

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

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

1.1 Product identifier

Trade name	: Ethylene oxide
Product code	: U1111, U1114
Registration number EU	: 01-2119432402-53-0011, 01-2119432402-53-0013
Synonyms	: EO (Ethylene Oxide), Oxirane
CAS-No.	: 75-21-8

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

Use of the Sub- stance/Mixture	: Chemical intermediate. Please refer to section 16 and/or the annexes for the registered uses under REACH.
Uses advised against	: This product must not be used in applications other than the above without first seeking the advice of the supplier.

1.3 Details of the supplier of the safety data sheet

Manufacturer/Supplier	: Shell Chemicals Europe B.V. PO Box 2334 3000 CH Rotterdam Netherlands
Telephone	: +31 (0)10 441 5137 / +31 (0)10 441 5191
Telefax	: +31 (0)20 716 8316 / +31 (0)20 713 9230
Contact for Safety Data Sheet	: sccmsds@shell.com

1.4 Emergency telephone number

+44 (0) 1235 239 670 (This telephone number is available 24 hours per day, 7 days per week)
Giftnotruf (Berlin): +49 (0) 30 3068 6700

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification (REGULATION (EC) No 1272/2008)

Flammable gases, Category 1A	H220: Extremely flammable gas.
Chemically unstable gas, Category A	H230: May react explosively even in the absence of air.

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version 6.0 Revision Date: 22.08.2022 SDS Number: 800001000479 Date of last issue: 04.03.2021
Print Date 29.08.2022

Gases under pressure, Liquefied gas	H280: Contains gas under pressure; may explode if heated.
Acute toxicity, Category 3, Oral	H301: Toxic if swallowed.
Skin corrosion, Category 1	H314: Causes severe skin burns and eye damage.
Serious eye damage, Category 1	H318: Causes serious eye damage.
Acute toxicity, Category 3, Inhalation	H331: Toxic if inhaled.
Specific target organ toxicity - single exposure, Category 3, Respiratory system	H335: May cause respiratory irritation.
Specific target organ toxicity - single exposure, Category 3, Central nervous system	H336: May cause drowsiness or dizziness.
Germ cell mutagenicity, Category 1B	H340: May cause genetic defects.
Carcinogenicity, Category 1B	H350: May cause cancer.
Reproductive toxicity, Category 1B	H360Fd: May damage fertility. Suspected of damaging the unborn child.
Specific target organ toxicity - repeated exposure, Category 1, Central nervous system	H372: Causes damage to organs through prolonged or repeated exposure.

2.2 Label elements

Labelling (REGULATION (EC) No 1272/2008)

Hazard pictograms :



Signal word : Danger

Hazard statements :

PHYSICAL HAZARDS:

H220 Extremely flammable gas.

H230 May react explosively even in the absence of air.

H280 Contains gas under pressure; may explode if heated.

HEALTH HAZARDS:

H301 Toxic if swallowed.

H314 Causes severe skin burns and eye damage.

H318 Causes serious eye damage.

H331 Toxic if inhaled.

H335 May cause respiratory irritation.

H336 May cause drowsiness or dizziness.

H340 May cause genetic defects.

H350 May cause cancer.

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

H360Fd May damage fertility. Suspected of damaging the unborn child.

H372 Causes damage to organs (Central nervous system) through prolonged or repeated exposure.

ENVIRONMENTAL HAZARDS:

Not classified as environmental hazard according to CLP criteria.

Precautionary statements :

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.

P260 Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.

P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.

Response:

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

P381 In case of leakage, eliminate all ignition sources.

P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.

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

P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Storage:

P403 + P233 Store in a well-ventilated place. Keep container tightly closed.

P405 Store locked up.

Disposal:

P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Other hazards

Even with proper grounding and bonding, this material can still accumulate an electrostatic charge.

If sufficient charge is allowed to accumulate, electrostatic discharge and ignition of flammable air-vapour mixtures can occur.

Dangerous polymerisation can occur on contact with highly catalytic surfaces.

Highly reactive.

This material is shipped under pressure.

Exposure to rapidly expanding gases may cause frost burns to eyes and/or skin.

Liquid solutions of ethylene oxide cause serious chemical burns of the skin and eye lesions. The severity of injury will vary depending on the concentration and duration of skin contact. Concentrations of around 50% are the most dangerous, however a 1% solution of EO in water and gaseous EO dissolved in sweat can also cause damage to the skin. The onset of effects may be delayed for several hours.

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version 6.0 Revision Date: 22.08.2022 SDS Number: 800001000479 Date of last issue: 04.03.2021
Print Date 29.08.2022

Causes burns.

SECTION 3: Composition/information on ingredients

3.1 Substances

Components

Chemical name	CAS-No. EC-No.	Concentration (% w/w)
Ethylene Oxide	75-21-8 200-849-9	100

SECTION 4: First aid measures

4.1 Description of first aid measures

- General advice : DO NOT DELAY.
Keep victim calm. Obtain medical treatment immediately.
DO NOT attempt to rescue the victim unless proper respiratory protection is worn.
Take appropriate steps to avoid fire, explosion and inhalation hazards.
Contaminated leather articles including shoes cannot be decontaminated and should be destroyed to prevent reuse.
- Protection of first-aiders : When administering first aid, ensure that you are wearing the appropriate personal protective equipment according to the incident, injury and surroundings.
- If inhaled : Call emergency number for your location / facility.
Remove to fresh air. Do not attempt to rescue the victim unless proper respiratory protection is worn. If the victim has difficulty breathing or tightness of the chest, is dizzy, vomiting, or unresponsive, give 100% oxygen with rescue breathing or Cardio-Pulmonary Resuscitation as required and transport to the nearest medical facility.
- In case of skin contact : DO NOT DELAY.
Call emergency number for your location / facility.
Remove contaminated clothing. Immediately flush skin with large amounts of water for at least 15 minutes, and follow by washing with soap and water if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.
All burns should receive medical attention.
- In case of eye contact : Immediately flush eye(s) with plenty of water.
Remove contact lenses, if present and easy to do. Continue

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

rinsing.

