Product Safety Assessment
Triethylene Glycol Monoethyl Ether (Ethoxytriglycol)

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Names
- CAS No. 112-50-5
- Triethylene glycol monoethyl ether (TGEE)
- Ethoxytriglycol
- Ethyltriglycol
- Ethanol,2-[2-(2-ethoxyethoxy)ethoxy]ethanol

Product Overview
- Ethoxytriglycol, or Triethylene Glycol Monoethyl Ether (TGEE), is a colorless liquid with a slight odor that is produced by The Dow Chemical Company. This solvent is completely soluble in water, and has a low evaporation rate. See Product Description.
- About 95% of the TGEE produced is used in automotive hydraulic brake fluid formulations. Other possible uses include: dye carrier for textile dye processes, coatings solvent, chemical process solvent and intermediate, coupling agent for resins and dyes in water-based printing inks, and solvent for: household and industrial cleaning formulations, paint and floor polish strippers, hard surface cleaners, and disinfectants. See Product Uses.
- TGEE is manufactured, stored, and formulated into brake fluid in closed systems. The greatest worker exposure potential exists in automotive plants and brake service/repair shops using TGEE-containing hydraulic brake fluids. Consumer exposure could occur when car owners top off their master brake cylinders with brake fluids purchased in small containers, or through the use of household cleaning formulations. See Exposure Potential.
- Eye contact with TGEE may cause slight irritation and/or slight temporary corneal injury. TGEE is essentially nonirritating to the skin. Prolonged skin contact is not likely to result in absorption of harmful amounts. At room temperature, exposure to TGEE vapor is low due to its low volatility, or evaporation rate, and not likely to be hazardous. See Health Information.
- TGEE is thermally stable at typical use temperatures. Avoid contact with strong acids, strong bases, and strong oxidizers. See Physical Hazard Information.

Manufacture of Product
- Capacity – Dow is the world’s largest producer of ethylene-oxide-based glycol ethers. In 2002, global consumption of E-series glycol ethers, including TGBE, was 606,000 metric tons (1,336 million pounds). Global consumption of TGEE 3,600 metric tons (8 million pounds) in 2002. Dow has glycol ether production facilities in the following U.S. locations: Midland,
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Michigan; Hahnville\textsuperscript{†} and Plaquemine, Louisiana; and Seadrift\textsuperscript{†}, Texas. Dow also has production facilities in San Lorenzo, Argentina and Stade, Germany.

- **Process** – TGEE is produced in a closed, continuous process by the reaction of ethanol and ethylene oxide in the presence of a catalyst. The final product is purified by distillation. TGEE, or ethoxytriglycol, can also be produced by the reaction of diethylene glycol monoethyl ether with ethylene oxide.\textsuperscript{10}

\[
3 \text{H}_2\text{C} = \text{CH}_2 + \text{CH}_3\text{CH}_2\text{OH} \rightarrow \text{HOCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OCH}_2\text{CH}_3
\]

Ethylene oxide Ethanol Ethoxytriglycol

Product Description\textsuperscript{11}
TGEE is a colorless liquid with a slight odor and very low evaporation rate. This material, a solvent produced by Dow, is completely soluble in water.

Ethoxytriglycol contains greater than 85% TGEE. Minor chemical components are tetraethylene glycol monoethyl ether, diethylene glycol, and diethylene glycol monoethyl ether.

Product Uses\textsuperscript{12,13,14}
TGEE is used for a wide variety of applications. The main commercial uses for TGEE made by Dow are:

- Chemical process solvent and intermediate for making esters used as solvents, surfactants, and plasticizers
- Mining applications
- Miscellaneous other uses

Household products which may contain TGEE are: cleaners (including hard surface cleaners), disinfectants, paint or floor polish strippers, and automotive brake fluid.

Exposure Potential
Based on the uses for TGEE, the public could be exposed through:

- **Workplace exposure**\textsuperscript{15} – The use of enclosed equipment, engineering controls, and personal protective equipment during the manufacture of TGEE minimizes the opportunity for human contact. Worker exposure during hydraulic brake fluid formulation is low due to the fact it is a closed-system process. Those working with TGEE in manufacturing operations could be exposed during maintenance, sampling, testing, or other procedures. The greatest TGEE exposure potential exists in automotive plants and brake service/repair shops where brake lines and cylinders are filled. Workplace exposure could also occur in facilities using TGEE to manufacture other products or in the textile industry during the fabric dying process. Each facility should have a thorough training program for employees, appropriate work processes and safety equipment in place to limit unnecessary exposure. See Health Information.

