



SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

1,3-Butadiene, stabilized

Issue Date: 16.01.2013 Version: 1.2 SDS No.: 000010021790
 Last revised date: 01.03.2022 1/37

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

1.1 Product identifier

Product name: 1,3-Butadiene, stabilized

Additional identification

Chemical name: Buta-1,3-diene
 Chemical formula: C₄H₆
 INDEX No. 601-013-00-X
 CAS-No. 106-99-0
 EC No. 203-450-8
 REACH Registration No. 01-2119471988-16

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

Identified uses: Industrial and professional. Perform risk assessment prior to use. Using gas alone or in mixtures for the calibration of analysis equipment. Using gas as feedstock in chemical processes. Formulation of mixtures with gas in pressure receptacles.
Uses advised against Consumer use. Contact supplier for more information on uses. Uses other than those listed above are not supported.

1.3 Details of the supplier of the safety data sheet

Supplier
 Linde Gas GmbH Telephone: +43 50 4273
 Carl-von-Linde-Platz 1
 A-4651 Stadl-Paura
 E-mail: office@at.linde-gas.com

1.4 Emergency telephone number: Emergency number UMC0: +49 89 220 61012 (German), +44 1865 407333 (English)

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 as amended.

Physical Hazards

Gases under pressure	Liquefied gas	H280: Contains gas under pressure; may explode if heated.
Flammable gas	Category 1	H220: Extremely flammable gas.



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Health Hazards

Germ Cell Mutagenicity	Category 1B	H340: May cause genetic defects.
Carcinogenicity	Category 1A	H350: May cause cancer.

2.2 Label Elements

Contains: Buta-1,3-diene



Signal Word: Danger

Hazard Statement(s):
 H220: Extremely flammable gas.
 H280: Contains gas under pressure; may explode if heated.
 H340: May cause genetic defects.
 H350: May cause cancer.

Precautionary Statements

General None.

Prevention:
 P202: Do not handle until all safety precautions have been read and understood.
 P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
 P280: Wear protective gloves/protective clothing/eye protection/face protection.

Response:
 P308+P313: IF exposed or concerned: Get medical advice/attention.
 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.

Disposal: None.

2.3 Other hazards: None.



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3/37**SECTION 3: Composition/information on ingredients****3.1 Substances**

Chemical name: Buta-1,3-diene
 INDEX No.: 601-013-00-X
 CAS-No.: 106-99-0
 EC No.: 203-450-8
 REACH Registration No.: 01-2119471988-16
 Purity: 100%

The purity of the substance in this section is used for classification only, and does not represent the actual purity of the substance as supplied, for which other documentation should be consulted.

Trade name: -

Chemical name	Chemical formula	Concentration	CAS-No.	REACH Registration No.	M-Factor:	Notes
Buta-1,3-diene	C ₄ H ₆	100%	106-99-0	01-2119471988-16	-	#

The concentrations of the components in the SDS header, product name on page one and in section 3.2 are in mol due to regulatory requirements. All concentrations are nominal.

This substance has workplace exposure limit(s).

PBT: persistent, bioaccumulative and toxic substance.

vPvB: very persistent and very bioaccumulative substance.

SECTION 4: First aid measures

General: In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.

4.1 Description of first aid measures

Inhalation: In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.

Eye contact: Adverse effects not expected from this product.

Skin Contact: Adverse effects not expected from this product.

Ingestion: Ingestion is not considered a potential route of exposure.



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4.2 Most important symptoms and effects, both acute and delayed: Respiratory arrest. Danger of serious damage to health by prolonged exposure.

4.3 Indication of any immediate medical attention and special treatment needed

Hazards: Danger of serious damage to health by prolonged exposure.

Treatment: Get immediate medical advice/attention.

SECTION 5: Firefighting measures

General Fire Hazards: Heat may cause the containers to explode.

5.1 Extinguishing media

Suitable extinguishing media: Water. Dry powder. Foam. Use water spray to reduce vapors or divert vapor cloud drift.

Unsuitable extinguishing media: Carbon Dioxide.

5.2 Special hazards arising from the substance or mixture: Incomplete combustion may form carbon monoxide Incomplete combustion may form carbon monoxide

5.3 Advice for firefighters

Special fire fighting procedures: In case of fire: Stop leak if safe to do so. Do not extinguish flames at leak because possibility of uncontrolled explosive reignition exists. Continue water spray from protected position until container stays cool. Use extinguishants to contain the fire. Isolate the source of the fire or let it burn out. Use of water may result in the formation of very toxic aqueous solutions. Keep run-off water out of sewers and water sources. Dike for water control.

