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

1.1 Product identifier

Trade name/designation	Propylene oxide
Art-Nr(n).	3600
Substance name	propylene oxide
Index No	603-055-00-4
EC No	200-879-2
REACH No.	01-2119480483-35
CAS No	75-56-9

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

Sector of uses [SU]
SU3 Industrial uses
SU8 Manufacture of bulk, large scale chemicals (including petroleum products)

* **Process categories [PROC]**
PROC1 Use in closed process, no likelihood of exposure
PROC2 Use in closed, continuous process with occasional controlled exposure
PROC3 Use in closed batch process (synthesis or formulation)
PROC8a Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities
PROC8b Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities
PROC9 Transfer of substance or preparation into small containers (dedicated filling line, including weighing)
PROC15 Use as laboratory reagent

* **Environmental release categories [ERC]**
ERC1 Manufacture of substances
ERC6a Industrial use resulting in manufacture of another substance (use of intermediates)
ERC2 Formulation into mixture
ERC6c Use of monomer in polymerisation processes at industrial site (inclusion or not into/onto article)

1.3 Details of the supplier of the safety data sheet

Supplier
GHC Gerling, Holz & Co. Handels GmbH
Ruhrstraße 113
D-22761 Hamburg
Telephone +49 40 853 123 0
E-mail hamburg@ghc.de
Website www.ghc.com

Department responsible for information:
GHC Gerling, Holz & Co. Handels GmbH
Telephone +49 40 853 123 0

E-mail (competent person):
msds@ghc.de

* 1.4 Emergency telephone number

EN: Poison Information Center Mainz +49 6131 19240

* SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 [CLP]	Classification procedure
Flam. Liq. 1, H224	
Acute Tox. 4, H302	
Acute Tox. 3, H311	
Acute Tox. 3, H331	

Classification according to Regulation (EC) No 1272/2008 [CLP]	Classification procedure
Eye Irrit. 2, H319	
Muta. 1B, H340	
Carc. 1B, H350	
STOT SE 3, H335	

Hazard statements for physical hazards
H224 Extremely flammable liquid and vapour.

Hazard statements for health hazards
H302 Harmful if swallowed.
H311 Toxic in contact with skin.
H319 Causes serious eye irritation.
H331 Toxic if inhaled.
H335 May cause respiratory irritation.
H340 May cause genetic defects.
H350 May cause cancer.

* **2.2 Label elements**

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

Hazard pictograms

GHS02 GHS06 GHS08

Signal word
Danger

Hazard statements
H224 Extremely flammable liquid and vapour.
H302 Harmful if swallowed.
H311 Toxic in contact with skin.
H319 Causes serious eye irritation.
H331 Toxic if inhaled.
H335 May cause respiratory irritation.
H340 May cause genetic defects.
H350 May cause cancer.

* **Precautionary statements**
P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P261 Avoid breathing mist/vapours.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302 + P352 IF ON SKIN: Wash with plenty of water and soap.
P304 + P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P315 Get immediate medical advice/attention.
P403 Store in a well-ventilated place.
P405 Store locked up.

* **Supplemental hazard information**
EIGA0803 Restricted to professional users.

* **2.3 Other hazards**

Adverse human health effects and symptoms
Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below ground level.
The product is skin resorptive.

* **Results of PBT and vPvB assessment**
The substance/mixture does not contain components meeting the PBT/vPvB criteria of the Reach Regulation, Annex XIII, at levels of 0.1% or higher.

SECTION 3: Composition / information on ingredients

3.1 Substances

Substance name	propylene oxide
Index No	603-055-00-4
EC No	200-879-2
REACH No.	01-2119480483-35
CAS No	75-56-9
ATE	ATE(oral): 382 mg/kg ATE(dermal): 1.5 ml/kg ATE(): 4197 ppm

Additional information
Content: >= 99,9 %

Remark
The substance has been added to the candidate list for substances of very high concern (SVHC) in accordance with Article 59 (10) of Regulation (EC) No 1907/2006 [REACH].

3.2 Mixtures

not applicable

* SECTION 4: First aid measures

* 4.1 Description of first aid measures

* **General information**
Remove contaminated, saturated clothing immediately.
In the event of persistent symptoms obtain medical treatment.
First aider: Pay attention to self-protection!

Following inhalation
Remove casualty to fresh air and keep warm and at rest.
In case of respiratory standstill give artificial respiration by respiratory bag (Ambu bag) or respirator. Obtain medical assistance.

* **Following skin contact**
In case of skin contact rinse with warm water.
Take off contaminated clothing.

After eye contact
Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Obtain medical assistance.

Following ingestion
Do NOT induce vomiting.
Rinse mouth immediately and drink plenty of water.

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

* **Symptoms**
Headache
Gastrointestinal complaints
Unconsciousness
Depression of central nervous system

* **Effects**
Made worse through the drinking of alcohol beverages
Pulmonary oedema
Cyanosis

4.3 Indication of any immediate medical attention and special treatment needed

Notes for the doctor
Treat symptomatically.
Symptoms may be delayed.

* SECTION 5: Firefighting measures

* 5.1 Extinguishing media

* **Suitable extinguishing media**
Extinguishing powder
Carbon dioxide (CO2)
Water spray jet
alcohol resistant foam

Unsuitable extinguishing media
Full water jet

* 5.2 Special hazards arising from the substance or mixture

* **Hazardous combustion products**
In case of fire formation of dangerous gases possible.
Formation of explosive gas mixtures in contact with air.
Carbon monoxide
Carbon dioxide (CO2)

* 5.3 Advice for firefighters

* **Special protective equipment for firefighters**
Wear a self-contained breathing apparatus and chemical protective clothing.

*** Additional information**
If possible, shut off gas valves and move containers to a safe location.
Use water spray jet to protect personnel and to cool endangered containers.
Exposure to fire may cause rupture / explosion of the containers.
Do not extinguish a leaking gas flame unless absolutely necessary. Spontaneous/explosive re-ignition may occur. Extinguish any other fire.
Dispose of fire residues and contaminated extinguishing water in accordance with local, official regulations.

* SECTION 6: Accidental release measures

* 6.1 Personal precautions, protective equipment and emergency procedures

* **For non-emergency personnel**
Use personal protection equipment.
Leave the danger area.
Keep people away and stay on the upwind side.

* **For emergency responders**
Personal protection by wearing close-fitting protective clothing and breathing apparatus.
Eliminate all ignition sources if safe to do so.
Remove persons to safety.

* 6.2 Environmental precautions

If possible, stop flow of product.
Do not allow to enter into soil/subsoil.
Do not allow to enter into surface water or drains.

* 6.3 Methods and material for containment and cleaning up

* **For containment**
If necessary, secure leaky pressure receptacles using a salvage container.
Prevent the liquid from spreading over a wide area (set up barriers, cover sewage systems).
Limit expansion of the gas (water spray jet).

* **For cleaning up**
Absorb with liquid-binding material (sand, diatomaceous earth, acid- or universal binding agents).
Provide adequate ventilation.

6.4 Reference to other sections

Disposal: see section 13
Personal protection equipment: see section 8

* SECTION 7: Handling and storage

* 7.1 Precautions for safe handling

*

Protective measures
Use only in well-ventilated areas.
Transfer and handle product only in closed systems.
Usual measures for fire prevention.
Containers' temperature should not be increased above 50 °C.
The working pressure in the receptacle must not exceed the saturation vapour pressure of the pure product resulting at a temperature of 50 °C.
Prevent cylinders from falling over.
Take precautionary measures against static discharges. Ground barrels and installations. Use only antistatically equipped (spark-free) tools.
Use explosion-proof machinery, apparatus, ventilation facilities, tools etc.
Ensure valve protection device is correctly fitted.
Ensure valve outlet cap nut or plug (where provided) is correctly fitted.
Open valve slowly to avoid pressure shock.
Do not allow backflow into the container.
Entering of water into the container must be prevented.
No water to valves, flanges and other fittings.
Purging of pipes and valves with inert gases - to avoid: water, solvents.

Advices on general occupational hygiene
When using do not eat, drink, smoke, sniff.
Wash hands before breaks and after work.
Remove contaminated clothing and protective equipment before entering eating areas.

