1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

1.1. Substance Identification

Trade name	**1,2-Propylene oxide**
IUPAC name	1,2- Epoxypropane
Synonym	methyloxirane, methyl ethylene oxide
EC#	200-879-2
CAS #	75-56-9
Molecular Formula	C_3H_6O
Molecular weight	58.1
REACH Registration number	01-2119480483-35-0076
Chemical characterization	Mono-constituent substance-organic

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

Uses by workers in industrial settings
- distribution of the substance
- polymer production;
- intermediate

Uses by professional workers

-laboratory use

Uses advised against

No uses identified to be advised against.

1.3. Details of the supplier of the safety data sheet

Name	S.C. OLTCHIM S.A
Address	1 Uzinei Street, 240050 Ramnicu Valcea, Romania
Phone N°	+40 250 701 200

FAX N°	+40 250 735 030
E-mail of competent person responsible for SDS in the MS or in the EU:	tehnic@oltchim.ro

1.4. Emergency telephone

European Emergency N°:	112
Emergency telephone at the company:	+40/250/738141
Available outside office hours:	24h/day/365days

2. HAZARD IDENTIFICATION

2.1.Classification of the substance

2.1.1.Classification according to Regulation (EC) 1272/2008

Flamamble liquid
Acute Toxicitycateg.4
STOT SE 3 – Acute toxicity- irreversible damage after single exposure Iritant pile 2
Eye irritation 2
Carcinogen 1B
Mutagen 1B

Recommended Changes to Classification Hazard Categories to Annex VI Table 3.1

Endpoints	Classification	Reason for no classification
Irritation / Corrosion	Eye Category 2 STOT SE- Cat 3 for Respiratory tract irritation	New test data demonstrate that propylene oxide is not irritating to the skin and hence Skin Irritation Category 2 classification is not warranted.

2.1.2. Classification according to Directive 67/548/EEC

F+; R12, Carc. Cat. 2; R45
Muta. Cat. 2; R46
Xn; R20/21/22; Xi; R36/37/38

2.2. Label elements

2.2.1. Labeling according to Regulation (EC) 1272/2008

Signal word: Danger

Pictograms:

GHS02: flame

GHS07: exclamation mark

GHS08: health hazard

Hazard statements:

H224: Extremely flammable liquid and vapour.
H302: Harmful if swallowed.
H312: Harmful in contact with skin.
H315: Causes skin irritation
H319: Causes serious eye irritation.
H335: May cause respiratory irritation.
H332: Harmful if inhaled.
H340: May cause genetic defects via the intraperitoneal route only.

H350: May cause cancer.

Precautionary statements:

P201: Obtain special instructions before use.
P202: Do not handle until all safety precautions have been read and understood.
P280: Wear protective gloves/protective clothing/eye protection/face protection.
P281: Use personal protective equipment as required.
P210: Keep away from heat/sparks/open flames/... /hot surfaces.... No smoking.
P233: Keep container tightly closed.
P240: Ground/bond container and receiving equipment.
P241: Use explosion-proof electrical/ventilating/lighting/... / equipment.
P242: Use only non-sparking tools.
P243: Take precautionary measures against static discharge.

2.2.2. Labeling according to Directive 67/548/EEC
Labelling

Indication of danger:

F+ - extremely flammable

T-toxic

R-phrases:

R12 - extremely flammable

R20/21/22 - harmful by inhalation, in contact with skin and if swallowed
R36/37/38 - irritating to eyes, respiratory system and skin
R45 - may cause cancer
R46 - may cause heritable genetic damage

S-phrases:

S45 - in case of accident or if you feel unwell, seek medical advice immediately (show the label where possible)
S53 - avoid exposure - obtain special instructions before use

Health effects: Propylene oxide should be handled as a CARCINOGEN-WITH EXTREME CAUTION. Contact with eyes can cause severe burns leading to permanent damage. Skin contact can cause severe irritations or burns. Breathing exposure irritates the nose, throat and lungs and/or lead to pneumonia. Affects central nervous system. Overexposure can cause headache and make you feel dizzy, lightheaded and even pass out. Pour coordination can also occur.

Environmental effects: Propylene oxide is very soluble in water and is expected to be very mobile in soils. It is not expected to absorb to suspended solids or sediments in water. When release into the soil and surface water, propylene oxide quickly hydrolyzes. Propylene oxide is biodegradable and is not expected to bioaccumulate.

Emergency overview: Propylene oxide is a hazardous material and must be handled carefully and properly. The liquid and vapor are extremely flammable. Vapor may cause flash fire. The vapour is heavier than air, spreads along the ground and distant ignition is possible. Will float and can be reignited on surface water. Electrostatic charges may be generated during pumping. Electrostatic discharge may cause fire.
Propylene oxide may polymerize violently in closed containers under high temperatures or prolonged storage.
The substance may polymerize violently under the influence of bases, acids and metal chlorides with fire or explosion hazard.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical name	PBT/ vPvB	CAS no/EC No/REACH No.	Classification according to Reg (EC) No. 1272/2008)	Classification according to D 67/548/EC	Concentration (%)
1,2-Propylene oxide	No/No	75-56-9/200-879-2/01-2119480483-35-0076	Flamamble liquid Acute Toxicity 4 STOT SE 3 Eye irritation 2 Carcinogen 1B Mutagen 1B	F+; R12, Carc. Cat. 2; R45 Muta. Cat. 2; R46 Xn; R20/21/22; Xi; R36/37/38	99.8

Impurities
No impurities relevant for classification and labeling.
See section 16 for the full text of the R phrases and H-statement declared above.

4 . FIRST - AID MEASURES

Seek medical attention immediately in all cases of exposure!

Inhalation: Respiratory irritation signs and symptoms may include a temporary burning sensation of the nose and throat, coughing, and/or difficulty breathing. Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified medical personnel may administer oxygen. Get medical attention immediately.

Skin contact: Immediately remove contaminated clothing and shoes. Under a safety shower, flush skin thoroughly with large amounts of running water for at least 15 minutes. Wash with soap or detergent. Do not attempt to neutralize with chemical agents. Get medical attention immediately. Discard or decontaminate clothing and shoes before reuse.

Eye contact: Wash the eyes immediately with large amount of water lifting the upper and lower lids, until no evidence of chemical remains at least 15-20 minutes. Do not attempt to neutralize with chemical agents. If irritation persists after washing get medical attention.