Special protective equipment for fire-fighters: Gas tight chemically protective clothing (Type 1) in combination with self contained breathing apparatus.
Guideline: EN 943-2 Protective clothing against liquid and gaseous chemicals, aerosols and solid particles. Performance requirements for gas-tight (Type 1) chemical protective suits for emergency teams (ET)



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SECTION 6: Accidental release measures

- | | |
|---|---|
| 6.1 Personal precautions, protective equipment and emergency procedures: | Evacuate area. Provide adequate ventilation. Consider the risk of potentially explosive atmospheres. In case of leakage, eliminate all ignition sources. Monitor the concentration of the released product. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. EN 137 Respiratory protective devices - Self-contained open-circuit compressed air breathing apparatus with full face mask - Requirements, testing, marking. |
| 6.2 Environmental Precautions: | Prevent further leakage or spillage if safe to do so. Reduce vapour with fog or fine water spray. Keep run-off water out of sewers and water sources. Dike for water control. |
| 6.3 Methods and material for containment and cleaning up: | Provide adequate ventilation. Eliminate sources of ignition. |
| 6.4 Reference to other sections: | Refer to sections 8 and 13. |

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SDS No.: 000010021790
6/37**SECTION 7: Handling and storage:****7.1 Precautions for safe handling:**

Only experienced and properly instructed persons should handle gases under pressure. Avoid exposure - obtain special instructions before use. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Installation of a cross purge assembly between the container and the regulator is recommended. Excess pressure must be vented through an appropriate scrubber system. Purge system with dry inert gas (e.g. helium or nitrogen) before gas is introduced and when system is placed out of service. Purge air from system before introducing gas. Containers, which contain or have contained flammable or explosive substances, must not be inerted with liquid carbon dioxide. Assess the risk of a potentially explosive atmosphere and the need for suitable equipment i.e. explosion-proof. Take precautionary measures against static discharges. Keep away from ignition sources (including static discharges). Provide electrical earthing of equipment and electrical equipment usable in explosive atmospheres. Use non-sparking tools. Refer to supplier's handling instructions. The substance must be handled in accordance with good industrial hygiene and safety procedures. Ensure the complete system has been (or is regularly) checked for leaks before use. Protect containers from physical damage; do not drag, roll, slide or drop. Do not remove or deface labels provided by the supplier for the identification of the container contents. When moving containers, even for short distances, use appropriate equipment eg. trolley, hand truck, fork truck etc. Secure cylinders in an upright position at all times, close all valves when not in use. Provide adequate ventilation. Suck back of water into the container must be prevented. Do not allow backfeed into the container. Avoid suckback of water, acid and alkalis. Keep container below 50°C in a well ventilated place. Observe all regulations and local requirements regarding storage of containers. When using do not eat, drink or smoke. Store in accordance with local/regional/national/international regulations. Never use direct flame or electrical heating devices to raise the pressure of a container. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. Damaged valves should be reported immediately to the supplier. Close container valve after each use and when empty, even if still connected to equipment. Never attempt to repair or modify container valves or safety relief devices. Replace valve outlet caps or plugs and container caps where supplied as soon as container is disconnected from equipment. Keep container valve outlets clean and free from contaminants particularly oil and water. If user experiences any difficulty operating container valve discontinue use and contact supplier. Never attempt to transfer gases from one container to another. Container valve guards or caps should be in place. Always remove grease with soap and water or skin cleaning agent, never use organic solvents.



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7.2 Conditions for safe storage, including any incompatibilities: All electrical equipment in the storage areas should be compatible with the risk of a potentially explosive atmosphere. Segregate from oxidant gases and other oxidants being stored. Containers should not be stored in conditions likely to encourage corrosion. Stored containers should be periodically checked for general conditions and leakage. Container valve guards or caps should be in place. Store containers in location free from fire risk and away from sources of heat and ignition. Keep away from combustible material. Keep away from food, drink and animal feeding stuffs.

7.3 Specific end use(s): None.

SECTION 8: Exposure controls/personal protection

8.1 Control Parameters

Occupational Exposure Limits

Chemical name	Type	Exposure Limit Values	Source
Buta-1,3-diene	TRK STEL	8 ppm 17 mg/m ³	Austria. TRK List, OEL Ordinance (GwV), as amended (04 2021)
	TRK	1 ppm 2,2 mg/m ³	Austria. TRK List, OEL Ordinance (GwV), as amended (04 2021)
	TWA	1 ppm 2,2 mg/m ³	EU. OELs, Directive 2004/37/EC on carcinogen and mutagens from Annex III, Part A, as amended (12 2017)

DNEL-Values

Critical component	Type	Value	Remarks
Buta-1,3-diene	Worker - inhalative, long-term - systemic	2,21 mg/m ³	-

8.2 Exposure controls

Appropriate engineering controls:

Consider a work permit system e.g. for maintenance activities. Provide adequate general and local exhaust ventilation. Keep concentrations well below lower explosion limits. Keep concentrations well below occupational exposure limits. Gas detectors should be used when quantities of flammable gases or vapours may be released. Gas detectors should be used when toxic quantities may be released. Systems under pressure should be regularly checked for leakages. Product to be handled in a closed system and under strictly controlled conditions. Only use permanent leak tight installations (e.g. welded pipes). Take precautionary measures against static discharges.



