals
Product categories [PC]:	PC19: Intermediate (precursor)

Name of contributing environmental scenario and corresponding ERC	Industrial uses: ERC6a: Industrial use resulting in manufacture of another substance (use of intermediates)

List of names of contributing worker scenarios and corresponding PROCs	Industrial uses: PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC3: Use in closed batch process (synthesis or formulation) PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC8a: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities PROC15: Use as laboratory reagent

Further explanations	
Other Process or activity:	Use of substance as an intermediate (not related to Strictly Controlled Conditions). Includes recycling/ recovery, material transfers, storage, sampling, associated laboratory activities, maintenance and loading (including marine vessel/barge, road/rail car and bulk container).

2.1.Contributing exposure scenario controlling environmental exposure for: Industrial uses, Use as an intermediate

Environmental Release Category (ERC)	ERC6a: Industrial use resulting in manufacture of another substance (use of intermediates)

Further explanations	
Other Process or activity:	As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

Product characteristics

Concentration of the substance in a mixture:	

Physical state	Gas

Viscosity:	
Kinematic viscosity:	This information is not available.
Dynamic viscosity:	This information is not available.

Amounts used

Frequency and duration of use

Batch process:	not relevant
Continuous process:	not relevant

Environment factors not influenced by risk management

Flow rate of receiving surface water (m^3/d):	not relevant
Local freshwater dilution factor	not relevant
Local marine water dilution factor	not relevant

Other given operational conditions affecting environmental exposure

Other relevant operational conditions	not relevant

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release
See chapter 8 of the safety data sheet (Environmental exposure controls).

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Air	not relevant
Soil	not relevant
Water	not relevant
Sediment:	not relevant
Remarks:	not relevant

Organisational measures to prevent/limit release from site:
none

Conditions and measures related to sewage treatment plant

Conditions and measures related to external treatment of waste for disposal
This information is not available.

Conditions and measures related to external recovery of waste

This information is not available.

Additional good practice advice beyond the REACH CSA

This information is not available.

2.2. Contributing exposure scenario controlling worker exposure for: Industrial uses, Use as an intermediate

Process Categories:	PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC3: Use in closed batch process (synthesis or formulation) PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC8a: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities PROC15: Use as laboratory reagent

Further explanations:	
Other Process or activity:	Other General exposures (closed systems) General exposures (open systems) Equipment cleaning and maintenance Process sampling Laboratory activities Bulk transfers Closed systems , or: Open systems Storage

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.

Physical form of the product:	gaseous
Vapour pressure:	not relevant
Process temperature:	not relevant
Remarks	not relevant

Amounts used

Frequency and duration of use

Covers daily exposures up to 8 hours

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting workers exposure

Area of use	Room size:	Temperature :	Ventilation rate	Remarks
Indoor use				

Other relevant operational conditions:	not relevant

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See chapter 7 of the safety data sheet

Technical conditions and measures to control dispersion from source towards the worker

Application	Route of Exposure	Protective Measures	Effectiveness	Remarks
Industrial:	Inhalation exposure	Provide a basic standard of general ventilation (1 to 3 air changes per hour)., Provide extract ventilation to points where emissions occur.		

Organisational measures to prevent/limit releases, dispersion and exposure

Application	Route of Exposure	Protective Measures	Remarks
Industrial:	Dermal exposure	Assumes a good basic standard of occupational hygiene is implemented., Supervision in place to check that the RMMs (Risk Management Measures) in place are being used correctly and OCs (Operational Conditions) followed., Take precautionary measures against static discharges., Keep away from sources of ignition - No smoking., Keep away from heat/sparks/open flames. - No smoking.	

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

Application	Route of Exposure	Protective Measures	Effectiveness	Remarks
Industrial:	Dermal exposure	For personal protection see section 8.		

Additional good practice advice beyond the REACH CSA

This information is not available.

3. Exposure estimation

Environment:

Industrial uses, Use as an intermediate:

ERC6a:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Humans via the environment		< 1	Qualitative approach used to conclude safe use.	Risk checked

Health:

Industrial uses, Use as an intermediate:

PROC1:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
Worker - all relevant routes			< 1	Qualitative approach used to conclude safe use.	Risk checked

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required. The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. Measured data could be used to confirm exposure levels are within the boundaries of the exposure scenario.