Continue flushing for an additional 15 minutes if medical attention is not immediately available. Contact lenses should not worn with this product.

Ingestion: : If person is conscious and can swallow, immediately give two glasses of water, but do not induce vomiting. If vomiting occurs, give fluids again. Have physician determine if condition of person will permit induction of vomiting or evacuation of stomach. Do not give anything by mouth to an unconscious or convulsing person.

Note to Physician: Aspiration of this product during induced emesis may result in severe lung injury. If evacuation of stomach is necessary, use method least likely to cause aspiration, such as gastric lavage after endotracheal intubation

5. FIRE - FIGHTING MEASURES

Suitable extinguishing media: Dry chemical, alcohol resistant foam, carbon dioxide and water spray. Use water spray to cool fire-exposed containers.

Unsuitable extinguishing media: None

Exposure hazards: Extremely flammable materials may release vapors that travel long distances, ignite and flash back. Do not expose to heat, sparks, static or other sources of ignition. When handling, use non-sparking tool, ground and bond all containers. Explosive air-vapor mixtures may form. Containers may explode in a fire. Reacts violently with chlorine, ammonia, strong oxidants, acids causing fire and explosion hazard.

Protection of fire-fighters: Wear full protective clothing and self contained breathing apparatus with full face piece operated in positive pressure mode. Approach fire from upwind to avoid
hazardous vapors and toxic decomposition products. Discard or decontaminate any clothing and shoes that may contain chemical residues.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions: Restrict persons not wearing protective equipment from area of spill or leak until clean-up is complete. Remove all ignition sources.Ventilate area of leak or spill. Persons performing clean-up work should wear adequate personal protective equipment and a self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Keep unnecessary and unprotected personnel from entering. Slippery walking. Spread granular cover.

Environmental precautions: Prevent contamination of ground and surface water by isolating the hazard area. Contain and recover liquid when possible. Eliminate all ignition sources including internal combustion engines and power tools. Keep closed containers and dispose according to all applicable federal, state or local environment regulations.

Methods of cleaning up: Collect leaking liquid in sealable containers. Absorb remaining liquid in vermiculite, dry sand, earth or a similar non-combustible material and place in a chemical waste container. If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. It may necessary to contain and dispose of propylene oxide as a hazardous waste.

Special precautions: Do not use clay-based absorbents, as this material reacts with clay. Do not use combustible materials, such as saw dust. Do not flush to sewer!

7. HANDLING AND STORAGE

Handling: Special attention is required when propylene oxide is handled. Protect from physical damage. Containers should be bonded and grounded for transfer to avoid static sparks. Sources of ignition, such as open flames and smoking, are prohibited where propylene oxide is used, handled or stored in manner that could create a potential fire or explosion hazard. Use only non-sparking tools and equipment, especially when opening and closing containers of propylene oxide. Wherever propylene oxide is used, handled, manufactured or stored, use explosion proof electrical equipment and fittings. Do not use compressed air for filling, discharging or handling.

Storage: Store in tightly closed containers in a cool, well-ventilated area, away from sources of heat, and incompatibles. Outside or dedicated storage is preferred. At ambient temperature can be stored in mild steel tanks for as long as three months with negligible loss of product

quality. Do not use copper, copper alloys or other acetylide-forming metals for storage or shipping containers. Refrigeration and insulation of storage tanks is necessary only when dictated by the user's process. Drums must be equipped with self- closing valves, pressure vacuum bungs and flame arresters.
An gas inert atmosphere or pad of nitrogen or methane is required over propylene oxide for storage or shipment to prevent air from entering the system and forming explosive air-vapor mixtures. Propylene oxide may polymerize on prolonged storage and at elevated temperatures. Protect
containers from physical damage. Sources of ignition such as smoking and open flames prohibited where propylene oxide is handled.

8 . EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control parameters

PNEC aqua (freshwater): 0.052 mg/L
PNEC aqua (marine water): 0.0052 mg/L
PNEC aqua (intermittent releases): 0.52 mg/L
PNEC sediment (freshwater): 0.245 mg/kg sediment dw
PNEC sediment (marine water): 0.02458 mg/kg sediment dw
PNEC STP: 10 mg/L mg/L
PNEC soil: 0.0186 mg/kg soil dw

DNEL workwrs (inhalation/acute effects-15 min. to 8h) : 170 mg/ m^3
DNEL population (inhalation/acute effects-15 min. to 8h) : 170 mg/ m^3

DNEL worker (inhalation/long terms effects):1,7 5 mg/ m^3
DNELpopulation (inhalation/long terms effects): 5 mg/ m^3

Exposure limit values

STEL: 150 ppm (450 mg/m3)

Engineering control: A system of local and/or general exhaust is recommended to keep employee exposure as low as possible. Local exhaust ventilation is generally preferred

because it can control the emission of the contaminant at its sources, preventing dispersions of it into the general work
area. Ventilation equipment should be explosion- proof if explosive concentration of dust, vapor or fume are present.

Respiratory protection: Where the potential exists for exposures over 20 ppm, use a approved supplier-air respirator with a full face piece, hood or helmet in the continuous flow mode, or use a approved self-contained breathing apparatus with a full face piece operated in pressure-demand or other positive pressure mode.

Warning! Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Hand protection: Wear chemical protective gloves

Eye / Face protection: Use chemical safety goggles and/or full face shield where splashing is possible. Maintain eye wash and quick-drench facilities in work area.

Skin protection: : Chemical splash goggles and/or face shield must be worn when possibility exist for eye contact due to splashing or spraying liquid, airborne particles or vapor. Contact lenses
must not be worn.

Other precautions: Maintain shower, eye wash fountain and quick-drench facilities in work area.

---

9. PHYSICAL AND CHEMICAL PROPERTIES

General informations

Appearance	Colorless liquid with
Odor	Ether-like odour

Important health, safety and environmental informations

pH of 100g/l solution	7
Boiling point	34.1^{o}C at 1 atm. pressure

Flash point	-37.2^{O}C
Flammability	Extremely flammable
Explosive properties	may form explosive vapor/air mixture explosive limits in air: 1.8-36%.
Oxidizing properties	no oxidizing properties
Vapor pressure, at 20 ^{o}C	442 mmHg
Specific gravity (water=1)	0.8305 at 20^{0}C
Water solubility	405 g/l la 20^{o}C
Partition coefficient (log K_{ow})	0,03
Vapor relative density (air=1)	2,0 at 20^{0}C
Dynamic viscosity	0.32 mPas at 20^{0}C

Other informations

Melting point	-104^{o}C
Autoignition temperature	449^{O}C

10. STABILITY AND REACTIVITY

Chemical stability: Stable under ordinary conditions of use and storage

Conditions to avoid: Heat, flame, light,sources of ignition and incompatibles.