* 7.2 Conditions for safe storage, including any incompatibilities

*

Requirements for storage rooms and vessels
All regulations and local requirements for the storage of containers have to be respected.
Keep container tightly closed and in a well-ventilated place.
Containers' temperature should not be increased above 50 °C.
Prevent cylinders from falling over.
Only use containers specifically approved for the substance/product.
Information on suitable materials for receptacles and valves see ISO 11114.

*

Materials to avoid
Do not store together with explosives.
Do not store with gases.
Do not store together with flammable solids.
Do not store together with pyrophoric and self-heating substances.
Do not store together with oxidizing liquids or oxidizing solids.
Do not store together with toxic liquids or toxic solids.
Do not store together with infectious substances.
Do not store together with radioactive material.
Do not store together with food or feed.

* 7.3 Specific end use(s)

*

Recommendation
Exposure scenarios (ES) see annex to this safety data sheet.

* SECTION 8: Exposure controls/personal protection

* 8.1 Control parameters

*

Occupational exposure limit values

CAS No	EC No	Substance name	occupational exposure limit value
75-56-9	200-879-2	1,2-epoxypropane	1 [ml/m³(ppm)] 2,4 [mg/m³] (IE)

*

DNEL worker

CAS No	Substance name	DNEL value	DNEL type	Remark
75-56-9	propylene oxide	2.4 mg/m³	long-term inhalative (local)	
75-56-9	propylene oxide	170 mg/m³	acute inhalative (local)	

* **DNEL Consumer**

CAS No	Substance name	DNEL value	DNEL type	Remark
75-56-9	propylene oxide	0.6 mg/m³	long-term inhalative (local)	Assessment factor 100
75-56-9	propylene oxide	170 mg/m³	acute inhalative (local)	

* **PNEC**

CAS No	Substance name	PNEC Value	PNEC type	Remark
75-56-9	propylene oxide	0.005 mg/L	aquatic, marine water	Assessment factor 10000
75-56-9	propylene oxide	0.019 mg/kg dw	soil	
75-56-9	propylene oxide	0.025 mg/kg dw	sediment, marine water	
75-56-9	propylene oxide	0.052 mg/L	aquatic, freshwater	Assessment factor 1000
75-56-9	propylene oxide	0.245 mg/kg dw	sediment, freshwater	
75-56-9	propylene oxide	0.52 mg/L	aquatic, intermittent release	Assessment factor 100
75-56-9	propylene oxide	10 mg/L	sewage treatment plant (STP)	Assessment factor 10

* **8.2 Exposure controls**

Appropriate engineering controls

Technical measures to prevent exposure
Transfer and handle only in enclosed systems.

* **Personal protection equipment**

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

* **Hand protection**
Safety gloves according to EN 374:
Information on glove material [type, thickness, penetration time/wear time]: IIR, >= 0.6 mm, > 240 min

Body protection:
Safety shoes with steel toecap.
Body covering work clothing or chemical resistant suit at increased risk.

* **Respiratory protection**
Keep self contained breathing apparatus readily available for emergency use.
Respiratory protection necessary at:
high concentrations
Respiratory protection complying with EN 137.
Short term: filter apparatus, filter AX
In case of rescue and maintenance activities in storage containers use environment-independent breathing apparatus because of risk of suffocation due to displacement of oxygen.

* **Environmental exposure controls**

* **Remark**
Prevent release to the environment.

* SECTION 9: Physical and chemical properties

* **9.1 Information on basic physical and chemical properties**

Physical state
liquid

Colour
colourless

Odour
like:
Ether

Safety relevant basis data

	Value	Method	Source, Remark
Odour threshold:			8.4 - 480 mg/m³
Melting point/freezing point			not applicable
Boiling point or initial boiling point and boiling range	34 °C		
flammability			Extremely flammable liquid and vapour (H224).
Lower and upper explosion limit	Upper explosion limit 38.8 Vol-%		
Lower and upper explosion limit	Lower explosion limit 1.9 Vol-%		
Flash point			not applicable
Auto-ignition temperature	430 °C		
Decomposition temperature			No decomposition if used as directed.
pH			not applicable
Viscosity	kinematic 0.374 mm²/s (20°C)		
Solubility(ies)	Water solubility 681 g/L (20°C)		
Partition coefficient n-octanol/water (log value)	0.03		
Vapour pressure	588 hPa (20°C)		
Density and/or relative density			not applicable
Relative vapour density	2		air = 1
particle characteristics			not applicable

* 9.2 Other information

* **Other information**
Vapours are heavier than air.

* SECTION 10: Stability and reactivity

* 10.1 Reactivity

Formation of explosive gas mixtures in contact with air.

* 10.2 Chemical stability

The substance is chemically stable under recommended conditions of storage, use and temperature.

* 10.3 Possibility of hazardous reactions

Reactions with numerous chemical compounds.
Danger of polymerisation
Oxygen
Reactions with acids.
Reactions with oxidising agents.

* 10.4 Conditions to avoid

Heat sources / heat - risk of bursting.
Ignition sources, open flames, glowing metal surfaces, etc.

* 10.5 Incompatible materials

Ammonia
Chlorine
Hydrochloric gas

10.6 Hazardous decomposition products

When handled and stored appropriately, no dangerous decomposition products are known.

* SECTION 11: Toxicological information

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

*** Acute toxicity**

*** Animal data**

	Effective dose	Method,Evaluation	Source, Remark
Acute oral toxicity	CAS No75-56-9 propylene oxide LD50: 382 mg/kg Species Rat	OECD 401	
Acute dermal toxicity	CAS No75-56-9 propylene oxide LD50: 1.5 ml/kg Species Rabbit		
Acute inhalation toxicity	CAS No75-56-9 propylene oxide LC50: 4197 ppm Species Rat Exposure time 4 h	OECD 403	

*** Assessment/classification**
Toxic by inhalation and in contact with skin.
Harmful if swallowed.

*** Skin corrosion/irritation**

Animal data

Result / Evaluation	Method	Source, Remark
non-irritant. Species Rabbit	OECD 431	

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

*** Serious eye damage/irritation**

Animal data

Result / Evaluation	Method	Source, Remark
Irritant. Species Rabbit		

*** Assessment/classification**
Causes serious eye irritation.

*** Sensitisation to the respiratory tract**

*** Assessment/classification**
No data available

*** Skin sensitisation**

Animal data

Result / Evaluation	Dose / Concentration	Method	Source, Remark
not sensitising.	Species Guinea pig		

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

* **Germ cell mutagenicity**

	Value	Method	Result / Evaluation	Remark
In vitro mutagenicity/genotoxicity	Species mouse lymphoma cells		positive	
In vivo mutagenicity/genotoxicity	Species Rat		positive	

* **Assessment/classification**
May cause genetic defects.

* **Carcinogenicity**

Animal data

	Value	Method	Result / Evaluation	Remark
Carcinogenicity	NOAEL(C): 200 ppm Species Rat	OECD 451	positive	

* **Assessment/classification**
May cause cancer.

* **Reproductive toxicity**

Animal data

	Value	Method	Result / Evaluation	Remark
Reproductive toxicity	NOAEL(C): > 300 ppm	OECD 416		

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

* **STOT-single exposure**

* **STOT SE 1 and 2**

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

* **STOT SE 3**

* **Irritation to respiratory tract**

* **Assessment/classification**
May cause respiratory irritation.

* **STOT-repeated exposure**

* **Animal data**

	Effective dose	Method	Specific effects:	Organs affected:	Source, Remark
Inhalative specific target organ toxicity (repeated exposure)	NOAEL(C): 30 ppm Species Rat	OECD 453			

* **Assessment/classification**
May cause damage to the upper respiratory tract and central nervous system through prolonged or repeated exposure if inhaled.

* **Aspiration hazard**

* **Assessment/classification**
Study technically not feasible.

11.2 Information on other hazards

* **Additional information**
Danger of serious damage to health by prolonged exposure.

