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

1.1. Product identifier

Name of product	But-1-ene Art-Nr(n).: 2410, 70241
Name of substance	butene
Index No	601-012-00-4
EC No	203-449-2
REACH registration number	01-2119456615-34
CAS No	106-98-9

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

Identified uses

! **Sector of uses [SU]**
SU10 - Formulation [mixing] of preparations and/or re-packaging (excluding alloys)
SU22 - Professional uses: Public domain (administration, education, entertainment, services, craftsmen)
SU3 - Industrial uses: Uses of substances as such or in preparations at industrial sites.

! **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.
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.
PROC8b - Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities.
PROC15 - Use as laboratory reagent
PROC21 - Low energy manipulation of substances bound in materials and/or articles.

! **Environmental release categories [ERC]**
ERC7 - Industrial use of substances in closed systems
ERC1 - Manufacture of substances.
ERC8d - Wide dispersive outdoor use of processing aids in open systems
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)

! **Remark**
Restricted to professional users.

Recommended intended purpose(s)
Basic substance.

1.3. Details of the supplier of the safety data sheet

Manufacturer/distributor	GHC Gerling, Holz & Co. Handels GmbH Ruhrstraße 113, D-22761 Hamburg Phone +49 40 853 123-0, Fax +49 40 853 123-66 E-Mail hamburg@ghc.de Internet www.ghc.com

Advice	GHC Gerling, Holz & Co. Handels GmbH Phone +49 40 853 123-0 Fax +49 40 853 123-66 E-mail (competent person): msds@ghc.de

1.4. Emergency telephone number

Emergency advice	Giftinformationszentrum (Poison Control Centre) Mainz Phone +49 6131 19240

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture
Classification according to Regulation (EC) No 1272/2008 [CLP/GHS]

Hazard classes and Hazard categories	Hazard Statements	Classification procedure
Flam. Gas 1	**H220**	
Liquef. Gas	**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/GHS]


GHS02


GHS04

Signal word
Danger

Hazard statements for physical hazards

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

Precautionary Statements

Prevention

P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

Response

P377	Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381	In case of leakage, eliminate all ignition sources.

Storage

P403	Store in a well-ventilated place.

Hazardous ingredients for labeling
butene

2.3. Other hazards

! **Information pertaining to special dangers for human and environment**
In high concentrations may cause asphyxiation.
Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level.
Contact with liquid may cause cold burns/frostbite.
Receptacle under pressure.

! **Results of PBT and vPvB assessment**
This substance does not meet the PBT/vPvB criteria of REACH, annex XIII.

! SECTION 3: Composition/ information on ingredients

3.1. Substances

! **Description**
Content: > 99 %

CAS No 106-98-9 **butene**
EC No 203-449-2
Index No 601-012-00-4
REACH registration number 01-2119456615-34

3.2. Mixtures

not applicable

! SECTION 4: First aid measures

4.1. Description of first aid measures

General information
Remove contaminated soaked clothing immediately.
Adhere to personal protective measures when giving first aid.
Seek medical advice immediately.

In case of inhalation
Remove the casualty into fresh air and keep him immobile.
Seek medical treatment immediately.
In case of respiratory standstill give artifical respiration by respiratory bag (Ambu bag) or respirator. Send for a doctor.

In case of skin contact
In case of contact with skin wash off with warm water.
In case of frostbite rinse with plenty of water. Don`t remove clothing.
In case of frostbite spray with lukewarm (not hot) water for at least 15 minutes. Do not remove clothing frozen to the skin. Thaw it with lukewarm water. Apply a sterile dressing. Obtain medical assistance.

In case of eye contact
Rinse cautiously with water for several minuts. Remove contact lenses, if present and easy to do. Continue rinsing.
Call for a doctor immediately.

In case of ingestion
Ingestion is not considered a potential route of exposure.

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

! **Physician's information / possible symptoms**
Contact with liquid may cause cold burns/frostbite.

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

! **Treatment (Advice to doctor)**
Treat symptoms.
Monitor circulation.

! SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media

Foam
Dry powder
Carbon dioxide
Water spray jet

Unsuitable extinguishing media

Full water jet

5.2. Special hazards arising from the substance or mixture

In case of fire formation of dangerous gases possible.
Formation of explosive gas mixtures in air.
In the event of fire the following can be released:
Carbon monoxide (CO)

5.3. Advice for firefighters

Special protective equipment for fire-fighters

Use breathing apparatus with independent air supply (isolated).
Wear full protective clothing.

! **Additional information**

Cool endangered containers with water spray jet.
Exposure to fire may cause containers to rupture / explode.
Do not extinguish a leaking gas flame unless absolutely necessary. Spontaneous/explosive re-ignition may occur.
Extinguish any other fire.
Fire residues and contaminated firefighting water must be disposed of in accordance with the local regulations.

! SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

! **For non-emergency personnel**

Evacuate area.
Keep people away and stay on the upwind side.
Keep away sources of ignition.

! **For emergency responders**

Remove persons to safety.
Keep area evacuated and free from ignition sources until any spilled liquid has evaporated. (Ground free from frost).
Personal protection by wearing close-fitting protective clothing and breathing apparatus.
Eliminate all ignition sources if safe to do so.

6.2. Environmental precautions

If possible, stop flow of product.
Do not discharge into the drains/surface waters/groundwater.
Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.
If necessary, secure leaky pressure receptacles in a salvage packaging.

6.3. Methods and material for containment and cleaning up

Ensure adequate air ventilation.
Allow to vaporise.

6.4. Reference to other sections

Safe handling: see section 7
Disposal: see section 13
Personal protection equipment: see section 8

! SECTION 7: Handling and storage

7.1. Precautions for safe handling

! **Advice on safe handling**

Use only in thoroughly ventilated areas.
Transfer and handle only in enclosed systems.
Containers' temperature may not be increased above 50 °C.
Do not heat with open flames.
The working pressure in the receptacle must not exceed 2/3 of the test pressure of the pressure receptacle.
Take measures against electrostatically charging.
Barrels and installations thoroughly earthing (grounding).
Use antistatic tools.
Treatment only in suitable rooms and systems.
Provide good room ventilation even at ground level (vapours are heavier than air).
Prevent cylinders from falling over.
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 backfeed into the container.
Suck back 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.

General protective measures

Do not inhale gases/vapours/aerosols.

Hygiene measures

At work do not eat, drink and smoke.

! **Advice on protection against fire and explosion**

The product is combustible.
Because of risk of explosion avoid vapours getting into cellar, sewage system and holes.
Take precautionary measures against static discharges.
Formation of explosive gas mixtures in air.
Pay attention to general rules of internal fire prevention.
Use explosion-proof equipment / fittings and non-sparking tools.

7.2. Conditions for safe storage, including any incompatibilities

! **Requirements for storage rooms and vessels**

Keep in closed original container.
Ventilate store-rooms thoroughly.
Use transportable pressure equipment.
Suitable materials: Normalised carbon steel, tempered alloy steel, aluminium alloys, austenitic stainless steels.
Valve: Suitable materials: Brass, copper alloys, carbon steels, aluminium alloys, austenitic stainless steels.
Other material details see ISO 11114.
All regulations and local requirements for the storage of containers have to be respected.

! **Advice on storage compatibility**

Do not store with spontaneously flammable materials.
Do not store together with combustible liquids or combustible solids.
Do not store together with animal feedstuffs.
Do not store together with explosives.
Do not store together with infectious substances.
Do not store together with radioactive material.
Do not store together with toxic liquids or toxic solids.
Do not store together with food.
Do not store together with oxidizing liquids or oxidizing solids.

! **Further information on storage conditions**
Ensure valve protection device is correctly fitted.
Keep container tightly closed and store at cool and aired place.
Prevent cylinders from falling over.
Protect of heat.
Storage temperature may not exceed 50°C (=122°F).

7.3. Specific end use(s)

! **Recommendation(s) for intended use**
Exposure scenarios (ES) see annex to this safety data sheet.