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Individual protection measures, such as personal protective equipment

- General information:** Keep suitable chemically resistant protective clothing readily available for emergency use. Protect eyes, face and skin from contact with product. A risk assessment should be conducted and documented in each work area to assess the risks related to the use of the product and to select the PPE that matches the relevant risk. The following recommendations should be considered. Keep self contained breathing apparatus readily available for emergency use. Personal protective equipment for the body should be selected based on the task being performed and the risks involved. Refer to local regulations for restriction of emissions to the atmosphere. See section 13 for specific methods for waste gas treatment. Do not eat, drink or smoke when using the product.
- Eye/face protection:** Wear eye protection to EN 166 when using gases.
Guideline: EN 166 Personal Eye Protection.
- Skin protection**
- Hand Protection:** Guideline: EN 388 Protective gloves against mechanical risks.
Additional Information: Wear working gloves while handling containers
Guideline: EN 374-1/2/3 Protective gloves against chemicals and micro-organisms.
Additional Information: Chemically resistant gloves complying with EN 374 should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Material: Butyl rubber.
Break-through time: 30 min
Glove thickness: 0,7 mm
Additional Information: Chemically resistant gloves complying with EN 374 should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Material: Fluoroelastomer.
Break-through time: 480 min
Glove thickness: 0,4 mm
Additional Information: Chemically resistant gloves complying with EN 374 should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Guideline: EN 374-1/2/3 Protective gloves against chemicals and micro-organisms.
- Body protection:** Wear fire resistant or flame retardant clothing.
Guideline: ISO/TR 2801:2007 Clothing for protection against heat and flame --
General recommendations for selection, care and use of protective clothing.
- Other:** Wear safety shoes while handling containers
Guideline: ISO 20345 Personal protective equipment - Safety footwear.



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Respiratory Protection: Reference should be made to European Standard EN 689 for methods for the assessment of exposure by inhalation to chemical agents and national guidance documents for methods for the determination of hazardous substances. When allowed by a risk assessment Respiratory Protective Equipment (RPE) may be used. The selection of the Respiratory Protective Device (RPD) must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected RPD. Self-contained breathing apparatus (SCBA) or positive pressure airline with mask are to be used in oxygen-deficient atmospheres.

Guideline: EN 137 Respiratory protective devices - Self-contained open-circuit compressed air breathing apparatus with full face mask - Requirements, testing, marking.
 Guideline: EN 136 Respiratory protective devices. Full face masks. Requirements, testing, marking. Material: Filter AX
 Guideline: EN 14387 Respiratory protective devices. Gas filter(s) and combined filter(s). Requirements, testing, marking.

Thermal hazards: No precautionary measures are necessary.

Hygiene measures: Obtain special instructions before use. Do not eat, drink or smoke when using the product.

Environmental exposure controls: For waste disposal, see section 13 of the SDS.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance	
Physical state:	Gas
Form:	Liquefied gas
Color:	Colorless
Odor:	Mild aromatic
Odor Threshold:	Odor threshold is subjective and is inadequate to warn of over exposure.
pH:	Not applicable.
Melting Point:	-108,9 °C Experimental result, Key study
Boiling Point:	-4,41 °C (1.013 hPa) Experimental result, Key study
Sublimation Point:	Not applicable.
Critical Temp. (°C):	152,0 °C
Flash Point:	Not applicable to gases and gas mixtures.
Evaporation Rate:	Not applicable to gases and gas mixtures.



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Flammability (solid, gas):	Flammable gas
Flammability Limit - Upper (%):	16,3 %(V)
Flammability Limit - Lower (%):	1,4 %(V)
Vapor pressure:	217 kPa (17 °C) 255 kPa (22 °C)
Vapor density (air=1):	1,92 AIR=1
Relative density:	0,6149
Solubility(ies)	
Solubility in Water:	735 mg/l (20 °C)
Partition coefficient (n-octanol/water):	1,99
Autoignition Temperature:	415 °C
Decomposition Temperature:	> 200 °C May decomp explosively when heated above 200°C 1 kbar. When heated to decomp, emits acrid smoke and fumes.
Viscosity	
Kinematic viscosity:	No data available.
Dynamic viscosity:	0,008 mPa.s (20 °C)
Explosive properties:	Not applicable.
Oxidizing properties:	Not applicable.

9.2 Other information:	Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level.
Molecular weight:	54,09 g/mol (C4H6)
Minimum ignition energy:	0,13 mj

SECTION 10: Stability and reactivity

10.1 Reactivity:	No reactivity hazard other than the effects described in sub-section below.
10.2 Chemical Stability:	Stable under normal conditions. May polymerise.
10.3 Possibility of hazardous reactions:	Can form a potentially explosive atmosphere in air. May react violently with oxidants.
10.4 Conditions to avoid:	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Avoid moisture in the installation.
10.5 Incompatible Materials:	Air and oxidizers. For material compatibility see latest version of ISO-11114.
10.6 Hazardous Decomposition Products:	Under normal conditions of storage and use, hazardous decomposition products should not be produced.



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SECTION 11: Toxicological information

General information: None.