Materials to avoid: Reacts violently with anhydrous metal chlorides, chlorine, iron, strong acids (such as hydrochloric, sulfuric and nitric acids), strong bases and peroxides, ammonia, copper or copper alloys causing fire and explosion hazard. Propylene oxide will attack some forms of plastics rubber and coatings.

Hazardous decomposition products: Carbon monoxide and dioxide may form when heated to decomposition. Aldehydes, acids or ketones may also be formed. The substance may polymerize violently under the influence of bases, acids and metal chloride with fire or explosion hazard.

11. TOXICOLOGICAL INFORMATION

Endpoint		Dose descriptor	Qualitative assessment
Acute toxicity	oral	LD50: 382-587 mg/kg bw	NA[1]
Acute toxicity	dermal	LD50: 950 mg/kg bw	NA
Acute toxicity	inhalation	LC50: 9.95 mg/L (4 h)	NA
Irritation / Corrosivity	skin	NA	Skin Irritation: not irritating
Irritation / Corrosivity	eye	NA	Eye irritation: irritating
Irritation / Corrosivity	respiratory tract	NA	Respiratory tact irritation: irritating
Sensitisation	skin	NA	Sensitisation: not sensitising
Repeated dose toxicity: sub-acute / sub-chronic / chronic	oral	LOAEL: 15 mg/kg bw (twice weekly) for local forestomach effects	Repeated dose toxicity: Local gastrointestinal effects
Repeated dose toxicity: sub-acute / sub-chronic / chronic	dermal	NA	NA
Repeated dose toxicity: sub-acute / sub-chronic / chronic	inhalation	LOAEC: 100 ppm (30 ppm NOEC at 24 months; only marginal effects to nasal cavity at 28 months)	Repeated dose toxicity: Local nasal cavity effects
Mutagenicity	in vitro / in vivo	NA	Genetic toxicity: positive
Carcinogenicity	Oral	LOAEC: 15 mg/kg bw (twice weekly) for forestomach	Carcinogenicity: positive

Endpoint		Dose descriptor	Qualitative assessment
		tumors	
Carcinogenicity	dermal	NA	NA
Carcinogenicity	inhalation	NOAEC: 100 ppm for nasal tumors	Carcinogenicity: positive
Reproductive toxicity: fertility impairment	oral	NA	NA
Reproductive toxicity: fertility impairment	dermal	NA	NA
Reproductive toxicity: fertility impairment	inhalation	NOAEC (fertility): 300 ppm	Reproductive toxicity: negative
Reproductive toxicity: developmental toxicity	oral	NA	NA
Reproductive toxicity: developmental toxicity	dermal	NA	NA
Reproductive toxicity: developmental toxicity	inhalation	NOAEC (development): 300 ppm	Developmental toxicity: negative for selective effects on development.

[1] Not Applicable.

- **Inhalation** Vapors or mist, especially as generated from heating the material or as from exposure in poorly ventilated areas or confined spaces, may be irritating and cause discomfort in nose and throat, nasal discharge, and coughing. Prolonged over exposure may cause difficulty breathing. Inhalation may cause dizziness, drowsiness, euphoria, loss of coordination, disorientation, headache, nausea and vomiting. In poorly ventilated areas or confined spaces, unsconsciousness and asphyxiation may result. Inhalation may result in adsorption of potentially harmful amounts of material.

- **Skin contact:** Corrosive. Causes severe irritation with pain, severe excess redness and swelling with chemical burns, blister formation and possible tissue distruction. In addition to the potential skin irritation effects noted above, skin contact may result in other adverse heath effects.

- **Eye contact:** Corrosive. Causes severe irritation experienced as pain, with xcess blinking and tear production, as seen as extreme redness and swelling of the eye and chemical burns of the eye. Severe eye damage may cause blindness.

- **Ingestion:** Corrosive Causes abdominal discomfort, nausea, vomiting, diarrhea, weakness and collapse. Severe poisoning may cause death. Aspiration may occur during swallowing or vomiting, result in lung damage. May cause depression of central nervous system.

Chronic effect: Repeated inhalation may cause lung damage. Repeated skin contact may cause a persistent irritation or dermatitis. Prolonged and repeated exposure of animals to high concentrations of propylene oxide has caused liver injury.

---

12. ECOLOGICAL INFORMATION

Aquatic Toxicity

Short-term toxicity to fish

The 96-h LC50 is 52 mg/l in the freshwater, fish species *Oncorhynchus mykiss*.

The 96 h LC50 is 89 mg/L in the marine, fish species *Mugil cephalus*.

Long-term toxicity to fish

Due to the fact that the substance is considered ready biodegradable, no significant concentrations are present in the water compartment. So, no significant long term exposure of fish is assumed and therefore long-term toxicity tests with fish are not needed.

Short-term toxicity to aquatic invertebrates
The 48-h EC50 is 350 mg/l in Daphnia
Long-term toxicity to aquatic invertebrates:
Due to the fact that the substance is considered ready biodegradable, no significant concentrations are present in the water compartment. So, no significant long term exposure of aquatic invertebrates is assumed and therefore long-term toxicity tests with aquatic invertebrates are not needed.

Algae and aquatic plants
The 96-h EC50 is 240 mg/l in the fresh water *Selenastrum capricornutum*
Toxicity to sediment
In accordance with column 2 of REACH Annex IX and X, studies on sediment toxicity do not need to be conducted as the substance has a low potential for adsorption (log Kow < 1). No significant concentrations are expected in the sediment compartment.