\textsuperscript{†} Site of Union Carbide Corporation, a wholly owned subsidiary of The Dow Chemical Company
• **Consumer exposure to products containing TGEE**\(^{16}\) – The public could be exposed to TGEE when car owners top off their brake master cylinders with brake fluid, or through the use of household cleaners, disinfectants, and paint or floor polish strippers containing TGEE. Read and follow product instructions carefully to minimize the risk of exposure. See Health Information.

• **Environmental releases**\(^{17}\) – In the event of a spill, contain the material if possible. Collect in suitable and properly labeled containers. Prevent from entering soil, ditches, sewers, waterways, and/or groundwater. For small spills, absorb TGEE with appropriate absorbent materials such as sand or vermiculite. See Environmental, Health and Physical Hazard Information.

• **Large release** – For large spills, contain spilled material if possible. Isolate area. Pump into suitable and properly labeled containers. Keep unnecessary personnel from entering area. Use appropriate safety equipment. Follow emergency procedures carefully. In case of fire, do not use direct water stream. Use dry chemical fire extinguisher, water fog or fine spray. Alcohol resistant foams (ATC type) are preferred. See Environmental, Health and Physical Hazard Information.

For more information, see the relevant Safety Data Sheet (SDS).

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**Health Information**\(^{18}\)

Eye contact with TGEE may cause slight irritation and/or slight temporary corneal injury.

TGEE is essentially nonirritating to the skin. Prolonged skin contact is not likely to result in absorption of harmful amounts.

At room temperature, exposure to TGEE vapor is low due to its low volatility, and is not likely to be hazardous. This material has a very low toxicity if swallowed. In animals, effects have been reported on the kidney and liver.

**Minor Components**

For minor component(s), such as diethylene glycol tested separately, effects have been reported in the blood, central nervous system, kidney, liver, testes, bladder, and gastrointestinal tract. (This data may have relevance to effects in humans.) Diethylene glycol has caused toxicity to the fetus and some birth defects at maternally toxic, high doses in animals. Other animal studies have not reproduced birth defects even at much higher doses that caused severe maternal toxicity. Diethylene glycol did not interfere with reproduction in animal studies except at very high doses. However, at the highest doses, it caused the following toxic effects in offspring of treated animals: increased liver weight, decreased brain weight, and reduced sperm motility.

TGEE contains component(s) which did not cause cancer in laboratory animals. Diethylene glycol has been tested for carcinogenicity in animal studies and is not believed to pose a carcinogenic risk to humans.

For more information, see the relevant SDS.

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**Environmental Information**\(^{19}\)

The biodegradation of TGEE under aerobic static laboratory conditions is high. This material is ultimately biodegradable. TGEE is practically non-toxic to aquatic organisms on an acute basis. It is not expected to accumulate in the food chain.

For more information, see the relevant SDS.

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Physical Hazard Information

TGEE is thermally stable at typical use temperatures. This material can oxidize at elevated temperatures. Generation of gas during decomposition can cause pressure in closed systems. Avoid contact with strong acids, strong bases, and strong oxidizers.

General (mechanical) room ventilation is expected to be satisfactory. Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines.

Spills of these organic materials on hot fibrous insulations may lead to lowering of the auto-ignition temperatures, possibly resulting in spontaneous combustion.

Store TGEE the containers made from carbon steel or stainless steel, or in high-baked/phenolic-lined tanks. Do not store in aluminum, copper, galvanized iron, galvanized steel, Viton, Neoprene, Nitrile, or natural rubber.

Decomposition products depend upon temperature, air supply and the presence of other materials. Decomposition products can include and are not limited to: aldehydes, ketones, and organic acids.

For more information, see the relevant Safety Data Sheet (SDS).

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Regulatory Information

Regulations may exist that govern the manufacture, sale, transportation, use and/or disposal of TGEE. These regulations may vary by city, state, country or geographic region. Information may be found by consulting the relevant SDS or Contact Us.

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Additional Information

- Safety Data Sheet (http://www.dow.com/webapps/msds/msdssearch.asp)
- Contact Us (http://www.dow.com/oxysolvents/contact/index.htm)

For more business information about TGEE, visit Dow’s Oxygenated Solvents web site. (http://www.dow.com/oxysolvents/)

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References

14 Estimates by The Dow Chemical Company.

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