Transport to the nearest medical facility for additional treatment.

If swallowed

- : Do not induce vomiting. If victim is alert, rinse mouth and drink 1/2 to 1 glass of water to help dilute the material. Do not give liquids to a drowsy, convulsing, or unconscious person. Transport to nearest medical facility for additional treatment. Rinse mouth.

4.2 Most important symptoms and effects, both acute and delayed

Symptoms

- : Respiratory irritation signs and symptoms may include a temporary burning sensation of the nose and throat, coughing, and/or difficulty breathing.
Breathing of high vapour concentrations may cause central nervous system (CNS) depression resulting in dizziness, light-headedness, headache, nausea and loss of coordination. Continued inhalation may result in unconsciousness and death.
Corrosive to skin.
Contact with the skin can cause chemical burns, redness, swelling, and tissue damage.
Corrosive to eyes.
Contact can cause severe eye damage including chemical burns, pain, clouding of the eye surface, inflammation of the eye, and may result in permanent loss of vision.
- Rapid release of gases which are liquids under pressure may cause frost burns of exposed tissues (skin, eye) due to evaporative cooling.
Peripheral nerve damage may be evidenced by impairment of motor function (incoordination, unsteady walk, or muscle weakness in the extremities, and/or loss of sensation in the arms and legs).
- Other signs and symptoms of central nervous system (CNS) depression may include headache, nausea, and lack of coordination.
Symptoms may vary by the agent. Symptoms may extend to being locally corrosive to involving generalized systems including respiratory system, circulatory system, central nervous system (CNS), and may lead to death.
Burns and tearing of the esophagus and stomach are possible.

4.3 Indication of any immediate medical attention and special treatment needed

Treatment

- : IMMEDIATE TREATMENT IS EXTREMELY IMPORTANT!
Treat symptomatically.
Artificial respiration and/or oxygen may be necessary.
Call a doctor or poison control center for guidance.

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

SECTION 5: Firefighting measures

5.1 Extinguishing media

- Suitable extinguishing media : Shut off supply. If not possible and no risk to surroundings, let the fire burn itself out.
- Unsuitable extinguishing media : Do not use water in a jet.

5.2 Special hazards arising from the substance or mixture

- Specific hazards during fire-fighting : The vapour is heavier than air, spreads along the ground and distant ignition is possible.
Sustained fire attack on vessels may result in a Boiling Liquid Expanding Vapor Explosion (BLEVE).
Containers exposed to intense heat from fires should be cooled with large quantities of water.
Contents are under pressure and can explode when exposed to heat or flames.
As the vapours become lighter than air, the vapours may reach ignition sources at ground or elevated locations.

5.3 Advice for firefighters

- Special protective equipment for firefighters : Wear full protective clothing and self-contained breathing apparatus.
- Proper protective equipment including chemical resistant gloves are to be worn; chemical resistant suit is indicated if large contact with spilled product is expected. Self-Contained Breathing Apparatus must be worn when approaching a fire in a confined space. Select fire fighter's clothing approved to relevant Standards (e.g. Europe: EN469).
- Specific extinguishing methods : Standard procedure for chemical fires.
- Further information : Clear fire area of all non-emergency personnel.
If the fire cannot be extinguished the only course of action is to evacuate immediately.
Large fires should only be fought by properly trained fire fighters.
Evacuate the area of all non-essential personnel.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

- Personal precautions : 6.1.1 For non emergency personnel:
Avoid contact with spilled or released material. For guidance on selection of personal protective equipment see Section 8 of

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

this Safety Data Sheet.

Isolate hazard area and deny entry to unnecessary or unprotected personnel.

Stay upwind and keep out of low areas.

Where there is a potential for direct exposure to the product use a gas tight suit.

6.1.2 For emergency responders:

Avoid contact with spilled or released material. For guidance on selection of personal protective equipment see Section 8 of this Safety Data Sheet.

Isolate hazard area and deny entry to unnecessary or unprotected personnel.

Stay upwind and keep out of low areas.

Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks.

Note - Since the danger of fire is so great, bunker gear worn over protective clothing is highly recommended.

6.2 Environmental precautions

Environmental precautions : Shut off leaks, if possible without personal risks. Remove all possible sources of ignition in the surrounding area and evacuate all personnel. Attempt to disperse the gas or to direct its flow to a safe location for example by using fog sprays. Take precautionary measures against static discharge. Ensure electrical continuity by bonding and grounding (earthing) all equipment. Monitor area with combustible gas meter. Prevent from spreading or entering into waterways, sewers, basements or confined areas. Use water spray barriers (curtains) to contain the toxic clouds.

6.3 Methods and material for containment and cleaning up

Methods for cleaning up : Use water spray (fog) to reduce vapours or divert vapour cloud drift. Do not use water in a jet. Alcohol foam applied to surface of liquid pools may slow release of EO vapours into the atmosphere.

