

Product Safety Assessment

Diethylene Glycol

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Names

- CAS No. 111-46-6
- Diethylene glycol
- Ethylene diglycol
- Diglycol
- Dihydroxyethyl ether
- Glycol ethyl ether
- 2,2'-Dihydroxyethyl ether
- DEG

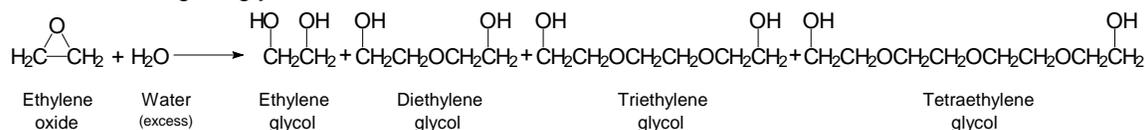
Product Overview

- Diethylene glycol (DEG) is a colorless, low volatility, low viscosity, hygroscopic (picks up water from the air) liquid. It is completely miscible with water and many organic liquids.¹ See [Product Description](#).
- Diethylene glycol is almost entirely used for industrial and commercial applications. The largest use of diethylene glycol in Europe and the U.S. is as an intermediate in the production of unsaturated polyester resins, polyols, and polyurethanes. Other applications for diethylene glycol include its use as an intermediate for the manufacture of triethylene glycol and tetraethylene glycol, as an ingredient in antifreeze and heat transfer fluids, and as a solvent for inks and cleaning filters.² MEGlobal has identified numerous non-recommended uses for DEG which can be accessed at their web site at <http://www.meglobal.biz/non-supported-applications>. See [Product Uses](#).
- Exposure to Diethylene glycol will normally occur in the context of industrial or commercial activities. Occupational exposure can occur in a diethylene glycol production facility or in facilities using diethylene glycol or products containing diethylene glycol. Consumers are unlikely to come into contact with diethylene glycol.³ See [Exposure Potential](#).
- Eye contact with diethylene glycol may cause slight irritation. Skin contact is essentially nonirritating. Repeated skin exposure may result in absorption of harmful amounts. The oral toxicity of diethylene glycol is moderate. However, swallowing large amounts (2 oz) of diethylene glycol may cause serious injury, even death. Excessive exposure may result in effects on the central nervous system, kidney failure, and other effects.⁴ See [Health Information](#).
- Diethylene glycol is readily biodegradable. Its bioconcentration potential (accumulation in the food chain) is low, and its potential for mobility in soil is very high. It is not classified as dangerous to aquatic organisms.⁵ See [Environmental Information](#).
- Diethylene glycol is thermally stable at recommended temperatures and pressures. Elevated temperatures can result in decomposition and pressure build-up in closed systems. Diethylene glycol is incompatible with strong acids, strong bases, and strong oxidizers.⁶ See [Physical Hazard Information](#).

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Manufacture of Product

- **Capacity**⁷ – Global consumption of diethylene glycol in 2012 was estimated to be 2.1 million metric tons (4.6 billion pounds). MEGlobal production facilities are located in Fort Saskatchewan and Red Deer Alberta Canada. In addition to its own production, MEGlobal also markets diethylene glycol produced by EQUATE (a joint venture between Petrochemical Industries Company (PIC) and The Dow Chemical Company) in Kuwait.
- **Process**^{8,9} – Diethylene glycol is manufactured by a closed, single reactor process using a catalyzed condensation reaction between ethylene oxide and a controlled amount of water as shown below. Ethylene glycol, triethylene glycol, and tetraethylene glycol are by-products. Ethylene glycol is recovered by distillation, followed by separation of the diethylene glycol from the higher glycols.