Exposure Scenario IV.

Exposure scenario worker

1.Industrial uses, Use in polymer production

List of use descriptors	
Life Cycle Stage	Use at industrial sites
Sector(s) of use	SU3: Industrial uses: Uses of substances as such or in preparations at industrial sites SU10: Formulation [mixing] of preparations and/or re-packaging (excluding alloys)
Product categories [PC]:	PC19: Intermediate (precursor)

Name of contributing environmental scenario and corresponding ERC	Industrial uses: ERC6a: Industrial use resulting in manufacture of another substance (use of intermediates)

List of names of contributing worker scenarios and corresponding PROCs	Industrial uses: PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure

	PROC3: Use in closed batch process (synthesis or formulation) PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC5: Mixing or blending in batch processes PROC6: Calendering operations PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities PROC14: Tabletting, compression, extrusion, pelletisation, granulation

Further explanations	
Other Process or activity:	Manufacture of polymers from monomers in continuous and batch processes. Including production, re-cycling and recovery, degassing, discharging, reactor maintenance and immediate polymer product formation (i.e. compounding, pelletisation, product off-gassing).

2.1.Contributing exposure scenario controlling environmental exposure for: Industrial uses, Use in polymer production

Environmental Release Category (ERC)	ERC6a: Industrial use resulting in manufacture of another substance (use of intermediates)

Further explanations	
Other Process or activity:	As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

Product characteristics

Concentration of the substance in a mixture:	

Physical state	Gas

Viscosity:	
Kinematic viscosity:	This information is not available.
Dynamic viscosity:	This information is not available.

Amounts used

Frequency and duration of use

Batch process:	not relevant
Continuous process:	not relevant

Environment factors not influenced by risk management

Flow rate of receiving surface water (m^3/d):	not relevant
Local freshwater dilution factor	not relevant
Local marine water dilution factor	not relevant

Other given operational conditions affecting environmental exposure

Other relevant operational conditions	not relevant

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See chapter 8 of the safety data sheet (Environmental exposure controls).

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Air	not relevant
Soil	not relevant
Water	not relevant
Sediment:	not relevant
Remarks:	not relevant

Organisational measures to prevent/limit release from site:

none

Conditions and measures related to sewage treatment plant

Conditions and measures related to external treatment of waste for disposal

This information is not available.

Conditions and measures related to external recovery of waste

This information is not available.

Additional good practice advice beyond the REACH CSA

This information is not available.

2.2. Contributing exposure scenario controlling worker exposure for: Industrial uses, Use in polymer production

Process Categories:	PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC3: Use in closed batch process (synthesis or formulation) PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC5: Mixing or blending in batch processes PROC6: Calendering operations PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities PROC14: Tabletting, compression, extrusion, pelletisation, granulation

Further explanations:	
Other Process or activity:	Other General exposures (closed systems) Polymerisation Bulk transfers Finishing operations Intermediate polymer storage Additivation and stabilisation Mixing operations Pelletising Pelletisation and pellet screening Transport Equipment maintenance Storage

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.

Physical form of the product:	gaseous
Vapour pressure:	not relevant
Process temperature:	not relevant
Remarks	not relevant

Amounts used

Frequency and duration of use

Covers daily exposures up to 8 hours

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting workers exposure

Area of use	Room size:	Temperature :	Ventilation rate	Remarks
Indoor use				

Other relevant operational conditions:	not relevant

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See chapter 7 of the safety data sheet

Technical conditions and measures to control dispersion from source towards the worker

Application	Route of Exposure	Protective Measures	Effectiveness	Remarks
Industrial:	Inhalation exposure	Provide a basic standard of general ventilation (1 to 3 air changes per hour)., Provide extract ventilation to points where emissions occur.		

