From:	Tyler G[redacted]
To:	CZA, Program (MailBox Resources)
Subject:	Public Comment for Starwood Digital Ventures Request for Status Decision - Project CZA-448SD
Date:	Friday, January 9, 2026 12:59:24 PM
Attachments:	Public Comment on Project CZA-448SD G[redacted], Tyler 09JAN2026.pdf NFPA110 Generator Testing.pdf EPA Glycol.pdf Clear Water Industries - Glycol.pdf

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Public Comment on Coastal Zone Act Status Decision

RE: Starwood Digital Ventures Request for Status Decision - Project CZA-448SD
Date: 09 January 2026

Dear Secretary Patterson,

My name is Tyler G[redacted], and I am a resident of [redacted]
Thank you for the opportunity to comment on the Starwood Digital Ventures Request for Status Decision.

I respectfully request that DNREC apply the criteria of the Coastal Zone Act (CZA) in full by **prohibiting this development as a heavy industry use scenario**. I strongly believe this hyperscale data center proposal is incompatible with the Coastal Zone given it presents a use involving more than 20 acres, calls for equipment with characteristics similar to the given examples of prohibited use, and it has the potential to pollute when equipment malfunctions or human error occurs.

This project proposal functionally resembles prohibited heavy industry use in terms of its size, magnitude of resource consumption, plans for continuous 24/7 operations, immense electricity use, the potential contamination risks from the quantity of large batteries, diesel fuel, and potentially glycol on site, and the need for significant supporting infrastructure. While it may not have the exact types of smokestacks or reaction columns that a traditional refinery or paper mill would have, this proposal calls for very similar components in terms of extensive cooling systems, multiple electrical substations, and a fleet of over 500 diesel generators each with a 5,000-gallon tank attached. Many characteristics of this proposed hyperscale data center campus raise material concerns that fall squarely within the CZA's protective mandate.

1. Applicable Law and Regulatory Framework

- The CZA defines Heavy Industry Use as, "a use characteristically involving more than 20 acres, and characteristically employing some but not necessarily all of such equipment such as, but not limited to, smokestacks, tanks, distillation or reaction columns, chemical processing equipment, scrubbing towers, pickling equipment and waste-treatment lagoons; which industry, although conceivably operable without polluting the environment, has the potential to pollute when equipment malfunctions or human error occurs." (7 Del. C. § 7001)
- The implementing regulation for the CZA defines "Potential to Pollute" as the "potential to cause pollution or short and long term adverse impacts on human

populations, air and water quality, wetlands, flora and fauna, or to produce dangerous or onerous levels of glare, heat, noise, vibration, radiation, electromagnetic interference and obnoxious odors." (7 DE Admin. Code 101)

- Under the CZA, DNREC must interpret a proposed activity's status "protect the natural environment of its bay and coastal areas" given that new heavy industry use is, "determined to be incompatible with the protection of that natural environment in those areas" (7 Del. C. § 7001).

A purely categorical exclusion for this project based on nomenclature alone undermines the CZA's core purpose to safeguard coastal ecology and resources. Hyperscale data centers did not exist when the original CZA text was written, and so the application needs reviewed with an eye for how this modern project aligns to the intent and context of those original definitions. The Starwood application is a proposed use with demonstrable negative environmental impacts and several characteristics of prohibited use, and as such, warrants prohibition.

2. Scale and Functionality Must Be Evaluated Substantively

The application describes a ~6.1 million building sq ft (apprx. 140 acres of just buildings) data center campus involving 11 new buildings with significant supporting electrical infrastructure, substations, a switchyard, and over 500 diesel-powered backup generators. (Application, pg 6-7)

- The project expects an electrical demand of 1.2 gigawatts; more than all Delaware residents combined use today.
- There are details for an estimated ~12.7 million GPY for water use (with additional startup use for cooling) and estimated water discharge at 2.7 million GPY.
- In addition, the application notes an estimated 27 tons/year of NO_x emissions, and an estimated 17 tons/year of CO emissions, in an absolute best-case scenario where the only time diesel generators are running are for maintenance or tests. Worst-case estimates go up to 616 and 419 tons/year, respectively.