* SECTION 12: Ecological information

* 12.1 Toxicity

* **Aquatic toxicity**

	Effective dose	Method,Evaluation	Source, Remark
Acute (short-term) fish toxicity	LC50: 52 mg/L Species Oncorhynchus mykiss (Rainbow trout) Test duration 96 h	EPA 660/3-75/009	
Chronic (long-term) fish toxicity	not determined		
Acute (short-term) toxicity to crustacea	EC50 350 mg/L Species Daphnia magna (Big water flea) Test duration 48 h	EPA 660/3-75/009	
Chronic (long-term) toxicity to aquatic invertebrate	not determined		
Acute (short-term) toxicity to algae and cyanobacteria	EC50 240 mg/L Species Pseudokirchneriella subcapitata Test duration 96 h	EPA 660/3-75/009	
Chronic (long-term) toxicity to aquatic algae and cyanobacteria	not determined		
Toxicity to other aquatic plants/organisms	not determined		
Toxicity to microorganisms	NOEC 3 mg/L Test duration 28 d	OECD 301D	

* 12.2 Persistence and degradability

	Value	Method	Source, Remark
Biodegradation	Degradation rate 89 % Test duration 28 d	modif. MITI-test	CAS No75-56-9 propylene oxide Biodegradable.

* 12.3 Bioaccumulative potential

* **Assessment/classification**
Based on the n-octanol/water partition coefficients of the individual components of the mixture, accumulation in organisms is not expected.

* 12.4 Mobility in soil

Assessment/classification
High mobility
Adsorption in soil is not likely.

* 12.5 Results of PBT and vPvB assessment

The substance/mixture does not contain components meeting the PBT/vPvB criteria of the Reach Regulation, Annex XIII, at levels of 0.1% or higher.

* 12.6 Endocrine disrupting properties

No data available

* 12.7 Other adverse effects

No data available

* SECTION 13: Disposal considerations

* 13.1 Waste treatment methods

Waste codes/waste designations according to EWC/AVV

Waste code product	Waste name
160508 *	discarded organic chemicals consisting of or containing hazardous substances

* **Appropriate disposal / Product**
Waste disposal according to directive 2008/98/EC, covering waste and dangerous waste.
Prevent release to the environment. No disposal via the sewage.

* **Appropriate disposal / Package**
Transportable pressure equipment (empty, residual pressure): Return to supplier / manufacturer.

* SECTION 14: Transport information

	Land transport (ADR/RID)	Sea transport (IMDG)	Air transport (ICAO-TI / IATA-DGR)
14.1 UN number or ID number	UN 1280	UN 1280	UN 1280
14.2 UN proper shipping name	PROPYLENE OXIDE	PROPYLENE OXIDE	Propylene oxide
14.3 Transport hazard class(es)	3	3	3
14.4 Packing group	I	I	I
14.5 Environmental hazards	No	No	No

14.6 Special precautions for user

The protective measures listed in Sections 6, 7 and 8 of the Safety Data Sheet have to be considered.

14.7 Maritime transport in bulk according to IMO instruments

No carriage in bulk.

Land transport (ADR/RID)

UN number or ID number	UN 1280
UN proper shipping name	PROPYLENE OXIDE
Transport hazard class(es)	3
Hazard label(s)	3
Classification code	F1
Packing group	I
Environmental hazards	No
Limited quantity (LQ)	0
Special provisions	-
Tunnel restriction code	D/E

* **Sea transport (IMDG)**

UN number or ID number	UN 1280
UN proper shipping name	PROPYLENE OXIDE
Transport hazard class(es)	3
Packing group	I
Environmental hazards	No
Limited quantity (LQ)	0
Marine pollutant	No
EmS	F-E, S-D

*** Air transport (ICAO-TI / IATA-DGR)**

UN number or ID number	UN 1280
UN proper shipping name	Propylene oxide
Transport hazard class(es)	3
Packing group	I
Environmental hazards	No

* SECTION 15: Regulatory information

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

*** EU legislation**

*** Restrictions of occupation**
Observe employment restrictions under the Maternity Protection Directive (92/85/EEC) for expectant or nursing mothers.
Observe restrictions to employment for juvenils according to the 'juvenile work protection guideline' (94/33/EC).

*** Other regulations (EU)**

*** To follow:**
Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), Annex XVII No 3.
Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), Annex XVII No 28 - 30.
Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), Annex XVII No 40.
Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), Annex XVII No 75.
Directive 2012/18/EU on the control of major-accident hazards involving dangerous substances.
National and local regulations concerning chemicals shall be observed.

*** Directive 2010/75/EU on industrial emissions [Industrial Emissions Directive] VOC**
VOC-value ≥ 99.9 %

15.2 Chemical Safety Assessment

*** National regulations**

For this substance a chemical safety assessment has been carried out.

* SECTION 16: Other information

*** Abbreviations and acronyms**
Flam. Liq. 1: Flammable Liquids, Category 1
Acute Tox. 4, H302: Acute Toxicity (oral), Category 4
Acute Tox. 3, H311: Acute toxicity (dermal), Category 3
Eye Irrit. 2: Eye irritation, Category 2
Muta. 1B: Germ cell mutagen, Sub-category 1B
Carc. 1B: Carcinogen, Category 1B
STOT SE 3, H335: Specific target organ toxicity (single exposure), Category 3
Acute Tox. 3, H331: Acute Toxicity (inhalation), Category 3

Key literature references and sources for data
Information from our suppliers and data from the "GESTIS Substances Database" and the "Registered Substances" database of the European Chemicals Agency (ECHA) were used to create this safety data sheet.

*** Additional information**
The information contained herein is based on the state of our knowledge. It characterizes the product with regard to the appropriate safety precautions. It does not represent a guarantee of the properties of the product.

Relevant H- and EUH-phrases (Number and full text)

H224	Extremely flammable liquid and vapour.
H302	Harmful if swallowed.
H311	Toxic in contact with skin.

H319	Causes serious eye irritation.
H331	Toxic if inhaled.
H335	May cause respiratory irritation.
H340	May cause genetic defects.
H350	May cause cancer.

Indication of changes
* Data changed compared with the previous version

Annex: Exposure scenarios

Exposure scenario title	Exposure scenario group	Sector of use	Use descriptors (PROC or PC)	Use descriptors (ERC)
ES01 Manufacture of substance	Industrial	SU 8	PROC 1, PROC 2, PROC 8a, PROC 8b, PROC 15	ERC 1
ES02 Distribution and transport of substance	Industrial	SU 8	PROC 1, PROC 2, PROC 3, PROC 8a, PROC 8b, PROC 9, PROC 15	ERC 2
ES03 Production of polymers	Industrial	SU 8	PROC 1, PROC 2, PROC 3, PROC 8a, PROC 8b, PROC 15	ERC 6c
ES04 Use as an intermediate	Industrial	SU 8	PROC 1, PROC 2, PROC 3, PROC 8a, PROC 8b, PROC 15	ERC 6a

Annex: Exposure scenarios

Exposure scenario 1. Manufacture of substance. - Industrial.

Based on ECHA Template CSA&IR Part D June 08 combined with the GES Narrative Format.