Organisational measures to prevent/limit releases, dispersion and exposure

Application	Route of Exposure	Protective Measures	Remarks
Industrial:	Dermal exposure	Assumes a good basic standard of occupational hygiene is implemented., Supervision in place to check that the RMMs (Risk Management Measures) in place are being used correctly and OCs (Operational Conditions) followed., Take precautionary measures against static discharges., Keep away from sources of ignition - No smoking., Keep away from heat/sparks/open flames. - No smoking.	

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

Application	Route of Exposure	Protective Measures	Effectiveness	Remarks
Industrial:	Dermal exposure	For personal protection see section 8.		

Additional good practice advice beyond the REACH CSA

This information is not available.

3. Exposure estimation

Environment:

Industrial uses, Use in polymer production:

ERC6a:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Humans via the environment		< 1	Qualitative approach used to conclude safe use.	Risk checked

Health:

Industrial uses, Use in polymer production:

PROC1:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
Worker - all relevant routes			< 1	Qualitative approach used to conclude safe use.	Risk checked

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required. The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. Measured data could be used to confirm exposure levels are within the boundaries of the exposure scenario.

Exposure Scenario V.

Exposure scenario worker

1.Industrial uses, Use in polymer processing

List of use descriptors	
Life Cycle Stage	Use at industrial sites
Sector(s) of use	SU3: Industrial uses: Uses of substances as such or in preparations at industrial sites

	SU10: Formulation [mixing] of preparations and/or re-packaging (excluding alloys)
Product categories [PC]:	PC19: Intermediate (precursor)

Name of contributing environmental scenario and corresponding ERC	Industrial uses: ERC4: Industrial use of processing aids in processes and products, not becoming part of articles

List of names of contributing worker scenarios and corresponding PROCs	Industrial uses: PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC3: Use in closed batch process (synthesis or formulation) PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC5: Mixing or blending in batch processes PROC6: Calendering operations PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities PROC9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) : Treatment of articles by dipping and pouring PROC14: Tabletting, compression, extrusion, pelletisation, granulation PROC21: Low energy manipulation of substances bound in materials and/or articles

Further explanations	
Other Process or activity:	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.

2.1.Contributing exposure scenario controlling environmental exposure for: Industrial uses, Use in polymer processing

Environmental Release Category (ERC)	ERC4: Industrial use of processing aids in processes and products, not becoming part of articles

Further explanations	
Other Process or activity:	As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

Product characteristics

Concentration of the substance in a mixture:	

Physical state	Gas

Viscosity:	
Kinematic viscosity:	This information is not available.
Dynamic viscosity:	This information is not available.

Amounts used

Frequency and duration of use

Batch process:	not relevant
Continuous process:	not relevant

Environment factors not influenced by risk management

Flow rate of receiving surface water (m^3/d):	not relevant
Local freshwater dilution factor	not relevant
Local marine water dilution factor	not relevant

Other given operational conditions affecting environmental exposure

Other relevant operational conditions	not relevant

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See chapter 8 of the safety data sheet (Environmental exposure controls).

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Air	not relevant
Soil	not relevant
Water	not relevant

Sediment:	not relevant
Remarks:	not relevant

Organisational measures to prevent/limit release from site:

none

Conditions and measures related to sewage treatment plant

Conditions and measures related to external treatment of waste for disposal

This information is not available.

Conditions and measures related to external recovery of waste

This information is not available.

Additional good practice advice beyond the REACH CSA

This information is not available.

2.2. Contributing exposure scenario controlling worker exposure for: Industrial uses, Use in polymer processing

Process Categories:	PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC3: Use in closed batch process (synthesis or formulation) PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises PROC5: Mixing or blending in batch processes PROC6: Calendering operations PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities PROC9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) : Treatment of articles by dipping and pouring PROC14: Tabletting, compression, extrusion, pelletisation, granulation PROC21: Low energy manipulation of substances bound in materials and/or articles

Further explanations:

Other Process or activity:	Other Bulk transfers Closed systems Dedicated facility Small scale weighing Additive premixing Calendering (including Banburys) Operation is carried out at elevated temperature (> 20 °C above ambient temperature). Production of articles by dipping and pouring Extrusion and masterbatching Injection moulding of articles Finishing operations Equipment maintenance Storage

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.