11.1 Information on toxicological effects

Acute toxicity - Oral Product Based on available data, the classification criteria are not met.

Acute toxicity - Dermal Product Based on available data, the classification criteria are not met.

Acute toxicity - Inhalation Product Based on available data, the classification criteria are not met.

Buta-1,3-diene LC 50 (Rat, 4 h): 285 mg/l

Repeated dose toxicity
 Buta-1,3-diene LOAEL (Mouse(Female, Male), Inhalation, 103 Weeks): 6,25 ppm(m) Inhalation
 Experimental result, Weight of Evidence study

Skin Corrosion/Irritation Product Based on available data, the classification criteria are not met.

Serious Eye Damage/Eye Irritation Product Based on available data, the classification criteria are not met.

Respiratory or Skin Sensitization Product Based on available data, the classification criteria are not met.

Germ Cell Mutagenicity Product May cause genetic defects.

Buta-1,3-diene May cause genetic defects.

Carcinogenicity Product May cause cancer.



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Buta-1,3-diene May cause cancer.

**Reproductive toxicity
Product**

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

**Specific Target Organ Toxicity - Single Exposure
Product**

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

**Specific Target Organ Toxicity - Repeated Exposure
Product**

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

**Aspiration Hazard
Product**

Not applicable to gases and gas mixtures..

SECTION 12: Ecological information

12.1 Toxicity

**Acute toxicity
Product**

No ecological damage caused by this product.

**Acute toxicity - Fish
Buta-1,3-diene**

LC 50 (96 h): 45 mg/l Remarks: QSAR QSAR, Key study

Acute toxicity - Aquatic Invertebrates

Buta-1,3-diene

EC 50 (48 h): 33 mg/l Remarks: QSAR QSAR, Key study

Chronic Toxicity - Fish

Buta-1,3-diene

NOEL (21 d): 6,62 mg/l (estimated)

Chronic Toxicity - Aquatic Invertebrates

Buta-1,3-diene

NOAEL (Daphnia magna, 21 d): 12,384 mg/l (estimated)

**12.2 Persistence and Degradability
Product**

Not applicable to gases and gas mixtures..



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Biodegradation

Buta-1,3-diene > 0 - 4 % (28 d) Detected in water. Experimental result, Weight of Evidence study
 The product is not readily biodegradable.

**12.3 Bioaccumulative potential
 Product**

The subject product is expected to biodegrade and is not expected to persist for long periods in an aquatic environment.

Bioconcentration Factor (BCF)

Buta-1,3-diene Bioconcentration Factor (BCF): 9,55 Aquatic sediment QSAR, Key study
 Because of the low log Kow, accumulation in organisms is not expected.

**12.4 Mobility in soil
 Product**

Because of its high volatility, the product is unlikely to cause ground or water pollution.

**12.5 Results of PBT and vPvB
 assessment
 Product**

Not classified as PBT or vPvB.

12.6 Other adverse effects:

No ecological damage caused by this product.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

General information:

Avoid discharges to atmosphere. Do not discharge into any place where its accumulation could be dangerous. Consult supplier for specific recommendations. Do not discharge into areas where there is a risk of forming an explosive mixture with air. Waste gas should be flared through a suitable burner with flash back arrestor.

Disposal methods:

Refer to the EIGA code of practice (Doc.30 "Disposal of Gases", downloadable at <http://www.eiga.org>) for more guidance on suitable disposal methods. Dispose of container via supplier only. Discharge, treatment, or disposal may be subject to national, state, or local laws.

European Waste Codes

Container:

16 05 04*: Gases in pressure containers (including halons) containing dangerous substances.



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SECTION 14: Transport information

ADR

14.1 UN Number: UN 1010
 14.2 UN Proper Shipping Name: Butadienes, stabilized
 14.3 Transport Hazard Class(es)
 Class: 2
 Label(s): 2.1
 Hazard No. (ADR): 239
 Tunnel restriction code: (B/D)
 14.4 Packing Group: -
 14.5 Environmental hazards: Not applicable
 14.6 Special precautions for user: -

RID

14.1 UN Number: UN 1010
 14.2 UN Proper Shipping Name: Butadienes, stabilized
 14.3 Transport Hazard Class(es)
 Class: 2
 Label(s): 2.1
 14.4 Packing Group: -
 14.5 Environmental hazards: Not applicable
 14.6 Special precautions for user: -

IMDG

14.1 UN Number: UN 1010
 14.2 UN Proper Shipping Name: Butadienes, stabilized
 14.3 Transport Hazard Class(es)
 Class: 2.1
 Label(s): 2.1
 EmS No.: F-D, S-U
 14.4 Packing Group: -
 14.5 Environmental hazards: Not applicable
 14.6 Special precautions for user: -



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IATA

14.1 UN Number: UN 1010
 14.2 Proper Shipping Name: Butadienes, stabilized
 14.3 Transport Hazard Class(es):
 Class: 2.1
 Label(s): 2.1
 14.4 Packing Group: -
 14.5 Environmental hazards: Not applicable
 14.6 Special precautions for user: -
 Other information
 Passenger and cargo aircraft: Forbidden.
 Cargo aircraft only: Allowed.

