



Isobutane

Version number: GHS 1.0

Date of compilation: 24.02.2022

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

1.1 Product identifier

Identification of the substance	Isobutane
Registration number (REACH)	01-2119485395-27-xxxx
EC number	200-857-2
CAS number	75-28-5
Alternative name(s)	isobutane
Product number	RDG-1104

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

Relevant identified uses	industrial uses Blowing agents Polymer production Polymer processing Use as a fuel feedstock use
Uses advised against	Do not use for products which come into contact with foodstuffs. Do not use for private purposes (household).

1.3 Details of the supplier of the safety data sheet

Rosneft Deutschland GmbH
Behrenstr. 18
10117 Berlin
Germany

Telephone: +49 30 70014 2597
e-mail: hseq@rosneft.de
Website: www.rosneft.de

e-mail (competent person) hseq@rosneft.de

1.4 Emergency telephone number

Poison centre			
Country	Name	Telephone	Opening hours
Germany	Giftnotruf München	0049 - 89 -19240	Mon - Fri 00:00 - 23:59

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 (CLP)

Section	Hazard class	Category	Hazard class and category	Hazard statement
2.2	flammable gas	1A	Flam. Gas 1A	H220
2.5	gas under pressure	L	Press. Gas L	H280

For full text of abbreviations: see SECTION 16.



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The most important adverse physicochemical, human health and environmental effects
Contains gas under pressure; may explode if heated.

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008 (CLP)

- Signal word danger

- Pictograms

GHS02, GHS04



- Hazard statements

H220 Extremely flammable gas.

H280 Contains gas under pressure; may explode if heated.

- Precautionary statements

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

P377 Leaking gas fire: Do not extinguish, unless leak can be stopped safely.

P381 In case of leakage, eliminate all ignition sources.

P410+P403 Protect from sunlight. Store in a well-ventilated place.

2.3 Other hazards

Results of PBT and vPvB assessment

According to the results of its assessment, this substance is not a PBT or a vPvB.

SECTION 3: Composition/information on ingredients

3.1 Substances

Name of substance	Isobutane
Identifiers	
REACH Reg. No	01-2119485395-27-xxxx
CAS No	75-28-5
EC No	200-857-2
Index No	601-004-01-8
Purity	>80 %

Impurities and additives, classification acc. to GHS

Name of substance	Identifier	Wt%	Classification acc. to GHS	Pictograms	Notes
Propane	CAS No 74-98-6 EC No 200-827-9	0 – 5	Flam. Gas 1A / H220 Press. Gas C / H280		GHS-HC U(b)
propylene 99 %	CAS No 115-07-1 EC No 204-062-1	0 – 5	Flam. Gas 1A / H220 Press. Gas C / H280		GHS-HC U(b)

Notes

GHS-HC: Harmonised classification (the classification of the substance corresponds to the entry in the list according to 1272/2008/EC,



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Notes

U(b): Annex VI)
The allocation to the group 'compressed gas' is based on the physical state in which the gas is packaged

Molecular formula C₄H₁₀
Molar mass 58,12 g/mol

For full text of abbreviations: see SECTION 16.

SECTION 4: First aid measures

4.1 Description of first aid measures

General notes

Do not leave affected person unattended. Remove victim out of the danger area. Keep affected person warm, still and covered. Take off immediately all contaminated clothing. In all cases of doubt, or when symptoms persist, seek medical advice. In case of unconsciousness place person in the recovery position. Never give anything by mouth.

Following inhalation

If breathing is irregular or stopped, immediately seek medical assistance and start first aid actions. Provide fresh air.

Following skin contact

Thaw frosted parts with lukewarm water. Do not rub affected area.

Following eye contact

Remove contact lenses, if present and easy to do. Continue rinsing. Irrigate copiously with clean, fresh water for at least 10 minutes, holding the eyelids apart.

Following ingestion

Rinse mouth with water (only if the person is conscious). Do NOT induce vomiting.

4.2 Most important symptoms and effects, both acute and delayed

Symptoms and effects are not known to date.

4.3 Indication of any immediate medical attention and special treatment needed

none

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media

Water spray, BC-powder

Unsuitable extinguishing media

Water jet

5.2 Special hazards arising from the substance or mixture

Contact with the product can cause burns and/or frostbite. Contains gas under pressure; may explode if heated.

Hazardous combustion products

Carbon monoxide (CO), Carbon dioxide (CO₂)

5.3 Advice for firefighters

In case of fire and/or explosion do not breathe fumes. Co-ordinate firefighting measures to the fire surroundings. Do not allow firefighting water to enter drains or water courses. Collect contaminated firefighting water separately. Fight fire with normal precautions from a reasonable distance.



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SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

For non-emergency personnel

Remove persons to safety.