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Product Description

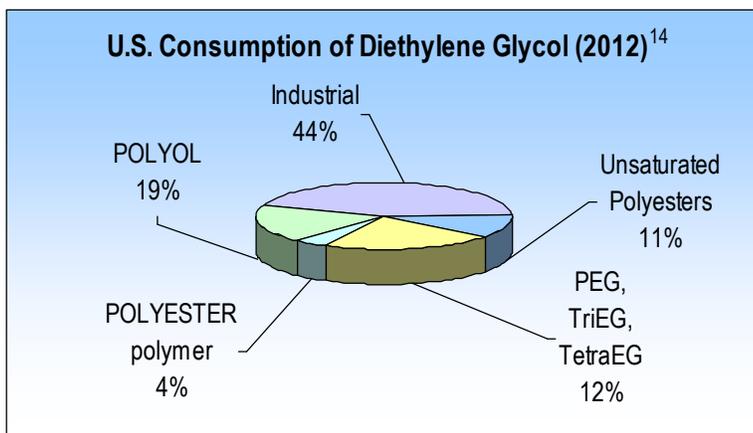
Diethylene glycol (DEG) is a colorless, practically odorless, low-volatility, low viscosity, hygroscopic (picks up water from the air) liquid. Diethylene glycol is completely miscible with water and many organic liquids.¹⁰ It is manufactured by MEGlobal, and EQUATE and marketed by MEGlobal. Two grades of diethylene glycol are manufactured and marketed: regular and high purity.

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Product Uses^{11,12,13,14}

The commercial uses for diethylene glycol include:

- **Chemical intermediate** for unsaturated polyester resins, polyester polyols (for polyurethane foams), thermoplastic polyurethanes, emulsifiers, lubricants, morpholine and higher glycols, such as triethylene glycol and tetraethylene glycol
- **Freezing point depressant** for antifreeze and coolant and heat-transfer fluids
- **Solvent** for printing inks, paint pigments, and dye formulations
- **Solvent coupler** to stabilize dispersions and compatibilize components of inks and paints
- **Lubricant** for glass and cement grinding aids, polishes, and mold-release agents



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Exposure Potential

Based on the uses for diethylene glycol, the public could be exposed through:

- **Workplace exposure**¹⁵ – The use of enclosed equipment, engineering controls, and personal protective equipment during the manufacture of diethylene glycol minimize the potential for human exposure. The most likely route of exposure is industrial, either in a diethylene glycol production facility or facilities using products containing diethylene glycol. Those working with diethylene glycol 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 and safety equipment in place to limit unnecessary chemical exposure. See [Health Information](#).
- **Consumer exposure to products containing diethylene glycol**¹⁶ – Almost all diethylene glycol is used industrially. Consumers are unlikely to be exposed to diethylene glycol. However, there have been reports of misuse of diethylene glycol in applications such as cough syrups. MEGlobal and Dow have customer service and product stewardship resources in place to assist customers with proper use. MEGlobal has identified numerous non-recommended uses for DEG which can be accessed at <http://www.meglobal.biz/non-supported-applications>. See [Health Information](#).
- **Environmental releases**¹⁷ – Diethylene glycol production or the use of diethylene glycol and products containing diethylene glycol could result in the release of this material to the environment through various waste streams. In the event of a spill, the focus is on containing the spill to prevent contamination of soil and surface or ground water. For small spills, absorb diethylene glycol with materials such as cat litter, sand, sawdust, or vermiculite. Collect in suitable and properly labeled containers and dispose of this material in compliance with all governmental requirements. See [Environmental Information](#), [Health Information](#), and [Physical Hazard Information](#).
- **Large release**¹⁸ – For large spills, dike the area. Pump the recovered material into suitable and properly labeled containers and dispose in compliance with all governmental requirements. Keep unnecessary personnel and wildlife from entering area. Use appropriate safety equipment. Follow emergency procedures carefully. Burning liquids may be extinguished by dilution with water, however, do not use direct water stream. Use dry-chemical or carbon-dioxide fire extinguishers, foam, water fog, or fine spray. During a fire, smoke may contain the original material in addition to toxic and/or irritating combustion products. Fight fire from a protected location or safe distance. Consider the use of unmanned hose holders. Firefighters should wear positive-pressure, self-contained breathing apparatus (SCBA) and protective fire-fighting clothing. See [Environmental Information](#), [Health Information](#), and [Physical Hazard Information](#).

