1. Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Trade name	:	1,3-Butadiene
Registration number	:	01-2119471988-16-0010, 01-2119471988-16-XXXX
Substance name	:	1,3-butadiene
Substance No.	:	203-450-8

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

Use of the Substance/Mixture	:	Raw material in chemical industry, Distribution, Use in polymer production, Use in polymer processing

1.3 Details of the supplier of the safety data sheet

Manufacturer	:	Borealis Polymers Oy P.O.Box 330, FI-06101 Porvoo, Finland Telephone: +358 9 394900
Supplier	:	Borealis AG Wagramerstrasse 17-19, 1220 Vienna, Austria Telephone: +43 1 22400 0
E-mail address	:	sds@borealisgroup.com

1.4 Emergency telephone number

0870 600 6266 National Poisons Information Service, UK (24h)

2. Hazards identification

2.1 Classification of the substance or mixture

Classification (REGULATION (EC) No 1272/2008)

Flammable gases, Category 1	H220: Extremely flammable gas.
Gases under pressure, Refrigerated liquefied gas	H281: Contains refrigerated gas; may cause cryogenic burns or injury.
Germ cell mutagenicity, Category 1B	H340: May cause genetic defects if inhaled.
Carcinogenicity, Category 1A	H350i: May cause cancer by inhalation.

Classification (67/548/EEC, 1999/45/EC)

Extremely flammable	R12: Extremely flammable.
Carcinogenic Category 1	R45: May cause cancer.
Mutagenic Category 2	R46: May cause heritable genetic damage.

2.2 Label elements

Labelling (REGULATION (EC) No 1272/2008)

Hazard pictograms :

Signal word : Danger

Hazard statements :	H220	Extremely flammable gas.
	H281	Contains refrigerated gas; may cause cryogenic burns or injury.
	H340	May cause genetic defects if inhaled.
	H350i	May cause cancer by inhalation.
Precautionary statements :	**Prevention:**	
	P202	Do not handle until all safety precautions have been read and understood.
	P210	Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
	P281	Use personal protective equipment as required.
	Response:	
	P377	Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
	P381	Eliminate all ignition sources if safe to do so.
	Storage:	
	P403	Store in a well-ventilated place.

Additional Labelling:

Restricted to professional users.

2.3 Other hazards

The product evaporates readily.
Rapid evaporation of the liquid may cause frostbite.
Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.
High concentration of vapours may induce unconsciousness.
High concentration of vapours may cause irritation to eyes and respiratory system.
Vapours may form explosive mixtures with air.
High risk of fire in case of leakage.

3. Composition/information on ingredients

3.1 Substances

Chemical Name	CAS-No. EINECS-No. / ELINCS No.	Concentration [%]
1,3-butadiene	106-99-0 203-450-8	> 99,5

4. First aid measures

4.1 Description of first aid measures

General advice	:	Move out of dangerous area. In the case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
If inhaled	:	Move to fresh air. Do not leave the victim unattended. Causes asphyxiation in high concentrations. The victim will not realize that he/she is suffocating. Keep patient warm and at rest. Seek medical advice immediately. If breathing is irregular or stopped, administer artificial respiration.
In case of skin contact	:	Contact with liquid or refrigerated gas can cause cold burns and frostbite. Wash frost-bitten areas with plenty of water. Do not remove clothing. Seek medical advice.
In case of eye contact	:	Remove contact lenses. Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. Keep eye wide open while rinsing.
If swallowed	:	Not probable: The product evaporates readily.

4.2 Most important symptoms and effects, both acute and delayed

Symptoms	:	Shortness of breath Unconsciousness Frostbite
Risks	:	May cause effects on the central nervous system, resulting in lowering of consciousness.

4.3 Indication of any immediate medical attention and special treatment needed

Treatment	:	Artificial respiration and/or oxygen may be necessary. There is no specific antidote available. Treat frost-bitten areas as needed.

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media	:	Dry powder, carbon dioxide, foam and water mist.
Unsuitable extinguishing	:	Do NOT use water jet.

media

5.2 Special hazards arising from the substance or mixture

Specific hazards during fire fighting	:	Vapours are heavier than air and may spread along floors. Flash back possible over considerable distance. Do not allow run-off from fire fighting to enter drains or water courses. Hazardous decomposition products formed under fire conditions. See chapter 10.

5.3 Advice for firefighters

Special protective equipment for fire-fighters	:	Wear self-contained breathing apparatus and protective suit.
Further information	:	Attempt to stop leakage without personal risk. If conditions permit, let fire burn itself out. Cool containers / tanks with water spray.

6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Personal precautions	:	Use personal protective equipment. Do not breathe vapours. Ensure adequate ventilation, especially in confined areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. Avoid all contact with the product. Keep people away from and upwind of spill/leak. Attempt to stop leakage without personal risk.

6.2 Environmental precautions

Environmental precautions	:	Prevent further leakage or spillage if safe to do so. Prevent product from entering environment and drains. If major spillage occurs, contact the proper local authorities.

6.3 Methods and materials for containment and cleaning up

Methods for cleaning up	:	Attempt to stop leakage without personal risk. Ventilate the area. Allow to evaporate.

6.4 Reference to other sections

For personal protection see section 8., For disposal considerations see section 13.

7. Handling and storage

7.1 Precautions for safe handling

Advice on safe handling	:	To be handled by trained personnel only. Refill and handle product only in closed system. Prevent leaks by checking valves, pipelines and joints regularly.

Ensure adequate ventilation.
In case of insufficient ventilation, wear suitable respiratory equipment.
Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
When using do not eat, drink or smoke.

Advice on protection against fire and explosion : Keep away from sources of ignition - No smoking.
Take precautionary measures against static discharges.
To avoid ignition of vapours by static electricity discharge, all metal parts of the equipment must be grounded.
High risk of fire in case of leakage.

7.2 Conditions for safe storage, including any incompatibilities

Requirements for storage areas and containers : Keep only in the original container in a cool, well-ventilated place.
Keep under dry nitrogen atmosphere.
Keep product and empty container away from heat and sources of ignition.
Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Further information on storage conditions : Ensure adequate ventilation.

Advice on common storage : Keep away from incompatible materials.
See chapter 10.