! SECTION 8: Exposure controls/personal protection

8.1. Control parameters
DNEL-/PNEC-values
DNEL worker

CAS No	Substance name	Value	Code	Remark
106-98-9	butene	1530 mg/m3	DNEL long-term inhalative (local)	Assessment factor 3, repeated dose toxicity.
		769 mg/m3	DNEL long-term inhalative (systemic)	Assessment factor 3, repeated dose toxicity.

DNEL Consumer

CAS No	Substance name	Value	Code	Remark
106-98-9	butene	918 mg/m3	DNEL long-term inhalative (local)	Assessment factor 5, repeated dose toxicity.
		163 mg/m3	DNEL long-term inhalative (systemic)	Assessment factor 5, repeated dose toxicity.

8.2. Exposure controls
Respiratory protection
Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe.
Keep self contained breathing apparatus readily available for emergency use.
In case of low concentrations in the breathing air: short term: filter apparatus, filter AX.

! **Hand protection**
Leather gloves
Safety gloves according EN 388

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

Other protection measures
Safety shoes with steel toe.
Body covering work clothing, or chemical resistant suit at increased risk.

! **Appropriate engineering controls**
Transfer and handle only in enclosed systems.

! SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance
Gaseous / liquefied under pressure.

Colour
colourless

Odour
sweetish

Odour threshold
not determined

Important health, safety and environmental information

	Value	Temperature	at	Method	Remark
pH value	not applicable				
Acid number	not applicable				
boiling point	-6,2 °C		1013 hPa		
melting point	-185 °C				
Flash point	< -40 °C			DIN 51755	
Vapourisation rate	not applicable				
Flammable (solid)	not applicable				
Flammability (gas)					flammable.
Ignition temperature	360 °C				
Self ignition temperature	385 °C				
Lower explosion limit	1,5 Vol-%				
Upper explosion limit	10,6 Vol-%				
Vapour pressure	2545 hPa	20 °C			
Relative density	2,594 kg/m3	0 °C	1013 mbar		
Bulk density	not applicable				
Vapour density	1,93				
Solubility in water	0,5 g/l	20 °C			
Solubility/other					soluble in organic solvent

	Value	Temperature	at	Method	Remark
Partition coefficient n-octanol/water (log P O/W)	2,42				
Decomposition temperature	not determined				
Viscosity dynamic	not applicable				

Oxidising properties
no

Explosive properties
no

9.2. Other information
Vapours are heavier than air.

! SECTION 10: Stability and reactivity

10.1. Reactivity
See section "Possibility of hazardous reactions".

10.2. Chemical stability
Stable under recommended conditions of use and storage (see section 7).

10.3. Possibility of hazardous reactions
Reactions with strong acids.
Reactions with strong oxidising agents.
Risk of polymerisation.

10.4. Conditions to avoid
Formation of explosive gas/air mixtures.
Heat sources / heat - risk of bursting.
Sources of ignition.

10.5. Incompatible materials
! **Substances to avoid**
Chlorine
hydrochloric gas
Fluorine
Oxidising agent, strong
Nitrogen oxides (NOx)
Acids.

10.6. Hazardous decomposition products
No hazardous decomposition products known.

Thermal decomposition

Remark No decomposition if used as directed.

! SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity/Irritation/Sensitization

	Value/Validation	Species	Method	Remark
LD50 acute oral	Study technically not feasible.			
LD50 acute dermal	Study technically not feasible.			
LC50 acute inhalation	> 10000 ppm (4 h)	rat (male / female)	OECD 403	
Skin irritation		Study technically not feasible.		
Eye irritation		Study technically not feasible.		
Skin sensitization		Study technically not feasible.		
Sensitization respiratory system		not determined		

Subacute Toxicity - Carcinogenicity

	Value	Species	Method	Validation
Subchronic Toxicity	NOAEC > 18,4 mg/l (28 d) Inhalation	Rat (male / female)	OECD TG 422	No effects of toxicological significance.
Mutagenicity				No experimental information on genotoxicity in vitro and in vivo available.
Reproduction-Toxicity	NOAEC > 18,4 mg/l Inhalation.	Rat (male / female)	OECD TG 422	No indications of toxic effects were observed in reproduction studies in animals.