For emergency responders

Wear breathing apparatus if exposed to vapours/dust/spray/gases.

6.2 Environmental precautions

Keep away from drains, surface and ground water. Retain contaminated washing water and dispose of it.

6.3 Methods and material for containment and cleaning up

Advice on how to contain a spill

Covering of drains

Other information relating to spills and releases

Place in appropriate containers for disposal. Ventilate affected area.

6.4 Reference to other sections

Hazardous combustion products: see section 5. Personal protective equipment: see section 8. Incompatible materials: see section 10. Disposal considerations: see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Recommendations

- Measures to prevent fire as well as aerosol and dust generation

Use local and general ventilation. Use only in well-ventilated areas.

Advice on general occupational hygiene

Wash hands after use. Do not eat, drink and smoke in work areas. Remove contaminated clothing and protective equipment before entering eating areas. Never keep food or drink in the vicinity of chemicals. Never place chemicals in containers that are normally used for food or drink. Keep away from food, drink and animal feedingstuffs.

7.2 Conditions for safe storage, including any incompatibilities

Managing of associated risks

- Flammability hazards

Keep away from sources of ignition - No smoking. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Take precautionary measures against static discharge. Protect from sunlight.

- Packaging compatibilities

Only packagings which are approved (e.g. acc. to ADR) may be used.

7.3 Specific end use(s)

See section 16 for a general overview.



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SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Occupational exposure limit values (Workplace Exposure Limits)											
Country	Name of agent	CAS No	Identifier	TWA [ppm]	TWA [mg/m ³]	STEL [ppm]	STEL [mg/m ³]	Ceiling-C [ppm]	Ceiling-C [mg/m ³]	Notation	Source
DE	isobutane	75-28-5	MAK	1.000	2.400	4.000	9.600				DFG
DE	isobutane	75-28-5	AGW	1.000	2.400	4.000	9.600				TRGS 900

Notation

Ceiling-C

STEL

TWA

ceiling value is a limit value above which exposure should not occur
short-term exposure limit: a limit value above which exposure should not occur and which is related to a 15-minute period (unless otherwise specified)
time-weighted average (long-term exposure limit): measured or calculated in relation to a reference period of 8 hours
time-weighted average (unless otherwise specified)

8.2 Exposure controls

Appropriate engineering controls

General ventilation.

Individual protection measures (personal protective equipment)

Eye/face protection

Wear eye/face protection.

Skin protection

- Hand protection

Wear protective gloves.

- Other protection measures

Take recovery periods for skin regeneration. Preventive skin protection (barrier creams/ointments) is recommended. Wash hands thoroughly after handling.

Respiratory protection

In case of inadequate ventilation wear respiratory protection.

Environmental exposure controls

Use appropriate container to avoid environmental contamination. Keep away from drains, surface and ground water.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	gaseous (liquefied)
Colour	colourless
Odour	odourless
Melting point/freezing point	-159,4 °C
Boiling point or initial boiling point and boiling range	-11,73 °C at 1.013 hPa



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Flammability	flammable gas in accordance with GHS criteria
Lower and upper explosion limit	1,5 vol% - 9,4 vol%
Flash point	<-50 °C (DIN EN ISO 2719)
Auto-ignition temperature	460 °C (ECHA)
Decomposition temperature	not relevant
pH (value)	not determined
Kinematic viscosity	not relevant

Solubility(ies)

Water solubility	(insoluble)
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Partition coefficient

Partition coefficient n-octanol/water (log value)	2,8 (pH value: 7, 20 °C) (ECHA)
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Vapour pressure	408,9 kPa at 30 °C
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Density and/or relative density

Density	563 kg/m ³ at 15 °C
Relative vapour density	not relevant (gaseous)

Particle characteristics	not relevant (gaseous)
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9.2 Other information

Information with regard to physical hazard classes

Flammable gases

- Explosion limits	1,5 vol% - 9,4 vol%
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Other safety characteristics

Gas group (explosion group)	IIA (Maximum Experimental Safe Gap value; MESG > 0,9 mm)
Temperature class (EU, acc. to ATEX)	T1 (maximum permissible surface temperature on the equipment: 450°C)



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SECTION 10: Stability and reactivity

10.1 Reactivity

Concerning incompatibility: see below "Conditions to avoid" and "Incompatible materials". It's a reactive substance. The mixture contains reactive substance(s). Gas under pressure. Risk of ignition.

If heated:

Danger of explosion, Gas under pressure, Danger of bursting container

10.2 Chemical stability

See below "Conditions to avoid".

10.3 Possibility of hazardous reactions

No known hazardous reactions.