Physical form of the product:	gaseous
Vapour pressure:	not relevant
Process temperature:	not relevant
Remarks	not relevant

Amounts used

Frequency and duration of use

Covers daily exposures up to 8 hours

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting workers exposure

Area of use	Room size:	Temperature :	Ventilation rate	Remarks
Indoor use				

Other relevant operational conditions:	not relevant

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See chapter 7 of the safety data sheet

Technical conditions and measures to control dispersion from source towards the worker

Application	Route of Exposure	Protective Measures	Effectiveness	Remarks
Industrial:	Inhalation exposure	Provide a basic standard of general ventilation (1 to 3 air changes per hour)., Provide extract ventilation to points where emissions occur.		

Organisational measures to prevent/limit releases, dispersion and exposure

Application	Route of Exposure	Protective Measures	Remarks
Industrial:	Dermal exposure	Assumes a good basic standard of occupational hygiene is implemented., Supervision in place to check that the RMMs (Risk Management Measures) in place are being used correctly and OCs (Operational Conditions) followed., Take precautionary measures against static discharges., Keep away from sources of ignition - No smoking., Keep away from heat/sparks/open flames. - No smoking.	

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

Application	Route of Exposure	Protective Measures	Effectiveness	Remarks
Industrial:	Dermal exposure	For personal protection see section 8.		

Additional good practice advice beyond the REACH CSA

This information is not available.

3. Exposure estimation

Environment:

Industrial uses, Use in polymer processing:

ERC4:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Humans via the environment		< 1	Qualitative approach used to conclude safe use.	Risk checked

Health:

Industrial uses, Use in polymer processing:

PROC1:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
Worker - all relevant routes			< 1	Qualitative approach used to conclude safe use.	Risk checked

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required. The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. Measured data could be used to confirm exposure levels are within the boundaries of the exposure scenario.

Exposure Scenario VI.

Exposure scenario worker

1.Professional uses, Use in polymer processing

List of use descriptors	
Life Cycle Stage	Widespread use by professional workers
Sector(s) of use	SU22: Professional uses: Public domain (administration, education, entertainment, services, craftsmen)

Product categories [PC]:	PC19: Intermediate (precursor)

Name of contributing environmental scenario and corresponding ERC	Professional uses: ERC8d: Wide dispersive outdoor use of processing aids in open systems

List of names of contributing worker scenarios and corresponding PROCs	Professional uses: PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC6: Calendering operations PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities PROC14: Production of preparations or articles by tabletting, compression, extrusion, pelletisation PROC21: Low energy manipulation of substances bound in materials and/or articles

Further explanations	
Other Process or activity:	Processing of formulated polymers including material transfers, moulding and forming activities, material re-works and associated maintenance.

2.1.Contributing exposure scenario controlling environmental exposure for: Professional uses, Use in polymer processing

Environmental Release Category (ERC)	ERC8d: Wide dispersive outdoor use of processing aids in open systems

Further explanations	
Other Process or activity:	As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

Product characteristics

Concentration of the substance in a mixture:	

Physical state	Gas

Viscosity:	
Kinematic viscosity:	This information is not available.
Dynamic viscosity:	This information is not available.

Amounts used

Frequency and duration of use

Batch process:	not relevant
Continuous process:	not relevant

Environment factors not influenced by risk management

Flow rate of receiving surface water (m^3/d):	not relevant
Local freshwater dilution factor	not relevant
Local marine water dilution factor	not relevant

Other given operational conditions affecting environmental exposure

Other relevant operational conditions	not relevant

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See chapter 8 of the safety data sheet (Environmental exposure controls).

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Air	not relevant
Soil	not relevant
Water	not relevant
Sediment:	not relevant
Remarks:	not relevant

Organisational measures to prevent/limit release from site:

none

Conditions and measures related to sewage treatment plant

Conditions and measures related to external treatment of waste for disposal

This information is not available.

Conditions and measures related to external recovery of waste

This information is not available.

Additional good practice advice beyond the REACH CSA

This information is not available.