7.3 Specific end uses

Specific use(s) : Not applicable

8. Exposure controls/personal protection

8.1 Control parameters

Components	CAS-No.	Value	Control parameters	Update	Basis
1,3-butadiene	106-99-0	TWA	10 ppm 22 mg/m3	2007-08-01	GB EH40
Further information	:	Carc: Capable of causing cancer and/or heritable genetic damage. The identified substances include those which: - are assigned the risk phrases 'R45: May cause cancer'; 'R46: may cause heritable genetic damage'; 'R49: May cause cancer by inhalation' or - a substance or process listed in Schedule 1 of COSHH. Where no specific short-term exposure limit is listed, a figure three times the long-term exposure should be used HSC/E plans to review the limit values for this substance.			

DNEL	:	End Use: Workers Exposure routes: Inhalation Potential health effects: Long-term, Systemic Value: 2,21 mg/m3 1 ppm Derived minimal effect level
	:	End Use: Workers Exposure routes: Skin contact Not applicable, (gaseous)
PNEC	:	Not applicable

8.2 Exposure controls

Engineering measures

Application in a closed system
Prevent unauthorised persons entering the zone.

Personal protective equipment

Respiratory protection	:	In case of insufficient ventilation: Self-contained breathing apparatus. Vapours are heavier than air and can cause suffocation by reducing oxygen available for breathing.
Hand protection	:	Low temperature resistant gloves Please observe the instructions regarding permeability and breakthrough time which are provided by the supplier of the gloves. Also take into consideration the specific local conditions under which the product is used, such as the danger of cuts, abrasion, and the contact time. The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it. This recommendation is only valid for the product mentioned in the safety data sheet and provided by us and for the application specified by us.
Eye protection	:	Safety goggles or face-shield.
Skin and body protection	:	Wear suitable protective clothing and rubber boots.
Protective measures	:	Avoid and prevent all spillage, contact and exposure.

Environmental exposure controls

General advice	:	Prevent further leakage or spillage if safe to do so. Prevent product from entering environment and drains. If major spillage occurs, contact the proper local authorities.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance	:	Refrigerated liquefied gas
Colour	:	clear
Odour	:	characteristic
pH	:	not applicable
Melting point	:	-109 °C
Boiling point	:	-4 °C
Flash point	:	-76 °C
Flammability (solid, gas)	:	Extremely flammable.
Lower explosion limit	:	lower flammability limit, 1,1 %(V)
Upper explosion limit	:	upper flammability limit, 16,3 %(V)
Vapour pressure	:	2.450 hPa, 20 °C
Relative vapour density	:	1,9
Relative density	:	0,6
Water solubility	:	0,735 g/l, 20 °C
Partition coefficient: n-octanol/water	:	log Pow: 1,99
Autoignition temperature	:	420 °C
Viscosity, dynamic	:	not applicable
Viscosity, kinematic	:	not applicable
Explosive properties	:	not applicable
Oxidizing properties	:	not applicable

9.2 Other information

Surface tension	:	not applicable

10. Stability and reactivity

10.1 Reactivity

Stable under recommended storage conditions. Vapours may form explosive mixture with air. Risk of violent reaction.

10.2 Chemical stability

No decomposition if stored and applied as directed.

10.3 Possibility of hazardous reactions

Hazardous reactions	:	Polymerises with risk of fire and explosion in contact with: Air

10.4 Conditions to avoid

Conditions to avoid	:	Keep away from heat and sources of ignition.

10.5 Incompatible materials

Materials to avoid	:	air Oxidizing agents Ozone nitrogen oxides Copper Copper alloys phenol chlorine dioxide crotonaldehyde hydroquinone

10.6 Hazardous decomposition products

Hazardous decomposition products	:	Under fire conditions: Carbon monoxide, carbon dioxide and unburned hydrocarbons (smoke).

11. Toxicological information

11.1 Information on toxicological effects

Product

Acute oral toxicity	:	Not relevant, (gaseous)
Acute dermal toxicity	:	Not relevant, (gaseous)
Skin corrosion/irritation	:	not applicable, (gaseous), Contact with liquid or refrigerated gas can cause cold burns and frostbite.
Serious eye damage/eye irritation	:	not applicable, (gaseous), Contact with liquid or refrigerated gas can cause cold burns and frostbite.
Respiratory or skin sensitization	:	High concentration of vapours may cause irritation to eyes and respiratory system.
Germ cell mutagenicity		
Genotoxicity in vitro	:	Ames test, with or without metabolic activation, Result: positive, Mutagenicity (in vitro mammalian cytogenetic test)
Genotoxicity in vivo	:	in vivo assay, mouse, Mutagenicity (micronucleus test), Result: positive
Assessment	:	May cause heritable genetic damage.
Reproductive toxicity	:	rat, Dose: 6000 ppm, Inhalation,
Teratogenicity	:	mouse, Dose: 40 ppm, Inhalation

STOT - repeated exposure	:	rat, Inhalation, NOAEL: 2.212 mg/m3 Assessment: May have effects on the bone marrow, resulting in leukaemia.
	:	Exposure routes: Inhalation Assessment: The substance or mixture is not classified as specific target organ toxicant, repeated exposure.
Acute effects (Assessment)	:	Vapours can cause suffocation by reducing oxygen available for breathing.

Components:
1,3-butadiene :

Acute inhalation toxicity	:	LC50: 285 mg/l, 4 h, rat,
	:	Effects: 8000 ppm, 8 h, human, No adverse effect has been observed in acute toxicity tests.

12. Ecological information

12.1 Toxicity

Components:

1,3-butadiene :

Toxicity to fish	:	LC50: 43 - 45 mg/l, 96 h, Fish, QSAR, estimated
Toxicity to daphnia and other aquatic invertebrates.	:	LC50: 24 - 33 mg/l, 48 h, Daphnia, QSAR, estimated
Toxicity to algae	:	EC50: 33 mg/l, 72 h, algae, QSAR, estimated
	:	EC50: 11 mg/l, 96 h, algae, QSAR, estimated

12.2 Persistence and degradability

Product:

Biodegradability	:	Result: Not readily biodegradable.

12.3 Bioaccumulative potential

Product:

Bioaccumulation	:	Elimination: The product evaporates readily., Bioaccumulation not expected: Partition coefficient (n-octanol/water) log Pow < 3.

12.4 Mobility in soil

Product:

Mobility	:	Not expected to adsorb on soil., Partition coefficient (n-octanol/water) log Kow < 3.
Distribution among environmental compartments	:	The product evaporates readily.

