Product Safety Assessment

1,2-Butylene Oxide

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Names
- CAS No. 106-88-7
- 1,2-Epoxybutane
- 1,2-Butylene epoxide
- 1,2-Butylene oxide
- 1,2-Butene oxide
- 2-Ethyloxirane

Product Overview
- 1,2-Butylene oxide is a clear liquid with a pungent odor. It is a highly reactive, volatile chemical.\(^1\) For further details, see Product Description.
- 1,2-Butylene oxide is mainly used as a chemical intermediate: a raw material for the production of other chemicals. In the United States, it is also used as a stabilizer for chlorinated hydrocarbon solvents.\(^2\) For further details, see Product Uses.
- Worker exposure to 1,2-butylene oxide is possible during its production, transfer, or use. Exposure is limited by engineering controls and personal protective equipment. This material is produced, stored, and consumed in closed systems. Consumers are unlikely to contact this material.\(^3\) For further details, see Exposure Potential.
- Eye contact may cause moderate irritation with slight corneal injury. Vapor may cause eye irritation experienced as mild discomfort or redness. Prolonged skin contact may cause skin burns. Prolonged or widespread skin contact may result in absorption of harmful amounts. In confined or poorly ventilated areas, vapor can easily accumulate and cause unconsciousness or death. Vapor exposure may cause severe irritation to the nose, throat, and lungs, and anesthetic or narcotic effects such as dizziness or drowsiness may occur if exposed to an excessive amount. This product is positive for in vitro genetic toxicity studies. It has been classified by IARC as a possible cancer hazard to humans; by EU CLP REGULATION (EC) No 1272/2008 as Carcinogenicity Category 2 (H351) – suspected of causing cancer; and by the EU Directives 67/548/EEC Carcinogen Category 3 (R40) – limited evidence of a carcinogenic effect.\(^4\) For further details, see Health Information.
- 1,2-Butylene oxide is readily biodegradable, is not expected to accumulate in the food chain, and is slightly toxic to fish and other aquatic organisms on an acute basis.\(^5,\(^6\) For further details, see Environmental Information.
- 1,2-Butylene oxide is a vapor explosion hazard. Both the liquid and vapor are extremely flammable. The vapor is heavier than air and can travel long distances; ignition or flashback
could occur. This material is stable under recommended storage conditions, but can decompose at elevated temperatures. Avoid two-phase storage with water; a slow exothermic (heat producing) reaction may be initiated. Avoid contact with oxidizing materials, acids, bases, water, and clay-based absorbents. Hazardous polymerization is possible with this material. For further details, see Physical Hazard Information.

Manufacture of Product
- **Production** – The Dow Chemical Company produces 1,2-butylene oxide at facilities in the United States.
- **Process** – The two major manufacturing processes are the chlorohydrin process and the direct oxidation process. The chlorohydrin process involves the reaction of butylene and chlorine in the presence of water, followed by dehydrochlorination with caustic or lime to form butylene oxide and salt. The direct oxidation process involves catalytic oxidation of butylene to butylene oxide. 1,2-Butylene oxide is normally produced by the chlorohydrin route as shown below.

\[
\begin{align*}
\text{H}_2\text{C} &= \text{CHCH}_2\text{CH}_3 + \frac{1}{2}\text{Cl}_2 & \rightarrow & \text{H}_2\text{C} &= \text{CHCH}_2\text{CH}_2\text{Cl} \\
& \text{Butylene} & & \text{Butylene chlorohydrin} \\
& \text{Chlorine} & & \text{Butylene oxide} \quad \text{Salt}
\end{align*}
\]

Product Description
1,2-Butylene oxide is a clear liquid with a pungent odor.