10.4 Conditions to avoid

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

10.5 Incompatible materials

Oxidisers

10.6 Hazardous decomposition products

Reasonably anticipated hazardous decomposition products produced as a result of use, storage, spill and heating are not known. Hazardous combustion products: see section 5.

SECTION 11: Toxicological information

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

Classification according to GHS (1272/2008/EC, CLP)

Acute toxicity

Shall not be classified as acutely toxic.

Skin corrosion/irritation

Shall not be classified as corrosive/irritant to skin.

Serious eye damage/eye irritation

Shall not be classified as seriously damaging to the eye or eye irritant.

Respiratory or skin sensitisation

Shall not be classified as a respiratory or skin sensitizer.

Germ cell mutagenicity

Shall not be classified as germ cell mutagenic.

Carcinogenicity

Shall not be classified as carcinogenic.

Reproductive toxicity

Shall not be classified as a reproductive toxicant.

Specific target organ toxicity - single exposure

Shall not be classified as a specific target organ toxicant (single exposure).

Specific target organ toxicity - repeated exposure

Shall not be classified as a specific target organ toxicant (repeated exposure). Depression of central nervous system.



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Aspiration hazard

Shall not be classified as presenting an aspiration hazard.

11.2 Information on other hazards

There is no additional information.

SECTION 12: Ecological information

12.1 Toxicity

Acc. to 1272/2008/EC: Shall not be classified as hazardous to the aquatic environment.
Verordnung über Anlagen zum Umgang mit wassergefährdenden Stoffen (Ordinance on facilities for handling substances hazardous to water) (AwSV): nwg, non-hazardous to water (Germany)

Biodegradation

The substance is readily biodegradable.

12.2 Persistence and degradability

Data are not available.

12.3 Bioaccumulative potential

Data are not available.

n-octanol/water (log KOW)	2,8 (pH value: 7, 20 °C) (ECHA)
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12.4 Mobility in soil

Data are not available.

12.5 Results of PBT and vPvB assessment

Data are not available.

12.6 Endocrine disrupting properties

Not listed.

12.7 Other adverse effects

Data are not available.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Sewage disposal-relevant information

Do not empty into drains. Avoid release to the environment. Refer to special instructions/safety data sheets.

Waste treatment of containers/packagings

It is a dangerous waste; only packagings which are approved (e.g. acc. to ADR) may be used. Completely emptied packages can be recycled. Handle contaminated packages in the same way as the substance itself.

Remarks

Please consider the relevant national or regional provisions. Waste shall be separated into the categories that can be handled separately by the local or national waste management facilities.



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SECTION 14: Transport information

14.1 UN number or ID number

ADR/RID/ADN	UN 1969
IMDG-Code	UN 1969
ICAO-TI	UN 1969

14.2 UN proper shipping name

ADR/RID/ADN	ISOBUTANE
IMDG-Code	ISOBUTANE
ICAO-TI	Isobutane

14.3 Transport hazard class(es)

ADR/RID/ADN	2 (2.1)
IMDG-Code	2.1
ICAO-TI	2.1

14.4 Packing group

not assigned

14.5 Environmental hazards

non-environmentally hazardous acc. to the dangerous goods regulations

14.6 Special precautions for user

Provisions for dangerous goods (ADR) should be complied within the premises.

14.7 Maritime transport in bulk according to IMO instruments

The cargo is not intended to be carried in bulk.

Information for each of the UN Model Regulations

Transport of dangerous goods by road, rail and inland waterway (ADR/RID/ADN) - Additional information

Classification code	2F
Danger label(s)	2.1



Special provisions (SP)	392, 657, 662, 674
Excepted quantities (EQ)	E0
Limited quantities (LQ)	0
Transport category (TC)	2
Tunnel restriction code (TRC)	B/D
Hazard identification No	23



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International Maritime Dangerous Goods Code (IMDG) - Additional information

Marine pollutant -
Danger label(s) 2.1



Special provisions (SP) 392
Excepted quantities (EQ) E0
Limited quantities (LQ) 0
EmS F-D, S-U
Stowage category E

International Civil Aviation Organization (ICAO-IATA/DGR) - Additional information

Danger label(s) 2.1



Special provisions (SP) A1
Excepted quantities (EQ) E0

SECTION 15: Regulatory information

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

Relevant provisions of the European Union (EU)

Restrictions according to REACH, Annex XVII

Dangerous substances with restrictions (REACH, Annex XVII)

Name of substance	Name acc. to inventory	CAS No	Restriction	No
Isobutane	flammable / pyrophoric		R40	40