14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code: Not applicable

Additional identification: Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers ensure that they are firmly secured. Ensure that the container valve is closed and not leaking. Container valve guards or caps should be in place. Ensure adequate air ventilation.

SECTION 15: Regulatory information

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

EU Regulations

Regulation (EC) No. 1907/2006 Annex XVII Substances subject to restriction on marketing and use:

The packaging shall be visibly, legibly and indelibly marked as follows:
 Restricted to professional users.

Chemical name	CAS-No.	Concentration
Buta-1,3-diene	106-99-0	100%

Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens and mutagens at work.:



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Chemical name	CAS-No.	Concentration
Buta-1,3-diene	106-99-0	100%

Directive 92/85/EEC: on the safety and health of pregnant workers and workers who have recently given birth or are breast feeding.:

Chemical name	CAS-No.	Concentration
Buta-1,3-diene	106-99-0	100%

EU. Directive 2012/18/EU (SEVESO III) on major accident hazards involving dangerous substances, as amended.:

Classification	Lower-tier Requirements	Upper-tier Requirements
P2: Flammable gases, Category 1 or 2	10 t	50 t

Directive 98/24/EC on the protection of workers from the risks related to chemical agents at work:

Chemical name	CAS-No.	Concentration
Buta-1,3-diene	106-99-0	100%

National Regulations

Council Directive 89/391/EEC on the introduction of measures to encourage improvements in the safety and health of workers at work Directive 89/686/EEC on personal protective equipment Directive 2014/34/EU on equipment and protective systems intended for use in potentially explosive atmospheres (ATEX) Only products that comply with the food regulations (EC) No. 1333/2008 and (EU) No. 231/2012 and are labelled as such may be used as food additives.
This Safety Data Sheet has been produced to comply with Regulation (EU) 2015/830.

15.2 Chemical safety assessment: CSA has been carried out.

SECTION 16: Other information

Revision Information: Not relevant.



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Key literature references and sources for data:

Various sources of data have been used in the compilation of this SDS, they include but are not exclusive to:
 Agency for Toxic Substances and Diseases Registry (ATSDR) (<http://www.atsdr.cdc.gov/>).
 European Chemical Agency: Guidance on the Compilation of Safety Data Sheets.
 European Chemical Agency: Information on Registered Substances <http://apps.echa.europa.eu/registered/registered-sub.aspx#search>
 European Industrial Gases Association (EIGA) Doc. 169 "Classification and Labelling guide", as amended.
 International Programme on Chemical Safety (<http://www.inchem.org/>)
 ISO 10156:2010 Gases and gas mixtures - Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets.
 Matheson Gas Data Book, 7th Edition.
 National Institute for Standards and Technology (NIST) Standard Reference Database Number 69.
 The ESIS (European chemical Substances Information System) platform of the former European Chemicals Bureau (ECB) ESIS (<http://ecb.jrc.ec.europa.eu/esis/>).
 The European Chemical Industry Council (CEFIC) ERICards.
 United States of America's National Library of Medicine's toxicology data network TOXNET (<http://toxnet.nlm.nih.gov/index.html>)
 Threshold Limit Values (TLV) from the American Conference of Governmental Industrial Hygienists (ACGIH).
 Substance specific information from suppliers.
 Details given in this document are believed to be correct at the time of publication.

Wording of the H-statements in section 2 and 3

H220	Extremely flammable gas.
H280	Contains gas under pressure; may explode if heated.
H340	May cause genetic defects.
H350	May cause cancer.

Training information: Users of breathing apparatus must be trained. Ensure operators understand the flammability hazard. Ensure operators understand the hazards.

Classification according to Regulation (EC) No 1272/2008 as amended.

Press. Gas Liq. Gas, H280
 Flam. Gas 1, H220
 Muta. 1B, H340
 Carc. 1A, H350



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Other information: Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out. Ensure adequate air ventilation. Ensure all national/local regulations are observed. Ensure equipment is adequately earthed. Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted.

Last revised date: 01.03.2022

Disclaimer: This information is provided without warranty. The information is believed to be correct. This information should be used to make an independent determination of the methods to safeguard workers and the environment.



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Annex to the extended Safety Data Sheet (eSDS)

Content

Exposure Scenario 1)	Industrial:, Formulation & (re)packing of substances and mixtures
Exposure Scenario 2)	Professional:, Use in laboratories
Exposure Scenario 3)	Industrial:, Using gas as feedstock in chemical processes.

Exposure Scenario 1)

Exposure Scenario worker

1.Industrial:, Formulation & (re)packing of substances and mixtures

List of use descriptors	
Sector(s) of use	
Product categories [PC]:	

Name of contributing environmental scenario and corresponding ERC	Industrial:; ERC2: Formulation into mixture
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Contributing Scenarios	Industrial:; PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities
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2.1.Contributing exposure scenario controlling environmental exposure for: Industrial:, Formulation of mixtures with gas in pressure receptacles, Transfiling gas or liquid.