Resulting PNECs

PNEC	**Assessment factor**	**Remarks/Justification**
PNEC aqua (freshwater): 0.052 mg/L	1000	Extrapolation method: assessment factor At least one short-term L(E)C50 from each of three trophic levels (fish, invertebrates (preferred Daphnia) and algae) is available. The lowest effect concentration found in fish (96- h LC50=52 mg/l) will be used.
PNEC aqua (marine water): 0.0052 mg/L	10000	Extrapolation method: assessment factor Lowest short-term L(E)C50 from freshwater or saltwater representatives of three taxonomic groups (algae, crustaceans and fish) of three trophic levels. The lowest effect concentration found in fish (96-h LC50=52 mg/l) will be used.
PNEC sediment (freshwater): 0.245 mg/kg sediment dw		Extrapolation method: partition coefficient The equilibrium partitioning method was used using a Koc value of 11.2 l/kg as described in Reach Guidance R.7
PNEC sediment (marine water): 0.0245 mg/kg sediment dw		Extrapolation method: partition coefficient The equilibrium partitioning method was used using a Koc value of 11.2 l/kg as described in Reach Guidance R.7
PNEC soil: 0.0186 mg/kg soil dw		Extrapolation method: partition coefficient The equilibrium partitioning method was used using a Koc value of 11.2

		l/kg and a Henry's Law constant of 5.48 Pa.m3/mol at 12 °C (calculated from the vapour pressure and the water solubility) as described in Reach Guidance R.7

Toxicity to soil macro-organisms
In accordance with column 2 of REACH Annex IX and X, studies on toxicity to soil organisms do not need to be conducted as the substance has a low potential for adsorption (log Kow < 1). No significant concentrations are expected in the soil compartment.

Toxicity to terrestrial plants:
In accordance with column 2 of REACH Annex IX and X, studies on toxicity to soil organisms do not need to be conducted as the substance has a low potential for adsorption (log Kow < 1). No significant concentrations are expected in the soil compartment.

12.2. Persistence and degradability:
The substance is found ready biodegradable.

12.3. Bioaccumulative potential:

No experimental data are available for bioaccumulation of propylene oxide. Based on the result of the octanol/water partition coefficient (Log Kow of 0.055) propylene oxide is not expected to significantly accumulate in aquatic organisms. Therefore, propylene oxide can be regarded as not bioaccumulative

12.4. Mobility
The substance has a low potential for adsorption (log Kow < 1), so no significant concentrations are expected in the soil compartment.

12.5. Results of PBT and vPvB assessment:

Regarding all available data on biotic and abiotic degradation, bioaccumulation and toxicity it can be stated that the substance does not fulfill the PBT/ vPvB criteria.

13. DISPOSAL CONSIDERATIONS

Waste treatment: Whatever cannot be saved for recovery or recycling should be handled as hazardous waste. Dispose of contaminated product, container residues and spill clean up materials in accordance with federal, state and local requirements. The waste water with propylene oxide will be treated in biological treatment plant providing accomodation of activated sludge.

Packaging treatment: The empty containers are blown down with nitrogen, to eliminate any propylene oxide traces, rinsed with 3 ata steam and dried with air. The resulted effluent are treated

in the same way as the wastes. The empty, cleaned and dried containers will be reused in conformity with regulations.

14. TRANSPORT INFORMATION

Propylene oxide is packaged in tank cars and tank trucks under nitrogen blanket at max. 20^0C temperature. At long distance shippment the tanks will be provided with cooling coiled pipes at exterior. The tanks can be shipped on railway and road according to RID/ADR regulations. Product is shipped on sea according to IMDG regulations.

Transport Labeling

Label Class 3
Flammable liquids

RID/ADR

UN Number	1280
Proper shipping name	**Propylene oxide**
Hazard class	3
UN Packing group	I
Classification code	F1
Danger panel	*33/1280 (33 Hazard Identification No.)* *(1280 UN Identification No)*

IMDG/IMO

UN No.	1280
Hazard class	3
Packing group	I
Proper shiping name	**Propylene oxide**
EmS	F-E, S-D
Marin Poluant	No

IATA/IT-ICAO

Proper shipping name	**Propylene oxide**
UN Number	1280
Hazard class	3
UN Packing Group	I

IATA Label	**Flammable**
Packaging Note Passenger	306
Packaging Note Cargo	304

15. REGULATORY INFORMATION

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

EU Regulation (EC) No. 1907/2006 (REACH)

Annex XIV - List of substances subject to authorisation
Substances of very high concern (Authorizations): Not listed

Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles
Restrictions on use: see Restriction 40 from Anex XVII.

Other EU regulations: Propyleneoxide is a SEVESO substance, not ozone depleting substance and not a persistent organic pollutant.

15.2 Chemical safety Assessment Assessment

A chemical safety assessment has been carried out for this substance.

16. OTHER INFORMATION

16.1. Full text of H-Statements

H224: Extremely flammable liquid and vapour.
H302: Harmful if swallowed.
H312: Harmful in contact with skin.
H315: Causes skin irritation
H319: Causes serious eye irritation.
H335: May cause respiratory irritation.
H332: Harmful if inhaled.
H340: May cause genetic defects via the intraperitoneal route only.
H350: May cause cancer.

16.2 Full text of R-phrases

R12 - extremely flammable
R20/21/22 - harmful by inhalation, in contact with skin and if swallowed
R36/37/38 - irritating to eyes, respiratory system and skin
R45 - may cause cancer
R46 - may cause heritable genetic damage

16.3. Full text of P-Statements

P201: Obtain special instructions before use.
P202: Do not handle until all safety precautions have been read and understood.
P280: Wear protective gloves/protective clothing/eye protection/face protection.
P281: Use personal protective equipment as required.
P210: Keep away from heat/sparks/open flames/... /hot surfaces.... No smoking.
P233: Keep container tightly closed.
P240: Ground/bond container and receiving equipment.
P241: Use explosion-proof electrical/ventilating/lighting/... / equipment.
P242: Use only non-sparking tools.
P243: Take precautionary measures against static discharge.

16.4. Full text of S-Statements

S45 - in case of accident or if you feel unwell, seek medical advice immediately (show the label where possible)
S53 - avoid exposure - obtain special instructions before use

16.5. Explanations for possible abbreviations mentioned in above sections

PBT: Persistent, bioaccumulative and toxic.
vPvB: Very persistent and very bioaccumulative.
ES: Exposure Scenario
PNEC: Predicted No-Effect Concentration
NOAEC: No Observed Adverse Effect Concentration
ADR: European **Agreement** concerning the International Carriage of **Dangerous** Goods by **Road**
RID: **International** Carriage of **Dangerous** Goods by **Road**
IMDG Code: International Maritime Dangerous Goods Code
ICAO/IATA: International Civil Aviation Organization/ International Air Transport Association

16.6. Revision:

Revion 1. Replace the previous edition issued on 08.07.2011
Section 11 and Section 12 were upgraded.