6.4 Reference to other sections

For personal protection see section 8., See Chapter 13 for information on disposal., Observe all relevant local regulations., Notify authorities if any exposure to the general public or the environment occurs or is likely to occur., Dike and contain spill water., Water dilution of at least 22:1 for open spaces or 100:1 for confined spaces is necessary to eliminate the fire hazard., Due to its high volatility, spilled liquid EO should either be allowed to evaporate or diluted with water as noted above., The vapour is heavier than air, spreads along the ground and distant ignition is possible., Monitor area with combustible gas indicator., Run-off may cause a fire or explosion hazard., DOT recommends evacuating in all directions. For small spills the distance to evacuate is at least 200 feet; protect persons downwind to at least 0.1 miles during the day and 0.2 miles at night. For large spills the distance to evacuate is at least 400 feet; protect persons downwind to at least 0.2 miles during the day and 0.6 miles at night.

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

SECTION 7: Handling and storage

7.1 Precautions for safe handling

- | | |
|-------------------------|---|
| Technical measures | : Avoid breathing of or direct contact with material. Only use in well ventilated areas. Wash thoroughly after handling. For guidance on selection of personal protective equipment see Section 8 of this Safety Data Sheet.
Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material.
Ensure that all local regulations regarding handling and storage facilities are followed. |
| Advice on safe handling | : Avoid exposure. Obtain special instructions before use. This product is intended for use in closed systems only. Ventilate workplace in such a way that the Occupational Exposure Limit (OEL) is not exceeded.
The vapour is heavier than air, spreads along the ground and distant ignition is possible.
Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment to reduce the risk.
The vapours in the head space of the storage vessel may lie in the flammable/explosive range and hence may be flammable.
Do NOT use compressed air for filling, discharging, or handling operations. |
| Product Transfer | : Refer to guidance under Handling section. Lines should be purged with nitrogen before and after product transfer. Refer to supplier for further product transfer instructions if required. |
| Hygiene measures | : Wash hands before eating, drinking, smoking and using the toilet. Launder contaminated clothing before re-use. |

7.2 Conditions for safe storage, including any incompatibilities

- | | |
|---|---|
| Requirements for storage areas and containers | : Refer to section 15 for any additional specific legislation covering the packaging and storage of this product. |
| Storage class (TRGS 510) | : 2A, Gases |
| Further information on storage stability | : Ethylene oxide (EO), an extremely flammable and toxic gas, and other hazardous vapours may evolve and collect in the headspace of storage tanks, transport vessels and other enclosed containers.
Tanks must be specifically designed for use with this product.
Tanks must be clean, dry and rust-free.
Keep container tightly closed.
Vapours from tanks should not be released to atmosphere.
Breathing losses during storage should be controlled by a |

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version 6.0 Revision Date: 22.08.2022 SDS Number: 800001000479 Date of last issue: 04.03.2021
Print Date 29.08.2022

suitable vapour treatment system.
Nitrogen blanket recommended.
Cleaning, inspection and maintenance of storage tanks is a specialist operation, which requires the implementation of strict procedures and precautions.
Keep away from flammables, oxidizing agents, and corrosives.
Storage Temperature:
30 °C / 86 °F maximum.
Potential exists for runaway reaction at elevated temperatures in the presence of strong bases and salts of strong bases.
Must be stored in a diked (bunded) well-ventilated area, away from sunlight, ignition sources and other sources of heat.
A reliable fixed sprinkler/deluge system should be installed.

Packaging material : Suitable material: Stainless steel., Mild steel., Carbon steel
Unsuitable material: Compatibility should be checked with the manufacturer.

Container Advice : Containers, even those that have been emptied, can contain explosive vapours. Do not cut, drill, grind, weld or perform similar operations on or near containers.

7.3 Specific end use(s)

Specific use(s) : Please refer to section 16 and/or the annexes for the registered uses under REACH.

Ensure that all local regulations regarding handling and storage facilities are followed.
See additional references that provide safe handling practices: American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practices on Static Electricity).
IEC/TS 60079-32-1: Electrostatic hazards, guidance

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Occupational Exposure Limits

Components	CAS-No.	Value type (Form of exposure)	Control parameters	Basis
Ethylene Oxide	75-21-8	Acceptable concentration	0,1 ppm 0,2 mg/m ³	DE TRGS 910
Further information: Skin-resorptive				
Ethylene Oxide		Tolerable concentration	1 ppm 2 mg/m ³	DE TRGS 910
Peak-limit: excursion factor (category): 2 - Excursion factor according to Number 3.2.6				
Further information: Skin-resorptive				

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version 6.0 Revision Date: 22.08.2022 SDS Number: 800001000479 Date of last issue: 04.03.2021
Print Date 29.08.2022

Ethylene Oxide		TWA	1 ppm 1,8 mg/m ³	2004/37/EC
Further information: Skin, Carcinogens or mutagens				
Ethylene Oxide		TWA	1 ppm 1,8 mg/m ³	Shell OEL = Shell Occupational Exposure Limit

Biological occupational exposure limits

Substance name	CAS-No.	Control parameters	Sampling time	Basis
Ethylene Oxide	75-21-8	N-(2-hydroxyethyl) valine: 3900 pmol/g globine (Whole blood erythrocyte fraction)	Equivalence Value for Tolerable concentration: after at least 3 months of exposure	TRGS 910

Derived No Effect Level (DNEL) according to Regulation (EC) No. 1907/2006:

Substance name	End Use	Exposure routes	Potential health effects	Value
Ethylene Oxide	Workers	Inhalation	Acute local effects	5 mg/m ³
Ethylene Oxide	Workers	Inhalation	Long-term systemic effects	1,6 mg/m ³

Predicted No Effect Concentration (PNEC) according to Regulation (EC) No. 1907/2006:

Substance name	Environmental Compartment	Value
Ethylene Oxide		
Remarks:	Exposure assessments have not been presented for the environment therefore PNEC values not required.	

8.2 Exposure controls

Engineering measures

Read in conjunction with the Exposure Scenario for your specific use contained in the Annex. The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include:

Use sealed systems as far as possible.