12.5 Results of PBT and vPvB assessment

Product:

Assessment	:	This substance is not considered to be persistent, bioaccumulating nor toxic (PBT)., This substance is not considered to be very persistent nor very bioaccumulating (vPvB).

12.6 Other adverse effects

Product:

Additional ecological information	:	Prone to photochemical degradation, reacting with OH radicals and ozone., Estimated atmospheric lifetime:, < 1 day, Degradation in water:, Half-life value:, 4 h

13. Disposal considerations

13.1 Waste treatment methods

Product	:	Dispose of as hazardous waste in compliance with local and national regulations. Where possible recycling is preferred to disposal or incineration. European waste code: 07 01 99 (wastes not otherwise specified (basic organic chemicals))

14. Transport information

14.1 UN number

ADR	:	1010
IMDG	:	1010

14.2 Proper shipping name

ADR	:	BUTADIENES, STABILIZED
IMDG	:	BUTADIENES, STABILIZED

14.3 Transport hazard class

ADR	:	2
IMDG	:	2.1

14.4 Packing group

ADR

	:	
Hazard identification No	:	239
Labels	:	2.1

IMDG

EmS Number : F-D, S-U

14.5 Environmental hazards

ADR
Environmentally hazardous : no

IMDG
Marine pollutant : no

14.6 Special precautions for user

not required

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

Ship type : N/A
Pollution category : N/A

15. Regulatory information

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

Other regulations : Comply with below indicated regulations, relevant updatings and amendments, as applicable:
Europe.Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work

15.2 Chemical Safety Assessment

A Chemical Safety Assessment has been carried out for this substance.

16. Other information

Full text of R-phrases referred to under sections 2 and 3

R12	Extremely flammable.
R45	May cause cancer.
R46	May cause heritable genetic damage.

Full text of H-Statements referred to under sections 2 and 3.

H220	Extremely flammable gas.
H281	Contains refrigerated gas; may cause cryogenic burns or injury.
H340	May cause genetic defects if inhaled.
H350i	May cause cancer by inhalation.

Further information

Other information : Changes since the last version are highlighted in the margin. This version replaces all previous versions.

Issuer : Borealis, Group Product Stewardship / Andreas Ekholm.

Sources of key data used to compile the Safety Data Sheet	:	Chemical Safety Report, 1,3-butadiene, Lower Olefins and Aromatics REACH Consortium, 2010 International Chemical Safety Card, 1,3-Butadiene, April 2000 (http://www.inchem.org/documents/icsc/icsc/eics0017.htm) IUCLID Dataset 2000 Buta-1,3-diene (http://ecb.jrc.ec.europa.eu/IUCLID-DataSheets/106990.pdf) IARC (International Agency for Research on Cancer) - Summaries & Evaluations, 1,3-Butadiene, 71 (1999) (http://www.inchem.org/documents/iarc/vol71/002-butadiene.html) European chemical Substance Information System (ESIS) (http://ecb.jrc.ec.europa.eu/esis/) Environment Guide 71; Environmental properties of chemicals, Finnish Environment Institute, Helsinki 2000

Disclaimer

To the best of our knowledge, the information contained herein is accurate and reliable as of the date of publication, however we do not assume any liability whatsoever for the accuracy and completeness of such information.

Borealis makes no warranties which extend beyond the description contained herein. Nothing herein shall constitute any warranty of merchantability or fitness for a particular purpose.

It is the customer's responsibility to inspect and test our products in order to satisfy itself as to the suitability of the products for the customer's particular purpose. The customer is responsible for the appropriate, safe and legal use, processing and handling of our products.

No liability can be accepted in respect of the use of Borealis' products in conjunction with other materials. The information contained herein relates exclusively to our products when not used in conjunction with any third party materials.

1. Short title of Exposure Scenario: Manufacture

Main User Groups	:	**SU 3:** Industrial uses: Uses of substances as such or in preparations at industrial sites
Sectors of end-use	:	**SU 3:** Industrial uses: Uses of substances as such or in preparations at industrial sites
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 **PROC15:** Use as laboratory reagent
Environmental Release Categories	:	**ERC1, ERC4:** Manufacture of substances, Industrial use of processing aids in processes and products, not becoming part of articles

2.1 Contributing scenario controlling environmental exposure for: ERC1, ERC4: Manufacture of substances, Industrial use of processing aids in processes and products, not becoming part of articles

Remarks	:	not required

2.2 Contributing scenario controlling worker exposure for: General measures (carcinogens), General risk management measures applicable to all activities PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC15: Use in closed process, no likelihood of exposure, Use in closed, continuous process with occasional controlled exposure, Use in closed batch process (synthesis or formulation), Use in batch and other process (synthesis) where opportunity for exposure arises, Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities, Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities, Use as laboratory reagent

Product characteristics

Concentration of the Substance in Mixture/Article	:	Covers the percentage of the substance in the product up to 100 % (unless stated differently).
Remarks	:	Liquid, vapour pressure > 10 kPa

Frequency and duration of use

Remarks	:	Covers daily exposures up to 8 hours (unless stated differently).

Other operational conditions affecting workers exposure

Remarks	:	Assumes use at not more than 20°C above ambient temperature., Assumes a good basic standard of occupational hygiene is implemented.

Organisational measures to prevent /limit releases, dispersion and exposure

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., 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 spills immediately., Dispose of empty containers and 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.

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

Wear suitable gloves tested to EN374.

2.3 Contributing scenario controlling worker exposure for: General exposures (closed systems)
PROC1: Use in closed process, no likelihood of exposure

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Outdoor

Technical conditions and measures

Handle substance within a closed system., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

2.4 Contributing scenario controlling worker exposure for: General exposures (closed systems), with sample collection, With occasional controlled exposure.
PROC2: Use in closed, continuous process with occasional controlled exposure

Other operational conditions affecting workers exposure

Outdoor / Indoor	:	Outdoor

Technical conditions and measures

Handle substance within a predominantly closed system provided with extract ventilation., Sample via a closed loop or other system to avoid exposure., Provide a good standard of general ventilation

(not less than 3 to 5 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 1 hour.