! **Specific target organ toxicity (single exposure)**
Substance or mixture is not classified in GHS-criteria as specific target organ toxic with single exposure.

! **Specific target organ toxicity (repeated exposure)**
Substance or mixture is not classified in GHS-criteria as specific target organ toxic with repeated exposure.

! **Aspiration hazard**
not applicable

Toxicity test (Additional information)
No experimental indication of genotoxicity in vitro (Ames-test negative).
No experimental indication of genotoxicity in vivo (micronucleus test negative).

No indication of cancerogenic effects (conclusion by analogy).

Experiences made from practice
May cause frostbite.
Gases have a suffocating effect.
Inhalation causes narcotic effect/intoxication.

! SECTION 12: Ecological information

12.1. Toxicity

Ecotoxicological effects

	Value	Species	Method	Validation
Fish	LC50 19 mg/l (96 h)	Fish	QSAR	The product is highly volatile.
Daphnia	LC50 11 mg/l (48 h)	Daphnia	QSAR	The product is highly volatile.
Algae	EC50 6,5 mg/l (96 h)	Algae	QSAR	The product is highly volatile.
Bacteria	not applicable			The product is highly volatile.

12.2. Persistence and degradability

	Elimination rate	Method of analysis	Method	Validation
Physico-chemical degradability	At normal temperature very highly volatile or gaseous product that can be released to atmosphere. Elimination test cannot be employed.			
Biological degradability			QSAR	readily degradable
Biological eliminability	not determined			

12.3. Bioaccumulative potential
The product has not been tested. Because of the product's consistency and low solubility in water bioavailability is not likely.

12.4. Mobility in soil
Adsorption in the soil is not likely.
Because of its high volatility, it is unlikely that the product soil, water caused.

12.5. Results of PBT and vPvB assessment
This substance does not meet the PBT/vPvB criteria of REACH, annex XIII.

12.6. Other adverse effects
Not known.

! SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste code No.	Name of waste
16 05 04*	gases in pressure containers (including halons) containing hazardous substances

Wastes marked with an asterisk are considered to be hazardous waste pursuant to Directive 2008/98/EC on hazardous waste.

! **Recommendations for the product**
Dispose of as hazardous waste.
Return to manufacturer.

Recommendations for packaging
Transportable pressure equipment (empty, residual pressure): Return to supplier / manufacturer.

! SECTION 14: Transport information

	ADR/RID	IMDG	IATA-DGR
14.1. UN number	1012	1012	1012
14.2. UN proper shipping name	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. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
not applicable
No transport as bulk according IBC - Code.

Land and inland navigation transport ADR/RID
Hazard label(s) 2.1
tunnel restriction code B/D
Classification code 2F

Marine transport IMDG
Ems: F-D, S-U

Air transport ICAO/IATA-DGR
Cargo aircraft only.

! SECTION 15: Regulatory information

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

! **Other regulations (EU)**
Please note:
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.

VOC standard
VOC content >=99 % 20 °C 2545 hPa

15.2. Chemical Safety Assessment
For this substance a chemical safety assessment is not required because it is not classified regarding health and environmental hazards.
The protective measures listed in Sections 6, 7 and 8 of the Safety Data Sheet have to be considered.
For this substance a chemical safety assessment has been carried out.
Exposure scenarios (ES) see annex to this safety data sheet.

! SECTION 16: Other information

Recommended uses and restrictions
National and local regulations concerning chemicals shall be observed.

Further information
All declarations of safety-data-sheet refer to pure substance.
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.

Indication of changes: "!" = Data changed compared with the previous version. Previous version: 6.2

! **Sources of key data used**
For the preparation of this safety data sheet, information from our suppliers as well as data from the "database of registered substances" of the European Chemicals Agency (ECHA) were used.

Table of content

ES1 - Use: Manufacture.

Main User Group	:	**SU3 -** Industrial uses: Uses of substances as such or in preparations at industrial sites
Environmental release category	:	**ERC1 -** Manufacture of substances
Process category	:	**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
Activity	:	**ESIG-GES1_I -** Manufacture of substance or use as process chemical or extracting 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.