Section 1	
Title.	**propylene oxide.** **Manufacture of substance.** **CAS:75-56-9.**
Sector(s) of Use:	Industrial (SU3).
Environmental Release Category(ies):	ERC1.
Process Category(ies):	PROC1, PROC2, PROC8a, PROC8b, PROC15.
Processes, tasks, activities covered:	Manufacture of the substance or use as a process chemical or extraction agent. Includes recycling/ recovery, material transfers, storage, maintenance and loading (including marine vessel/barge, road/rail car and bulk container), sampling and associated laboratory activities [GES1_I].
Assessment method:	Health: Assessment based on measured data. Environment: Used CHESAR model [EE3] (v2). Assessment based on measured data.
Section 2:	**Operational conditions and risk management measures.**

Section 2.1	**Control of environmental exposure:**
Product Characteristics:	Substance is a unique structure [PrC1]. Non-hydrophobic [PrC4b]. Liquid, vapour pressure > 10 kPa at STP [OC5]. Miscible in water. Harmful to aquatic species. Readily biodegradable [PrC5a]. Low bioaccumulation potential.
Amounts used per site (tonne per year).	500000. (1670000 kg/day.)
Frequency and duration of use:	Continuous process [CS54]. 300 days per year of operation.
Environmental factors not influenced by risk management:	Local freshwater dilution factor [EF1]: 168. Local marine water dilution factor [EF2]: 168.
Other operational conditions of use affecting environmental exposure.	none. Emission Days (days/year) [FD4]: 300. Continuous release [FD2].
Technical onsite conditions and measures to reduce or limit discharges, air emissions.	Treatment of air emissions is not required for the purposes of REACH compliance but may be needed to comply with other environmental legislation. Soil emission controls are not applicable as there is no direct release to soil [TCR4]. Onsite wastewater treatment required [TCR13]. Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ (%) [TCR8]: 99,9. Assumed industrial waste water treatment plant flow (m3/d): 31200.
Organisation measures to prevent/limit release from site.	Bund storage facilities to prevent soil and water pollution in the event of spillage [S5]. Prevent environmental discharge consistent with regulatory requirements [OMS4] Site should have a spill plan to ensure that adequate safeguards are in place to minimize the impact of episodic releases [W2].
Conditions and measures related to municipal sewage treatment plant.	Do not discharge to sewers or drains.
Conditions and measures related to external treatment of waste for disposal.	Estimated amount entering waste treatment no greater than: 0%.
Conditions and measures related to external recovery of waste.	Not applicable.
Other environmental control measures additional to above:	

Section 2.2:	**Control of worker exposure.**
Product Characteristics:	
Physical form of product:	Liquid, vapour pressure > 10 kPa at STP [OC5].
Concentration of substance in product:	Covers percentage substance in the product up to 100 % (unless stated differently) [G13].
Amounts used:	Not applicable.
Frequency and duration of use:	Covers daily exposures up to 8 hours (unless stated differently) [G2]. Continuous process [CS54].
Human factors not influenced by risk management:	none.
Other operational conditions affecting worker exposure:	Assumes a good basic standard of occupational hygiene is implemented [G1]. Assumes activities are at ambient temperature (unless stated differently) [G17].
Technical conditions and measures at a process level to prevent release and technical conditions and measures to control dispersion from source towards workers:	Handle substance within a closed system [E47]. Keep container tightly closed [P233]. □
	Contributing Scenarios:
General measures (carcinogens) [G18]:	Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of 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 [G20].
General measures (eye irritants) [G44].	Use suitable eye protection [PPE26]. Avoid direct eye contact with product, also via contamination on hands [E73]. Avoid splashing [C&H15].

Annex: Exposure scenarios

ES1-CS1: Use in closed process, no likelihood of exposure [PROC 1]. General exposures (closed systems) [CS15].	No specific measures identified [EI18].
ES1-CS2: Use in closed process, no likelihood of exposure [PROC 1]. General exposures (closed systems) [CS15]. Storage [CS67].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. , or, Ensure operation is undertaken outdoors [E69].
ES1-CS3: Use in closed, continuous process with occasional controlled exposure [PROC 2]. General exposures (closed systems) [CS15]. with sample collection [CS56].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. , or, Ensure operation is undertaken outdoors [E69]. Avoid carrying out activities involving exposure for more than 1 hour [OC27]. Sample via a closed loop or other system to avoid exposure [E8].
ES1-CS4: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities [PROC 8a]. Equipment cleaning and maintenance [CS39].	Provide a good standard of controlled ventilation (10 to 15 air changes per hour) [E40]. Wear a respirator conforming to EN140 with Type A filter or better [PPE22]. Change filter cartridge on respirator daily [PPE25]. Avoid carrying out activities involving exposure for more than 1 hour [OC27]. Drain down system prior to equipment break-in or maintenance [E65]. Retain drain downs in sealed storage pending disposal or for subsequent recycle [ENVT4].
ES1-CS5: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities [PROC 8b]. Bulk transfers [CS14]. Dedicated facility [CS81]. marine vessel/barge (un)loading. Road tanker/rail car loading.	Ensure operation is undertaken outdoors [E69]. Avoid carrying out activities involving exposure for more than 1 hour [OC27]. Use dry break couplings for material transfer [E75] , or, Wear a full face respirator conforming to EN140 with Type A/P2 filter or better [PPE32]. Clear transfer lines prior to de-coupling [E39]. Transfer via enclosed lines [E52].
ES1-CS6: Use as laboratory reagent [PROC 15].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Handle in a fume cupboard or under extract ventilation [E83]. Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Section 3:	**Exposure estimation:**
Environment:	Maximum exposure resulting from contributing scenarios described.
ES1-E1: ERC1.	Release fraction to air from process (initial release prior to RMM) [OOC4]: 182kg/day. Release fraction to wastewater from process (initial release prior to RMM) [OOC5]: 430kg/day. Release fraction to soil from process (initial release prior to RMM) [OOC6]: 0.
	PEC for microorganisms in STP: 138E-04mg/l. Risk characterisation ratio: 014E-04. Local PEC in surface water: 8.210E-08mg/l. Risk characterisation ratio: 016E-04. Local PEC in fresh water sediment: 004E-04mg/kgdw. Risk characterisation ratio: 016E-04. Local PEC in sea water during emission episode: 8.190E-08mg/l. Risk characterisation ratio: 164E-04. Local PEC in marine sediment: 004E-04mg/kgdw. Risk characterisation ratio: 154E-04. Local PEC in soil: Not applicable. Risk from environmental exposure is driven by marine water [TCR1c].
Health:	exposure resulting from contributing scenario ES1-CS1: Inhalation (vapour). 8 hour average 0,43mg/m3 - Risk characterisation ratio: 0,086. 15 minute average 1,72mg/m3 - Risk characterisation ratio: 0,01. Dermal: 0,03mg/kg/day.
	exposure resulting from contributing scenario ES1-CS2: Inhalation (vapour). 8 hour average 0,61mg/m3 - Risk characterisation ratio: 0,122. 15 minute average 2,44mg/m3 - Risk characterisation ratio: 0,01. Dermal: 0,03mg/kg/day.
	exposure resulting from contributing scenario ES1-CS3: Inhalation (vapour). 8 hour average 0,61mg/m3 - Risk characterisation ratio: 0,122. 15 minute average 12,2mg/m3 - Risk characterisation ratio: 0,07. Dermal: 0,27mg/kg/day.
	exposure resulting from contributing scenario ES1-CS4: Inhalation (vapour). 8 hour average 0,73mg/m3 - Risk characterisation ratio: 0,145. 15 minute average 14,5mg/m3 - Risk characterisation ratio: 0,09. Dermal: 2,7mg/kg/day.
	exposure resulting from contributing scenario ES1-CS5: Inhalation (vapour). 8 hour average 0,11mg/m3 - Risk characterisation ratio: 0,022. 15 minute average 2,2mg/m3 - Risk characterisation ratio: 0,01. Dermal: 2,7mg/kg/day.
	exposure resulting from contributing scenario ES1-CS6: Inhalation (vapour). 8 hour average 0,59mg/m3 - Risk characterisation ratio: 0,118. 15 minute average 11,8mg/m3 - Risk characterisation ratio: 0,07. Dermal: 0,068mg/kg/day.
	Risk management measures described will protect against acute exposure. It is not possible to derive a DNEL for this end point. Available hazard data do not enable the derivation of a DNEL for dermal irritant effects [G32]. Risk Management Measures are based on qualitative risk characterisation [G37]. Available hazard data do not enable the derivation of a DNEL for eye irritant effects [G45].
Section 4:	**Guidance to check compliance with the exposure scenario**
Environment:	Msafe: 102000000kg/day. 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 [DSU1].
	$\frac{m_{spERC} * (1 - E_{ER,spERC}) * F_{release,spERC}}{DF_{spERC}} \geq \frac{m_{site} * (1 - E_{ER,site}) * F_{release,site}}{DF_{site}}$

Annex: Exposure scenarios

	where: mspERC: Substance use rate in spERC. EER,spERC: Efficacy of RMM in spERC. Frelease,,spERC: Initial release fraction in spERC. DFspERC: dilution factor of STP effluent in river. msite: Susbstance use rate at site. EER,site: Efficacy of RMM at site. Frelease,,site: Initial release fraction at site. DFsite: dilution factor of STP effluent in river.
	If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required [DSU8].
Health:	Inhalation (vapour). No corrections required as all exposures are assumed to be substance concentrations of up to 100%.
	Dermal: No corrections required as all exposures are assumed to be substance concentrations of up to 100%.