2.5 Contributing scenario controlling worker exposure for: General exposures (closed systems), Use in contained batch processes
PROC3: Use in closed batch process (synthesis or formulation)

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor, Outdoor

Technical conditions and measures
Handle substance within a predominantly closed system provided with extract ventilation., Sample via a closed loop or other system to avoid exposure., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 15 minutes.

2.6 Contributing scenario controlling worker exposure for: General exposures (open systems), Batch process, with sample collection
PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor, Outdoor

Technical conditions and measures
Handle substance within a predominantly closed system provided with extract ventilation., Sample via a closed loop or other system to avoid exposure., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 15 minutes.

2.7 Contributing scenario controlling worker exposure for: Process sampling
PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor, Outdoor

Technical conditions and measures
Sample via a closed loop or other system to avoid exposure., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 15 minutes., Ensure operatives are trained to minimise exposures.

2.8 Contributing scenario controlling worker exposure for: Laboratory activities PROC15: Use as laboratory reagent

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor

Technical conditions and measures
Use high-performance fume cupboard., , alternatively:, Handle within a fume cupboard or implement equivalent measures to minimise exposures., Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour).

Conditions and measures related to personal protection, hygiene and health evaluation
Wear a full face respirator conforming to EN140 with Type A filter or better.

2.9 Contributing scenario controlling worker exposure for: Bulk transfers, (open systems), With potential for aerosol generation. PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor, Outdoor

Technical conditions and measures
Use dry break couplings for material transfer., Ensure material transfers are under containment or extract ventilation., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 1 hour.

2.10 Contributing scenario controlling worker exposure for: Bulk transfers, (closed systems) PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor, Outdoor

Technical conditions and measures
Use dry break couplings for material transfer., Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 1 hour.

2.11 Contributing scenario controlling worker exposure for: Equipment cleaning and maintenance
PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor, Outdoor

Technical conditions and measures
Drain down and flush system prior to equipment opening or maintenance., Provide extraction ventilation at points where emissions occur., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour)., Retain drain downs in sealed storage pending disposal or for subsequent recycle.

Organisational measures to prevent /limit releases, dispersion and exposure
Clear spills immediately.

Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator conforming to EN140 with Type A filter or better.

2.12 Contributing scenario controlling worker exposure for: Storage, With occasional controlled exposure.
PROC2: Use in closed, continuous process with occasional controlled exposure

Frequency and duration of use
Exposure duration : 15 min - 1 h

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor, Outdoor

Technical conditions and measures
Sample via a closed loop or other system to avoid exposure., Provide extract ventilation to material transfer points and other openings., Store substance within a closed system., Avoid dip sampling., Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour).

3. Exposure estimation and reference to its source

Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value	Level of Exposure	RCR
PROC1	ECETOC TRA		Inhalation	0,01 ppm	0,01

			Dermal	0,34 mg/kg/day	0,07
PROC2	ECETOC TRA		Inhalation	0,70 ppm	0,70
			Dermal	0,14 mg/kg/day	0,03
PROC3	ECETOC TRA		Inhalation	0,70 ppm	0,70
			Dermal	0,03 mg/kg/day	0,01
PROC4	ECETOC TRA		Inhalation	0,70 ppm	0,70
			Dermal	0,69 mg/kg/day	0,14
PROC8b	ECETOC TRA		Inhalation	0,53 ppm	0,53
			Dermal	0,69 mg/kg/day	0,14
PROC15	ECETOC TRA		Inhalation	0,50 ppm	0,50
			Dermal	0,03 mg/kg/day	0,01
PROC8b	ECETOC TRA		Inhalation	0,63 ppm	0,63
			Dermal	0,69 mg/kg/day	0,14
PROC8b	ECETOC TRA		Inhalation	0,63 ppm	0,63
			Dermal	0,69 mg/kg/day	0,14
PROC8a	ECETOC TRA		Inhalation	0,18 ppm	0,18
			Dermal	1,37 mg/kg/day	0,27
PROC2	ECETOC TRA		Inhalation	0,70 ppm	0,70
			Dermal	0,14 mg/kg/day	0,03

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

The safety data sheet at hand provides the user with risk management measures and operational conditions which enables him to work safely with the substance / mixture. If other risk management measures / operational conditions are adopted, the user has to ensure, that the risks are managed to at least equivalent levels.

1. Short title of Exposure Scenario: Distribution

Main User Groups	:	**SU 3:** Industrial uses: Uses of substances as such or in preparations at industrial sites
Sectors of end-use	:	**SU 3, SU8, SU9:** Industrial uses: Uses of substances as such or in preparations at industrial sites, Manufacture of bulk, large scale chemicals (including petroleum products), Manufacture of fine chemicals
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 **PROC9:** Transfer of substance or preparation into small containers (dedicated filling line, including weighing) **PROC15:** Use as laboratory reagent
Environmental Release Categories	:	**ERC1, ERC2, ERC3, ERC4, ERC5, ERC6a, ERC6b, ERC6c, ERC6d, ERC7:** Manufacture of substances, Formulation of preparations, Formulation in materials, Industrial use of processing aids in processes and products, not becoming part of articles, Industrial use resulting in inclusion into or onto a matrix, Industrial use resulting in manufacture of another substance (use of intermediates), Industrial use of reactive processing aids, Industrial use of monomers for manufacture of thermoplastics, Industrial use of process regulators for polymerisation processes in production of resins, rubbers, polymers, Industrial use of substances in closed systems

2.1 Contributing scenario controlling environmental exposure for: ERC1, ERC2, ERC3, ERC4, ERC5, ERC6a, ERC6b, ERC6d, ERC6c, ERC7: Manufacture of substances, Formulation of preparations, Formulation in materials, Industrial use of processing aids in processes and products, not becoming part of articles, Industrial use resulting in inclusion into or onto a matrix, Industrial use resulting in manufacture of another substance (use of intermediates), Industrial use of reactive processing aids, Industrial use of process regulators for polymerisation processes in production of resins, rubbers, polymers, Industrial use of monomers for manufacture of thermoplastics, Industrial use of substances in closed systems

Remarks	:	not required

2.2 Contributing scenario controlling worker exposure for: General measures (carcinogens), General risk management measures applicable to all activities PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9, PROC15: Use in closed process, no likelihood of exposure, Use in closed, continuous process with occasional controlled exposure, Use in closed batch process (synthesis or formulation), Use in batch and other process (synthesis) where opportunity for exposure arises, Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities, Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities, Transfer of substance or preparation into small containers (dedicated filling line, including weighing), Use as laboratory reagent

Product characteristics

Concentration of the Substance in Mixture/Article	:	Covers the percentage of the substance in the product up to 100 % (unless stated differently).
Remarks	:	Liquid, vapour pressure > 10 kPa

Frequency and duration of use

Remarks	:	Covers daily exposures up to 8 hours (unless stated differently).