ES2 - Use: Industrial use, Distribution of substance

Main User Group	:	**SU3 -** Industrial uses: Uses of substances as such or in preparations at industrial sites
Environmental release category	:	**ERC7 -** Industrial use of substances in closed systems
Process category	:	**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
Activity	:	**ESIG-GES1A_I -** 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.

ES3 - Use: Industrial use, Use as an intermediate

Main User Group	:	**SU3 -** Industrial uses: Uses of substances as such or in preparations at industrial sites
Environmental release category	:	**ERC6a -** Industrial use resulting in manufacture of another substance (use of intermediates)
Process category	:	**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
Activity	:	**GES1 B_I -** 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).

ES4 - Use: Industrial use, Polymer production

Main User Group	:	**SU3 -** Industrial uses: Uses of substances as such or in preparations at industrial sites
Environmental release category	:	**ERC6a -** Industrial use resulting in manufacture of another substance (use of intermediates)
Sector of use	:	**SU10-** Formulation [mixing] of preparations and/or re-packaging (excluding alloys)
Process category	:	**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. **PROC14 -** Production of preparations or articles by tabletting, compression, extrusion, pelletisation
Activity	:	**ESIG-GES20_I -** 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).

ES5 - Use: Industrial use, Polymer processing

and associated maintenance.

Main User Group	:	**SU3 -** Industrial uses: Uses of substances as such or in preparations at industrial sites
Environmental release category	:	**ERC4 -** Industrial use of processing aids in processes and products, not becoming part of articles
Sector of use	:	**SU10-** Formulation [mixing] of preparations and/or re-packaging (excluding alloys)
Process category	:	**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
Activity	:	**ESIG-GES23_I -** 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.

ES6 - Use: Professional use, Polymer processing

Main User Group	:	**SU22 -** Professional uses: Public domain (administration, education, entertainment, services, craftsmen)
Environmental release category	:	**ERC8d -** Wide dispersive outdoor use of processing aids in open systems
Process category	:	**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 preparation (charging/discharging) from/to vessels/large containers 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
Activity	:	**ESIG-GES23_P -** Processing of formulated polymers including material transfers, moulding and forming activities, material re-works and associated maintenance.

1. Short title of exposure scenario - ES1: Manufacture.

Main User Group	:	**SU3 -** Industrial uses: Uses of substances as such or in preparations at industrial sites
Environmental release category	:	**ERC1 -** Manufacture of substances
Process category	:	**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
Activity	:	**ESIG-GES1_I -** Manufacture of substance or use as process chemical or extracting 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 scenario controlling environmental exposure for:
ERC1: Manufacture of substances

As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

2.2. Contributing scenario controlling worker exposure for:
PROC1: Use in closed process, no likelihood of exposure

, alternatively:, 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

Remarks	:	Covers percentage substance in the product up to 100 %.
Physical Form (at time of use)	:	gaseous

Frequency and duration of use

Remarks	:	Covers daily exposures up to 8 hours

Other given operational conditions affecting worker exposure
Outdoor / Indoor : Indoor use

Technical conditions and measures
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 release, dispersion and 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/hot surfaces. No smoking.

Conditions and measures related to personal protection, hygiene and health evaluation
For personal protection see section 8.

3. Exposure estimation and reference to its source

Environment

Contributing Scenario	Exposure Assessment Method	Specific conditions	Compartment	Level of Exposure	RCR	Remarks
ERC1	Qualitative approach used to conclude safe use.		Humans via the environment		< 1	Risk checked

Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value type	Level of Exposure	RCR	Remarks
PROCs	Qualitative approach used to conclude safe use.		Worker - all relevant routes		< 1	Risk checked

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

For scaling see:
No additional relevant information available.

