Ethylene Oxide (EO, Oxirane)
Product Stewardship Summary

CAS number: 75-21-8
Chemical formula: C$_2$H$_4$O, Purity: 99.97%

What is Ethylene Oxide?
Ethylene Oxide is a colourless, highly reactive and flammable gas at room temperature and a liquid below 12°C. It is produced by direct oxidation of ethylene with oxygen. Because EO reacts readily with many chemicals, it is one of the most versatile intermediates and is used to produce many derivative products.

How is Ethylene Oxide used?
We sell EO only as a building block for the manufacture of a versatile range of derivative products. Ethylene oxide is used in the production of:

- ethylene glycols (used in antifreeze, polyester for fibres, polyethylene terephthalate (PET) bottles and containers, gas dehydration, heat transfer liquids, solvents, and polyesters);
- poly(ethylene) glycols (used in cosmetics, pharmaceutical preparations, lubricants, paint solvents, and plasticisers);
- ethylene oxide-based glycol ethers (used in brake fluids, detergents, and paint and lacquer solvents);
- ethanolamines (used in soaps, detergents, natural gas purification, and textile finishing);
- ethoxylated products of starches and fatty alcohols (used in detergents, surfactants, emulsifiers, and dispersants).

We don’t sell EO into the sterilisation market or as a component in chemicals weapons.

Health, Safety and Environmental considerations
For the physical hazard, EO is classified as a liquefied gas. In its gas form, EO is highly reactive and flammable as it contains gas under pressure that may explode if heated.

Ethylene Oxide easily penetrates through clothing and footwear, causing skin irritation and dermatitis, with the formation of blisters.
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EO is classified as a human carcinogen and can cause damage to reproductive organs (IARC category 1; ANNEX VI to regulation (EC) No 1272/2008 CARCINOGEN category 1B and MUTAGEN Category 1B). EO is classified as acutely toxic if inhaled (category 3). Liquid EO evaporates rapidly and can cause freezing of the skin as a consequence. It is also highly irritating to the eyes and skin and even in dilute solutions can cause blistering or severe damage to the skin or eyes.

EO is classified for specific target organ toxicity — single exposure — category 3, concerning respiratory irritation.

<table>
<thead>
<tr>
<th>Effect Assessment</th>
<th>Result</th>
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<tbody>
<tr>
<td>Acute Toxicity</td>
<td>Toxic if inhaled.</td>
</tr>
<tr>
<td>Irritation</td>
<td>Irritating to the skin and to the eyes. Causes irritation to the respiratory tract.</td>
</tr>
<tr>
<td>Sensitization</td>
<td>Human data do not exclude a skin sensitizing potential.</td>
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<tr>
<td>Mutagenicity</td>
<td>May cause genetic effects.</td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>May cause cancer.</td>
</tr>
<tr>
<td>Toxicity after repeated exposure</td>
<td>The substance may cause damage to the central nervous system after repeated inhalation, as shown in animal studies.</td>
</tr>
<tr>
<td>Toxicity for reproduction</td>
<td>The results of animal studies gave no indication of a fertility impairing effect. A potential to cause toxicity to development cannot be excluded at high doses.</td>
</tr>
</tbody>
</table>

The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned an eight-hour occupational exposure limit of 1 part per million (1 ppm). EO does not have good warning properties through smell.

Releases of EO liquid or vapour do not persist in the environment. EO has low to moderate aquatic toxicity and will not bioconcentrate.

As EO can be used as a pesticide, the export of EO is controlled by the Rotterdam Convention or PIC regulations.

Storing and transporting Ethylene Oxide

EO is transported in the US by rail to customers and by pipeline to internal users. In Europe, it is transported by truck, rail, pipeline and on cross channel ferry. EO is supplied to customers from Singapore via pipeline.

Ethylene Oxide is stored and/or transported as a liquid under moderate pressure. Hose connections are done preferably by dry-break coupling.

During the loading/unloading procedure those involved should wear personal protective equipment, including adequate protection for the respiratory tract.
Risk Characterization Summary

Risks associated with exposure to this product have been evaluated for the following “chain-of-commerce” activities: manufacture, storage, product transfer, transportation, and customers/markets. Due to health, safety and environmental considerations, it is only manufactured, stored and transported to customers in closed systems. Likewise, Shell’s customers are limited to those who only use the product in closed systems as an intermediate for the manufacture of other chemicals. Proper equipment design and handling procedures maintain low risk from exposure to EO where the product is handled as a chemical intermediate. As ethylene oxide is solely used as an intermediate for the production of other products, consumer exposure is not expected.

As such, the risks associated with the product are judged to be low.

This product stewardship summary is intended to give general information about the chemical or categories of chemicals addressed. It is not intended to provide an in-depth discussion of health and safety information. Additional information is available through the chemical’s applicable Material Safety Data Sheet, which should be consulted before use of the chemical. This product stewardship summary does not supplant or replace required regulatory and/or legal communication documents.

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