Annex: Exposure scenarios

Exposure scenario 2. Distribution of substance. - Industrial.

Based on ECHA Template CSA&IR Part D June 08 combined with the GES Narrative Format.

Section 1	
Title.	**propylene oxide.** **Distribution of substance.** **CAS:75-56-9.**
Sector(s) of Use:	Industrial (SU3).
Environmental Release Category(ies):	ERC2.
Process Category(ies):	PROC1, PROC2, PROC3, PROC8a, PROC8b, PROC9, PROC15.
Processes, tasks, activities covered:	Loading (including marine vessel/barge, rail/road car and IBC loading) and repacking (including drums and small packs) of substance, including its sampling, storage, unloading distribution and associated laboratory activities [GES1A_I].
Assessment method:	Health: Used CHESAR model [EE3] Environment: Used CHESAR model [EE3] Assessment based on measured data.
Section 2:	**Operational conditions and risk management measures.**

Section 2.1	**Control of environmental exposure:**
Product Characteristics:	Substance is a unique structure [PrC1]. Non-hydrophobic [PrC4b]. Liquid, vapour pressure > 10 kPa at STP [OC5]. Miscible in water. Harmful to aquatic species. Readily biodegradable [PrC5a]. Low bioaccumulation potential.
Amounts used per site (tonne per year).	330. (1100 kg/day.)
Frequency and duration of use:	Continuous process [CS54]. 300 days per year of operation.
Environmental factors not influenced by risk management:	Local freshwater dilution factor [EF1]: 168. Local marine water dilution factor [EF2]: 168.
Other operational conditions of use affecting environmental exposure.	none. Emission Days (days/year) [FD4]: 300. Continuous release [FD2].
Technical onsite conditions and measures to reduce or limit discharges, air emissions.	Treatment of air emissions is not required for the purposes of REACH compliance but may be needed to comply with other environmental legislation. Soil emission controls are not applicable as there is no direct release to soil [TCR4]. Onsite wastewater treatment required [TCR13]. Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ (%) [TCR8]: 99,9. Assumed industrial waste water treatment plant flow (m3/d): 31200.
Organisation measures to prevent/limit release from site.	Bund storage facilities to prevent soil and water pollution in the event of spillage [S5]. Prevent environmental discharge consistent with regulatory requirements [OMS4] Site should have a spill plan to ensure that adequate safeguards are in place to minimize the impact of episodic releases [W2].
Conditions and measures related to municipal sewage treatment plant.	Do not discharge to sewers or drains.
Conditions and measures related to external treatment of waste for disposal.	Estimated amount entering waste treatment no greater than: 0%.
Conditions and measures related to external recovery of waste.	Not applicable.
Other environmental control measures additional to above:	

Section 2.2:	**Control of worker exposure.**
Product Characteristics:	
Physical form of product:	Liquid, vapour pressure > 10 kPa at STP [OC5].
Concentration of substance in product:	Covers percentage substance in the product up to 100 % (unless stated differently) [G13].
Amounts used:	Not applicable.
Frequency and duration of use:	Covers daily exposures up to 8 hours (unless stated differently) [G2]. Continuous process [CS54].
Human factors not influenced by risk management:	none.
Other operational conditions affecting worker exposure:	Assumes a good basic standard of occupational hygiene is implemented [G1]. Assumes activities are at ambient temperature (unless stated differently) [G17].
Technical conditions and measures at a process level to prevent release and technical conditions and measures to control dispersion from source towards workers:	Handle substance within a closed system [E47]. Keep container tightly closed [P233]. □
	Contributing Scenarios:
General measures (carcinogens) [G18]:	Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of 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 [G20].
General measures (eye irritants) [G44].	Use suitable eye protection [PPE26]. Avoid direct eye contact with product, also via contamination on hands [E73]. Avoid splashing [C&H15].

Annex: Exposure scenarios

ES2-CS1: Use in closed process, no likelihood of exposure [PROC 1]. General exposures (closed systems) [CS15].	No specific measures identified [EI18].
ES2-CS2: Use in closed process, no likelihood of exposure [PROC 1]. General exposures (closed systems) [CS15]. Storage [CS67]. with sample collection [CS56].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. , or, Ensure operation is undertaken outdoors [E69]. Ensure dedicated sample points are provided [E10].
ES2-CS3: Use in closed, continuous process with occasional controlled exposure [PROC 2]. General exposures (closed systems) [CS15]. with sample collection [CS56].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. , or, Ensure operation is undertaken outdoors [E69]. Avoid carrying out activities involving exposure for more than 1 hour [OC27]. Sample via a closed loop or other system to avoid exposure [E8].
ES2-CS4: Use in closed batch process (synthesis or formulation) [PROC 3]. General exposures (closed systems) [CS15]. Batch process [CS55]. with sample collection [CS56].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Handle substance within a predominantly closed system provided with extract ventilation [E49]. Avoid carrying out activities involving exposure for more than 15 minutes [OC26].
ES2-CS5: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities [PROC 8a]. Equipment cleaning and maintenance [CS39].	Provide a good standard of controlled ventilation (10 to 15 air changes per hour) [E40]. Wear a respirator conforming to EN140 with Type A filter or better [PPE22]. Change filter cartridge on respirator daily [PPE25]. Avoid carrying out activities involving exposure for more than 1 hour [OC27]. Drain down system prior to equipment break-in or maintenance [E65]. Retain drain downs in sealed storage pending disposal or for subsequent recycle [ENVT4].
ES2-CS6: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities [PROC 8b]. General exposures (closed systems) [CS15]. Dedicated facility [CS81]. marine vessel/barge (un)loading. Road tanker/rail car loading.	Ensure operation is undertaken outdoors [E69]. Avoid carrying out activities involving exposure for more than 1 hour [OC27]. Use dry break couplings for material transfer [E75] , or, Wear a full face respirator conforming to EN140 with Type A/P2 filter or better [PPE32]. Clear transfer lines prior to de-coupling [E39]. Transfer via enclosed lines [E52].
ES2-CS7: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) [PROC 9]. Drum and small package filling [CS6]. Dedicated facility [CS81].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Fill containers/cans at dedicated fill points supplied with local extract ventilation [E51]. Wear a respirator conforming to EN140 with Type A filter or better [PPE22]. Change filter cartridge on respirator daily [PPE25]. Avoid carrying out activities involving exposure for more than 1 hour [OC27].
ES2-CS8: Use as laboratory reagent [PROC 15].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Handle in a fume cupboard or under extract ventilation [E83]. Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Section 3:	**Exposure estimation:**
Environment:	Maximum exposure resulting from contributing scenarios described.
ES2-E1: ERC2.	Release fraction to air from process (initial release prior to RMM) [OOC4]: 0,121kg/day. Release fraction to wastewater from process (initial release prior to RMM) [OOC5]: 0,286kg/day. Release fraction to soil from process (initial release prior to RMM) [OOC6]: 0.
	PEC for microorganisms in STP: 917E-08mg/l. Risk characterisation ratio: 092E-08. Local PEC in surface water: 039E-08mg/l. Risk characterisation ratio: 752E-08. Local PEC in fresh water sediment: 184E-08mg/kgdw. Risk characterisation ratio: 751E-08. Local PEC in sea water during emission episode: 008E-08mg/l. Risk characterisation ratio: 1.634E-08. Local PEC in marine sediment: 039E-08mg/kgdw. Risk characterisation ratio: 1.544E-08. Local PEC in soil: Not applicable. Risk from environmental exposure is driven by marine water [TCR1c].
Health:	exposure resulting from contributing scenario ES2-CS1: Inhalation (vapour). 8 hour average 0,024mg/m3 - Risk characterisation ratio: 0,005. 15 minute average 0,0967mg/m3 - Risk characterisation ratio: <0.001. Dermal: 0,03mg/kg/day.
	exposure resulting from contributing scenario ES2-CS2: Inhalation (vapour). 8 hour average 0,017mg/m3 - Risk characterisation ratio: 0,003. 15 minute average 0,0677mg/m3 - Risk characterisation ratio: <0.001. Dermal: 0,03mg/kg/day.
	exposure resulting from contributing scenario ES2-CS3: Inhalation (vapour). 8 hour average 0,85mg/m3 - Risk characterisation ratio: 0,169. 15 minute average 16,9mg/m3 - Risk characterisation ratio: 0,1. Dermal: 0,27mg/kg/day.
	exposure resulting from contributing scenario ES2-CS4: Inhalation (vapour). 8 hour average 0,85mg/m3 - Risk characterisation ratio: 0,169. 15 minute average 33,8mg/m3 - Risk characterisation ratio: 0,2. Dermal: 0,069mg/kg/day.
	exposure resulting from contributing scenario ES2-CS5: Inhalation (vapour). 8 hour average 0,73mg/m3 - Risk characterisation ratio: 0,145. 15 minute average 14,5mg/m3 - Risk characterisation ratio: 0,09. Dermal: 2,7mg/kg/day.
	exposure resulting from contributing scenario ES2-CS6: Inhalation (vapour). 8 hour average 0,11mg/m3 - Risk characterisation ratio: 0,022. 15 minute average 2,2mg/m3 - Risk characterisation ratio: 0,01. Dermal: 2,7mg/kg/day.
	exposure resulting from contributing scenario ES2-CS7: Inhalation (vapour). 8 hour average 0,68mg/m3 - Risk characterisation ratio: 0,135. 15 minute average 13,5mg/m3 - Risk characterisation ratio: 0,08. Dermal: 1,4mg/kg/day.
	exposure resulting from contributing scenario ES2-CS8: Inhalation (vapour). 8 hour average 0,59mg/m3 - Risk characterisation ratio: 0,118. 15 minute average 11,8mg/m3 - Risk characterisation ratio: 0,07. Dermal: 0,068mg/kg/day.