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.
Physical form of the product	See section 9 of the SDS.



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Viscosity:	
Kinematic viscosity:	No data available.
Dynamic viscosity:	0,008 mPa.s (20 °C)

Amounts used

The actual tonnage handled per site is not considered to influence the immissions as such for this scenario as there is practically no release

Frequency and duration of use

Batch process:	not relevant
Continuous process:	not relevant

Environment factors not influenced by risk management

Other given operational conditions affecting environmental exposure

Other relevant operational conditions	not relevant
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Risk management measures (RMM)

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

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

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

Air	Closed systems are used in order to prevent unintended emissions
Soil	Soil emission controls are not applicable as there is no direct release to soil.
Water	Wastewater emission controls are not applicable as there is no direct release to wastewater.
Sediment:	not relevant
Remarks:	not relevant



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Organisational measures to prevent/limit release from site:

none

Conditions and measures related to sewage treatment plant

type:	Sewage treatment plant
Discharge rate:	not relevant
Treatment effectiveness:	not relevant
Sludge treatment technique:	not relevant
Measures to limit air emissions:	not relevant
Remarks:	Wastewater emission controls are not applicable as there is no direct release to wastewater.

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment:

Suitable waste treatment	Treatment effectiveness	Remarks
See section 13 of the SDS		External treatment and disposal of waste should comply with applicable local and/or national regulations.

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment:

Suitable recovery operations:	Treatment effectiveness	Remarks
See section 13 of the SDS		External recovery and recycling of waste should comply with applicable local and/or national regulations.

Additional good practice advice beyond the REACH Chemical Safety Report

Ensure operatives are trained to minimise releases

2.2. Contributing exposure scenario controlling worker exposure for: Industrial:, Formulation of mixtures with gas in pressure receptacles, Transfilling gas or liquid.

Process Categories:	PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment
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	conditions PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities
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Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.
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Physical form of the product:	See section 9 of the SDS.
Vapour pressure:	217 kPa
Process temperature:	17 °C
Remarks	not relevant

Amounts used

Daily amount per site	The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROCs and technical conditions) is the main determinant of the process-intrinsic emission potential.
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Frequency and duration of use

	Use duration:	Frequency of use:	Remarks
Hours per shift	<= 8 h	< 240 days per year	PROC1, PROC8b

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting workers exposure

Other relevant operational conditions:	. See section 8 of the SDS.
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Risk management measures (RMM)

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

See section 8 of the safety data sheet

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



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inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).				Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).				Transfer of substance or mixture (charging and discharging) at dedicated facilities
Provide extract ventilation to points where emissions occur.: 97 %				Transfer of substance or mixture (charging and discharging) at dedicated facilities
Transfer via enclosed lines.: 90 %				Transfer of substance or mixture (charging and discharging) at dedicated facilities
Clear transfer lines prior to de-coupling.				Transfer of substance or mixture (charging and discharging) at dedicated facilities

Organisational measures to prevent/limit releases, dispersion and exposure

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
				See section 7 of the SDS.
				Ensure operatives are trained to minimise exposures.
				Ensure supervision is in place to check that the RMMs are in place and are being used correctly and that the OCs are being followed

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



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inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
				See section 8 of the safety data sheet (Personal protection equipment)

Additional good practice advice beyond the REACH Chemical Safety Report

See section 7 of the SDS. Handle product within a closed system. Drain down and flush system prior to equipment break-in or maintenance. Apply a good standard of general or controlled ventilation when maintenance activities are carried out.

3. Exposure estimation

Environment:

Industrial:, Formulation of mixtures with gas in pressure receptacles, Transfilling gas or liquid.:

ERC2:

Compartment	PEC	RCR	Method	Remarks
Air	mg/m ³	< 1	Qualitative approach used to conclude safe use.	Not classified as PBT or vPvB. As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

ERC2:

Compartment	PEC	RCR	Method	Remarks
Water	mg/l	< 1	Qualitative approach used to conclude safe use.	Not classified as PBT or vPvB. As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

Health:

Industrial:, Formulation of mixtures with gas in pressure receptacles, Transfilling gas or liquid.:

PROC1:

Route of Exposure	Specific condition	Exposure level	RCR	Method	Remarks



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inhalative, long-term, systemic	Indoor use, General ventilation, No RPE	0,01 ppm	0,01	ESIG GES tool, Worker	none
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PROC8b:

Route of Exposure	Specific condition	Exposure level	RCR	Method	Remarks
inhalative, long-term, systemic	Indoor use, General ventilation, with local exhaust ventilation, Outdoor use, No RPE	0,45 ppm	0,45	ESIG GES tool, Worker	none

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

Check that RMMs and OCs are as described above or of equivalent efficiency Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. For scaling see <http://www.esig.org/en/regulatory-information/reach/ges-library/ges-library-3>

Exposure Scenario 2)

Exposure Scenario worker

1. Professional, Use in laboratories

List of use descriptors	
Sector(s) of use	SU24: Scientific research and development
Product categories [PC]:	PC21: Laboratory chemicals
Name of contributing environmental scenario and corresponding ERC	<u>Professional::</u> ERC8a: Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor)
Contributing Scenarios	<u>Professional::</u> PROC15: Use as laboratory reagent



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2.1. Contributing exposure scenario controlling environmental exposure for: Professional; Using gas alone or in mixtures for the calibration of analysis equipment.