For more information, see the relevant [Safety Data Sheet](#). <http://www.dow.com/webapps/msds/msdssearch.asp>

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Health Information^{19,20}

Eye contact with diethylene glycol may cause slight temporary irritation. Corneal injury is unlikely.

Prolonged skin contact with diethylene glycol is essentially nonirritating and unlikely to result in absorption of harmful amounts. However, repeated skin contact may result in absorption of harmful amounts. Massive contact with damaged skin or of material sufficiently hot to burn skin may result in absorption of potentially lethal amounts.

At room temperature, exposure to diethylene glycol vapor is minimal due to its low volatility. With good ventilation, a single exposure is not expected to cause adverse effects. If the material is heated or areas are poorly ventilated, vapor or mist may accumulate and cause respiratory irritation and symptoms such as headache and nausea.

The oral toxicity of diethylene glycol is moderate. Small amounts swallowed incidental to normal handling are not likely to cause injury. However, swallowing larger amounts may cause nausea,

vomiting, abdominal discomfort, diarrhea, and/or serious injury—even death. The approximate lethal dose for adult humans is 2 oz. Excessive exposure to diethylene glycol may cause central nervous system effects, cardiopulmonary effects (metabolic acidosis), and kidney failure.

Effects of repeated exposure to diethylene glycol in humans on the kidney and gastrointestinal tract have been reported. The use of topical applications containing this material may not be appropriate in severely burned patients or individuals with impaired renal function. Reports of kidney failure and death in burn patients suggest that diethylene glycol may have been a factor. In animals, effects have been reported on the bladder, respiratory tract, liver, kidney, central nervous system, and gastrointestinal tract.

In some animal studies, diethylene glycol has caused toxicity to the fetus and some birth defects at doses that are toxic to the mother. Other animal studies have not reproduced birth defects, even at much higher doses. Diethylene glycol did not interfere with reproduction in animal studies except at very high doses.

For more information, see the relevant [Safety Data Sheet](#).

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Environmental Information²¹

Diethylene glycol is practically nontoxic to aquatic organisms on an acute basis. Diethylene glycol is readily biodegradable, its bioconcentration (accumulation in the food chain) potential is low, and its potential for mobility in soil is very high. However due to the fact that DEG is readily biodegradable in water and will consume oxygen in this process it could cause a depletion of oxygen in bodies of water that could harm aquatic organisms.

For more information, see the relevant [Safety Data Sheet](#).

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Physical Hazard Information²²

Diethylene glycol is thermally stable at recommended storage and use temperatures and pressures. Exposure to elevated temperatures can cause decomposition. Gas generated during decomposition can cause pressure build-up in closed systems. The decomposition products of diethylene glycol depend upon temperature, air supply, and the presence of other materials, but may include aldehydes, alcohols, and ethers.

Diethylene glycol is incompatible with strong acids, strong bases, and strong oxidizers. Avoid contact with these materials.

Spills of diethylene glycol on hot fibrous insulation may lead to a reduction of the autoignition temperature, resulting in the potential for spontaneous combustion.

For more information, see the relevant [Safety Data Sheet](#).

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Regulatory Information

Regulations may exist that govern the manufacture, sale, transportation, use, and/or disposal of diethylene glycol. These regulations may vary by city, state, country, or geographic region. Information may be found by consulting the relevant [Safety Data Sheet](#) or by contacting [MEGlobal](#).