Legend

- R40
- Shall not be used, as substance or as mixtures in aerosol dispensers where these aerosol dispensers are intended for supply to the general public for entertainment and decorative purposes such as the following:
 - metallic glitter intended mainly for decoration,
 - artificial snow and frost,
 - 'whoopee' cushions,
 - silly string aerosols,
 - imitation excrement,
 - horns for parties,
 - decorative flakes and foams,
 - artificial cobwebs,
 - stink bombs.
 - Without prejudice to the application of other Community provisions on the classification, packaging and labelling of substances, suppliers shall ensure before the placing on the market that the packaging of aerosol dispensers referred to above is marked visibly, legibly and indelibly with:
'For professional users only'.
 - By way of derogation, paragraphs 1 and 2 shall not apply to the aerosol dispensers referred to Article 8 (1a) of Council Directive 75/324/EEC (2).
 - The aerosol dispensers referred to in paragraphs 1 and 2 shall not be placed on the market unless they conform to the requirements indicated.

List of substances subject to authorisation (REACH, Annex XIV) / SVHC - candidate list

not listed

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Deco-Paint Directive

VOC content	100 %
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Industrial Emissions Directive (IED)

VOC content	100 %
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Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)

not listed

Regulation concerning the establishment of a European Pollutant Release and Transfer Register (PRTR)

not listed

Water Framework Directive (WFD)

not listed

Regulation on persistent organic pollutants (POP)

Not listed.

National regulations (Germany)

Verordnung über Anlagen zum Umgang mit wassergefährdenden Stoffen (Ordinance on facilities for handling substances hazardous to water) (AwSV)

Wassergefährdungsklasse, WGK nwg non-hazardous to water
(water hazard class)

Index number 562

Technical instructions on air quality control (Germany)

Number	Group of substances	Class	Conc.	Mass flow	Mass concentration	Notation
5.2.5	organic substances		≥ 25 wt%	0,5 kg/h	50 mg/m ³	3)

Notation

3) a total mass flow of 0.50 kg/h or a total mass concentration of 50 mg/m³, each of which to be indicated as total carbon, shall not be exceeded (except organic particulate matter)

Storage of hazardous substances in non-stationary containers (TRGS 510) (Germany)

Storage class (LGK) 2 A (gases (except aerosol dispensers and lighters))

National inventories

Country	Inventory	Status
EU	REACH Reg.	substance is listed

Legend

REACH Reg. REACH registered substances

15.2 Chemical Safety Assessment

No Chemical Safety Assessment has been carried out for this substance.



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SECTION 16: Other information

Abbreviations and acronyms

Abbr.	Descriptions of used abbreviations
ADN	Accord européen relatif au transport international des marchandises dangereuses par voies de navigation intérieures (European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways)
ADR	Accord relatif au transport international des marchandises dangereuses par route (Agreement concerning the International Carriage of Dangerous Goods by Road)
ADR/RID/ADN	Agreements concerning the International Carriage of Dangerous Goods by Road/Rail/Inland Waterways (ADR/RID/ADN)
AGW	Workplace exposure limit
CAS	Chemical Abstracts Service (service that maintains the most comprehensive list of chemical substances)
Ceiling-C	Ceiling value
CLP	Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures
DFG	Deutsche Forschungsgemeinschaft MAK-und BAT-Werte-Liste, Senatskommission zur Prüfung gesundheitsschädlicher Arbeitsstoffe, Wiley-VCH, Weinheim
DGR	Dangerous Goods Regulations (see IATA/DGR)
EC No	The EC Inventory (EINECS, ELINCS and the NLP-list) is the source for the seven-digit EC number, an identifier of substances commercially available within the EU (European Union)
EINECS	European Inventory of Existing Commercial Chemical Substances
ELINCS	European List of Notified Chemical Substances
EmS	Emergency Schedule
Flam. Gas	Flammable gas
GHS	"Globally Harmonized System of Classification and Labelling of Chemicals" developed by the United Nations
IATA	International Air Transport Association
IATA/DGR	Dangerous Goods Regulations (DGR) for the air transport (IATA)
ICAO	International Civil Aviation Organization
ICAO-TI	Technical instructions for the safe transport of dangerous goods by air
IMDG	International Maritime Dangerous Goods Code
IMDG-Code	International Maritime Dangerous Goods Code
index No	The Index number is the identification code given to the substance in Part 3 of Annex VI to Regulation (EC) No 1272/2008
LGK	Lagerklasse (storage class according to TRGS 510, Germany)
NLP	No-Longer Polymer
PBT	Persistent, Bioaccumulative and Toxic
ppm	Parts per million
Press. Gas	Gas under pressure
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals



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Abbr.	Descriptions of used abbreviations
RID	Règlement concernant le transport International ferroviaire des marchandises Dangereuses (Regulations concerning the International carriage of Dangerous goods by Rail)
STEL	Short-term exposure limit
SVHC	Substance of Very High Concern
TRGS	Technische Regeln für Gefahrstoffe (technical rules for hazardous substances, Germany)
TRGS 900	Arbeitsplatzgrenzwerte (TRGS 900)
TWA	Time-weighted average
VOC	Volatile Organic Compounds
vPvB	Very Persistent and very Bioaccumulative

Key literature references and sources for data

Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures. Regulation (EC) No. 1907/2006 (REACH), amended by 2020/878/EU.

