

ETHYLENE GLYCOLS Product Stewardship Summary

CAS number

Ethylene Glycol: 107-21-1, Diethylene Glycol: 111-46-6, Triethylene Glycol: 112-27-6

Chemical formula

Ethylene Glycol: C₂H₆O₂, Diethylene Glycol: C₄H₁₀O₃, Triethylene Glycol: C₆H₁₄O₄

What are ethylene glycols?

Ethylene glycols is the term used to describe a group of products comprising monethylene glycol (MEG), diethylene glycol (DEG) and triethylene glycol (TEG). Mono-, di- and triethylene glycols are the first three members of a homologous series of dihydroxyalcohols. They are colourless, essentially odourless stable liquids with low viscosities and high boiling points. The three glycols have many similar chemical properties. Differences in their applications are due mainly to variations in physical properties such as viscosity, hygroscopicity and boiling point.

Most ethylene glycol (EG) is produced by the direct hydration of ethylene oxide. Smaller amounts of diethylene glycol (DEG) and triethylene glycol (TEG) are co-produced in this process. Additional quantities of DEG and TEG can be produced by reacting EG with additional ethylene oxide.

How are ethylene glycols used?

Glycols are widely used in industry because of their high boiling points, hygroscopicity, non-corrosiveness, freeze point depression, lubricating, plasticising and solvent properties. In addition, their ease of chemical reaction, due to their alcohol end groups, makes them popular intermediates in the formation of numerous esters. More specifically, this is how each of the ethylene glycols are used:

Ethylene glycol (EG): EG is by far the largest volume glycol product and is used in a variety of applications. EG is typically commercially available in three grades: fibre, industrial and antifreeze.

The markets for EG products are polyester fibres; polyethylene terephthalate (PET) plastics; coolants in automobile antifreeze; and resins. The excellent humectant (hygroscopicity) properties of EG products also make them ideal for use in fibres treatment, paper, adhesives, printing inks, leather and cellophane.

Diethylene glycol (DEG): DEG is an important chemical intermediate in the manufacture of unsaturated polyester resins, polyurethanes and plasticisers. Other uses for DEG depend largely on its hygroscopic properties. In natural gas processing, DEG serves as a dehydration agent. It is also used in the treatment of corks, glue, paper and cellophane.

Triethylene glycol (TEG): the main uses for TEG depend upon its hygroscopic properties. TEG is employed as a liquid desiccant for the dehydration of natural gas. Air conditioning systems use TEG as dehumidifiers. TEG also finds use as a vinyl plasticiser, as an intermediate in the manufacture of polyester resins and polyols, and as a solvent in many miscellaneous applications.

Health, Safety and Environmental considerations

Under normal conditions of use, ethylene glycols are not expected to cause irritation to the skin, eyes or respiratory tract. However, in applications where vapours or mists are created, inhaling may cause a mild burning sensation in the nose, throat and lungs.

EG is very toxic if ingested by animals or man. Repeated high dose oral exposure in laboratory animals has resulted in birth defects; however, these effects are not believed to be relevant to humans under normal conditions of use.

The toxicity of DEG is similar to that of EG, but birth defects following repeated high dose oral exposure in laboratory animals have not been reported. TEG is less acutely toxic than the other products.

The American Conference of Governmental Hygienists (ACGIH) has set a ceiling on worker exposure to ethylene glycol vapours or mists of 39.4 ppm. ACGIH has not established worker exposure limits for DEG or TEG. Specific countries may have more stringent requirements than ACGIH. If there is a potential for exposure above these limits, proper protective clothing and appropriate respiratory protection is required.

Ethylene glycols are biodegradable, have a low potential to bioaccumulate and have low toxicity to aquatic organisms.

Ethylene glycols are not flammable.

Storage and Transport

Ethylene glycols are transported in trucks and rail cars and by bulk marine shipments. For smaller shipments, Shell chemicals companies or their distributors package these products in isotainers or drums. Most ethylene

glycol shipments are directly from the point of manufacture to the customer, although depots and distributors are used in some countries.

Risk Characterization Summary

Risks associated with exposure to these products have been evaluated for the following “chain-of-commerce” activities: manufacture, storage, product transfer, transportation, and customers/markets. They are manufactured, stored and transported to customers in closed systems. Depending on the customer, end uses may vary from use as an intermediate for the manufacture other chemicals, commercial products, or certain formulated consumer products. Proper equipment design and handling procedures maintain low risk from exposure to ethylene glycols where the product is used as a chemical intermediate. Exposures may be higher in commercial and consumer applications. To minimize risk, additional controls, such as, special handling procedures and protective packaging, are implemented.

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.