Annex I to SDS- Exposure Scenarios

This MSDS has been elaborated in accordance with Regulation (EC) No.1907/2006 REACH.
The information contained here in is based on the present 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.
This MSDS cannot cover all possible situations which the user may experience during handling and processing. Each aspect of the user's operation should be examined to determine if, or where, additional precautions may be necessary. All health and safety information contained within this MSDS should be provided to the user's employees or customers.

ANNEX I- EXPOSURE SCENARIOS

1. ES1 - Manufacturing of propylene oxide

1.1. Exposure scenario

Section 1	Exposure Scenario Title
Title	Manufacture of Propylene Oxide; CAS NR 75-56-9
Use Descriptor	Sector of Use: Industrial (SU3, SU8)
	Process Categories: PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9, PROC15
	Environmental Release Categories: ERC1
Processes, tasks, activities covered	Manufacture of Propylene Oxide. Includes 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
Field for additional statements to explain scenario if required.	
Section 2.1	Control of worker exposure
Product characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa [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].
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting worker exposure	Assumes activities are at ambient temperature (unless stated differently) [G17].; Assumes a good basic standard of occupational hygiene is implemented [G1].
Contributing Scenarios	Risk Management Measures Note: list RMM standard phrases according to the control hierarchy indicated in the ECHA template: 1. Technical measures to prevent release, 2. Technical measures to prevent dispersion, 3. Organisational measures, 4. Personal protection.

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 (irritants) [G19].	Avoid all skin contact with product, clean up contamination/spills as soon as they occur. Wear gloves (tested to EN374) if hand contamination likely, wash off any skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin problems that may develop [E3].
General exposures (closed systems) [CS15].	No specific measures identified [EI18].
General exposures (closed systems) [CS15]. With sample collection [CS56].	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 4 hours [OC28], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
General exposures (closed systems) [CS15]. Use in contained batch processes [CS37]. ; With sample collection [CS56].	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 1 hour [OC27], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
General exposures (open systems) [CS16]. Batch process [CS55]. ; With sample collection [CS56].	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 15 minutes [OC26], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Process sampling [CS2]. Dedicated facility [CS81]	Provide extract ventilation to points where emissions occur [E54]. Avoid carrying out activities involving exposure for more than 1 hour [OC27], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Small package filling [CS7]. ; Dedicated facility	Avoid carrying out activities involving exposure for more than 15 minutes [OC26]Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]

[CS81]	
Laboratory activities [CS36]. Cleaning [CS47] [wiping, brushing, flushing]	Use high-performance fume cupboard [E86].
Bulk closed loading and unloading [CS501].Dedicated facility [CS81]road tanker/rail car loading [CS511].	Use dry break couplings for material transfer [E75]., or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24] Specific European guidelines for distribution of PO are in: http://www.petrochemistry.net/ftp/pressroom/Guidelines_PO_UK_WEB.pdf
Bulk open loading and unloading [CS503].marine vessel/barge (un)loading [CS510].	Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24] Specific European guidelines for distribution of PO are in: http://www.petrochemistry.net/ftp/pressroom/Guidelines_PO_UK_WEB.pdf
Equipment cleaning and maintenance [CS39].	Drain down and flush system prior to equipment break-in or maintenance [E55].Avoid carrying out activities involving exposure for more than 4 hours [OC28]Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Storage [CS67]; General exposures (closed systems) [CS15]. With sample collection [CS56].	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 4 hours [OC28], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Section 2.2	**Control of consumer exposure**
Not relevant: no consumer exposure	
Section 2.3	**Control of environmental exposure**
Product characteristics	Substance is a unique structure [PrC1]. Non-hydrophobic [PrC4b]. Readily biodegradable [PrC5a].
Operational Conditions	Outdoor use [OOC1].
Amounts used	
Amounts used in the EU (tonnes/year)	1,500,000
Fraction of EU tonnage used in region [A1]:	0.33
Regional use tonnage (tonnes/year) [A2]:	495,000
Fraction of regional tonnage used locally	1

[A3]:	
Maximum daily site tonnage (kg/day) [A4].	1,650,000
Frequency and duration of use	
Type of release	Continuous release [FD2].
Emission days (days/year) [FD4]:	≥300
Environmental factors not influenced by risk management	
Local freshwater dilution factor [EF1].	168
Local marine water dilution factor [EF2].	168
Other given operational conditions affecting environmental exposure	Used in closed systems.
Release fraction to air from process [OOC4].	$1.1 \cdot 10^{-4}$
Release fraction to wastewater from process [OOC5].	$2.6 \cdot 10^{-4}$
Release fraction to soil from process (regional only) [OOC6].	0
Risk Management Measures	
Technical conditions and measures at process level (source) to prevent release	Common practices vary across sites thus conservative process release estimates used [TCS 1].
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Air:	
Waste water:	Provide onsite wastewater removal efficiency of ≥99.9% [TCr12]:
Soil:	Soil emission controls are not applicable as there is no direct release to soil [TCR4].
Organizational measures to prevent/limit release from site	Prevent discharge of undissolved substance to or recover from wastewater [OMS1]. Sludge should be incinerated, contained or reclaimed [OMS3].

Conditions and measures related to industrial waste water treatment plant	Assumed industrial waste water treatment plant flow 31,200 m3/d.
Conditions and measures related to municipal sewage treatment plant	Domestic sewage treatment is not assumed [STP2].
Conditions and measures related to external treatment of waste for disposal	Not applicable.
Conditions and measures related to external recovery of waste	Not applicable.
Other environmental control measures additional to above	None.