Adequate explosion-proof ventilation to control airborne concentrations below the exposure guidelines/limits.

Local exhaust ventilation is recommended.

The American Industrial Hygiene Association has established emergency response planning guidelines (ERPG) for ethylene oxide. These guidelines are estimates of concentration ranges which alone could reasonably anticipate observing adverse effects.

Ethylene Oxide ERPG-2, 50 ppm, is a maximum airborne concentration below which individuals could be exposed for up to 1 hour without experiencing mild transient health effects.

Ethylene Oxide ERPG-3, 500 ppm, is a maximum airborne concentration below which it is believed that individuals could be exposed for up to 1 hour without experiencing or developing life threatening health effects.

Firewater monitors and deluge systems are recommended.

Eye washes and showers for emergency use.

General Information:

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

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 there is potential for inhalation; clear up spills immediately and dispose of wastes safely. Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance.

Do not ingest. If swallowed, then seek immediate medical assistance

Items that cannot be decontaminated should be destroyed (see Chapter 13).

Personal protective equipment

Read in conjunction with the Exposure Scenario for your specific use contained in the Annex. The provided information is made in consideration of the PPE directive (Council Directive 89/686/EEC) and the CEN European Committee for Standardisation (CEN) standards.

Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.

Eye protection : Wear goggles for use against liquids and gas, combined with face shield with chin guard.

Approved to EU Standard EN166.

Hand protection

Remarks : 4Htm (PE/EVAL) or butyl rubber gloves, First Responder chemical suit. Neoprene, Polyvinyl Chloride (PVC) or Vitontm are not recommended.

Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection. Longer term protection: Butyl rubber. Incidental contact/Splash protection: Nitrile rubber gloves. For continuous contact we recommend gloves with breakthrough time of more than 240 minutes with preference for > 480 minutes where suitable gloves can be identified. For short-term/splash protection we recommend the same but recognize that suitable gloves offering this level of protection may not be available and in this case a lower breakthrough time maybe acceptable so long as appropriate maintenance and replacement regimes are followed. Glove thickness is not a good predictor of glove resistance to a chemical as it is dependent on the exact composition of the glove material. Glove thickness should be typically greater than 0.35 mm depending on the glove make and model. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. Personal hygiene is a key

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended.

Skin and body protection : Where risk of splashing or in spillage clean up, use chemical resistant one-piece overall with integral hood, chemical resistant knee length boots and chemical resistant gloves. Otherwise use chemical resistant apron and gauntlets.

Protective clothing approved to EU Standard EN14605.

Respiratory protection : If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are unsuitable (e.g. airborne concentrations are high, risk of oxygen deficiency, confined space) use appropriate positive pressure breathing apparatus. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. If air-filtering respirators are suitable for conditions of use:

Select a filter suitable for organic gases and vapours [Type AX boiling point < 65°C (149°F)] meeting EN14387.

An approved respirator should be used when making or breaking connections to an ethylene oxide rail car or when sampling this material.

The odour threshold for ethylene oxide is above 250 ppm. This is much greater than the OSHA exposure limits. Therefore, do not depend on sense of smell for warning. If you smell ethylene oxide, you are in danger. Absence of odour, though, does not assure low enough exposure levels; its vapour may deaden the sense of smell.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Physical state	: Liquid under pressure.
Colour	: clear
Odour	: Ethereal, sweet
Odour Threshold	: Data not available
Melting point/freezing point	: -112 °C

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

Boiling point/boiling range : 10,6 °C

Flammability

Flammability (solid, gas) : Extremely flammable.

Lower explosion limit and upper explosion limit / flammability limit

Upper explosion limit /
upper flammability limit : 99,99 %(V)

Lower explosion limit /
Lower flammability limit : 2,6 %(V)

Flash point : -57 °C

Auto-ignition temperature : 428 °C

Decomposition temperature

Decomposition temperature : Data not available

pH : Not applicable

Viscosity

Viscosity, dynamic : 0,41 mPa.s (0 °C)
Method: ASTM D445

Viscosity, kinematic : Data not available

Solubility(ies)

Water solubility : completely miscible

Solubility in other solvents : Data not available

Partition coefficient: n-
octanol/water : log Pow: -0,3

Vapour pressure : 144,6 kPa (20 °C)

Relative density : Data not available

Density : 898 kg/m³ (0 °C)
Method: ASTM D4052

Relative vapour density : ca. 1,5

Particle characteristics

Particle size : Data not available

9.2 Other information

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

Explosives : Not applicable

Oxidizing properties : Not applicable

Evaporation rate : Data not available

Conductivity : Electrical conductivity: > 10,000 pS/m

A number of factors, for example liquid temperature, presence of contaminants, and anti-static additives can greatly influence the conductivity of a liquid, This material is not expected to be a static accumulator.

Surface tension : Data not available

Molecular weight : 44 g/mol

SECTION 10: Stability and reactivity

10.1 Reactivity

The product does not pose any further reactivity hazards in addition to those listed in the following sub-paragraph.

10.2 Chemical stability

Stable under normal conditions of use.

Pure EO or EO vapour mixed with air or inert gases can decompose explosively. The violence of the explosion depends on pressure, temperature and concentration; the form and energy of the ignition source, and the type of container.

Reacts exothermically with bases (eg caustic soda), ammonia, primary and secondary amines, alcohols, water and acids.

10.3 Possibility of hazardous reactions

Hazardous reactions : Data not available

10.4 Conditions to avoid

Conditions to avoid : Heat, flames, and sparks.
Temperatures above 30 °C / 86 °F.
Prevent vapour accumulation.