Annex: Exposure scenarios

	Risk management measures described will protect against acute exposure. It is not possible to derive a DNEL for this end point. Available hazard data do not enable the derivation of a DNEL for dermal irritant effects [G32]. Risk Management Measures are based on qualitative risk characterisation [G37]. Available hazard data do not enable the derivation of a DNEL for eye irritant effects [G45].
Section 4:	**Guidance to check compliance with the exposure scenario**
Environment:	Msafe: 67300000kg/day. 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 [DSU1].
	$\frac{m_{spERC} * (1 - E_{ER,spERC}) * F_{release,spERC}}{DF_{spERC}} \geq \frac{m_{site} * (1 - E_{ER,site}) * F_{release,site}}{DF_{site}}$ where: mspERC: Substance use rate in spERC. EER,spERC: Efficacy of RMM in spERC. Frelease,,spERC: Initial release fraction in spERC. DFspERC: dilution factor of STP effluent in river. msite: Susbstance use rate at site. EER,site: Efficacy of RMM at site. Frelease,,site: Initial release fraction at site. DFsite: dilution factor of STP effluent in river.
	If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required [DSU8].
Health:	Inhalation (vapour). No corrections required as all exposures are assumed to be substance concentrations of up to 100%.
	Dermal: No corrections required as all exposures are assumed to be substance concentrations of up to 100%.

Annex: Exposure scenarios

Exposure scenario 3. Polymer production. - Industrial.

Based on ECHA Template CSA&IR Part D June 08 combined with the GES Narrative Format.

Section 1	
Title.	**propylene oxide.** **Polymer production.** **CAS:75-56-9.**
Sector(s) of Use:	Industrial (SU3).
Environmental Release Category(ies):	ERC6c.
Process Category(ies):	PROC1, PROC2, PROC3, PROC8a, PROC8b, PROC15.
Processes, tasks, activities covered:	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) [GES20_I].
Assessment method:	Health: Used CHESAR model [EE3] Environment: Used CHESAR model [EE3] (v3).
Section 2:	**Operational conditions and risk management measures.**

Section 2.1	**Control of environmental exposure:**
Product Characteristics:	Substance is a unique structure [PrC1]. Non-hydrophobic [PrC4b]. Liquid, vapour pressure > 10 kPa at STP [OC5]. Miscible in water. Harmful to aquatic species. Readily biodegradable [PrC5a]. Low bioaccumulation potential.
Amounts used per site (tonne per year).	32500. (108000 kg/day.)
Frequency and duration of use:	Continuous process [CS54]. 300 days per year of operation.
Environmental factors not influenced by risk management:	Local freshwater dilution factor [EF1]: 168. Local marine water dilution factor [EF2]: 168.
Other operational conditions of use affecting environmental exposure.	none. Emission Days (days/year) [FD4]: 300. Continuous release [FD2].
Technical onsite conditions and measures to reduce or limit discharges, air emissions.	Treatment of air emissions is not required for the purposes of REACH compliance but may be needed to comply with other environmental legislation. Soil emission controls are not applicable as there is no direct release to soil [TCR4]. Onsite wastewater treatment required [TCR13]. Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ (%) [TCR8]: 95. Assumed industrial waste water treatment plant flow (m3/d): 31200.
Organisation measures to prevent/limit release from site.	Bund storage facilities to prevent soil and water pollution in the event of spillage [S5]. Prevent environmental discharge consistent with regulatory requirements [OMS4] Site should have a spill plan to ensure that adequate safeguards are in place to minimize the impact of episodic releases [W2].
Conditions and measures related to municipal sewage treatment plant.	Do not discharge to sewers or drains.
Conditions and measures related to external treatment of waste for disposal.	Estimated amount entering waste treatment no greater than: 0%.
Conditions and measures related to external recovery of waste.	Not applicable.
Other environmental control measures additional to above:	

Section 2.2:	**Control of worker exposure.**
Product Characteristics:	
Physical form of product:	Liquid, vapour pressure > 10 kPa at STP [OC5].
Concentration of substance in product:	Covers percentage substance in the product up to 100 % (unless stated differently) [G13].
Amounts used:	Not applicable.
Frequency and duration of use:	Covers daily exposures up to 8 hours (unless stated differently) [G2]. Continuous process [CS54].
Human factors not influenced by risk management:	none.
Other operational conditions affecting worker exposure:	Assumes a good basic standard of occupational hygiene is implemented [G1]. Assumes activities are at ambient temperature (unless stated differently) [G17].
Technical conditions and measures at a process level to prevent release and technical conditions and measures to control dispersion from source towards workers:	Handle substance within a closed system [E47]. Keep container tightly closed [P233]. □
	Contributing Scenarios:
General measures (carcinogens) [G18]:	Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of 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 [G20].
General measures (eye irritants) [G44].	Use suitable eye protection [PPE26]. Avoid direct eye contact with product, also via contamination on hands [E73]. Avoid splashing [C&H15].