2. ES2 – Distribution of Propylene Oxide– industrial

2.1. Exposure scenario

Section 1	Exposure Scenario Title
Title	Distribution of Propylene Oxide; CAS NR 75-56-9
Use Descriptor	Sector of Use: Industrial (SU3, SU8)
	Process Categories: PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC15
	Environmental Release Categories: ERC1, ERC2
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 distribution and associated laboratory activities
Section 2	Operational conditions and risk management measures
Field for additional statements to explain scenario if required.	
Section 2.1	Control of worker exposure
Product characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa [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]
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting worker exposure	Assumes use at not > 20oC above ambient [G15]; Assumes a good basic standard of occupational hygiene is implemented [G1]. ; Specific European guidelines for distribution of PO are in: http://www.petrochemistry.net/ftp/pressroom/Guidelines_PO_UK_WEB.pdf
Contributing Scenarios	**Risk Management Measures** **Note: list RMM standard phrases according to the control hierarchy indicated in the ECHA template: 1. Technical measures to prevent release, 2. Technical measures to prevent dispersion, 3. Organisational measures , 4. Personal protection.**
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 pers ons; 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 (irritants) [G19].	Avoid all skin contact with product, clean up contamination/spills as soon as they occur. Wear gloves (tested to EN374) if hand contamination likely, wash off any skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin problems that may develop [E3].
General exposures (closed systems) [CS15].	No specific measures identified [EI18].
General exposures (closed systems) [CS15]. With sample collection [CS56].	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 1 hour [OC27], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
General exposures (closed systems) [CS15]. Use in contained batch processes [CS37]. ; With sample collection [CS56].	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 1 hour [OC27], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
General exposures (open systems) [CS16]. Batch process [CS55]. ; With sample collection [CS56].	Provide extract ventilation to points where emissions occur [E54]. Avoid carrying out activities involving exposure for more than 15 minutes [OC26], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Process sampling [CS2].	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 15 minutes [OC26], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Bulk closed loading and unloading [CS501].Dedicated facility [CS81] road tanker/rail car loading [CS511].	Use dry break couplings for material transfer [E75]., or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]

Bulk open loading and unloading [CS503].marine vessel/barge (un)loading [CS510].	Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Drum and small package filling [CS6]. Dedicated facility [CS81]	Avoid carrying out activities involving exposure for more than 15 minutes [OC26]Wear a full face respirator conforming to EN14 0 with Type A filter or better. [PPE24]
Laboratory activities [CS36]. Cleaning [CS47] [wiping, brushing, flushing]	Use high-performance fume cupboard [E86].
Equipment cleaning and maintenance [CS39].	Drain down and flush system prior to equipment break-in or maintenance [E55].Avoid carrying out activities involving exposure for more than 4 hours [OC28] Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Storage [CS67]With sample collection [CS56].	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 4 hours [OC28], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Section 2.2	**Control of consumer exposure**
Not relevant: no consumer exposure	
Section 2.3	**Control of environmental exposure**
Product characteristics	Substance is a unique structure [PrC1]. Non-hydrophobic [PrC4b]. Readily biodegradable [PrC5a].
Operational Conditions	Outdoor use [OOC1].
Amounts used	
Amounts used in the EU (tonnes/year)	1,500,000
Fraction of EU tonnage used in region [A1]:	0.33
Regional use tonnage (tonnes/year) [A2]:	495,000
Fraction of regional tonnage used locally [A3]:	1
Maximum daily site tonnage (kg/day) [A4].	1,650,000
Frequency and duration of use	

Type of release	Continuous release [FD2].
Emission days (days/year) [FD4]:	≥300
Environmental factors not influenced by risk management	
Local freshwater dilution factor [EF1].	168
Local marine water dilution factor [EF2].	168
Other given operational conditions affecting environmental exposure	Used in closed systems.
Release fraction to air from process [OOC4].	$1.1 \cdot 10^{-4}$
Release fraction to wastewater from process [OOC5].	$2.6 \cdot 10^{-4}$
Release fraction to soil from process (regional only) [OOC6].	0
Risk Management Measures	
Technical conditions and measures at process level (source) to prevent release	Common practices vary across sites thus conservative process release estimates used [TCS 1].
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Air:	
Waste water:	Provide onsite wastewater removal efficiency of ≥99.9% [TCr12]:
Soil:	Soil emission controls are not applicable as there is no direct release to soil [TCR4].
Organizational measures to prevent/limit release from site	Prevent discharge of undissolved substance to or recover from wastewater [OMS1]. Sludge should be incinerated, contained or reclaimed [OMS3].
Conditions and measures related to industrial waste water treatment plant	Assumed industrial waste water treatment plant flow 31,200 m3/d.
Conditions and	Domestic sewage treatment is not assumed [STP2].

measures related to municipal sewage treatment plant	
Conditions and measures related to external treatment of waste for disposal	Not applicable.
Conditions and measures related to external recovery of waste	Not applicable.
Other environmental control measures additional to above	None.

3. ES3 - Use of propylene oxide in polymer production - Industrial

The activities covered in this ES are considered part of the polymer production process, polymerization and the related process steps

9.3.1. Exposure scenario

Section 1	Exposure Scenario Title
Title	Use in polymer production of Propylene Oxide;CAS RN75-56-9
Use Descriptor	Sector of Use: Industrial (SU3, SU8)
	Process Categories: PROC1, PROC2, PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC9, PROC15
	Environmental Release Categories: ERC1, ERC6c
Processes, tasks, activities covered	Manufacture of polymers from monomers in continuous and batch processes, include sparging, discharging, and reactor maintenance and immediate polymer product formation (i.e. compounding, pelletisation, product off-gassing).
Section 2	Operational conditions and risk management measures
Field for additional statements to explain scenario if required.	
Section 2.1	Control of worker exposure
Product characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa [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].
Human factors not influenced by risk management	Not applicable
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].;
Contributing Scenarios	Risk Management Measures Note: list RMM standard phrases according to the control hierarchy indicated in the ECHA template: 1. Technical measures to prevent release, 2. Technical measures to prevent dispersion, 3. Organisational measures , 4. Personal protection.

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 (irritants) [G19].	Avoid all skin contact with product, clean up contamination/spills as soon as they occur. Wear gloves (tested to EN374) if hand contamination likely, wash off any skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin problems that may develop [E3].
General exposures (closed systems) [CS15]. ; Continuous process [CS54].	No specific measures identified [EI18].
Bulk transfers [CS14]. ; Dedicated facility [CS81]Transport [CS58]. ; With sample collection [CS56].	Use dry break couplings for material transfer [E75]., or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24] Specific European guidelines for distribution of PO are in: http://www.petrochemistry.net/ftp/pressroom/Guidelines_PO_UK_WEB.pdf
Polymerisation (bulk and batch) [CS65]; (closed systems) [CS107]Continuous process [CS54]. ; With sample collection [CS56].	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 1 hour [OC27], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Polymerisation (bulk and batch) [CS65]; (closed systems) [CS107]Batch process [CS55]. ; With sample collection [CS56].	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 1 hour [OC27], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Finishing operations [CS102]Batch process [CS55]. ;	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 1 hour [OC27], or: Wear a full face respirator conforming to EN140 with Type A filter or better.