In certain circumstances product can ignite due to static electricity.

10.5 Incompatible materials

Materials to avoid : Avoid contamination with organic bases, strong acids, ammonia, copper, silver, magnesium and their salts, anhydrous chlorides of iron, tin and aluminium, and alkali metal hydroxides.

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

10.6 Hazardous decomposition products

Thermal decomposition is highly dependent on conditions. A complex mixture of airborne solids, liquids and gases including carbon monoxide, carbon dioxide, sulphur oxides and unidentified organic compounds will be evolved when this material undergoes combustion or thermal or oxidative degradation.

SECTION 11: Toxicological information

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

Information on likely routes of exposure : Exposure may occur via inhalation, ingestion, skin absorption, skin or eye contact, and accidental ingestion.
This material penetrates the intact skin and eye rapidly as a liquid or mist, producing severe burns.

Acute toxicity

Components:

Ethylene Oxide:

Acute oral toxicity	: LD 50 (Rat, male): > 300 - <= 2000 mg/kg Method: Literature data Remarks: Harmful if swallowed.
Acute inhalation toxicity	: LC 50 (Rat, male): > 500 - <= 2500 ppm Exposure time: 4 h Test atmosphere: gas Method: Literature data Remarks: Toxic if inhaled. High concentrations may cause central nervous system depression resulting in headaches, dizziness and nausea; continued inhalation may result in unconsciousness and/or death.
Acute dermal toxicity	: Remarks: Based on available data, the classification criteria are not met.

Skin corrosion/irritation

Components:

Ethylene Oxide:

Species	: Rabbit
Method	: Acceptable non-standard method.
Remarks	: Causes skin irritation. Liquid solutions of ethylene oxide cause serious chemical burns of the skin and eye lesions. The severity of injury will vary depending on the concentration and duration of skin contact. Rapid release of gases which are liquids under pressure may cause frost burns of exposed tissues (skin, eye) due to evaporative cooling.

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

Serious eye damage/eye irritation

Components:

Ethylene Oxide:

Species	:	Rabbit
Method	:	Literature data
Remarks	:	Causes serious eye irritation.

Respiratory or skin sensitisation

Components:

Ethylene Oxide:

Species	:	Guinea pig
Method	:	Literature data
Remarks	:	Based on available data, the classification criteria are not met.

Germ cell mutagenicity

Components:

Ethylene Oxide:

Genotoxicity in vitro	:	Method: OECD Test Guideline 471 Remarks: May cause genetic defects.
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	:	Method: Literature data Remarks: May cause genetic defects.
--	---	--

Genotoxicity in vivo	:	Species: Mouse Application Route: Inhalation Method: Literature data Remarks: May cause genetic defects.
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Germ cell mutagenicity- Assessment	:	May cause genetic defects.
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Carcinogenicity

Components:

Ethylene Oxide:

Species	:	Rat, male and female
Application Route	:	Inhalation
Method	:	Literature data
Remarks	:	May cause cancer.

Carcinogenicity - Assessment	:	May cause cancer.
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SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version 6.0 Revision Date: 22.08.2022 SDS Number: 800001000479 Date of last issue: 04.03.2021
Print Date 29.08.2022

Material	GHS/CLP Carcinogenicity Classification
Ethylene Oxide	Carcinogenicity Category 1B

Material	Other Carcinogenicity Classification
Ethylene Oxide	IARC: Group 1: Carcinogenic to humans

Reproductive toxicity

Components:

Ethylene Oxide:

Effects on fertility : Species: Rat
Sex: male and female
Application Route: Inhalation

Method: Literature data
Remarks: Based on available data, the classification criteria are not met., May impair fertility based on animal studies.

Reproductive toxicity - Assessment : This product does not meet the criteria for classification in categories 1A/1B.

STOT - single exposure

Components:

Ethylene Oxide:

Exposure routes : Inhalation
Target Organs : Respiratory system
Remarks : May cause respiratory irritation.

STOT - repeated exposure

Components:

Ethylene Oxide:

Exposure routes : Inhalation
Target Organs : Nervous system
Remarks : Causes damage to organs through prolonged or repeated exposure.

Repeated dose toxicity

Components:

Ethylene Oxide:

Species : Rat, male and female
Application Route : Inhalation
Test atmosphere : vapour

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

Method	:	Test(s) equivalent or similar to OECD Test Guideline 453
Target Organs	:	Nervous system

Aspiration toxicity

Components:

Ethylene Oxide:

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

11.2 Information on other hazards

Further information

Components:

Ethylene Oxide:

Remarks	:	Classifications by other authorities under varying regulatory frameworks may exist.
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SECTION 12: Ecological information

12.1 Toxicity

Components:

Ethylene Oxide:

Toxicity to fish	:	LC50 (Pimephales promelas (fathead minnow)): 84 mg/l Exposure time: 96 h Method: Test(s) equivalent or similar to OECD Guideline 203 Remarks: Harmful LL/EL/IL50 >10 <= 100 mg/l
Toxicity to daphnia and other aquatic invertebrates	:	LC50 (Daphnia magna (Water flea)): 137 - 300 mg/l Exposure time: 48 h Method: Test(s) equivalent or similar to OECD Guideline 202 Remarks: Practically non toxic: LC/EC/IC50 > 100 mg/l
Toxicity to algae/aquatic plants	:	EC50 (Pseudokirchneriella subcapitata (algae)): 240 mg/l Exposure time: 96 h Method: Information given is based on data obtained from similar substances. Remarks: Practically non toxic: LC/EC/IC50 > 100 mg/l
Toxicity to microorganisms	:	EC50 (Activated sludge, domestic waste): > 713 mg/l Exposure time: 3 h Method: OECD Test Guideline 209 Remarks: Practically non toxic: LC/EC/IC50 > 100 mg/l

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

Toxicity to fish (Chronic toxicity) : Remarks: Data not available

Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity) : Remarks: Data not available

12.2 Persistence and degradability

Components:

Ethylene Oxide:

Biodegradability : Biodegradation: 93 - 98 %
Exposure time: 28 d
Method: Information given is based on data obtained from similar substances.
Remarks: Readily biodegradable.
Rapidly hydrolyses in water and soil.