Other operational conditions affecting workers exposure

Remarks	:	Assumes use at not more than 20°C above ambient temperature., Assumes a good basic standard of occupational hygiene is implemented.

Organisational measures to prevent /limit releases, dispersion and exposure

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., 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 spills immediately., Dispose of empty containers and 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.

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

Wear suitable gloves tested to EN374.

2.3 Contributing scenario controlling worker exposure for: General exposures (closed systems)
PROC1: Use in closed process, no likelihood of exposure

Other operational conditions affecting workers exposure
Outdoor / Indoor : Outdoor

Technical conditions and measures
Handle substance within a closed system.

2.4 Contributing scenario controlling worker exposure for: General exposures (closed systems), with sample collection, With occasional controlled exposure. PROC2: Use in closed, continuous process with occasional controlled exposure

Other operational conditions affecting workers exposure
Outdoor / Indoor : Outdoor

Technical conditions and measures
Handle substance within a closed system., Ensure material transfers are under containment or extract ventilation., Sample via a closed loop or other system to avoid exposure.

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 1 hour.

2.5 Contributing scenario controlling worker exposure for: General exposures (closed systems), Use in contained batch processes PROC3: Use in closed batch process (synthesis or formulation)

Other operational conditions affecting workers exposure
Outdoor / Indoor : Outdoor

Technical conditions and measures
Handle substance within a closed system., Ensure material transfers are under containment or extract ventilation., Sample via a closed loop or other system to avoid exposure.

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 1 hour.

2.6 Contributing scenario controlling worker exposure for: General exposures (closed systems), Batch process, with sample collection PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor, Outdoor

Technical conditions and measures
Handle substance within a closed system., Ensure material transfers are under containment or extract ventilation., Sample via a closed loop or other system to avoid exposure., Clear transfer lines prior to de-coupling., Transfer via enclosed lines.

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 4 hours.

2.7 Contributing scenario controlling worker exposure for: Process sampling PROC3: Use in closed batch process (synthesis or formulation)

Frequency and duration of use
Exposure duration : 15 min - 1 h

Other operational conditions affecting workers exposure
Outdoor / Indoor : Outdoor

Technical conditions and measures
Handle substance within a closed system., Sample via a closed loop or other system to avoid exposure., Avoid dip sampling.

2.8 Contributing scenario controlling worker exposure for: Laboratory activities PROC15: Use as laboratory reagent

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor

Technical conditions and measures
Use high-performance fume cupboard., , alternatively:, Handle within a fume cupboard or implement equivalent measures to minimise exposures., Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour).

Conditions and measures related to personal protection, hygiene and health evaluation
Wear a full face respirator conforming to EN140 with Type A filter or better.

2.9 Contributing scenario controlling worker exposure for: Bulk transfers, (closed systems) PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities

Other operational conditions affecting workers exposure
Outdoor / Indoor : Outdoor

Technical conditions and measures
Clear transfer lines prior to de-coupling., Transfer via enclosed lines., Ensure material transfers are under containment or extract ventilation., Ensure operation is undertaken outdoors.

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 1 hour.

2.10 Contributing scenario controlling worker exposure for: Bulk transfers, (open systems)
PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities

Other operational conditions affecting workers exposure
Outdoor / Indoor : Outdoor

Technical conditions and measures
Clear transfer lines prior to de-coupling., Transfer via enclosed lines., Ensure material transfers are under containment or extract ventilation., Ensure operation is undertaken outdoors.

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 1 hour.

2.11 Contributing scenario controlling worker exposure for: Drum and small package filling
PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

Other operational conditions affecting workers exposure
Outdoor / Indoor : Indoor

Technical conditions and measures
Transfer via enclosed lines., Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour)., Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings., Put lids on containers immediately after use.

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 1 hour., Clear spills immediately.

2.12 Contributing scenario controlling worker exposure for: Equipment cleaning and maintenance
PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

Technical conditions and measures
Drain down and flush system prior to equipment opening or maintenance., Provide extraction ventilation at points where emissions occur., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour)., Transfer via enclosed lines., Retain drain downs in sealed storage pending disposal or for subsequent recycle.

Organisational measures to prevent /limit releases, dispersion and exposure
Clear spills immediately., Apply vessel entry procedures including use of forced supplied air.

2.13 Contributing scenario controlling worker exposure for: Storage, With occasional controlled exposure.
PROC2: Use in closed, continuous process with occasional controlled exposure

Other operational conditions affecting workers exposure
Outdoor / Indoor : Outdoor

Technical conditions and measures
Transfer via enclosed lines., Provide extraction ventilation at points where emissions occur., Avoid dip sampling.

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 4 hours.

3. Exposure estimation and reference to its source

Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value	Level of Exposure	RCR
PROC1	ECETOC TRA		Inhalation	0,01 ppm	0,01
			Dermal	0,34 mg/kg/day	0,00
PROC2	ECETOC TRA		Inhalation	0,35 ppm	0,35
			Dermal	0,00 mg/kg/day	0,00
PROC3	ECETOC TRA		Inhalation	0,70 ppm	0,70
			Dermal	0,03 mg/kg/day	0,00
PROC4	ECETOC TRA		Inhalation	0,90 ppm	0,90
			Dermal	0,69 mg/kg/day	0,00
PROC8b	ECETOC TRA		Inhalation	0,70 ppm	0,70
			Dermal	0,03 mg/kg/day	0,00
PROC15	ECETOC TRA		Inhalation	0,35 ppm	0,35
			Dermal	0,03 mg/kg/day	0,00
PROC8b	ECETOC TRA		Inhalation	0,63 ppm	0,63
			Dermal	0,69 mg/kg/day	0,00
PROC8b	ECETOC TRA		Inhalation	0,63 ppm	0,63
			Dermal	0,69 mg/kg/day	0,00
PROC9	ECETOC TRA		Inhalation	0,72 ppm	0,72
			Dermal	0,69 mg/kg/day	0,00
PROC8a	ECETOC TRA		Inhalation	0,18 ppm	0,18
			Dermal	13,71 mg/kg/day	0,04
PROC2	ECETOC TRA		Inhalation	0,90 ppm	0,90
			Dermal	1,37 mg/kg/day	0,00

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

The safety data sheet at hand provides the user with risk management measures and operational conditions which enables him to work safely with the substance / mixture. If other risk management measures / operational conditions are adopted, the user has to ensure, that the risks are managed to at least equivalent levels.