With sample collection [CS56].	[PPE24]
Intermediate polymer storage [CS66]With sample collection [CS56].	Provide extract ventilation to points where emissions occur [E54]. Avoid carrying out activities involving exposure for more than 15 minutes [OC26], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Additivation and stabilisation [CS69]With sample collection [CS56].	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 1 hour [OC27], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Mixing in containers [CS23].Batch process [CS55].	Provide extract ventilation to points where emissions occur [E54]. Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Drum and small package filling [CS6]. Dedicated facility [CS81]	Avoid carrying out activities involving exposure for more than 15 minutes [OC26]Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Laboratory activities [CS36]. Cleaning [CS47] [wiping, brushing, flushing]	Use high-performance fume cupboard [E86].
Pelletisation and pellet screening [CS68](open systems) [CS108]; Dedicated facility [CS81]	Provide extract ventilation to material transfer points and other openings [E82].Avoid carrying out activities involving exposure for more than 1 hour [OC27], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Bulk transfers [CS14]. ; (closed systems) [CS107]; Continuous process [CS54]. With sample collection [CS56].	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 1 hour [OC27], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Bulk transfers [CS14]. ; Batch process [CS55]. ; (closed systems) [CS107] With sample collection [CS56].	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 1 hour [OC27], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Transport [CS58]. With sample collection [CS56]. ; Dedicated facility [CS81]	Provide extract ventilation to points where emissions occur [E54]. Avoid carrying out activities involving exposure for more than 1 hour [OC27], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]

Equipment maintenance [CS5].	Drain down and flush system prior to equipment break-in or maintenance [E55].Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Section 2.2	**Control of consumer exposure**
Not relevant: no consumer exposure	
Section 2.3	**Control of environmental exposure**
Product characteristics	Substance is a unique structure [PrC1]. Non-hydrophobic [PrC4b]. Readily biodegradable [PrC5a].
Operational Conditions	Indoor/Outdoor use [OOC3].
Amounts used	
Regional use tonnage (tonnes/year) [A2]:	470,000
Fraction of regional tonnage used locally [A3]:	0.069
Maximum daily site tonnage (kg/day) [A4].	108,100
Frequency and duration of use	
Type of release	Continuous release [FD2].
Emission days (days/year) [FD4]:	≥300
Environmental factors not influenced by risk management	
Local freshwater dilution factor [EF1].	168
Local marine water dilution factor [EF2].	168
Other given operational conditions affecting environmental exposure	Used in closed systems.
Release fraction to air from process [OOC4].	$3.7 \cdot 10^{-5}$
Release fraction to wastewater from process [OOC5].	$7.0 \cdot 10^{-5}$
Release fraction to soil from process (regional only) [OOC6].	0

Risk Management Measures	
Technical conditions and measures at process level (source) to prevent release	Common practices vary across sites thus conservative process release estimates used [TCS 1].
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Air:	
Waste water:	Provide onsite wastewater removal efficiency of ≥95% [TCr12]:
Soil:	Soil emission controls are not applicable as there is no direct release to soil [TCR4].
Organizational measures to prevent/limit release from site	Prevent discharge of undissolved substance to or recover from wastewater [OMS1]. Sludge should be incinerated, contained or reclaimed [OMS3].
Conditions and measures related to industrial waste water treatment plant	Assumed industrial waste water treatment plant flow 31,200 m3/d.
Conditions and measures related to municipal sewage treatment plant	Domestic sewage treatment is not assumed [STP2].
Conditions and measures related to external treatment of waste for disposal	Not applicable.
Conditions and measures related to external recovery of waste	Not applicable.
Other environmental control measures additional to above	None.

4. ES4: Use of propylene oxide as an intermediate - Industrial

4.1. Exposure scenario

Section 1	Exposure Scenario Title
Title	Use of Propylene Oxide as intermediate;CAS NR 75-56-9
Use Descriptor	Sector of Use: Industrial (SU3, SU8)
	Process Categories: PROC1, PROC2, PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC9, PROC15
	Environmental Release Categories: ERC2, ERC6a
Processes, tasks, activities covered	Use as intermediate. Includes 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
Field for additional statements to explain scenario if required.	
Section 2.1	Control of worker exposure
Product characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa [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].
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting worker exposure	Assumes activities are at ambient temperature (unless stated differently) [G17].; Assumes a good basic standard of occupational hygiene is implemented [G1].
Contributing Scenarios	Risk Management Measures **Note: list RMM standard phrases according to the control hierarchy indicated in the ECHA template: 1. Technical measures to prevent release, 2. Technical measures to prevent dispersion, 3. Organisational measures , 4. Personal protection.**
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 (irritants) [G19].	Avoid all skin contact with product, clean up contamination/spills as soon as they occur. Wear gloves (tested to EN374) if hand contamination likely, wash off any skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin problems that may develop [E3].
General exposures (closed systems) [CS15].	No specific measures identified [EI18].
General exposures (closed systems) [CS15]. With sample collection [CS56].	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 4 hours [OC28], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
General exposures (closed systems) [CS15]. Use in contained batch processes [CS37]. ; With sample collection [CS56].	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 1 hour [OC27], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
General exposures (open systems) [CS16]. Batch process [CS55]. ; With sample collection [CS56].	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 15 minutes [OC26], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Process sampling [CS2]. Dedicated facility [CS81]	Provide extract ventilation to points where emissions occur [E54]. Avoid carrying out activities involving exposure for more than 1 hour [OC27], or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Small package filling [CS7]. ; Dedicated facility [CS81]	Avoid carrying out activities involving exposure for more than 15 minutes [OC26]Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Laboratory activities [CS36]. Cleaning [CS47] [wiping, brushing, flushing]	Use high-performance fume cupboard [E86].