12.3 Bioaccumulative potential

Components:

Ethylene Oxide:

Bioaccumulation : Remarks: Does not have the potential to bioaccumulate significantly.

12.4 Mobility in soil

Components:

Ethylene Oxide:

Mobility : Remarks: When released to air, transfers to soil or water by wet and dry deposition.

12.5 Results of PBT and vPvB assessment

Components:

Ethylene Oxide:

Assessment : The substance does not fulfill all screening criteria for persistence, bioaccumulation and toxicity and hence is not considered to be PBT or vPvB..

12.6 Endocrine disrupting properties

no data available

12.7 Other adverse effects

no data available

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

SECTION 13: Disposal considerations

13.1 Waste treatment methods

- Product : Do not dispose into the environment, in drains or in water courses
Waste product should not be allowed to contaminate soil or water.
Waste arising from a spillage or tank cleaning should be disposed of in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand.
- Disposal should be in accordance with applicable regional, national, and local laws and regulations.
Local regulations may be more stringent than regional or national requirements and must be complied with.
- Contaminated packaging : Dispose in accordance with prevailing regulations, preferably to a recognized collector or contractor. The competence of the collector or contractor should be established beforehand.

SECTION 14: Transport information

14.1 UN number or ID number

- ADN : 1040
ADR : 1040
RID : 1040
IMDG : 1040
IATA : 1040
(Not permitted for transport)

14.2 UN proper shipping name

- ADN : ETHYLENE OXIDE WITH NITROGEN
ADR : ETHYLENE OXIDE WITH NITROGEN
RID : ETHYLENE OXIDE WITH NITROGEN
IMDG : ETHYLENE OXIDE WITH NITROGEN
IATA : ETHYLENE OXIDE WITH NITROGEN

14.3 Transport hazard class(es)

- ADN : 2
ADR : 2
RID : 2

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

IMDG : 2.3
IATA : 2.3
Not permitted for transport

14.4 Packing group

ADN

Packing group : Not Assigned
Classification Code : 2TF
Labels : 2.3 (2.1)
CDNI Inland Water Waste : NST 8199 Ethylene Oxide
Agreement

ADR

Packing group : Not assigned by regulation
Classification Code : 2TF
Hazard Identification Number : 263
Labels : 2.3 (2.1)

RID

Packing group : Not assigned by regulation
Classification Code : 2TF
Hazard Identification Number : 263
Labels : 2.3 (2.1)

IMDG

Packing group : Not assigned by regulation
Labels : 2.3 (2.1)

IATA

Packing group : Not Assigned

14.5 Environmental hazards

ADN

Environmentally hazardous : no

ADR

Environmentally hazardous : no

RID

Environmentally hazardous : no

IMDG

Marine pollutant : no

14.6 Special precautions for user

Remarks : Special Precautions: Refer to Section 7, Handling & Storage, for special precautions which a user needs to be aware of or needs to comply with in connection with transport.

14.7 Maritime transport in bulk according to IMO instruments

Pollution category : Not applicable
Ship type : Not applicable
Product name : Not applicable

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

Additional Information : SHUNT WITH CARE (Label nr. 13 - for RID only) This product may be transported under nitrogen blanketing. Nitrogen is an odourless and invisible gas. Exposure to nitrogen may cause asphyxiation or death. Personnel must observe strict safety precautions when involved with a confined space entry.

SECTION 15: Regulatory information

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

REACH - List of substances subject to authorisation (Annex XIV)	:	Product is not subject to Authorisation under REACH.
REACH - Candidate List of Substances of Very High Concern for Authorisation (Article 59).	:	This product does not contain substances of very high concern (Regulation (EC) No 1907/2006 (REACH), Article 57).
Seveso III: Directive 2012/18/EU of the European Parliament and of the Council on the control of major-accident hazards involving dangerous substances.	20	Ethylene oxide
Water hazard class (Germany)	:	WGK 3 highly hazardous to water Code Number: 253 Remarks: Classification according to AwSV

Other regulations:

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

Product is subject Betriebs-Sicherheits-Verordnung (BetrSichV).
Compliance with paragraph 22 of Youth Employment Law.
Take note of Law on the protection of mothers at work, in education and in studies (Maternity Protection Act - MuSchG).
Product is subject to Störfallverordnung (12. BImSchV) based on Seveso III directive (2012/18/EU).

The product is subject to the supply restrictions of the Ordinance on the Prohibition of Chemicals.