1. Short title of exposure scenario - ES2: Industrial use, Distribution of substance

Main User Group	:	**SU3 -** Industrial uses: Uses of substances as such or in preparations at industrial sites
Environmental release category	:	**ERC7 -** Industrial use of substances in closed systems
Process category	:	**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
Activity	:	**ESIG-GES1A_I -** 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 scenario controlling environmental exposure for:
ERC7: Industrial use of substances in closed systems

As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

2.2. Contributing scenario controlling worker exposure for:
PROC1: Use in closed process, no likelihood of exposure

, alternatively:, 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

Remarks	:	Covers percentage substance in the product up to 100 %.
Physical Form (at time of use)	:	gaseous

Frequency and duration of use

Remarks	:	Covers daily exposures up to 8 hours

Other given operational conditions affecting worker exposure
Outdoor / Indoor : Indoor use

Technical conditions and measures
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 release, dispersion and 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/hot surfaces. No smoking.

Conditions and measures related to personal protection, hygiene and health evaluation
For personal protection see section 8.

3. Exposure estimation and reference to its source

Environment

Contributing Scenario	Exposure Assessment Method	Specific conditions	Compartment	Level of Exposure	RCR	Remarks
ERC7	Qualitative approach used to conclude safe use.		Humans via the environment		< 1	Risk checked

Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value type	Level of Exposure	RCR	Remarks
PROCs	Qualitative approach used to conclude safe use.		Worker - all relevant routes		< 1	Risk checked

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

For scaling see:
No additional relevant information available.

1. Short title of exposure scenario - ES3: Industrial use, Use as an intermediate

Main User Group	:	**SU3 -** Industrial uses: Uses of substances as such or in preparations at industrial sites
Environmental release category	:	**ERC6a -** Industrial use resulting in manufacture of another substance (use of intermediates)
Process category	:	**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
Activity	:	**GES1 B_I -** 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 scenario controlling environmental exposure for:
ERC6a: Industrial use resulting in manufacture of another substance (use of intermediates)

As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

2.2. Contributing scenario controlling worker exposure for:
PROC1: Use in closed process, no likelihood of exposure

, alternatively:, 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

Remarks	:	Covers percentage substance in the product up to 100 %.
Physical Form (at time of use)	:	gaseous

Frequency and duration of use

Remarks	:	Covers daily exposures up to 8 hours

Other given operational conditions affecting worker exposure
Outdoor / Indoor : Indoor use

Technical conditions and measures
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 release, dispersion and 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/hot surfaces. No smoking.

Conditions and measures related to personal protection, hygiene and health evaluation
For personal protection see section 8.

3. Exposure estimation and reference to its source

Environment

Contributing Scenario	Exposure Assessment Method	Specific conditions	Compartment	Level of Exposure	RCR	Remarks
ERC6a	Qualitative approach used to conclude safe use.		Humans via the environment		< 1	Risk checked

Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value type	Level of Exposure	RCR	Remarks
PROCs	Qualitative approach used to conclude safe use.		Worker - all relevant routes		< 1	Risk checked

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

For scaling see:
No additional relevant information available.

1. Short title of exposure scenario - ES4: Industrial use, Polymer production

Main User Group	:	**SU3 -** Industrial uses: Uses of substances as such or in preparations at industrial sites
Environmental release category	:	**ERC6a -** Industrial use resulting in manufacture of another substance (use of intermediates)
Sector of use	:	**SU10 -** Formulation [mixing] of preparations and/or re-packaging (excluding alloys)
Process category	:	**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. **PROC14 -** Production of preparations or articles by tabletting, compression, extrusion, pelletisation
Activity	:	**ESIG-GES20_I -** 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 scenario controlling environmental exposure for:
ERC6a: Industrial use resulting in manufacture of another substance (use of intermediates)

As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

2.2. Contributing scenario controlling worker exposure for:
PROC1: Use in closed process, no likelihood of exposure

, alternatively:, 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

Annex: Exposure scenarios

Product characteristics
Remarks : Covers percentage substance in the product up to 100 %.
Physical Form (at time of use) : gaseous

Frequency and duration of use
Remarks : Covers daily exposures up to 8 hours

Other given operational conditions affecting worker exposure
Outdoor / Indoor : Indoor use

Technical conditions and measures
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 release, dispersion and 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/hot surfaces. No smoking.

Conditions and measures related to personal protection, hygiene and health evaluation
For personal protection see section 8.