1. Short title of Exposure Scenario: Use in polymer production

Main User Groups	:	**SU 3:** Industrial uses: Uses of substances as such or in preparations at industrial sites
Sectors of end-use	:	**SU 3, SU 10:** Industrial uses: Uses of substances as such or in preparations at industrial sites, Formulation [mixing] of preparations and/ or re-packaging (excluding alloys)
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 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) **PROC14:** Production of preparations or articles by tabletting, compression, extrusion, pelletisation **PROC21:** Low energy manipulation of substances bound in materials and/ or articles
Environmental Release Categories	:	**ERC6a, ERC6c:** Industrial use resulting in manufacture of another substance (use of intermediates), Industrial use of monomers for manufacture of thermoplastics

2.1 Contributing scenario controlling environmental exposure for: ERC6a, ERC6c: Industrial use resulting in manufacture of another substance (use of intermediates), Industrial use of monomers for manufacture of thermoplastics

Remarks	:	not required

2.2 Contributing scenario controlling worker exposure for: General measures (carcinogens), General risk management measures applicable to all activities

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

Product characteristics

Concentration of the Substance in Mixture/Article	:	Covers the percentage of the substance in the product up to 100 % (unless stated differently).
Remarks	:	Liquid, vapour pressure > 10 kPa

Frequency and duration of use

Remarks	:	Covers daily exposures up to 8 hours (unless stated differently).

Other operational conditions affecting workers exposure

Remarks	:	Assumes use at not more than 20°C above ambient temperature., Assumes a good basic standard of occupational hygiene is implemented.

Organisational measures to prevent /limit releases, dispersion and exposure

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., 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 spills immediately., Dispose of empty containers and 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.

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

Wear suitable gloves tested to EN374.

2.3 Contributing scenario controlling worker exposure for: General exposures (closed systems), Continuous process, no sampling
PROC1: Use in closed process, no likelihood of exposure

Technical conditions and measures

Handle substance within a closed system.

2.4 Contributing scenario controlling worker exposure for: Bulk transfers, transport, with sample collection
PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities

Technical conditions and measures
Ensure material transfers are under containment or extract ventilation., Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour)., Sample via a closed loop or other system to avoid exposure.

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 4 hours.

2.5 Contributing scenario controlling worker exposure for: Polymerisation (bulk and batch), Continuous process, with sample collection
PROC2: Use in closed, continuous process with occasional controlled exposure

Technical conditions and measures
Handle substance within a closed system., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour)., Provide extraction ventilation at points where emissions occur., Sample via a closed loop or other system to avoid exposure.

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 1 hour.

2.6 Contributing scenario controlling worker exposure for: Polymerisation (bulk and batch), Batch process, with sample collection
PROC3: Use in closed batch process (synthesis or formulation)

Technical conditions and measures
Handle substance within a closed system., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour)., Provide extraction ventilation at points where emissions occur., Sample via a closed loop or other system to avoid exposure.

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 1 hour.

2.7 Contributing scenario controlling worker exposure for: Finishing operations, Batch process, with sample collection
PROC3: Use in closed batch process (synthesis or formulation)

Technical conditions and measures
Handle substance within a closed system., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour)., Provide extraction ventilation at points where emissions occur., Sample via a closed loop or other system to avoid exposure.

Organisational measures to prevent /limit releases, dispersion and exposure
Limit the substance content in the product to 5 %.

2.8 Contributing scenario controlling worker exposure for: Intermediate polymer storage
PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises

Technical conditions and measures
Handle substance within a closed system., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour)., Ensure material transfers are under containment or extract ventilation., Sample via a closed loop or other system to avoid exposure.

Organisational measures to prevent /limit releases, dispersion and exposure
Limit the substance content in the product to 5 %.

2.9 Contributing scenario controlling worker exposure for: Additivation and stabilisation
PROC3: Use in closed batch process (synthesis or formulation)

Technical conditions and measures
Handle substance within a closed system., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour)., Ensure material transfers are under containment or extract ventilation., Sample via a closed loop or other system to avoid exposure.

Organisational measures to prevent /limit releases, dispersion and exposure
Limit the substance content in the product to 5 %.

2.10 Contributing scenario controlling worker exposure for: Mixing in containers, Batch process
PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)

Product characteristics

Concentration of the Substance in Mixture/Article	:	Covers percentage substance in the product up to 1 %.

Technical conditions and measures
Handle substance within a closed system., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour)., Ensure material transfers are under containment or extract ventilation., Sample via a closed loop or other system to avoid exposure.

2.11 Contributing scenario controlling worker exposure for: Pelletizing, Extrusion and masterbatching
PROC6: Calendering operations

Technical conditions and measures
Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings., Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Limit the substance content in the product to 1 %.

2.12 Contributing scenario controlling worker exposure for: Pelletizing
PROC14: Production of preparations or articles by tabletting, compression, extrusion, pelletisation

Technical conditions and measures
Provide extraction ventilation at points where emissions occur., Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Limit the substance content in the product to 1 %.

2.13 Contributing scenario controlling worker exposure for: Pelletisation and pellet screening, (open systems)
PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities

Technical conditions and measures
Ensure material transfers are under containment or extract ventilation.

Organisational measures to prevent /limit releases, dispersion and exposure
Limit the substance content in the product to 1 %.

2.14 Contributing scenario controlling worker exposure for: Bulk transfers, Continuous process, with sample collection
PROC3: Use in closed batch process (synthesis or formulation)

Technical conditions and measures
Handle substance within a closed system., Ensure material transfers are under containment or extract ventilation., Sample via a closed loop or other system to avoid exposure., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 1 hour.

2.15 Contributing scenario controlling worker exposure for: transport, with sample collection
PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities

Technical conditions and measures
Ensure material transfers are under containment or extract ventilation.

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 1 hour.