Transport of dangerous goods by road, rail and inland waterway (ADR/RID/ADN). International Maritime Dangerous Goods Code (IMDG). Dangerous Goods Regulations (DGR) for the air transport (IATA).

List of relevant phrases (code and full text as stated in section 2 and 3)

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

Disclaimer

This information is based upon the present state of our knowledge. This SDS has been compiled and is solely intended for this product.

Exposure Scenario / ES No 1

1 TITLE SECTION

Exposure Scenario name: Use as a fuel - Consumer

Sectors of use [SU]

SU21: Consumer uses.

Product categories [PC]

PC13: Fuels.

2 Operational conditions and risk management measures

2.1 Control of environmental exposure not applicable

2 Operational conditions and risk management measures

2.2 Control of consumer exposure

Product characteristics

Physical form of product liquefied
Vapour pressure 408.9 kPa at 30 °C

Concentration of substance in preparation/
mixture or article Covers concentrations up to: 5 %

Amounts used

Covers use up to 45000 g, Covers skin contact
area up to 0 cm²

Frequency and duration of use

Covers use up to 0,143 times per day, Covers ex-
posure up to 0,05 h/event

**Other given operational conditions affecting
consumers exposure**

Covers use at ambient temperatures, Covers use
in room size of 20 m³, Covers use under typical
household ventilation

Contributing Scenarios: Operational conditions and risk management measures

Products Category: PC13: Fuels liquid: Automotive refuelling

Operational conditions - Consumer: Covers concentrations up to 5 %, Covers use up to 52 Days per
year, Covers use up to 1 Times per day, Covers use up to 45000 g, Covers outdoor use, Covers use
in room size of 100 m³, Covers exposure up to 0,05 h/event

Risk management measures (RMM): No specific risk management measure identified beyond those
operational conditions stated.

Products Category: PC13: Fuels liquid: Liquid: Home space heater fuel

Operational conditions - Consumer: Covers concentrations up to 5 %, Covers use up to 26 Days per
year, Covers use up to 1 Times per day, Covers use up to 13000 g, Covers use in room size of 20 m³,
Covers exposure up to 0,03 h/event

Risk management measures (RMM): No specific risk management measure identified beyond those
operational conditions stated.

Annex to the extended Safety Data Sheet (eSDS)

Isobutane

Version number: GHS 1.0

Issue date: 2022-01-12

3 Exposure estimation and reference to its source

Exposure assessment (environment)

Qualitative approach used to conclude safe use

Exposure assessment (human)

The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated

4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Environment

No additional risk management measures required.

Health

Not applicable.

Exposure Scenario / ES No 2

1 TITLE SECTION

Exposure Scenario name: Use as a fuel

Sectors of use [SU]

SU3: Industrial uses.

Process categories [PROC]

PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions.

PROC2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions.

PROC3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition.

PROC8a: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities.

PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities.

PROC16: Use of fuels.

Environmental release categories [ERC]

ERC7: Use of functional fluid at industrial site.

ERC7: Industrial use of substances in closed systems.

2 Operational conditions and risk management measures

2.1 Control of environmental exposure not applicable

2.2 Control of worker exposure

Product characteristics

Physical form of product	liquefied
Vapour pressure	408.9 kPa at 30 °C
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently).

Amounts used not applicable

Frequency and duration of use Covers daily exposures up to 8 hours (unless stated differently)

Other given operational conditions affecting workers exposure Assumes use at not more than 20 °C above ambient temperature, unless stated differently. Assumes a good basic standard of occupational hygiene is implemented.

Contributing Scenarios: Operational conditions and risk management measures

Annex to the extended Safety Data Sheet (eSDS)