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Additional Information

- Safety Data Sheet
(http://www.meglobal.biz/sites/default/files/MEGlobal_MSDS_DEG_Americas.pdf)
- Contact Us (<http://www.meglobal.biz/contact>)
- *Diethylene Glycol Product Guide*, MEGlobal, Form No.001-00004-0508-CRCG, April, 2012
(http://www.meglobal.biz/literature/product_guides/MEGlobal_DEG.pdf)
- *SIAR Ethylene Glycols*, SIDS Initial Assessment Report for SIAM 18, Paris, France, April 20–23, 2004 (revised January 26, 2007)

For more business information about diethylene glycol, visit MEGlobal's web site at www.meglobal.biz

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References

- ¹ *Diethylene Glycol Product Guide*, MEGlobal, Form No.001-00004-0508-CRCG, April 2012, page 3.
- ² *SIAR Ethylene Glycols*, SIDS Initial Assessment Report for SIAM 18, Paris, France, January 26, 2007, page 13.
- ³ *SIAR Ethylene Glycols*, SIDS Initial Assessment Report for SIAM 18, Paris, France, January 26, 2007, page 21.
- ⁴ *Diethylene Glycol High Purity, Material Safety Data Sheet*, MEGlobal, December 5, 2012, pages 1–2 and 5–6.
- ⁵ *Diethylene Glycol High Purity, Material Safety Data Sheet*, MEGlobal, December 5, 2012, page 6.
- ⁶ *Diethylene Glycol High Purity, Material Safety Data Sheet*, MEGlobal, December 5, 2012, page 5.
- ⁷ “*PCI Xylenes & Polyesters Ltd – PCI Client database*”, DEG Selective Multi-client Study. Subscription are required to access the data.
- ⁸ *SIAR Ethylene Glycols*, SIDS Initial Assessment Report for SIAM 18, Paris, France, January 26, 2007, page 11.
- ⁹ MEGlobal: Products and Applications: EG Manufacture web site:
(<http://www.meglobal.biz/ethylene-glycol>)
- ¹⁰ *Diethylene Glycol Product Guide*, MEGlobal, Form No.001-00004-0508-CRCG, April 2012, page 3.
- ¹¹ *Diethylene Glycol Product Guide*, MEGlobal, Form No.001-00004-0508-CRCG, April 2012, page 4.
- ¹² *SIAR Ethylene Glycols*, SIDS Initial Assessment Report for SIAM 18, Paris, France, January 26, 2007, page 14.
- ¹³ MEGlobal: Products and Applications: DEG Products and Applications web site:
(<http://www.meglobal.biz/diethylene-glycol/applications>)
- ¹⁴ “*PCI Xylenes & Polyesters Ltd – PCI Client database*”, MEG Monthly Balance Forecast Data 2013 and DEG US Can. Subscription are required to access the data.
- ¹⁵ *SIAR Ethylene Glycols*, SIDS Initial Assessment Report for SIAM 18, Paris, France, January 26, 2007, pages 21–22.
- ¹⁶ *SIAR Ethylene Glycols*, SIDS Initial Assessment Report for SIAM 18, Paris, France, January 26, 2007, page 23.
- ¹⁷ *Diethylene Glycol High Purity, Material Safety Data Sheet*, MEGlobal, December 5, 2012, page 3.
- ¹⁸ *Diethylene Glycol High Purity, Material Safety Data Sheet*, MEGlobal, December 5, 2012, page 3.
- ¹⁹ *Diethylene Glycol High Purity, Material Safety Data Sheet*, MEGlobal, December 5, 2012, pages 1–2.
- ²⁰ *SIAR Ethylene Glycols*, SIDS Initial Assessment Report for SIAM 18, Paris, France, January 26, 2007, pages 24–38.

²¹ *Diethylene Glycol High Purity, Material Safety Data Sheet*, MEGlobal, December 5, 2012, page 6.

²² *Diethylene Glycol High Purity, Material Safety Data Sheet*, MEGlobal, December 5, 2012, pages 4–5.

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NOTICES:

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