Bulk closed loading and unloading [CS501].Dedicated facility [CS81]road tanker/rail car loading [CS511].	Use dry break couplings for material transfer [E75]., or: Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24] Specific European guidelines for distribution of PO are in: http://www.petrochemistry.net/ftp/pressroom/Guidelines_PO_UK_WEB.pdf
Bulk open loading and unloading [CS503].marine vessel/barge (un)loading [CS510].	Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24] Specific European guidelines for distribution of PO are in: http://www.petrochemistry.net/ftp/pressroom/Guidelines_PO_UK_WEB.pdf
Equipment cleaning and maintenance [CS39].	Drain down and flush system prior to equipment break-in or maintenance [E55].Avoid carrying out activities involving exposure for more than 4 hours [OC28] Wear a full face respirator conforming to EN140 with Type A filter or better. [PPE24]
Storage [CS67]; General exposures (closed systems) [CS15]. With sample collection [CS56].	Sample via a closed loop or other system to avoid exposure [E8].Avoid carrying out activities involving exposure for more than 4 hours [OC28], or: Wear a full face respirator conforming to EN 140 with Type A filter or better. [PPE24]
Section 2.2	**Control of consumer exposure**
Not relevant: no consumer exposure	
Section 2.3	**Control of environmental exposure**
Product characteristics	Substance is a unique structure [PrC1]. Non-hydrophobic [PrC4b]. Readily biodegradable [PrC5a].
Operational Conditions	Outdoor use [OOC1].
Amounts used	
Regional use tonnage (tonnes/year) [A2]:	470,000
Fraction of regional tonnage used locally [A3]:	0.069
Maximum daily site tonnage (kg/day) [A4].	108,100
Frequency and duration of use	
Type of release	Continuous release [FD2].
Emission days (days/year) [FD4]:	≥300
Environmental factors not influenced by risk management	
Local freshwater	168

dilution factor [EF1].	
Local marine water dilution factor [EF2].	168
Other given operational conditions affecting environmental exposure	Used in closed systems.
Release fraction to air from process [OOC4].	$3.7 \cdot 10^{-5}$
Release fraction to wastewater from process [OOC5].	$7.0 \cdot 10^{-5}$
Release fraction to soil from process (regional only) [OOC6].	0
Risk Management Measures	
Technical conditions and measures at process level (source) to prevent release	Common practices vary across sites thus conservative process release estimates used [TCS 1].
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Air:	
Waste water:	Provide onsite wastewater removal efficiency of ≥95% [TCr12]:
Soil:	Soil emission controls are not applicable as there is no direct release to soil [TCR4].
Organizational measures to prevent/limit release from site	Prevent discharge of undissolved substance to or recover from wastewater [OMS1]. Sludge should be incinerated, contained or reclaimed [OMS3].
Conditions and measures related to industrial waste water treatment plant	Assumed industrial waste water treatment plant flow 31,200 m3/d.
Conditions and measures related to municipal sewage treatment plant	Domestic sewage treatment is not assumed [STP2].
Conditions and measures related to external treatment of	Not applicable.

waste for disposal	
Conditions and measures related to external recovery of waste	Not applicable.
Other environmental control measures additional to above	None.

5. ES5 - Laboratory use of propylene oxide – Professional

5.1. Exposure scenario

Section 1	Exposure Scenario Title
Title	Use in laboratory reagents of Propylene Oxide;CAS RN75-56-9
Use Descriptor	Sector of Use: Professional (SU22, SU8)
	Process Categories: PROC15, PROC8a
	Environmental Release Categories: ERC8a
Processes, tasks, activities covered	Use of Propylene Oxide as reagent in laboratory, including use for preparation of tissue samples for Electron Microscopy
Section 2	Operational conditions and risk management measures
Field for additional statements to explain scenario if required.	
Section 2.1	Control of worker exposure
Product characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa [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].
Human factors not influenced by risk management	Not applicable
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].; Indoor [OC8].;
Contributing Scenarios	**Risk Management Measures** **Note: list RMM standard phrases according to the control hierarchy indicated in the ECHA template: 1. Technical measures to prevent release, 2. Technical measures to prevent dispersion, 3. Organisational measures , 4. Personal protection.**
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 (irritants) [G19].	Avoid all skin contact with product, clean up contamination/spills as soon as they occur. Wear gloves (tested to EN374) if hand contamination likely, wash off any skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin problems that may develop [E3].
Laboratory activities [CS36].	Use high-performance fume cupboard [E86].
Laboratory activities [CS36]. ; Equipment cleaning and maintenance [CS39]. cleaning of glassware contaminated with PO	Use high-performance fume cupboard [E86].Avoid carrying out operation for more than 1 hour [OC11], or: Wear a full face re spirator conforming to EN140 with Type A filter or better. [PPE24]
Section 2.2	**Control of consumer exposure**
Not relevant: no consumer exposure	
Section 2.3	**Control of environmental exposure**
Product characteristics	Substance is a unique structure [PrC1]. Non-hydrophobic [PrC4b]. Readily biodegradable [PrC5a].
Operational Conditions	Outdoor use [OOC1].
Amounts used	
Regional use tonnage (tonnes/year) [A2]:	24,800
Fraction of regional tonnage used locally [A3]:	$1.51 \cdot 10^{-4}$
Maximum daily site tonnage (kg/day) [A4].	10.3
Frequency and duration of use	
Type of release	Dispersive use [FD3].

Emission days (days/year) [FD4]:	365
Environmental factors not influenced by risk management	
Local freshwater dilution factor [EF1].	10
Local marine water dilution factor [EF2].	100
Other given operational conditions affecting environmental exposure	Used in open systems.
Release fraction to air from process [OOC4].	0.5
Release fraction to wastewater from process [OOC5].	0.5
Release fraction to soil from process (regional only) [OOC6].	0
Risk Management Measures	
Technical conditions and measures at process level (source) to prevent release	Common practices vary across sites thus conservative process release estimates used [TCS 1].
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Air:	No air emission controls required; required removal efficiency is 0% [TCR5].
Waste water:	Provide onsite wastewater removal efficiency of ≥95% [TCR12]:
Soil:	Soil emission controls are not applicable as there is no direct release to soil [TCR4].
Organizational measures to prevent/limit release from site	Prevent discharge of undissolved substance to or recover from wastewater [OMS1]. Sludge should be incinerated, contained or reclaimed [OMS3].
Conditions and measures related to industrial waste water treatment plant	Assumed industrial waste water treatment plant flow is 31,200 m3/d.
Conditions and measures related to municipal sewage	Estimated substance removal from wastewater via domestic sewage treatment is 73% [STP3]. Assumed domestic sewage treatment plant flow is 2,000 m3/d [STP4].

treatment plant	
Conditions and measures related to external treatment of waste for disposal	Not applicable.
Conditions and measures related to external recovery of waste	Not applicable.
Other environmental control measures additional to above	None.