Annex: Exposure scenarios

ES3-CS1: Use in closed process, no likelihood of exposure [PROC 1]. General exposures (closed systems) [CS15]. Continuous process [CS54].	No specific measures identified [EI18].
ES3-CS2: Use in closed, continuous process with occasional controlled exposure [PROC 2]. General exposures (closed systems) [CS15]. Continuous process [CS54]. Polymer production. with sample collection [CS56].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Avoid carrying out activities involving exposure for more than 1 hour [OC27]. Sample via a closed loop or other system to avoid exposure [E8].
ES3-CS3: Use in closed batch process (synthesis or formulation) [PROC 3]. General exposures (closed systems) [CS15]. with sample collection [CS56]. Polymerisation (bulk and batch) [CS65].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Avoid carrying out activities involving exposure for more than 1 hour [OC27]. Sample via a closed loop or other system to avoid exposure [E8].
ES3-CS4: Use in closed batch process (synthesis or formulation) [PROC 3]. General exposures (closed systems) [CS15]. Batch process [CS55]. Finishing operations [CS102]. with sample collection [CS56].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Avoid carrying out activities involving exposure for more than 1 hour [OC27]. Sample via a closed loop or other system to avoid exposure [E8].
ES3-CS5: Use in closed batch process (synthesis or formulation) [PROC 3]. General exposures (closed systems) [CS15]. Additivation and stabilisation [CS69]. with sample collection [CS56].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Avoid carrying out activities involving exposure for more than 1 hour [OC27]. Sample via a closed loop or other system to avoid exposure [E8].
ES3-CS6: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities [PROC 8a]. Equipment cleaning and maintenance [CS39].	Provide a good standard of controlled ventilation (10 to 15 air changes per hour) [E40]. Wear a respirator conforming to EN140 with Type A filter or better [PPE22]. Change filter cartridge on respirator daily [PPE25]. Avoid carrying out activities involving exposure for more than 1 hour [OC27]. Drain down and flush system prior to equipment break-in or maintenance [E55]. Retain drain downs in sealed storage pending disposal or for subsequent recycle [ENVT4].
ES3-CS7: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities [PROC 8b]. General exposures (open systems) [CS16]. Dedicated facility [CS81]. marine vessel/barge (un)loading. Road tanker/rail car loading.	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Ensure material transfers are under containment or extract ventilation [E66]. Avoid carrying out activities involving exposure for more than 15 minutes [OC26].
ES3-CS8: Use as laboratory reagent [PROC 15].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Handle in a fume cupboard or under extract ventilation [E83]. Avoid carrying out activities involving exposure for more than 1 hour [OC27].
Section 3:	**Exposure estimation:**
Environment:	Maximum exposure resulting from contributing scenarios described.
ES3-E1: ERC6c.	Release fraction to air from process (initial release prior to RMM) [OOC4]: 0,00004. Release fraction to wastewater from process (initial release prior to RMM) [OOC5]: 0,00007. Release fraction to soil from process (initial release prior to RMM) [OOC6]: 0.
	PEC for microorganisms in STP: 193E-04mg/l. Risk characterisation ratio: 019E-04. Local PEC in surface water: 001E-04mg/l. Risk characterisation ratio: 022E-04. Local PEC in fresh water sediment: 005E-04mg/kgdw. Risk characterisation ratio: 022E-04. Local PEC in sea water during emission episode: 001E-04mg/l. Risk characterisation ratio: 230E-04. Local PEC in marine sediment: 005E-04mg/kgdw. Risk characterisation ratio: 217E-04. Local PEC in soil: Not applicable. Risk from environmental exposure is driven by marine water [TCR1c].
Health:	exposure resulting from contributing scenario ES3-CS1: Inhalation (vapour). 8 hour average 0,024mg/m3 - Risk characterisation ratio: 0,005. 15 minute average 0,0967mg/m3 - Risk characterisation ratio: <0.001. Dermal: 0,03mg/kg/day.
	exposure resulting from contributing scenario ES3-CS2: Inhalation (vapour). 8 hour average 0,85mg/m3 - Risk characterisation ratio: 0,169. 15 minute average 16,9mg/m3 - Risk characterisation ratio: 0,1. Dermal: 0,27mg/kg/day.
	exposure resulting from contributing scenario ES3-CS3: Inhalation (vapour). 8 hour average 1,7mg/m3 - Risk characterisation ratio: 0,338. 15 minute average 33,8mg/m3 - Risk characterisation ratio: 0,2. Dermal: 0,14mg/kg/day.
	exposure resulting from contributing scenario ES3-CS4: Inhalation (vapour). 8 hour average 1,7mg/m3 - Risk characterisation ratio: 0,338. 15 minute average 33,8mg/m3 - Risk characterisation ratio: 0,2. Dermal: 0,14mg/kg/day.
	exposure resulting from contributing scenario ES3-CS5: Inhalation (vapour). 8 hour average 1,7mg/m3 - Risk characterisation ratio: 0,338. 15 minute average 33,8mg/m3 - Risk characterisation ratio: 0,2. Dermal: 0,14mg/kg/day.
	exposure resulting from contributing scenario ES3-CS6: Inhalation (vapour). 8 hour average 0,36mg/m3 - Risk characterisation ratio: 0,073. 15 minute average 7,25mg/m3 - Risk characterisation ratio: 0,04. Dermal: 2,7mg/kg/day.

Annex: Exposure scenarios

	exposure resulting from contributing scenario ES3-CS8: Inhalation (vapour). 8 hour average 0,59mg/m3 - Risk characterisation ratio: 0,118. 15 minute average 11,8mg/m3 - Risk characterisation ratio: 0,07. Dermal: 0,068mg/kg/day.
	Risk management measures described will protect against acute exposure. It is not possible to derive a DNEL for this end point. Available hazard data do not enable the derivation of a DNEL for dermal irritant effects [G32]. Risk Management Measures are based on qualitative risk characterisation [G37]. Available hazard data do not enable the derivation of a DNEL for eye irritant effects [G45].
Section 4:	**Guidance to check compliance with the exposure scenario**
Environment:	Msafe: 4700000kg/day. 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 [DSU1].
	$\frac{m_{spERC} * (1 - E_{ER,spERC}) * F_{release,spERC}}{DF_{spERC}} \geq \frac{m_{site} * (1 - E_{ER,site}) * F_{release,site}}{DF_{site}}$ where: mspERC: Substance use rate in spERC. EER,spERC: Efficacy of RMM in spERC. Frelease,,spERC: Initial release fraction in spERC. DFspERC: dilution factor of STP effluent in river. msite: Susbstance use rate at site. EER,site: Efficacy of RMM at site. Frelease,,site: Initial release fraction at site. DFsite: dilution factor of STP effluent in river.
	If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required [DSU8].
Health:	Inhalation (vapour). No corrections required as all exposures are assumed to be substance concentrations of up to 100%.
	Dermal: No corrections required as all exposures are assumed to be substance concentrations of up to 100%.

Annex: Exposure scenarios

Exposure scenario 4. Use as an intermediate. - Industrial.

Based on ECHA Template CSA&IR Part D June 08 combined with the GES Narrative Format.

Section 1	
Title.	**propylene oxide.** **Use as an intermediate.** **CAS:75-56-9.**
Sector(s) of Use:	Industrial (SU3).
Environmental Release Category(ies):	ERC6c.
Process Category(ies):	PROC1, PROC2, PROC3, PROC8a, PROC8b, PROC15.
Processes, tasks, activities covered:	Use of substance as an intermediate (not related to Strictly Controlled Conditions). Includes recycling/ recovery, material transfers, storage, sampling, associated laboratory activities, maintenance and loading (including marine vessel/barge, road/rail car and bulk container) [GES1B_I].
Assessment method:	Health: Used CHESAR model [EE3] Environment: Used CHESAR model [EE3] (v3). Assessment based on measured data.
Section 2:	**Operational conditions and risk management measures.**

Section 2.1	**Control of environmental exposure:**
Product Characteristics:	Substance is a unique structure [PrC1]. Non-hydrophobic [PrC4b]. Liquid, vapour pressure > 10 kPa at STP [OC5]. Miscible in water. Harmful to aquatic species. Readily biodegradable [PrC5a]. Low bioaccumulation potential.
Amounts used per site (tonne per year).	32500. (108000 kg/day.)
Frequency and duration of use:	Continuous process [CS54]. 300 days per year of operation.
Environmental factors not influenced by risk management:	Local freshwater dilution factor [EF1]: 168. Local marine water dilution factor [EF2]: 168.
Other operational conditions of use affecting environmental exposure.	none. Emission Days (days/year) [FD4]: 300. Continuous release [FD2].
Technical onsite conditions and measures to reduce or limit discharges, air emissions.	Treatment of air emissions is not required for the purposes of REACH compliance but may be needed to comply with other environmental legislation. Soil emission controls are not applicable as there is no direct release to soil [TCR4]. Onsite wastewater treatment required [TCR13]. Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency of ≥ (%) [TCR8]: 95. Assumed industrial waste water treatment plant flow (m3/d): 31200.
Organisation measures to prevent/limit release from site.	Bund storage facilities to prevent soil and water pollution in the event of spillage [S5]. Prevent environmental discharge consistent with regulatory requirements [OMS4] Site should have a spill plan to ensure that adequate safeguards are in place to minimize the impact of episodic releases [W2].
Conditions and measures related to municipal sewage treatment plant.	Do not discharge to sewers or drains.
Conditions and measures related to external treatment of waste for disposal.	Estimated amount entering waste treatment no greater than: 0%.
Conditions and measures related to external recovery of waste.	Not applicable.
Other environmental control measures additional to above:	