The components of this product are reported in the following inventories:

AIIC	:	Listed
DSL	:	Listed
IECSC	:	Listed

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

ENCS	: Listed
KECI	: Listed
NZIoC	: Listed
PICCS	: Listed
TSCA	: Listed
TCSI	: Listed

15.2 Chemical safety assessment

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

SECTION 16: Other information

Full text of other abbreviations

2004/37/EC	: Europe. Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work
DE TRGS 910	: Germany. TRGS 910 - Substance-specific acceptable and tolerable concentrations and equivalence values for carcinogenic hazardous substances.
TRGS 910	: Germany. TRGS 910 - Substance-specific acceptable and tolerable concentrations and equivalence values for carcinogenic hazardous substances
2004/37/EC / TWA	: Long term exposure limit
DE TRGS 910 / Acceptable concentration	: Acceptable concentration
DE TRGS 910 / Tolerable concentration	: Tolerable concentration

ADN - European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways; ADR - Agreement concerning the International Carriage of Dangerous Goods by Road; AIIC - Australian Inventory of Industrial Chemicals; ASTM - American Society for the Testing of Materials; bw - Body weight; CLP - Classification Labelling Packaging Regulation; Regulation (EC) No 1272/2008; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DSL - Domestic Substances List (Canada); ECHA - European Chemicals Agency; EC-Number - European Community number; ECx - Concentration associated with x% response; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test popula-

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version	Revision Date:	SDS Number:	Date of last issue: 04.03.2021
6.0	22.08.2022	800001000479	Print Date 29.08.2022

tion; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; n.o.s. - Not Otherwise Specified; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RID - Regulations concerning the International Carriage of Dangerous Goods by Rail; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; SVHC - Substance of Very High Concern; TCSI - Taiwan Chemical Substance Inventory; TECL - Thailand Existing Chemicals Inventory; TRGS - Technical Rule for Hazardous Substances; TSCA - Toxic Substances Control Act (United States); UN - United Nations; vPvB - Very Persistent and Very Bioaccumulative

Further information

Training advice : Provide adequate information, instruction and training for operators.

Other information : For Industry guidance and tools on REACH please visit the CEFIC website at <http://cefic.org/Industry-support>.
The substance does not fulfill all screening criteria for persistence, bioaccumulation and toxicity and hence is not considered to be PBT or vPvB.

A vertical bar (|) in the left margin indicates an amendment from the previous version.

This product is classified as R22/H302 Harmful if swallowed. The same control advice applies to all uses of this product and is included in Section 8 of the SDS. An exposure scenario is not presented.

Sources of key data used to compile the Safety Data Sheet : The quoted data are from, but not limited to, one or more sources of information (e.g. toxicological data from Shell Health Services, material suppliers' data, CONCAWE, EU IUCLID data base, EC 1272 regulation, etc).

Classification of the mixture:

Flam. Gas 1A	H220
Chem. Unst. Gas A	H230
Press. Gas Liquefied gas	H280
Acute Tox. 3	H301
Skin Corr. 1	H314
Eye Dam. 1	H318
Acute Tox. 3	H331

Classification procedure:

On basis of test data.
On basis of test data.
On basis of test data.
Expert judgement and weight of evidence determination.
Expert judgement and weight of evidence determination.
Expert judgement and weight of evidence determination.
Expert judgement and weight of evidence determination.

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version 6.0	Revision Date: 22.08.2022	SDS Number: 800001000479	Date of last issue: 04.03.2021 Print Date 29.08.2022
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STOT SE 3	H335	dence determination. Expert judgement and weight of evidence determination.
STOT SE 3	H336	Expert judgement and weight of evidence determination.
Muta. 1B	H340	Expert judgement and weight of evidence determination.
Carc. 1B	H350	Expert judgement and weight of evidence determination.
Repr. 1B	H360Fd	Expert judgement and weight of evidence determination.
STOT RE 1	H372	Expert judgement and weight of evidence determination.

Identified Uses according to the Use Descriptor System

Uses - Worker

Title : Manufacture of substance- Industrial

Uses - Worker

Title : Use as an intermediate- Industrial

Uses - Worker

Title : Polymer production- Industrial

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

DE / EN

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version 6.0 Revision Date: 22.08.2022 SDS Number: 800001000479 Date of last issue: 04.03.2021
Print Date 29.08.2022

Exposure Scenario - Worker

300000000703	
SECTION 1	EXPOSURE SCENARIO TITLE
Title	Manufacture of substance- Industrial
Use Descriptor	Sector of Use: SU3, SU8, SU9 Process Categories: PROC 1, PROC 2, PROC 3, PROC 8b Environmental Release Categories: ERC1
Scope of process	Manufacture of the substance or use as a process chemical or extraction agent within closed or contained systems. Includes incidental exposures during recycling/ recovery, material transfers, storage, sampling, associated laboratory activities, maintenance and loading (including marine vessel/barge, road/rail car and bulk container).

SECTION 2	OPERATIONAL CONDITIONS AND RISK MANAGEMENT MEASURES
Additional Information	No exposure assessment presented for the environment.

Section 2.1	Control of Worker Exposure
Product Characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa at STP
Concentration of the Substance in Mixture/Article	Covers use of substance/product up to 100% (unless stated differently).
Frequency and Duration of Use	
Covers daily exposures up to 8 hours (unless stated differently).	
Other Operational Conditions affecting Exposure	
Assumes a good basic standard of occupational hygiene is implemented.	

Contributing Scenarios	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 maintain all control measures. Consider the need for risk based health surveillance.

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version 6.0 Revision Date: 22.08.2022 SDS Number: 800001000479 Date of last issue: 04.03.2021
Print Date 29.08.2022

General exposures (closed systems)	No other specific measures identified.
Process samplingProduct sampling.	Sample via a closed loop or other system to avoid exposure Wear a respirator conforming to EN140 with Type AX filter or better.
Bulk product storage	Store substance within a closed system.
Bulk transfersDedicated facility	Transfer via enclosed lines. Clear transfer lines prior to de-coupling. Wear a respirator conforming to EN140 with Type AX filter or better.
Equipment cleaning and maintenance	Drain down and flush system prior to equipment opening or maintenance. Wear a respirator conforming to EN140 with Type AX filter or better.

Section 2.2	Control of Environmental Exposure
No exposure assessment presented for the environment.	