2.2. Contributing exposure scenario controlling worker exposure for: Professional uses, Use in polymer processing

Process Categories:	PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC6: Calendering operations PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities PROC14: Production of preparations or articles by tabletting, compression, extrusion, pelletisation PROC21: Low energy manipulation of substances bound in materials and/or articles

Further explanations:	
Other Process or activity:	Other Bulk transfers Closed systems Material transfers Injection moulding of articles Rework of articles Equipment maintenance Storage

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.

Physical form of the product:	gaseous
Vapour pressure:	not relevant
Process temperature:	not relevant
Remarks	not relevant

Amounts used

Frequency and duration of use

Covers daily exposures up to 8 hours

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting workers exposure

Area of use	Room size:	Temperature :	Ventilation rate	Remarks
Outdoor use				

Other relevant operational conditions:	not relevant

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See chapter 7 of the safety data sheet

Technical conditions and measures to control dispersion from source towards the worker

Application	Route of Exposure	Protective Measures	Effectiveness	Remarks
Professional:	Inhalation exposure	Provide a basic standard of general ventilation (1 to 3 air changes per hour)., Provide extract ventilation to points where emissions occur.		

Organisational measures to prevent/limit releases, dispersion and exposure

Application	Route of Exposure	Protective Measures	Remarks
Professional:	Dermal exposure	Assumes a good basic standard of occupational hygiene is implemented., Supervision in place to check that the RMMs (Risk Management Measures) in place are being used correctly and OCs (Operational Conditions) followed., Take precautionary measures against static discharges., Keep away from sources of ignition - No smoking., Keep away from heat/sparks/open flames. - No smoking.	

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

Application	Route of Exposure	Protective Measures	Effectiveness	Remarks
Professional:	Dermal exposure	For personal protection see section 8.		

Additional good practice advice beyond the REACH CSA

This information is not available.

3. Exposure estimation

Environment:

Professional uses, Use in polymer processing:

ERC8d:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Humans via the environment		< 1	Qualitative approach used to conclude safe use.	Risk checked

Health:

Professional uses, Use in polymer processing:

PROC1:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
Worker - all relevant routes			< 1	Qualitative approach used to conclude safe use.	Risk checked

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required. The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. Measured data could be used to confirm exposure levels are within the boundaries of the exposure scenario.

Exposure Scenario VII.

Exposure scenario worker

1.Professional uses, Use in propellants, Functional fluids

List of use descriptors	
Life Cycle Stage	Widespread use by professional workers
Sector(s) of use	SU22: Professional uses: Public domain (administration, education, entertainment, services, craftsmen)

Product categories [PC]:	

Name of contributing environmental scenario and corresponding ERC	Professional uses: ERC9a: Wide dispersive indoor use of substances in closed systems

List of names of contributing worker scenarios and corresponding PROCs	Professional uses: PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC28: Manual maintenance (cleaning and repair) of machinery PROC20: Use of functional fluids in small devices PROC8a: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

2.1.Contributing exposure scenario controlling environmental exposure for: Professional uses, Use in propellants, Functional fluids

Environmental Release Category (ERC)	ERC9a: Wide dispersive indoor use of substances in closed systems

Further explanations	
Other Process or activity:	As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

Product characteristics

Concentration of the substance in a mixture:	

Physical state	

Viscosity:	
Kinematic viscosity:	This information is not available.
Dynamic viscosity:	This information is not available.

Amounts used

Frequency and duration of use

Batch process:	not relevant
Continuous process:	not relevant

Environment factors not influenced by risk management

Flow rate of receiving surface water (m^3/d):	not relevant
Local freshwater dilution factor	not relevant
Local marine water dilution factor	not relevant

Other given operational conditions affecting environmental exposure

Other relevant operational conditions	not relevant

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See chapter 8 of the safety data sheet (Environmental exposure controls).

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Air	not relevant
Soil	not relevant
Water	not relevant
Sediment:	not relevant
Remarks:	not relevant

Organisational measures to prevent/limit release from site:

none

Conditions and measures related to sewage treatment plant

Conditions and measures related to external treatment of waste for disposal

This information is not available.

Conditions and measures related to external recovery of waste

This information is not available.

Additional good practice advice beyond the REACH CSA

This information is not available.