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Version number: GHS 1.1

Issue date: 2022-02-16

General measures (carcinogens):	Consider technical advances and process upgrades (including automation) for the elimination of releases. minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of waste 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
General exposures (closed systems):	Handle substance within a closed system. Wear suitable gloves tested to EN374.
General exposures (closed systems) - With occasional controlled exposure:	Handle substance within a predominantly closed system provided with extract ventilation
General exposures (closed systems) - Batch process:	Handle substance within a predominantly closed system provided with extract ventilation. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
General exposures (open systems):	Provide a good standard of controlled ventilation (10 to 15 air changes per hour)
General exposures (open systems) - Batch process:	Handle substance within a predominantly closed system provided with extract ventilation. Provide a good standard of controlled ventilation (10 to 15 air changes per hour).
Vessel and container cleaning:	Drain or remove substance from equipment prior to break-in or maintenance. Provide a good standard of controlled ventilation (10 to 15 air changes per hour). Only allow access to authorised persons.
Bulk transfers:	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour)
Drum/batch transfers:	Ensure material transfers are under containment or extract ventilation. Wear suitable gloves tested to EN374.
Equipment maintenance:	Drain or remove substance from equipment prior to break-in or maintenance. Drain down and flush system prior to equipment break-in or maintenance. Provide a good standard of controlled ventilation (10 to 15 air changes per hour).
Storage:	Store substance within a closed system.
Storage - With occasional controlled exposure:	Provide extract ventilation to points where emissions occur. Store substance within a closed system.

Annex to the extended Safety Data Sheet (eSDS)

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Version number: GHS 1.1

Issue date: 2022-02-16

3 Exposure estimation and reference to its source

Exposure assessment (environment)

Qualitative approach used to conclude safe use

Exposure assessment (human)

The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated

4 Guidance to check compliance with the exposure scenario

Environment

No additional risk management measures required.

Health

Not applicable.

Exposure Scenario / ES No 3

1 TITLE SECTION

Exposure Scenario name: Use as a fuel

Sectors of use [SU]

SU22: Professional uses.

Process categories [PROC]

PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions.

PROC2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions.

PROC3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition.

PROC4: Chemical production where opportunity for exposure arises.

PROC8a: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities.

PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities.

PROC16: Use of fuels.

Environmental release categories [ERC]

ERC9a: Wide dispersive indoor use of substances in closed systems.

ERC9a: Widespread use of functional fluid (indoor).

ERC9b: Wide dispersive outdoor use of substances in closed systems.

ERC9b: Widespread use of functional fluid (outdoor).

2 Operational conditions and risk management measures

2.1 Control of environmental exposure not applicable

2.2 Control of worker exposure

Product characteristics

Physical form of product liquefied

Concentration of substance in product Covers percentage substance in the product up to 100 % (unless stated differently).

Amounts used

not applicable

Frequency and duration of use

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

Other given operational conditions affecting workers exposure

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

Contributing Scenarios: Operational conditions and risk management measures

Annex to the extended Safety Data Sheet (eSDS)

Isobutane

Version number: GHS 1.1

Issue date: 2022-02-16

General measures (carcinogens):	Consider technical advances and process upgrades (including automation) for the elimination of releases. minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of waste 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
General exposures (closed systems):	Handle substance within a closed system.
General exposures (closed systems) - With occasional controlled exposure:	Ensure material transfers are under containment or extract ventilation. Ensure operation is undertaken outdoors. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
General exposures (closed systems) - Batch process:	Provide a good standard of controlled ventilation (10 to 15 air changes per hour). Ensure material transfers are under containment or extract ventilation.
General exposures (open systems):	Ensure operation is undertaken outdoors. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Vessel and container cleaning:	Drain or remove substance from equipment prior to break-in or maintenance. Provide a good standard of controlled ventilation (10 to 15 air changes per hour). Only allow access to authorised persons.
Bulk transfers:	Provide a good standard of controlled ventilation (10 to 15 air changes per hour). Ensure material transfers are under containment or extract ventilation. Avoid carrying out activities involving exposure for more than 4 hours.
Drum/batch transfers:	Ensure material transfers are under containment or extract ventilation. Ensure operation is undertaken outdoors. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Avoid carrying out activities involving exposure for more than 15 minutes.
Equipment cleaning and maintenance:	Drain down and flush system prior to equipment break-in or maintenance. Ensure material transfers are under containment or extract ventilation. Ensure operation is undertaken outdoors. Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Wear a respirator conforming to EN140 with Type A filter or better.

Annex to the extended Safety Data Sheet (eSDS)

Isobutane

Version number: GHS 1.1

Issue date: 2022-02-16

Storage: Store substance within a closed system.

3 Exposure estimation and reference to its source

Exposure assessment (environment) Qualitative approach used to conclude safe use

Exposure assessment (human) The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated

4 Guidance to check compliance with the exposure scenario

Environment

No additional risk management measures required.

Health

Not applicable.

Exposure Scenario / ES No 4

1 TITLE SECTION

Exposure Scenario name: Blowing agents - Industrial

Sectors of use [SU]

SU3: Industrial uses.

Process categories [PROC]

PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions.

PROC2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions.

PROC3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition.

PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities.

PROC9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing).

PROC12: Use of blowing agents in manufacture of foam.

Environmental release categories [ERC]

ERC4: Use of non-reactive processing aid at industrial site (no inclusion into or onto article).