Section 2.2:	**Control of worker exposure.**
Product Characteristics:	
Physical form of product:	Liquid, vapour pressure > 10 kPa at STP [OC5].
Concentration of substance in product:	Covers percentage substance in the product up to 100 % (unless stated differently) [G13].
Amounts used:	Not applicable.
Frequency and duration of use:	Covers daily exposures up to 8 hours (unless stated differently) [G2]. Continuous process [CS54].
Human factors not influenced by risk management:	none.
Other operational conditions affecting worker exposure:	Assumes a good basic standard of occupational hygiene is implemented [G1]. Assumes activities are at ambient temperature (unless stated differently) [G17].
Technical conditions and measures at a process level to prevent release and technical conditions and measures to control dispersion from source towards workers:	Handle substance within a closed system [E47]. Keep container tightly closed [P233]. □
	Contributing Scenarios:
General measures (carcinogens) [G18]:	Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of 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 [G20].
General measures (eye irritants) [G44].	Use suitable eye protection [PPE26]. Avoid direct eye contact with product, also via contamination on hands [E73]. Avoid splashing [C&H15].

Annex: Exposure scenarios

ES4-CS1: Use in closed process, no likelihood of exposure [PROC 1]. General exposures (closed systems) [CS15]. Continuous process [CS54].	No specific measures identified [EI18].
ES4-CS2: Use in closed process, no likelihood of exposure [PROC 1]. General exposures (closed systems) [CS15]. Storage [CS67]. with sample collection [CS56].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. , or, Ensure operation is undertaken outdoors [E69].
ES4-CS3: Use in closed, continuous process with occasional controlled exposure [PROC 2]. General exposures (closed systems) [CS15]. Continuous process [CS54]. with sample collection [CS56].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Avoid carrying out activities involving exposure for more than 4 hours [OC28]. Sample via a closed loop or other system to avoid exposure [E8].
ES4-CS4: Use in closed batch process (synthesis or formulation) [PROC 3]. General exposures (closed systems) [CS15]. Batch process [CS55]. with sample collection [CS56].	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. Avoid carrying out activities involving exposure for more than 1 hour [OC27]. Sample via a closed loop or other system to avoid exposure [E8].
ES4-CS5: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities [PROC 8a]. Equipment cleaning and maintenance [CS39].	Provide a good standard of controlled ventilation (10 to 15 air changes per hour) [E40]. Wear a full face respirator conforming to EN140 with Type A filter or better [PPE24]. Change filter cartridge on respirator daily [PPE25]. Avoid carrying out activities involving exposure for more than 4 hours [OC28]. Drain down system prior to equipment break-in or maintenance [E65].
ES4-CS6: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities [PROC 8b]. General exposures (closed systems) [CS15]. Dedicated facility [CS81]. marine vessel/barge (un)loading. Road tanker/rail car loading.	Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour) [E11]. , or, Ensure operation is undertaken outdoors [E69]. Avoid carrying out activities involving exposure for more than 1 hour [OC27]. Use dry break couplings for material transfer [E75] , or, Wear a full face respirator conforming to EN140 with Type A filter or better [PPE24].
ES4-CS5: Use as laboratory reagent [PROC 15].	Provide a good standard of controlled ventilation (10 to 15 air changes per hour) [E40]. Handle in a fume cupboard or under extract ventilation [E83].
Section 3:	**Exposure estimation:**
Environment:	Maximum exposure resulting from contributing scenarios described.
ES4-E1: ERC6c.	Release fraction to air from process (initial release prior to RMM) [OOC4]: 0,00004. Release fraction to wastewater from process (initial release prior to RMM) [OOC5]: 0,00007. Release fraction to soil from process (initial release prior to RMM) [OOC6]: 0.
	PEC for microorganisms in STP: 193E-04mg/l. Risk characterisation ratio: 019E-04. Local PEC in surface water: 001E-04mg/l. Risk characterisation ratio: 022E-04. Local PEC in fresh water sediment: 005E-04mg/kgdw. Risk characterisation ratio: 022E-04. Local PEC in sea water during emission episode: 001E-04mg/l. Risk characterisation ratio: 230E-04. Local PEC in marine sediment: 005E-04mg/kgdw. Risk characterisation ratio: 217E-04. Local PEC in soil: Not applicable. Risk from environmental exposure is driven by marine water [TCR1c].
Health:	exposure resulting from contributing scenario ES4-CS1: Inhalation (vapour). 8 hour average 0,024mg/m3 - Risk characterisation ratio: 0,005. 15 minute average 0,0967mg/m3 - Risk characterisation ratio: <0.001. Dermal: 0,03mg/kg/day.
	exposure resulting from contributing scenario ES4-CS2: Inhalation (vapour). 8 hour average 0,017mg/m3 - Risk characterisation ratio: 0,003. 15 minute average 0,0677mg/m3 - Risk characterisation ratio: <0.001. Dermal: 0,03mg/kg/day.
	exposure resulting from contributing scenario ES4-CS3: Inhalation (vapour). 8 hour average 0,21mg/m3 - Risk characterisation ratio: 0,042. 15 minute average 1,4mg/m3 - Risk characterisation ratio: 0,01. Dermal: 0,82mg/kg/day.
	exposure resulting from contributing scenario ES4-CS4: Inhalation (vapour). 8 hour average 0,21mg/m3 - Risk characterisation ratio: 0,042. 15 minute average 4,2mg/m3 - Risk characterisation ratio: 0,02. Dermal: 0,14mg/kg/day.
	exposure resulting from contributing scenario ES4-CS5: Inhalation (vapour). 8 hour average 1,1mg/m3 - Risk characterisation ratio: 0,218. 15 minute average 7,25mg/m3 - Risk characterisation ratio: 0,04. Dermal: 8,2mg/kg/day.
	exposure resulting from contributing scenario ES4-CS6: Inhalation (vapour). 8 hour average 0,11mg/m3 - Risk characterisation ratio: 0,022. 15 minute average 2,2mg/m3 - Risk characterisation ratio: 0,01. Dermal: 2,7mg/kg/day.
	exposure resulting from contributing scenario ES4-CS5: Inhalation (vapour). 8 hour average 0,59mg/m3 - Risk characterisation ratio: 0,118. 15 minute average 2,36mg/m3 - Risk characterisation ratio: 0,01. Dermal: 0,34mg/kg/day.
	Risk management measures described will protect against acute exposure. It is not possible to derive a DNEL for this end point. Available hazard data do not enable the derivation of a DNEL for dermal irritant effects [G32]. Risk Management Measures are based on qualitative risk characterisation [G37]. Available hazard data do not enable the derivation of a DNEL for eye irritant effects [G45].
Section 4:	**Guidance to check compliance with the exposure scenario**
Environment:	Msafe: 4700000kg/day. 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 [DSU1].

Annex: Exposure scenarios

	$\frac{m_{spERC} * (1 - E_{ER,spERC}) * F_{release,spERC}}{DF_{spERC}} \geq \frac{m_{site} * (1 - E_{ER,site}) * F_{release,site}}{DF_{site}}$ where: mspERC: Substance use rate in spERC. EER,spERC: Efficacy of RMM in spERC. Frelease,,spERC: Initial release fraction in spERC. DFspERC: dilution factor of STP effluent in river. msite: Susbstance use rate at site. EER,site: Efficacy of RMM at site. Frelease,,site: Initial release fraction at site. DFsite: dilution factor of STP effluent in river.
	If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required [DSU8].
Health:	Inhalation (vapour). No corrections required as all exposures are assumed to be substance concentrations of up to 100%.
	Dermal: No corrections required as all exposures are assumed to be substance concentrations of up to 100%.