Just like mills and refineries, the electrical demand proposed acts as a grid-anchoring load: they require dedicated substations, uninterruptible power, drive significant transmission upgrade needs beyond their property line, and could crowd out other loads on the same grid. Just like mills and refineries, this project needs vast amounts of water for cooling purposes, and that water gets discharged as higher-temperature or chemically treated effluent in some way. Just like mills and refineries, this project would leverage redundant combustion systems for energy reliability and would use them frequently (not just for "emergencies") to ensure uptime. And while a data center might not have visible 'smokestacks,' they still release many of the same chemical emissions (NO_x, CO, and VOCs) as mills and refineries.

From a functional perspective, this project represents a high-intensity, heavy industrial use in terms of size, energy, water demands, and emissions that are far beyond typical non-industrial activities. Even if the project does not "manufacture" tangible physical goods, its operational and infrastructure footprint is comparable to uses that are traditionally prohibited under the

CZA.

3. Air Quality Impact and Combustion Emissions Are Material

The applicant's figures anticipate tens of tons per year of NO_x and CO from emergency generation systems under the most optimistic assumptions. Emissions even at the estimated best-case scale are still consistent with source permits (NOx at 25 tons/year, per 7 DE Admin. Code 1125) and may contribute to local air quality degradation. Emission sources in this range would be large enough to warrant cumulative air dispersion analysis rather than categorical exclusion. Many existing data centers across the country operate generators much more frequently than what's provided in Starwood's best-case estimate; Many cases exist where all generators are tested monthly to ensure functionality, or the facility runs generators to ensure continued operations on days where the outside electrical grid is experiencing heavy load. The application's best-case estimate does not appear to align with National Fire Protection Association (NFPA) 110, which calls for monthly load testing "under actual or equivalent load for 30 minutes at or above 30% nameplate rating." The baseline estimate provided in the application reflects, "up to 20 hours of operation that will occur throughout the year." (Application, pg 11) Delaware's state fire prevention regulations incorporate compliance to NFPA 110, (1 DE Admin. Code 702) so true emissions would have to be higher than what's put forth. New Castle County also experiences severe snowfall, wind, and thunderstorms that could further impact energy availability and increase projected emissions due to periodic blackouts and brownouts.

Ignoring these emissions in a status determination would conflict with the CZA's requirement to assess significant environmental impacts, particularly in an area already influenced by industrial air sources. While this project may look different from a mill or refinery, it would ultimately have a similar effect on the nearby area, on wildlife, and on residents. This project proposal represents an increased health hazard to Delawareans susceptible to poor air quality, which fits the definition of "Potential to pollute," further justifying classifying the project as heavy industry use.

4. Water Withdrawal, Use, and Resource Stress

The application estimates ~12.7 million gallons of water use per year for data center cooling and humidification, supplied by a public utility. An additional 600,000 gallons is needed to establish a closed-loop cooling, where repair work could potentially require some or all of the coolant system to be drained, further increasing water use estimates. That equates to over 35,000 gallons per day of ongoing demand; a non-trivial burden when evaluated against regional water resources and infrastructure capacity. It is also worth calling attention to the fact that the application only notes that, "Options for an advanced cooling system are being explored with one using a closed loop system with a water/glycol coolant" (Application, pg 14) so it is possible that water demands could exceed these estimates should a less efficient cooling system be used instead. If the water/glycol approach is pursued, the risk should be made clear: glycol poses environmental and safety risks that warrant careful consideration, particularly at large facilities where substantial volumes may be stored onsite. (See epa.gov Summary)

Closed-loop systems are not leak-proof, and glycol releases can occur due to pipe failures, seal degradation, corrosion, maintenance errors, equipment malfunctions, or human error. If released, glycol can migrate through soil and contaminate groundwater or enter nearby surface waters, where its rapid biodegradation can deplete dissolved oxygen and harm aquatic life. (See Clear Water Industries - Glycol) Wetlands and floodplains are especially vulnerable, as contaminants tend to persist longer and spread more widely in these environments, potentially impairing natural filtration, habitat, and flood attenuation functions. While propylene glycol is less toxic than ethylene glycol, both substances can cause environmental harm at an industrial scale, and larger releases may require hazardous material response and costly remediation. For these reasons, glycol-based cooling systems are typically expected to include secondary containment, leak detection, and spill response planning, particularly when located near sensitive environmental resources. There is only one mention of spill handling in the project's application and it relates to the electrical substations' expected use of batteries containing sulfuric acid. (Application, pg 25) Given this use has the "potential to pollute" the coastal zone as a result of equipment malfunction or human error, it must be considered heavy industry.