2 Operational conditions and risk management measures

2.1 Control of environmental exposure not applicable

2.2 Control of worker exposure

Product characteristics

Physical form of product liquefied

Concentration of substance in product Covers percentage substance in the product up to 100 % (unless stated differently).

Amounts used not applicable

Frequency and duration of use Covers daily exposures up to 8 hours (unless stated differently)

Other given operational conditions affecting workers exposure Assumes use at not more than 20 °C above ambient temperature, unless stated differently. Assumes a good basic standard of occupational hygiene is implemented.

Contributing Scenarios: Operational conditions and risk management measures

Annex to the extended Safety Data Sheet (eSDS)

Isobutane

Version number: GHS 1.1

Issue date: 2022-02-16

General measures (carcinogens):	Consider technical advances and process upgrades (including automation) for the elimination of releases. minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of waste 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
Mixing operations - Closed systems:	Handle substance within a closed system. Provide a good standard of controlled ventilation (10 to 15 air changes per hour).
Material transfers:	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).
Semi-bulk packaging:	Provide a good standard of controlled ventilation (10 to 15 air changes per hour)
Drum and small package filling:	Provide a good standard of controlled ventilation (10 to 15 air changes per hour).
Storage:	Ensure material transfers are under containment or extract ventilation. Store substance within a closed system.

3 Exposure estimation and reference to its source

Exposure assessment (environment)	Qualitative approach used to conclude safe use
Exposure assessment (human)	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated

4 Guidance to check compliance with the exposure scenario

Environment

No additional risk management measures required.

Health

Not applicable.

Exposure Scenario / ES No 5

1 TITLE SECTION

Exposure Scenario name: Polymer processing - Industrial

Sectors of use [SU]

SU3: Industrial uses.

SU10: Formulation [mixing] of preparations and/or re-packaging (excluding alloys).

Process categories [PROC]

PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions.

PROC2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions.

PROC3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition.

PROC4: Chemical production where opportunity for exposure arises.

PROC5: Mixing or blending in batch processes.

PROC6: Calendaring operations.

PROC8a: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities.

PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities.

PROC9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing).

PROC13 Treatment of articles by dipping and pouring.

PROC14: Tableting, compression, extrusion, pelletisation, granulation.

PROC21: Low energy manipulation of substances bound in materials and/or articles.

Environmental release categories [ERC]

ERC4: Use of non-reactive processing aid at industrial site (no inclusion into or onto article).

2 Operational conditions and risk management measures

2.1 Control of environmental exposure not applicable

2.2 Control of worker exposure

Product characteristics

Physical form of product

liquefied

Concentration of substance in product

Covers percentage substance in the product up to 100 % (unless stated differently).

Amounts used

not applicable

Frequency and duration of use

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

Other given operational conditions affecting workers exposure

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

Annex to the extended Safety Data Sheet (eSDS)

Isobutane

Version number: GHS 1.1

Issue date: 2022-02-17

Contributing Scenarios: Operational conditions and risk management measures

General measures (carcinogens):

Consider technical advances and process upgrades (including automation) for the elimination of releases. minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of waste 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

Bulk transfers - Closed systems:

Handle substance within a closed system.

Bulk transfers - Closed systems - With occasional controlled exposure:

Handle substance within a closed system. Ensure material transfers are under containment or extract ventilation.

Bulk transfers - Dedicated facility:

Ensure material transfers are under containment or extract ventilation.

Bulk transfers - Drum/batch transfers:

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.

Bulk transfers - Small package filling:

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

Equipment maintenance:

Drain down and flush system prior to equipment break-in or maintenance. Provide a good standard of controlled ventilation (10 to 15 air changes per hour).

Storage - With occasional controlled exposure:

Handle substance within a closed system. Provide extract ventilation to points where emissions occur. Store substance within a closed system.

3 Exposure estimation and reference to its source

Exposure assessment (environment)

Qualitative approach used to conclude safe use

Exposure assessment (human)

The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated

Annex to the extended Safety Data Sheet (eSDS)

Isobutane

Version number: GHS 1.1

Issue date: 2022-02-17

4 Guidance to check compliance with the exposure scenario

Environment

No additional risk management measures required.

Health

Not applicable.

Exposure Scenario / ES No 6

1 TITLE SECTION

Exposure Scenario name: Polymer processing - Professional

Sectors of use [SU]

SU22: Professional uses.

Process categories [PROC]

PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions.

PROC2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions.

PROC6: Calendering operations.

PROC8a: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities.

PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities.

PROC14: Tableting, compression, extrusion, pelletisation, granulation.

PROC21: Low energy manipulation of substances bound in materials and/or articles.

PROC21: Low energy manipulation and handling of substances bound in/on materials or articles.