3. Exposure estimation and reference to its source

Environment

Contributing Scenario	Exposure Assessment Method	Specific conditions	Compartment	Level of Exposure	RCR	Remarks
ERC6a	Qualitative approach used to conclude safe use.		Humans via the environment		< 1	Risk checked

Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value type	Level of Exposure	RCR	Remarks
PROCs	Qualitative approach used to conclude safe use.		Worker - all relevant routes		< 1	Risk checked

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

For scaling see:
No additional relevant information available.

1. Short title of exposure scenario - ES5: Industrial use, Polymer processing

Main User Group	:	**SU3 -** Industrial uses: Uses of substances as such or in preparations at industrial sites
Environmental release category	:	**ERC4 -** Industrial use of processing aids in processes and products, not becoming part of articles
Sector of use	:	**SU10 -** Formulation [mixing] of preparations and/or re-packaging (excluding alloys)
Process category	:	**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
Activity	:	**ESIG-GES23_I -** 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 scenario controlling environmental exposure for:
ERC4: Industrial use of processing aids in processes and products, not becoming part of articles

As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

2.2. Contributing scenario controlling worker exposure for:

PROC1: Use in closed process, no likelihood of exposure

, alternatively:, 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
Remarks : Covers percentage substance in the product up to 100 %.
Physical Form (at time of use) : gaseous

Frequency and duration of use
Remarks : Covers daily exposures up to 8 hours

Other given operational conditions affecting worker exposure
Outdoor / Indoor : Indoor use

Technical conditions and measures
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 release, dispersion and 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/hot surfaces. No smoking.

Conditions and measures related to personal protection, hygiene and health evaluation
For personal protection see section 8.

3. Exposure estimation and reference to its source

Environment

Contributing Scenario	Exposure Assessment Method	Specific conditions	Compartment	Level of Exposure	RCR	Remarks
ERC4	Qualitative approach used to conclude safe use.		Humans via the environment		< 1	Risk checked

Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value type	Level of Exposure	RCR	Remarks
PROCs	Qualitative approach used to conclude safe use.		Worker - all relevant routes		< 1	Risk checked

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

For scaling see:
No additional relevant information available.

1. Short title of exposure scenario - ES6: Professional use, Polymer processing

Main User Group	:	**SU22 -** Professional uses: Public domain (administration, education, entertainment, services, craftsmen)
Environmental release category	:	**ERC8d -** Wide dispersive outdoor use of processing aids in open systems
Process category	:	**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 preparation (charging/discharging) from/to vessels/large containers 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
Activity	:	**ESIG-GES23_P -** Processing of formulated polymers including material transfers, moulding and forming activities, material re-works and associated maintenance.

2.1. Contributing scenario controlling environmental exposure for:
ERC8d: Wide dispersive outdoor use of processing aids in open systems

As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

2.2. Contributing scenario controlling worker exposure for:
PROC1: Use in closed process, no likelihood of exposure

, alternatively:, Other, Bulk transfers, Closed systems, Material transfers, Injection moulding of articles, Rework of articles, Equipment maintenance, Storage

Product characteristics

Remarks	:	Covers percentage substance in the product up to 100 %.
Physical Form (at time of use)	:	gaseous

Frequency and duration of use

Remarks	:	Covers daily exposures up to 8 hours

Other given operational conditions affecting worker exposure
Outdoor / Indoor : Outdoor use

Technical conditions and measures
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 release, dispersion and 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/hot surfaces. No smoking.

Conditions and measures related to personal protection, hygiene and health evaluation
For personal protection see section 8.

3. Exposure estimation and reference to its source

Environment

Contributing Scenario	Exposure Assessment Method	Specific conditions	Compartment	Level of Exposure	RCR	Remarks
ERC8d	Qualitative approach used to conclude safe use.		Humans via the environment		< 1	Risk checked

Workers

Contributing Scenario	Exposure Assessment Method	Specific conditions	Value type	Level of Exposure	RCR	Remarks
PROCs	Qualitative approach used to conclude safe use.		Worker - all relevant routes		< 1	Risk checked

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

For scaling see:
No additional relevant information available.