2.2. Contributing exposure scenario controlling worker exposure for: Professional uses, Use in propellants, Functional fluids

Process Categories:	PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) PROC1: Use in closed process, no likelihood of exposure PROC2: Use in closed, continuous process with occasional controlled exposure PROC28: Manual maintenance (cleaning and repair) of machinery PROC20: Use of functional fluids in small devices PROC8a: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.

Physical form of the product:	gaseous
Vapour pressure:	not relevant
Process temperature:	not relevant
Remarks	not relevant

Amounts used

Frequency and duration of use

Covers daily exposures up to 8 hours

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting workers exposure

Area of use	Room size:	Temperature :	Ventilation rate	Remarks
Outdoor use				

Other relevant operational conditions:	not relevant

Risk management measures (RMM)

Technical conditions and measures at process level (source) to prevent release

See chapter 7 of the safety data sheet

Technical conditions and measures to control dispersion from source towards the worker

Application	Route of Exposure	Protective Measures	Effectiveness	Remarks
Professional:	Inhalation exposure	Provide a basic standard of general ventilation (1 to 3 air changes per hour)., Provide extract ventilation to points where emissions occur.		

Organisational measures to prevent/limit releases, dispersion and exposure

Application	Route of Exposure	Protective Measures	Remarks
Professional:	Dermal exposure	Assumes a good basic standard of occupational hygiene is implemented., Supervision in place to check that the RMMs (Risk Management Measures) in place are being used correctly and OCs (Operational Conditions) followed., Take precautionary measures against static discharges., Keep away from sources of ignition - No smoking., Keep away from heat/sparks/open flames. - No smoking.	

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

Application	Route of Exposure	Protective Measures	Effectiveness	Remarks
Professional:	Dermal exposure	For personal protection see section 8.		

Additional good practice advice beyond the REACH CSA

This information is not available.

3. Exposure estimation

Environment:

Professional uses, Use in propellants, Functional fluids:

ERC9a:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Humans via the environment		< 1	Qualitative approach used to conclude safe use.	Risk checked

Health:

Professional uses, Use in propellants, Functional fluids:

PROC1:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
Worker - all relevant routes			< 1	Qualitative approach used to conclude safe use.	Risk checked

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required. The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. Measured data could be used to confirm exposure levels are within the boundaries of the exposure scenario.

Exposure Scenario VIII.

Exposure scenario consumer

1.Fuel:

List of use descriptors	
Life Cycle Stage	Consumer use
Sector(s) of use	SU21: Consumer uses: Private households (= general public =

	consumers)
Product Categories:	PC13_1: Liquid: automotive refuelling PC13_2: Liquid: scooter refuelling PC13_4: Liquid: Garden equipment - Refuelling

Name of contributing environmental scenario and corresponding ERC	Consumer uses: ERC9a: Wide dispersive indoor use of substances in closed systems ERC9b: Wide dispersive outdoor use of substances in closed systems

List of names of contributing worker scenarios and corresponding PROCs	Fuel: :

2.1.Contributing exposure scenario controlling environmental exposure for: Consumer uses, Fuel

Environmental Release Category (ERC)	ERC9a ERC9b: Wide dispersive indoor use of substances in closed systems Wide dispersive outdoor use of substances in closed systems

Further explanations	
Other Process or activity:	As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

Product characteristics

Concentration of the substance in a mixture:	

Physical state	

Viscosity	
Kinematic viscosity	This information is not available.
Dynamic viscosity	This information is not available.

Amounts used

This information is not available.

Frequency and duration of use

Batch process	not relevant
Continuous process	not relevant

Environment factors not influenced by risk management

Flow rate of receiving surface water (m^3/d):	not relevant
Local freshwater dilution factor	not relevant
Local marine water dilution factor	not relevant

Other given operational conditions affecting environmental exposure

Other relevant operational conditions	not relevant

Risk management measures (RMM)

Conditions and measures related to municipal sewage treatment plant

Conditions and measures related to external treatment of waste for disposal

none

Conditions and measures related to external recovery of waste

none

Additional good practice advice beyond the REACH CSA

This information is not available.