Environmental release categories [ERC]

ERC8a: Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor).

ERC8a: Wide dispersive indoor use of processing aids in open systems.

ERC8d: Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor).

ERC8d: Wide dispersive outdoor use of processing aids in open systems.

2 Operational conditions and risk management measures

2.1 Control of environmental exposure not applicable

2.2 Control of worker exposure

Product characteristics

Physical form of product liquefied

Concentration of substance in product Covers percentage substance in the product up to 100 % (unless stated differently).

Amounts used not applicable

Frequency and duration of use Covers daily exposures up to 8 hours (unless stated differently)

Other given operational conditions affecting workers exposure Assumes use at not more than 20 °C above ambient temperature, unless stated differently. Assumes a good basic standard of occupational hygiene is implemented.

Contributing Scenarios: Operational conditions and risk management measures

Annex to the extended Safety Data Sheet (eSDS)

Isobutane

Version number: GHS 1.1

Issue date: 2022-02-17

General measures (carcinogens):	Consider technical advances and process upgrades (including automation) for the elimination of releases. minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of waste 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
Bulk transfers - Closed systems:	Handle substance within a closed system.
Bulk transfers - Closed systems - With occasional controlled exposure:	Handle substance within a closed system. Provide extract ventilation to points where emissions occur. Provide a good standard of controlled ventilation (10 to 15 air changes per hour).
Material transfers:	Provide a good standard of controlled ventilation (10 to 15 air changes per hour). Ensure material transfers are under containment or extract ventilation. Avoid carrying out activities involving exposure for more than 4 hours.
Equipment maintenance:	Drain down and flush system prior to equipment break-in or maintenance. Provide a good standard of controlled ventilation (10 to 15 air changes per hour).
Storage:	Store substance within a closed system.
Storage - With occasional controlled exposure:	Provide a good standard of controlled ventilation (10 to 15 air changes per hour). Provide extract ventilation to points where emissions occur. Store substance within a closed system.

3 Exposure estimation and reference to its source

Exposure assessment (environment)	Qualitative approach used to conclude safe use
Exposure assessment (human)	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated

4 Guidance to check compliance with the exposure scenario

Environment

No additional risk management measures required.

Health

Not applicable.

Exposure Scenario / ES No 7

1 TITLE SECTION

Exposure Scenario name: Polymer production - Industrial

Sectors of use [SU]

SU3: Industrial uses.

SU8: Manufacture of bulk, large scale chemicals (including petroleum products).

SU9: Manufacture of fine chemicals.

Process categories [PROC]

PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions.

PROC2: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions.

PROC3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition.

PROC4: Chemical production where opportunity for exposure arises.

PROC5: Mixing or blending in batch processes.

PROC6: Calendering operations.

PROC8a: Transfer of substance or mixture (charging and discharging) at non-dedicated facilities.

PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities.

PROC9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing).

PROC14: Tableting, compression, extrusion, pelletisation, granulation.

PROC21: Low energy manipulation of substances bound in materials and/or articles.

PROC21: Low energy manipulation and handling of substances bound in/on materials or articles.

Environmental release categories [ERC]

ERC6a: Use of intermediate.

ERC6c: Use of monomer in polymerisation processes at industrial site (inclusion or not into/onto article).

2 Operational conditions and risk management measures

2.1 Control of environmental exposure not applicable

2.2 Control of worker exposure

Product characteristics

Physical form of product

liquefied

Concentration of substance in product

Covers percentage substance in the product up to 100 % (unless stated differently).

Amounts used

not applicable

Frequency and duration of use

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

Other given operational conditions affecting workers exposure

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

Annex to the extended Safety Data Sheet (eSDS)

Isobutane

Version number: GHS 1.1

Issue date: 2022-02-17

Contributing Scenarios: Operational conditions and risk management measures

General measures (carcinogens):

Consider technical advances and process upgrades (including automation) for the elimination of releases. minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of waste 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

General exposures (closed systems) - Continuous process - No sampling:

Handle substance within a closed system. No other specific measures identified.

Bulk transfers - With sample collection:

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).

Equipment maintenance:

Drain down system prior to equipment break-in or maintenance. Clear spills immediately. Wear a respirator conforming to EN140 with Type A filter or better. Retain drain downs in sealed storage pending disposal or for subsequent recycle.

Storage - With occasional controlled exposure:

Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour). Store substance within a closed system. Avoid carrying out activities involving exposure for more than 1 hour.

3 Exposure estimation and reference to its source

Exposure assessment (environment)

Qualitative approach used to conclude safe use

Exposure assessment (human)

The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated

4 Guidance to check compliance with the exposure scenario

Environment

No additional risk management measures required.

Health

Not applicable.