Product Uses
1,2-Butylene oxide is mainly used as a chemical intermediate or raw material for the production of other chemicals. It is used in the following products and applications:
- Fuel additives
- Nonionic surfactants
- Butylene glycols and their derivatives (polybutylene glycols, mixed polyglycols, glycol ethers, glycol esters)
- Stabilizer for chlorinated solvents

Exposure Potential
1,2-Butylene oxide is mainly used as a chemical intermediate for the production of other chemicals. Based on this, the public could be exposed through:
- **Workplace exposure** – Exposure can occur in facilities that manufacture 1,2-butylene oxide or use it as a chemical raw material. It is produced, stored, transported, and consumed in closed systems, and direct contact with workers is minimal. Those working with this material in manufacturing operations could be exposed during maintenance, sampling, testing, or other procedures. Each manufacturing facility should have a thorough training program for employees and appropriate work processes, ventilation, and safety equipment in place to limit exposure. See Health Information.
- **Consumer exposure to products containing 1,2-butylene oxide** – Dow does not sell this material for direct consumer use and it is consumed (reacted) when producing other chemicals. See Health Information.
- **Environmental releases** – 1,2-Butylene oxide is used entirely in closed systems, therefore, releases to the environment will be minimal. When introduced to water, the compound will tend to volatilize from water with little tendency to bind to soil and sediment. In air, the
compound will be degraded by reaction with hydroxyl radicals. Since the compound is readily biodegradable, it will likely be removed from water and soil environments, including wastewater-treatment facilities. See Environmental, Health, and Physical Hazard Information.

- **Large release** – Industrial spills or releases are infrequent and generally contained. If a large spill does occur, the major focus is to prevent a fire event as well as contain the spill to prevent contamination of soil and surface or ground water. Do not use absorbents. Evacuate personnel upwind and out of low-lying areas. This material is a vapor explosion hazard. Vapors are heavier than air and can travel long distances and accumulate in low-lying areas. Contact Dow for cleanup assistance. Only trained and properly protected personnel must be involved in cleanup operations. Use foam to smother or suppress vapors. Ground and bond all containers and handling equipment. Eliminate all sources of ignition in the vicinity of the spill or released vapor. Pump recovered material with explosion-proof equipment and collect in suitable and properly labeled containers. Use appropriate safety equipment. Warn the public of downwind explosion hazard. See Environmental, Health, and Physical Hazard Information.

- **In case of fire** – Keep people away. Isolate the fire and deny unnecessary entry. Use water fog or fine spray, dry-chemical or carbon-dioxide extinguishers, or foam to fight the fire. Alcohol resistant foams (ATC type) are preferred. General purpose synthetic foams (including AFFF) or protein foams may function, but will be less effective. A direct water stream may spread the fire. Firefighters must wear positive-pressure, self-contained breathing apparatus (SCBA) and protective firefighting clothing. Avoid accumulation of water. Product may be carried across the water surface, spreading the fire or contacting an ignition source. Follow emergency procedures carefully. See Environmental, Health, and Physical Hazard Information.

For more information, request the Safety Data Sheet from the Dow Customer Information Group.

**Health Information**

- **Eye contact** – Contact may cause moderate eye irritation with slight corneal injury. Vapor may cause eye irritation, experienced as mild discomfort and redness.

- **Skin contact** – Prolonged contact may cause skin burns and repeated contact may cause severe skin burns. Symptoms may include pain, severe local redness, and tissue damage. The response may be more severe if confined under covered skin or if skin is abraded or cut. Prolonged or widespread skin contact with 1,2-butylene oxide may result in absorption of potentially harmful amounts.

- **Inhalation** – In confined or poorly ventilated areas, vapor can readily accumulate and cause unconsciousness and death. Prolonged excessive exposure may cause serious adverse effects, even death. Vapor may cause severe irritation of the upper respiratory tract (nose and throat) and lungs. Symptoms of excessive exposure may be anesthetic or narcotic effects and dizziness or drowsiness.

- **Ingestion** – This material has low toxicity if swallowed. Small amounts swallowed incidental to normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury.

- **Repeated exposure** – In animals, effects have been reported on the peripheral nervous system and respiratory tract.

