

Product Stewardship Summary

Propylene Oxide

General Statement

Propylene oxide is a high volume chemical with uses in manufacturing everyday items. Propylene oxide is produced commercially by several methods, and is not known to occur naturally. Nearly all propylene oxide produced is used to form derivatives, including polyether polyols, propylene glycols, and propylene glycol ethers. These derivatives are used in the production of polymers such as polyesters and polyurethanes. Additionally, a small portion of propylene oxide production is used as an herbicide or fumigant for dried fruits, cocoa, spices, processed nutmeats, and other dry foods.

Chemical Identity

Name: Propylene Oxide

Brand Names: Some product lines including propylene oxide derivatives and polymers are: Tectyl™ corrosion preventatives; Pliogrip™ adhesives; Derakane™ resins; Klucel™, Culminal™, and Combizel™ modified cellulosics; Strodex™ surfactants.

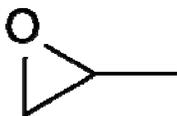
Chemical name (IUPAC): 1,2-Epoxypropane

CAS number(s): 75-56-9

ES number: 200-879-2

Molecular formula: C₃H₆O

Structure:



Uses and Applications

Propylene oxide is used globally as an intermediate to produce numerous products. Polyether polyols account for 60- 70% of the global propylene oxide production, propylene glycol 20%, and propylene glycol ethers account for a further 5%. The polyether polyols are primarily used in the production of polyurethane foams. Propylene oxide is also used as a fumigant, herbicide, and sterilization agent for packaged foods including dried fruits, cocoa, spices, and nuts.



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Physical/Chemical Properties

Phys/Chem Safety Assessment

Propylene oxide is a colorless, low boiling, highly volatile liquid with a sweet, ether-like odor. It is highly flammable and highly reactive.

Property	Value
Form	Colorless liquid
Physical state	Liquid
Color	Colorless
Odor	Sweet, ether-like
Density	0.86 g/cm ³ @ 20°C
Melting / boiling point	-112°C / 35°C
Flammability	H224: Extremely flammable liquid and vapor
Explosive properties	Not classified
Self-ignition temperature	>400°C
Vapor pressure	740 hPa @ 25°C
Mol weight	58.08 g/mol
Water solubility	42.5 – 45% (w/w) @ 20°C
Flash point	38°C @ 1 atmosphere
Octanol-water partition coefficient (Log _{K_{ow}})	0.055

Exposure, Hazard and Safety Assessment

The following section describes possible exposures scenarios and hazards associated with propylene oxide. The exposure assessment describes both the amount of and the frequency with which a chemical substance reaches a person, a population of people, or the environment. Hazard refers to the inherent properties of a substance that make it capable of causing harm to human health or the environment. The safety assessment reports the possibility of a harmful event arising from exposure to a chemical or physical agent under specific conditions. Just because a substance may possess potentially harmful properties does not mean that it automatically poses a risk. It is not possible to make that determination without understanding the exposure.

Human Health Effects

Human Exposure Assessment

Consumer: Consumer exposure to propylene oxide is minimal, as very little propylene oxide monomer remains in any polymers to which consumers may be exposed.

Worker: Workers in several sectors including polyester and polyurethane production may be exposed to propylene oxide vapors. In the chemical industry, engineering controls limit exposure, though significant exposures have been reported during maintenance operations. Some exposure to propylene oxide may occur from the exhaust of hydrocarbon (such as oil fractions) combustion.

Human Hazard Assessment

Effect Assessment	Result
Acute Toxicity Oral / inhalation / dermal	H302: Harmful if swallowed H312: Harmful in contact with skin H332: Harmful if inhaled
Irritation / corrosion Skin / eye / respiratory test	H319: Causes serious eye irritation H335: May cause respiratory irritation
Sensitization	Does not cause allergic reactions upon contact with skin
Toxicity after repeated exposure Oral / inhalation / dermal	Prolonged or repeated exposure does not cause any harmful effects
Genotoxicity / Mutagenicity	H340: May cause genetic defects via the intraperitoneal route only.
Carcinogenicity	H350: May cause cancer.
Reproductive / Developmental Toxicity	Not toxic to reproduction or to unborn children
Aspiration hazard	Not applicable

Human Health Safety Assessment

Consumer: Exposure to hazardous concentrations of propylene oxide is very unlikely.

Worker: Acute exposure of humans and animals to propylene oxide causes eye and respiratory tract irritation. Coughing, difficulty breathing, and pulmonary edema may result from inhalation exposure and may lead to pneumonia.

Skin contact may cause skin irritation and necrosis, however, propylene oxide generally does not cause adverse effects to the skin if it can freely evaporate. Propylene oxide also acts as a mild nervous system depressant. Acute exposure to high concentrations may cause headache, motor weakness, incoordination, ataxia, and coma. Propylene oxide also has moderate to high toxicity from ingestion.