2.16 Contributing scenario controlling worker exposure for: Equipment maintenance
PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

Technical conditions and measures
Drain down and flush system prior to equipment opening or maintenance., Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour)., Retain drain downs in sealed storage pending disposal or for subsequent recycle.

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 4 hours., Clear spills immediately.

Conditions and measures related to personal protection, hygiene and health evaluation
Wear a respirator conforming to EN140 with Type A filter or better.

2.17 Contributing scenario controlling worker exposure for: Storage, With occasional controlled exposure.
PROC2: Use in closed, continuous process with occasional controlled exposure

Technical conditions and measures
Provide extraction ventilation at points where emissions occur., Sample via a closed loop or other

system to avoid exposure., Store substance within a closed system.

Organisational measures to prevent /limit releases, dispersion and exposure
Avoid carrying out activities involving exposure for more than 1 hour.

3. Exposure estimation and reference to its source

Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value	Level of Exposure	RCR
PROC1	ECETOC TRA		Inhalation	0,01 ppm	0,01
			Dermal	0,34 mg/kg/day	0,00
PROC8b	ECETOC TRA		Inhalation	0,81 ppm	0,81
			Dermal	0,69 mg/kg/day	0,00
PROC2	ECETOC TRA		Inhalation	0,35 ppm	0,35
			Dermal	0,14 mg/kg/day	0,00
PROC3	ECETOC TRA		Inhalation	0,70 ppm	0,70
			Dermal	0,34 mg/kg/day	0,00
PROC3	ECETOC TRA		Inhalation	0,70 ppm	0,70
			Dermal	0,03 mg/kg/day	0,00
PROC4	ECETOC TRA		Inhalation	0,70 ppm	0,70
			Dermal	0,69 mg/kg/day	0,00
PROC3	ECETOC TRA		Inhalation	0,70 ppm	0,70
			Dermal	0,03 mg/kg/day	0,00
PROC5	ECETOC TRA		Inhalation	0,38 ppm	0,38
			Dermal	1,37 mg/kg/day	0,00
PROC6	ECETOC TRA		Inhalation	0,75 ppm	0,75
			Dermal	1,37 mg/kg/day	0,00
PROC14	ECETOC TRA		Inhalation	0,75 ppm	0,75
			Dermal	0,34 mg/kg/day	0,00
PROC8b	ECETOC TRA		Inhalation	0,45 ppm	0,45
			Dermal	0,69 mg/kg/day	0,00
PROC3	ECETOC TRA		Inhalation	0,70 ppm	0,70
			Dermal	0,34 mg/kg/day	0,00
PROC8b	ECETOC TRA		Inhalation	0,90 ppm	0,90
			Dermal	0,69 mg/kg/day	0,00
PROC8a	ECETOC TRA		Inhalation	0,45 ppm	0,45
			Dermal	1,37 mg/kg/day	0,00
PROC2	ECETOC TRA		Inhalation	0,70 ppm	0,70
			Dermal	1,37 mg/kg/day	0,00

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

The safety data sheet at hand provides the user with risk management measures and operational conditions which enables him to work safely with the substance / mixture. If other risk management measures / operational conditions are adopted, the user has to ensure, that the risks are managed to at least equivalent levels.

1. Short title of Exposure Scenario: Use in polymer processing

Main User Groups	:	**SU 3:** Industrial uses: Uses of substances as such or in preparations at industrial sites
Sectors of end-use	:	**SU 3, SU 10:** Industrial uses: Uses of substances as such or in preparations at industrial sites, Formulation [mixing] of preparations and/ or re-packaging (excluding alloys)
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 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 **PROC21:** Low energy manipulation of substances bound in materials and/ or articles
Environmental Release Categories	:	**ERC4:** Industrial use of processing aids in processes and products, not becoming part of articles

2.1 Contributing scenario controlling environmental exposure for: ERC6d: Industrial use of process regulators for polymerisation processes in production of resins, rubbers, polymers

Remarks	:	not required

2.2 Contributing scenario controlling worker exposure for: General measures (carcinogens), General risk management measures applicable to all activities

PROC1, PROC2, PROC3, PROC4, PROC5, PROC6, PROC8a, PROC8b, PROC9, PROC13, PROC14, PROC21: Use in closed process, no likelihood of exposure, Use in closed, continuous process with occasional controlled exposure, Use in closed batch process (synthesis or formulation), Use in batch and other process (synthesis) where opportunity for exposure arises, Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact), Calendering operations, Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities, Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities, Transfer of substance or preparation into small containers (dedicated filling line, including weighing), Treatment of articles by dipping and pouring, Production of preparations or articles by tabletting, compression, extrusion, pelletisation, Low energy manipulation of substances bound in materials and/ or articles

Product characteristics

Concentration of the Substance in Mixture/Article	:	Covers the percentage of the substance in the product up to 100 % (unless stated differently).
Remarks	:	Liquid, vapour pressure > 10 kPa

Frequency and duration of use

Remarks	:	Covers daily exposures up to 8 hours (unless stated differently).

Other operational conditions affecting workers exposure

Remarks	:	Assumes use at not more than 20°C above ambient temperature., Assumes a good basic standard of occupational hygiene is implemented.

Organisational measures to prevent /limit releases, dispersion and exposure

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., 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 spills immediately., Dispose of empty containers and 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.

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

Wear suitable gloves tested to EN374.

2.3 Contributing scenario controlling worker exposure for: Bulk transfers, (closed systems)
PROC1: Use in closed process, no likelihood of exposure

Technical conditions and measures

Handle substance within a closed system.

2.4 Contributing scenario controlling worker exposure for: Bulk transfers, (closed systems), With occasional controlled exposure.
PROC2: Use in closed, continuous process with occasional controlled exposure

Technical conditions and measures
Handle substance within a closed system., Ensure material transfers are under containment or extract ventilation.

Organisational measures to prevent /limit releases, dispersion and exposure
Limit the substance content in the product to 1 %.

2.5 Contributing scenario controlling worker exposure for: Bulk transfers, Dedicated facility
PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities

Technical conditions and measures
Ensure material transfers are under containment or extract ventilation.

Organisational measures to prevent /limit releases, dispersion and exposure
Limit the substance content in the product to 1 %.

2.6 Contributing scenario controlling worker exposure for: Bulk weighing, (closed systems)
PROC1: Use in closed process, no likelihood of exposure

Technical conditions and measures
Handle substance within a closed system.