- **Developmental and reproductive information** – Did not cause birth defects or any other fetal effects in laboratory animals. Limited data in laboratory animals suggest that the material does not affect reproduction.
Genetic Information – In vitro genetic toxicity studies were positive. Animal genetic toxicity studies were negative.

Cancer Information – Butylene oxide has been shown to produce benign and malignant tumors in rats, but not mice. These tumors only occurred following high exposure levels, which first produced chronic upper respiratory tract irritation. Butylene oxide is not believed to pose a carcinogenic risk to man when handled as recommended. It has been classified by IARC as a possible cancer hazard to humans; by EU CLP REGULATION (EC) No 1272/2008 as Carcinogenicity Category 2 (H351) – suspected of causing cancer; and by the EU Directives 67/548/EEC Carcinogen Category 3 (R40) – limited evidence of a carcinogenic effect.

For more information, request the Safety Data Sheet from the Dow Customer Information Group.

Environmental Information

1,2-Butylene oxide is soluble in water and is highly volatile. If introduced to water, the compound will tend to evaporate from water with minimal tendency to bind to soil or sediment.

This product is unlikely to persist in the environment. Upon release to air, the compound will degrade from reaction with hydroxyl radicals. The OECD SIDS Report for 1,2-epoxybutane provides a calculated value for photodegradation in air: t_1/2 = 7.6 days. It is readily biodegradable, which suggests the chemical will be removed from water and soil environments, including biological wastewater-treatment facilities.

1,2-Butylene oxide is not likely to accumulate in the food chain (bioconcentration potential is low) and is considered slightly toxic to fish and aquatic organisms.

The OECD SIDS Initial Assessment Report (SIAR) for 1,2-Epoxybutane (butylene oxide) concluded that, when this material is used in closed systems no further work is recommended. For other uses, there is a need for an exposure assessment.

For more information, request the Safety Data Sheet from the Dow Customer Information Group.

Physical Hazard Information

1,2-butylene oxide is a vapor explosion hazard. Both liquid and vapor are extremely flammable. The vapor is heavier than air and can travel long distances. Ignition or flashback could occur. Avoid static discharge. This product is thermally stable under recommended storage conditions, but can decompose at elevated temperatures. Elevated temperatures can cause hazardous polymerization. Polymerization could result in a rapid, uncontrolled buildup of pressure and heat. Polymerization can be catalyzed by acidic pH, water, acids, alkali metal hydroxides, anhydrous metal chlorides (aluminum/iron/tin, etc.), bases, basic pH, and salts.

Avoid contact with oxidizing materials, acids, bases, water, and clay-based absorbents. Avoid two-phase storage with water; a slow, exothermic (heat generating) reaction may be initiated. Electrically bond and ground all containers and equipment before transfer or use of this material.

For more information, request the Safety Data Sheet from the Dow Customer Information Group.
Regulatory Information
Regulations may exist that govern the manufacture, sale, transportation, use, and/or disposal of 1,2-butylene oxide. These regulations may vary by city, state, country, or geographic region. Information may be found by consulting the relevant Safety Data Sheet or Contact Us.

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Additional Information
- Request a Safety Data Sheet from the Dow Customer Information Group (www.dow.com/assistance/dowcig.htm)
- Contact Us (www.dow.com/assistance/thoughts.htm)

For more business information about 1,2-butylene oxide, contact the Dow Customer Information Group at www.dow.com/assistance/dowcig.htm.

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References
1. 1,2-Butylene Oxide Material Safety Data Sheet, The Dow Chemical Company, July 4, 2011, pages 1 and 5.
7. 1,2-Butylene Oxide Material Safety Data Sheet, The Dow Chemical Company, July 4, 2011, pages 1, 4 and 6.
NOTICES:

As part of its 2015 Sustainability Goals, Dow has committed to make publicly available safety assessments for its products globally. This product safety assessment 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 relevant Safety Data Sheet, which should be consulted before use of the chemical. This product safety assessment does not replace required communication documents such as the Safety Data Sheet.

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