No human effects from chronic propylene oxide exposure have been reported in the peer-reviewed literature, however, studies have shown animal toxicity. Rodents chronically exposed to propylene oxide by inhalation have shown decreased weight gain, increased mortality, and an increased incidence of inflammatory lesions of the nasal cavity, trachea, and lungs. While there is no evidence that propylene oxide causes cancer in humans, it is a direct-acting mutagen and has caused tumors at or near the site of administration (nasal tumors for inhalation exposure and forestomach tumors for gavage exposure.)

Environmental Effects

Environmental Exposures

Industrial propylene oxide production results in minimal exposure to the environment. Propylene oxide rapidly evaporates and biodegrades.

Environmental Hazard Assessment:

Effect Assessment	Result
Aquatic toxicity	H402: Harmful to aquatic life.

Fate and behavior	Result
Biodegradation	Readily biodegradable
Bioaccumulation potential	Not bioaccumulative
PBT / vPvB conclusion	This substance is not considered to be persistent, bioaccumulating and toxic (PBT) or very persistent and very bioaccumulating (vPvB)

Environmental Safety Assessment

Acute exposure to high concentrations of propylene oxide can cause severe irritation. Potential toxicity is expected to be low due to the biodegradability of propylene oxide reaction products.

Risk Management Recommendations

Engineering controls serve as the primary defense against propylene oxide exposure. Due to the explosivity and toxicological hazards, the manufacturers of propylene oxide provide extensive guidance on safe use conditions. Beyond the engineering controls, workers with the potential for exposure to elevated levels of propylene oxide should be protected by the appropriate use of personal protective equipment (PPE). Eye and respiratory protection are essential in areas with potential exposure to propylene oxide liquid and/or vapors. Workers should wear dedicated clothing when working with propylene oxide, and avoid cross-contamination with normal attire. Leather items are very difficult to decontaminate, and should be destroyed after contact with propylene oxide to prevent accidental reuse.

Exposure to propylene oxide in the workplace is covered by established exposure limits. A partial list of references follows:

US OSHA PEL: 100 ppm (8h TWA) ACGIH TLV: 2 ppm (8h TWA)

EU and member states: <http://osha.europa.eu/en/topics/ds/oel/index.stm/members.stm> China: 5 mg/m³ (8h TWA)

Regulatory Agency Review

Propylene Oxide:

- is on the list of REACH Registered substances ((EC) 1907/2006)
- is on the US TSCA inventory
- is listed on Canada's DSL list
- is on the Australia Inventory of Chemical Substances
- is on the China Inventory of Existing Chemical Substances
- is on the Japan Inventory of New and Existing Chemical Substances
- is on the Korea Existing Chemicals Inventory
- is on the New Zealand Inventory of Chemicals
- is on the Philippines Inventory of Chemicals and Chemical Substances
- is classified as a Group 2B carcinogen by IARC
- is classified as a reasonably anticipated human carcinogen by the US NTP

Regulatory Information / Classification and Labeling

Under the Globally Harmonized System for classification and labeling (GHS), substances are classified according to their physical, health, and environmental hazards. The hazards are communicated via specific labels and the (Extended) SDS. GHS attempts to standardize hazard communication so that the intended audience (workers, consumers, transport workers, and emergency responders) can better understand the hazards of the chemicals in use.

GHS Classification:

Flammable liquids: Category 1
Acute toxicity (oral): Category 4
Acute toxicity (inhalation): Category 3
Acute toxicity (dermal): Category 4
Skin corrosion/irritation: Category 2
Serious eye damage/eye irritation: Category 2A
Germ cell mutagenicity: Category 1B
Carcinogenicity: Category 1B (inhalation)
Specific target organ toxicity (single exposure): Category 3 (respiratory system)
Aquatic acute toxicity: Category 3

Hazard Statements:

H224: Extremely flammable liquid and vapor
H302: Harmful if swallowed
H312: Harmful in contact with skin
H319: Causes serious eye irritation
H332: Harmful if inhaled
H335: May cause respiratory irritation
H340: May cause genetic defects via the intraperitoneal route only
H350: May cause cancer
H402: Harmful to aquatic life

Signal Word:

Danger

Precautionary Statements:

P201: Obtain special instructions before use
P202: Do not handle until all safety precautions have been read and understood.
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.
P273: Avoid release to the environment.
P280: Wear protective gloves/protective clothing/eye protection/face protection.
P281: Use personal protective equipment as required
P501: Dispose of contents/container in accordance with local/regional/national/international regulations

Hazard Pictograms:



Conclusion

Exposure to trace residues of propylene oxide in finished products is not likely to be hazardous. Exposure to concentrated propylene oxide may be hazardous.

Contact Information with Company

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Additional Information

For more information on GHS, visit <http://www.osha.gov/dsg/hazcom/ghsguideoct05.pdf> or http://live.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html.

Ashland product stewardship summaries are located at <http://www.ashland.com/sustainability/product/product-stewardship>

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REACH registration is specific to Importers/Manufacturers that place the chemical on the EU market, and is specific to registered uses. Inclusion on the list of REACH Registered Substances does not automatically imply registration by Ashland.

Inclusion on the New Zealand Inventory of Chemicals applies only to the pure substance listed. The importer of record must determine whether or not their substances are in compliance.