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Ethylene Glycol vs Propylene Glycol In Energy Recovery Systems

Background

The environmental issues regarding ethylene and propylene glycol became a media topic in the early 1990's when runoff from aircraft deicing activities was linked to harmful effects on aquatic organisms. Since that time extensive studies have been conducted and conclude that deicing fluid (both ethylene and propylene glycol) are harmful to aquatic organisms for two primary reasons.

The principal concern regarding the environmental impacts of glycol entering natural waterways relates to the amount of dissolved oxygen in water being consumed during the decomposition of both ethylene and propylene glycol. Oxygen consumption occurs when bacteria decompose organic materials (including glycols) and use oxygen in the process. This phenomenon can deplete all dissolved oxygen from the water if the rate of decomposition is very high.

Ethylene glycol is toxic to aquatic and mammalian organisms. For this reason it is being replaced, for now, by the less toxic propylene glycol for aircraft deicing. However, while ethylene glycol and propylene glycol are both biodegradable, propylene glycol degrades at a slower rate and has a greater biochemical oxygen demand. Thus, propylene glycol will remain in the environment longer than ethylene glycol and will consume more oxygen while it is being broken down. Therefore, it can still be harmful to the environment.

Biodegradation Time Period of Ethylene and Propylene Glycol

Ethylene Glycol:	10 – 30 days
Propylene Glycol:	More than 20 – 30 days

Hazardous Substance

If ingested, ethylene glycol can be fatal to humans and wildlife. For that reason, it is defined as a hazardous substance by the Resource Conservation and Recovery Act which is enforced by the USEPA.

The act identifies "reportable quantities" for each hazardous substance. If a quantity of a hazardous substance equal to or greater than the reportable quantity is released into the environment (outside of the building into the earth, a stream, or a storm drain) the release must be reported to EPA.

The reportable quantity for ethylene glycol is 5,000 lbs. or 539 gal, this means that it would take a release 539 gal of 100% ethylene glycol into the environment to have a reportable release. An energy recovery system using 35% ethylene glycol would have to release 1,539 gal of the ethylene glycol / water solution to the environment to have a reportable spill. This amount of ethylene glycol is only present in energy recovery systems for very large multi-story buildings (at least 250,000 cfm).

Energy Recovery System Performance

Ethylene glycol is the standard heat transfer fluid used in European energy recovery systems for a few primary reasons – its' viscosity (which is directly related to system performance), its' heat transfer properties and its' antifreeze properties.

At low temperatures, ethylene glycol has a lower viscosity than propylene glycol which increases the annual energy recovery performance by 5 – 10%.

To achieve the same level of freeze prevention, lower concentrations of ethylene glycol are required than if propylene glycol were used.

A typical Konvekta system contains about 200 gallons of ethylene glycol. The glycol is contained in a closed system. If a leak develops, a pressure drop is identified by the System Controller and immediately addressed by maintenance personnel. The Controller notification prevents any significant release of glycol.

Sources:

Airport and Aircraft Safety Research and Development Division
Federal Aviation Administration August 1998 USDOT FAA Study

Equistar/Lyondell (Glycol Manufacturer)

Dow Chemical

http://www.engineeringtoolbox.com/ethylene-propylene-glycol-d_904.html