2.2. Contributing exposure scenario controlling consumer exposure for: Fuel, Consumer use

Product Categories:	PC13_1: Liquid: automotive refuelling PC13_2: Liquid: scooter refuelling PC13_4: Liquid: Garden equipment - Refuelling

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.

Physical form of the product:	gaseous
Vapour pressure:	not relevant
Process temperature:	not relevant
Remarks	not relevant
Application:	not relevant

Amounts used

This information is not available.

Frequency and duration of use

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting consumers exposure

Other relevant operational conditions	not relevant

Risk management measures (RMM)

This information is not available.

Additional good practice advice beyond the REACH CSA

not relevant

3. Exposure estimation and reference to its source

Environment:

Consumer uses, Fuel:

ERC9a, ERC9b:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Humans via the environment		< 1	Qualitative approach used to conclude safe use.	Risk checked

Health:

Fuel, Consumer use:

PC13:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
Worker - all relevant routes			< 1	Qualitative approach used to conclude safe use.	Risk checked

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required. The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. Measured data could be used to confirm exposure levels are within the boundaries of the exposure scenario.

Exposure Scenario IX.

Exposure scenario consumer

1.Use in propellants, Functional fluids:

List of use descriptors	
Life Cycle Stage	Consumer use
Sector(s) of use	SU21: Consumer uses: Private households (= general public = consumers)
Product Categories:	PC16: Heat transfer fluids PC17: Hydraulic fluids

Name of contributing environmental scenario and corresponding ERC	Consumer uses: ERC9b: Wide dispersive outdoor use of substances in closed systems ERC9a: Wide dispersive indoor use of substances in closed systems

List of names of contributing worker scenarios and corresponding PROCs	Consumer uses: :

2.1.Contributing exposure scenario controlling environmental exposure for: Consumer uses, Functional fluids, Use in propellants

Environmental Release Category (ERC)	ERC9b ERC9a: Wide dispersive outdoor use of substances in closed systems Wide dispersive indoor use of substances in closed systems

Further explanations	
Other Process or activity:	As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

Product characteristics

Concentration of the substance in a mixture:	

Physical state	

Viscosity	
Kinematic viscosity	This information is not available.
Dynamic viscosity	This information is not available.

Amounts used

This information is not available.

Frequency and duration of use

Batch process	not relevant
Continuous process	not relevant

Environment factors not influenced by risk management

Flow rate of receiving surface water (m^3/d):	not relevant
Local freshwater dilution factor	not relevant
Local marine water dilution factor	not relevant

Other given operational conditions affecting environmental exposure

Other relevant operational conditions	not relevant

Risk management measures (RMM)

Conditions and measures related to municipal sewage treatment plant

Conditions and measures related to external treatment of waste for disposal

none

Conditions and measures related to external recovery of waste

none

Additional good practice advice beyond the REACH CSA

This information is not available.

2.2. Contributing exposure scenario controlling consumer exposure for: Consumer uses, Use in propellants, Functional fluids

Product Categories:	PC16: Heat transfer fluids PC17: Hydraulic fluids

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.

Physical form of the product:	gaseous
Vapour pressure:	not relevant
Process temperature:	not relevant
Remarks	not relevant
Application:	not relevant

Amounts used

This information is not available.

Frequency and duration of use

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting consumers exposure

Other relevant operational conditions	not relevant

Risk management measures (RMM)

This information is not available.

Additional good practice advice beyond the REACH CSA

not relevant

3. Exposure estimation and reference to its source

Environment:

Consumer uses, Functional fluids, Use in propellants:

ERC9a, ERC9b:

Compartment	Predicted environmental concentration (PEC)	Risk characterisation ratio (RCR)	Method	Remarks
Humans via the environment		< 1	Qualitative approach used to conclude safe use.	Risk checked

Health:

Consumer uses, Use in propellants, Functional fluids:

PC16, PC17:

Route of Exposure	Specific condition	Exposure level	Risk characterisation ratio (RCR)	Method	Remarks
Worker - all relevant routes			< 1	Qualitative approach used to conclude safe use.	Risk checked

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required. The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. Measured data could be used to confirm exposure levels are within the boundaries of the exposure scenario.