SECTION 3	EXPOSURE ESTIMATION
Section 3.1 - Health	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.	

Section 3.2 -Environment
No exposure assessment presented for the environment.

SECTION 4	GUIDANCE TO CHECK COMPLIANCE WITH THE EXPOSURE SCENARIO
Section 4.1 - Health	
Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.	

Section 4.2 -Environment
No exposure assessment presented for the environment.

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version 6.0 Revision Date: 22.08.2022 SDS Number: 800001000479 Date of last issue: 04.03.2021
Print Date 29.08.2022

Exposure Scenario - Worker

300000000705	
SECTION 1	EXPOSURE SCENARIO TITLE
Title	Use as an intermediate- Industrial
Use Descriptor	Sector of Use: SU3, SU8, SU9 Process Categories: PROC 1, PROC 2, PROC 3, PROC 8b Environmental Release Categories: ERC6a
Scope of process	Use of substance as an intermediate within closed or contained systems (not related to Strictly Controlled Conditions). Includes incidental exposures during recycling/recovery, material transfers, storage, sampling, associated laboratory activities, maintenance and loading (including marine vessel/barge, road/rail car and bulk container).

SECTION 2	OPERATIONAL CONDITIONS AND RISK MANAGEMENT MEASURES
Additional Information	No exposure assessment presented for the environment.

Section 2.1	Control of Worker Exposure
Product Characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa at STP
Concentration of the Substance in Mixture/Article	Covers use of substance/product up to 100% (unless stated differently).
Frequency and Duration of Use	
Covers daily exposures up to 8 hours (unless stated differently).	
Other Operational Conditions affecting Exposure	
Assumes a good basic standard of occupational hygiene is implemented.	

Contributing Scenarios	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 maintain all control measures. Consider the need for risk based health surveillance.

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version 6.0 Revision Date: 22.08.2022 SDS Number: 800001000479 Date of last issue: 04.03.2021
Print Date 29.08.2022

General exposures (closed systems)	No other specific measures identified.
Process samplingProduct sampling.	Sample via a closed loop or other system to avoid exposure Wear a respirator conforming to EN140 with Type AX filter or better.
Bulk product storage	Store substance within a closed system.
Bulk transfersDedicated facility	Transfer via enclosed lines. Clear transfer lines prior to de-coupling. Wear a respirator conforming to EN140 with Type AX filter or better.
Equipment cleaning and maintenance	Drain down and flush system prior to equipment opening or maintenance. Wear a respirator conforming to EN140 with Type AX filter or better.

Section 2.2	Control of Environmental Exposure
No exposure assessment presented for the environment.	

SECTION 3	EXPOSURE ESTIMATION
Section 3.1 - Health	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.	

Section 3.2 -Environment
No exposure assessment presented for the environment.

SECTION 4	GUIDANCE TO CHECK COMPLIANCE WITH THE EXPOSURE SCENARIO
Section 4.1 - Health	
Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.	

Section 4.2 -Environment
No exposure assessment presented for the environment.

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version 6.0 Revision Date: 22.08.2022 SDS Number: 800001000479 Date of last issue: 04.03.2021
Print Date 29.08.2022

Exposure Scenario - Worker

300000000707	
SECTION 1	EXPOSURE SCENARIO TITLE
Title	Polymer production- Industrial
Use Descriptor	Sector of Use: SU3, SU10 Process Categories: PROC 1, PROC 2, PROC 3, PROC 8b Environmental Release Categories: ERC 6C
Scope of process	Manufacture of polymers from monomers in continuous and batch processes. Including production, re-cycling and recovery, degassing, discharging, reactor maintenance and immediate polymer product formation (i.e. compounding, pelletisation, product off-gassing).

SECTION 2	OPERATIONAL CONDITIONS AND RISK MANAGEMENT MEASURES
Additional Information	No exposure assessment presented for the environment.

Section 2.1	Control of Worker Exposure
Product Characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa at STP
Concentration of the Substance in Mixture/Article	Covers use of substance/product up to 100% (unless stated differently).,
Frequency and Duration of Use	
Covers daily exposures up to 8 hours (unless stated differently).	
Other Operational Conditions affecting Exposure	
Assumes a good basic standard of occupational hygiene is implemented.	

Contributing Scenarios	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 maintain all control measures. Consider the need for risk based health surveillance.
General exposures (closed)	No other specific measures identified.

SAFETY DATA SHEET

According to EC No 1907/2006 as amended as at the date of this SDS

Ethylene oxide

Version 6.0 Revision Date: 22.08.2022 SDS Number: 800001000479 Date of last issue: 04.03.2021
Print Date 29.08.2022

systems)Continuous process	
Use in contained batch processes	Handle substance within a closed system.
Process samplingProduct sampling.	Sample via a closed loop or other system to avoid exposure Wear a respirator conforming to EN140 with Type AX filter or better.
Bulk product storage	Store substance within a closed system.
Bulk transfersDedicated facility	Transfer via enclosed lines. Clear transfer lines prior to de-coupling. Wear a respirator conforming to EN140 with Type AX filter or better.
Equipment cleaning and maintenance	Drain down and flush system prior to equipment opening or maintenance. Wear a respirator conforming to EN140 with Type AX filter or better.

Section 2.2	Control of Environmental Exposure
No exposure assessment presented for the environment.	

SECTION 3	EXPOSURE ESTIMATION
Section 3.1 - Health	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.	

Section 3.2 -Environment
No exposure assessment presented for the environment.

SECTION 4	GUIDANCE TO CHECK COMPLIANCE WITH THE EXPOSURE SCENARIO
Section 4.1 - Health	
Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.	

Section 4.2 -Environment
No exposure assessment presented for the environment.