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.
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Physical form of the product	See section 9 of the SDS.
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Viscosity:	
Kinematic viscosity:	No data available.
Dynamic viscosity:	0,008 mPa.s (20 °C)

Amounts used

The actual tonnage handled per site is not considered to influence the immissions as such for this scenario as there is practically no release

Frequency and duration of use

Batch process:	not relevant
Continuous process:	not relevant

Environment factors not influenced by risk management

Other given operational conditions affecting environmental exposure

Other relevant operational conditions	not relevant
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Risk management measures (RMM)

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

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

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



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Air	Closed systems are used in order to prevent unintended emissions
Soil	Soil emission controls are not applicable as there is no direct release to soil.
Water	Wastewater emission controls are not applicable as there is no direct release to wastewater.
Sediment:	not relevant
Remarks:	not relevant

Organisational measures to prevent/limit release from site:

none

Conditions and measures related to sewage treatment plant

type:	Sewage treatment plant
Discharge rate:	not relevant
Treatment effectiveness:	not relevant
Sludge treatment technique:	not relevant
Measures to limit air emissions:	not relevant
Remarks:	Wastewater emission controls are not applicable as there is no direct release to wastewater.

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment:

Suitable waste treatment	Treatment effectiveness	Remarks
See section 13 of the SDS		External treatment and disposal of waste should comply with applicable local and/or national regulations.

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment:

Suitable recovery operations:	Treatment effectiveness	Remarks
See section 13 of the SDS		External recovery and recycling of waste should comply with applicable local and/or national regulations.



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		national regulations.
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Additional good practice advice beyond the REACH Chemical Safety Report

Ensure operatives are trained to minimise releases

2.2. Contributing exposure scenario controlling worker exposure for: Professional:, Using gas alone or in mixtures for the calibration of analysis equipment.

Process Categories: PROC15: Use as laboratory reagent

Product characteristics

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

Physical form of the product: See section 9 of the SDS.

Vapour pressure: 217 kPa

Process temperature: 17 °C

Remarks: not relevant

Amounts used

Daily amount per site: The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROCs and technical conditions) is the main determinant of the process-intrinsic emission potential.

Frequency and duration of use

	Use duration:	Frequency of use:	Remarks
Hours per shift	<= 8 h	240 days per year	PROC15

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting workers exposure

Other relevant operational conditions: . See section 8 of the SDS.



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Risk management measures (RMM)

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

See section 8 of the safety data sheet

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

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
Provide a good standard of controlled ventilation (10 to 15 air changes per hour).				Use as laboratory reagent
Local exhaust ventilation: 99 %				Use as laboratory reagent

Organisational measures to prevent/limit releases, dispersion and exposure

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
				See section 7 of the SDS.
				Ensure operatives are trained to minimise exposures.
				Ensure supervision is in place to check that the RMMs are in place and are being used correctly and that the OCs are being followed

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

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
				See section 8 of the safety data sheet (Personal protection equipment)

Additional good practice advice beyond the REACH Chemical Safety Report

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See section 7 of the SDS. Handle product within a closed system. Drain down and flush system prior to equipment break-in or maintenance. Apply a good standard of general or controlled ventilation when maintenance activities are carried out.

3. Exposure estimation

Environment:

Professional:, Using gas alone or in mixtures for the calibration of analysis equipment.:

ERC8a:

Compartment	PEC	RCR	Method	Remarks
Air	mg/m ³	< 1	Qualitative approach used to conclude safe use.	Not classified as PBT or vPvB. As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

ERC8a:

Compartment	PEC	RCR	Method	Remarks
Water	mg/l	< 1	Qualitative approach used to conclude safe use.	Not classified as PBT or vPvB. As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

Health:

Professional:, Using gas alone or in mixtures for the calibration of analysis equipment.:

PROC15:

Route of Exposure	Specific condition	Exposure level	RCR	Method	Remarks
inhalative, long-term, systemic	Indoor use, General ventilation, with local exhaust ventilation	0,5 ppm	0,5	ESIG GES tool, Worker	none

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



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Check that RMMs and OCs are as described above or of equivalent efficiency Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. For scaling see <http://www.esig.org/en/regulatory-information/reach/ges-library/ges-library-3>

Exposure Scenario 3)

Exposure Scenario worker

1. Industrial:, Using gas as feedstock in chemical processes.

List of use descriptors	
Sector(s) of use	SU9: Manufacture of fine chemicals
Product categories [PC]:	PC21: Laboratory chemicals

Name of contributing environmental scenario and corresponding ERC	<u>Industrial::</u> ERC6a: Use of intermediate
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Contributing Scenarios	<u>Industrial::</u> PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities
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2.1. Contributing exposure scenario controlling environmental exposure for: Industrial:, Using gas as feedstock in chemical processes.