2.7 Contributing scenario controlling worker exposure for: Bulk weighing, With occasional controlled exposure.
PROC2: Use in closed, continuous process with occasional controlled exposure

Technical conditions and measures
Provide extraction ventilation at points where emissions occur., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Limit the substance content in the product to 1 %.

2.8 Contributing scenario controlling worker exposure for: Small scale weighing PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

Technical conditions and measures
Ensure material transfers are under containment or extract ventilation., Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Limit the substance content in the product to 1 %.

2.9 Contributing scenario controlling worker exposure for: Additive premixing, (closed systems) PROC3: Use in closed batch process (synthesis or formulation)

Technical conditions and measures
Handle substance within a closed system., Ensure material transfers are under containment or extract ventilation., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Limit the substance content in the product to 1 %., Carefully handle substance.

2.10 Contributing scenario controlling worker exposure for: Additive premixing, (open systems), with sample collection PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises

Technical conditions and measures
Ensure material transfers are under containment or extract ventilation., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Limit the substance content in the product to 1 %., Carefully handle substance.

2.11 Contributing scenario controlling worker exposure for: Additive premixing, General exposures (open systems) PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/ or significant contact)

Technical conditions and measures
Ensure material transfers are under containment or extract ventilation., Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Limit the substance content in the product to 1 %., Carefully handle substance.

2.12 Contributing scenario controlling worker exposure for: Bulk transfers, Drum/batch transfers
PROC8b: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at dedicated facilities

Technical conditions and measures
Ensure material transfers are under containment or extract ventilation., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Limit the substance content in the product to 1 %.

2.13 Contributing scenario controlling worker exposure for: Bulk transfers, Small package filling
PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

Technical conditions and measures
Transfer via enclosed lines., Ensure material transfers are under containment or extract ventilation., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Limit the substance content in the product to 1 %.

2.14 Contributing scenario controlling worker exposure for: Calendering (including Banburys)
PROC6: Calendering operations

Technical conditions and measures
Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure

Limit the substance content in the product to 1 %.

2.15 Contributing scenario controlling worker exposure for: Production of articles by dipping and pouring
PROC13: Treatment of articles by dipping and pouring

Technical conditions and measures
Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Limit the substance content in the product to 1 %.

2.16 Contributing scenario controlling worker exposure for: Extrusion and masterbatching
PROC14: Production of preparations or articles by tabletting, compression, extrusion, pelletisation

Technical conditions and measures
Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure
Limit the substance content in the product to 1 %.

2.17 Contributing scenario controlling worker exposure for: Injection moulding of articles
PROC14: Production of preparations or articles by tabletting, compression, extrusion, pelletisation

Product characteristics

Concentration of the Substance in Mixture/Article	:	Covers percentage substance in the product up to 1 %.

Technical conditions and measures
Restrict area of openings to equipment., Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

2.18 Contributing scenario controlling worker exposure for: Equipment maintenance

PROC8a: Transfer of substance or preparation (charging/ discharging) from/ to vessels/ large containers at non-dedicated facilities

Product characteristics

Concentration of the Substance in Mixture/Article : Covers percentage substance in the product up to 1 %.

Technical conditions and measures

Drain down system prior to equipment opening or maintenance., Provide a good standard of general or controlled ventilation (10 to 15 air changes per hour).

2.19 Contributing scenario controlling worker exposure for: Storage, With occasional controlled exposure.

PROC2: Use in closed, continuous process with occasional controlled exposure

Technical conditions and measures

Store substance within a closed system., Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

Organisational measures to prevent /limit releases, dispersion and exposure

Avoid carrying out activities involving exposure for more than 1 hour., Limit the substance content in the product to 1 %.

3. Exposure estimation and reference to its source

Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value	Level of Exposure	RCR
PROC1	ECETOC TRA		Inhalation	0,01 ppm	0,01
			Dermal	0,34 mg/kg/day	0,00
PROC2	ECETOC TRA		Inhalation	0,50 ppm	0,50
			Dermal	0,01 mg/kg/day	0,00
PROC8b	ECETOC TRA		Inhalation	0,45 ppm	0,45
			Dermal	0,07 mg/kg/day	0,00
PROC1	ECETOC TRA		Inhalation	0,01 ppm	0,01
			Dermal	0,34 mg/kg/day	0,00
PROC2	ECETOC TRA		Inhalation	0,35 ppm	0,35
			Dermal	1,37 mg/kg/day	0,00
PROC9	ECETOC TRA		Inhalation	0,60 ppm	0,60
			Dermal	0,07 mg/kg/day	0,00
PROC3	ECETOC TRA		Inhalation	0,70 ppm	0,70
			Dermal	0,00 mg/kg/day	0,00
PROC4	ECETOC TRA		Inhalation	0,70 ppm	0,70
			Dermal	0,07 mg/kg/day	0,00
PROC5	ECETOC TRA		Inhalation	0,75 ppm	0,75

			Dermal	0,07 mg/kg/day	0,00
PROC8b	ECETOC TRA		Inhalation	0,42 ppm	0,42
			Dermal	0,69 mg/kg/day	0,00
PROC9	ECETOC TRA		Inhalation	0,28 ppm	0,28
			Dermal	0,07 mg/kg/day	0,00
PROC6	ECETOC TRA		Inhalation	0,88 ppm	0,88
			Dermal	1,37 mg/kg/day	0,00
PROC13	ECETOC TRA		Inhalation	0,88 ppm	0,88
			Dermal	0,07 mg/kg/day	0,00
PROC14	ECETOC TRA		Inhalation	0,88 ppm	0,88
			Dermal	0,69 mg/kg/day	0,00
PROC14	ECETOC TRA		Inhalation	0,88 ppm	0,88
			Dermal	0,34 mg/kg/day	0,00
PROC8a	ECETOC TRA		Inhalation	0,75 ppm	0,75
			Dermal	1,37 mg/kg/day	0,00
PROC2	ECETOC TRA		Inhalation	0,70 ppm	0,70
			Dermal	0,14 mg/kg/day	0,00

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

The safety data sheet at hand provides the user with risk management measures and operational conditions which enables him to work safely with the substance / mixture. If other risk management measures / operational conditions are adopted, the user has to ensure, that the risks are managed to at least equivalent levels.