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.
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Physical form of the product	See section 9 of the SDS.
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Viscosity:	
Kinematic viscosity:	No data available.



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Dynamic viscosity:	0,008 mPa.s (20 °C)
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Amounts used

The actual tonnage handled per site is not considered to influence the immissions as such for this scenario as there is practically no release

Frequency and duration of use

Batch process:	not relevant
Continuous process:	not relevant

Environment factors not influenced by risk management

Other given operational conditions affecting environmental exposure

Other relevant operational conditions	not relevant
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Risk management measures (RMM)

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

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

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

Air	Closed systems are used in order to prevent unintended emissions
Soil	Soil emission controls are not applicable as there is no direct release to soil.
Water	Wastewater emission controls are not applicable as there is no direct release to wastewater.
Sediment:	not relevant
Remarks:	not relevant

Organisational measures to prevent/limit release from site:

none



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Conditions and measures related to sewage treatment plant

type:	Sewage treatment plant
Discharge rate:	not relevant
Treatment effectiveness:	not relevant
Sludge treatment technique:	not relevant
Measures to limit air emissions:	not relevant
Remarks:	Wastewater emission controls are not applicable as there is no direct release to wastewater.

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment:

Suitable waste treatment	Treatment effectiveness	Remarks
See section 13 of the SDS		External treatment and disposal of waste should comply with applicable local and/or national regulations.

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment:

Suitable recovery operations:	Treatment effectiveness	Remarks
See section 13 of the SDS		External recovery and recycling of waste should comply with applicable local and/or national regulations.

Additional good practice advice beyond the REACH Chemical Safety Report

Ensure operatives are trained to minimise releases

2.2. Contributing exposure scenario controlling worker exposure for: Industrial:, Using gas as feedstock in chemical processes.

Process Categories:	PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities
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Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.
Physical form of the product:	See section 9 of the SDS.
Vapour pressure:	217 kPa
Process temperature:	17 °C
Remarks	not relevant

Amounts used

Daily amount per site	The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROCs and technical conditions) is the main determinant of the process-intrinsic emission potential.
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Frequency and duration of use

	Use duration:	Frequency of use:	Remarks
Hours per shift	<= 8 h	240 days per year	PROC1
Hours per shift	<= 1 h	240 days per year	PROC8b

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting workers exposure

Other relevant operational conditions: . See section 8 of the SDS.

Risk management measures (RMM)

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

See section 8 of the safety data sheet

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

inhalation	dermal exposure	eye exposure	oral exposure	Remarks
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exposure				
Provide a basic standard of general ventilation (1 to 3 air changes per hour).				Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour): 30 %				Transfer of substance or mixture (charging and discharging) at dedicated facilities
Provide extract ventilation to points where emissions occur.: 97 %				Transfer of substance or mixture (charging and discharging) at dedicated facilities

Organisational measures to prevent/limit releases, dispersion and exposure

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
				See section 7 of the SDS.
				Ensure operatives are trained to minimise exposures.
				Ensure supervision is in place to check that the RMMs are in place and are being used correctly and that the OCs are being followed

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

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
				See section 8 of the safety data sheet (Personal protection equipment)

Additional good practice advice beyond the REACH Chemical Safety Report

See section 7 of the SDS. Handle product within a closed system. Drain down and flush system prior to equipment



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break-in or maintenance. Apply a good standard of general or controlled ventilation when maintenance activities are carried out.

3. Exposure estimation

Environment:

Industrial:, Using gas as feedstock in chemical processes.:

ERC6a:

Compartment	PEC	RCR	Method	Remarks
Air	mg/m ³	< 1	Qualitative approach used to conclude safe use.	Not classified as PBT or vPvB. As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

ERC6a:

Compartment	PEC	RCR	Method	Remarks
Water	mg/l	< 1	Qualitative approach used to conclude safe use.	Not classified as PBT or vPvB. As no environmental hazard was identified no environmental-related exposure assessment and risk characterization was performed.

Health:

Industrial:, Using gas as feedstock in chemical processes.:

PROC1:

Route of Exposure	Specific condition	Exposure level	RCR	Method	Remarks
inhalative, long-term, systemic	Indoor use, General ventilation, No RPE	0,01 ppm	0,01	ESIG GES tool, Worker	none

PROC8b:

Route of Exposure	Specific condition	Exposure level	RCR	Method	Remarks
inhalative, long-term,	Indoor use,	0,63 ppm	0,63	ESIG GES tool,	none



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systemic	General ventilation, Outdoor use, No RPE			Worker	
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4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Check that RMMs and OCs are as described above or of equivalent efficiency. Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. For scaling see <http://www.esig.org/en/regulatory-information/reach/ges-library/ges-library-3>