5. Fire Hazard and Environmental Risk from Energy Storage

Data centers rely on battery systems for power continuity. These systems have been linked to significant fire events involving toxic smoke, thermal runaway, difficult suppression requirements, and the potential for environmental contamination in multiple facilities worldwide. These risks implicate public health and hazardous substance release concerns; environmental effects explicitly referenced in the CZA's protective purpose and fitting the definition of "potential to pollute." The application here notes, "An element of the uninterruptible power systems will include batteries utilizing lithium titanate technology...Preliminary estimates indicate that approximately 960, 1 MW batteries may be needed."

While lithium titanate is generally considered safer than lithium ion because of its increased resistance to thermal runaway, any kind of large battery energy storage systems present significant fire-load and smoke hazards simply because of the quantity of stored energy. This risk of challenging fire events, coupled with the significant volume of diesel fuel storage at the site for emergency energy generation, creates a unique scenario not commonly seen in other "light" development or land-use cases. DNREC's interpretation of "environmental quality" must include acute hazards associated with energy storage technologies, not only traditional air and water impacts. Fires inside electrical or power infrastructure can lead to toxic smoke plumes, runoff from firefighting efforts (which can carry particulate, metals, and other combustion byproducts), and potential contamination of soil or stormwater if not properly contained. Again, fitting the "potential to pollute" definition for heavy industry.

6. Closing

For the reasons explained above, **I respectfully request that DNREC apply the regulatory criteria in the Delaware CZA in full to prohibit this development as a heavy industry use.** I ask that the status determination recognizes the proposal's use of greater than 20 acres of land, the potential for pollution as a result of equipment failure or human error, and the fact that the scale of resource consumption and 24/7 operations mimics that of prohibited heavy industry use as substantive grounds under the Act's protective purposes, not merely categorical exclusions based on facility description.

Thank you for your careful review of these comments.

Respectfully submitted,
Tyler G[redacted]
[redacted]

Understanding NFPA 110 Generator Testing Requirements

by Danny Chisholm
Feb 26, 2025 7:48:48 PM

If your facility relies on emergency generators, understanding NFPA 110 isn't optional—it's essential. Power outages can disrupt critical operations, threaten patient safety, and jeopardize compliance with CMS and AHJ requirements. NFPA 110 sets the standard for ensuring your emergency power system is ready when needed.

Our latest article breaks down the key testing requirements, including monthly and triennial load tests, acceptance testing, and load bank protocols. You'll also learn what inspectors look for, how to document your tests, and how to avoid common mistakes that could cost you downtime or failed inspections.

What is NFPA 110?

NFPA 110 is the standard that outlines the performance requirements for emergency and standby power systems. These systems are crucial for providing backup power during outages, ensuring critical equipment and systems remain in operation. Compliance with NFPA 110 helps guarantee your generator is ready to perform when needed.

NFPA 110 classifies backup power systems based on:

- **Class:** Length of time an emergency power supply system (EPSS) can operate without refueling. Ranging from **Class 0.083** (5 minutes) to **Class X** (user-defined duration).
- **Type:** Specifies the time allowed for power restoration, with **Type 10** requiring power restoration within **10 seconds**.
- **Level:** Level 1 systems must operate in situations where power failure could lead to loss of human life**.** While Level 2 systems support less critical loads.

NFPA 110 covers several aspects of emergency and standby power systems, including design, installation, maintenance, and testing. Understanding these components is essential to ensure compliance and effectiveness.

Engineers design the EPSS to provide electricity to essential electrical systems during power outages. NFPA 110 ensures these systems meet reliability and safety requirements.

Generator Testing Requirements

Regular testing ensures your generator is always ready to provide power when needed. NFPA 110 outlines specific testing requirements to maintain backup power system reliability.

Monthly Testing

- Verifying that the generator operates within proper voltage and frequency limits

The test must be documented, including the date, duration, and load conditions. If the load is less than 30%, you must conduct annual load bank testing.

Triennial (36-Month) Testing

NFPA 110 requires a **full system extended run load test** at least once every **36 months** for Level 1 installations. This test must:

- Run the EPSS at its actual building load or **30% of its nameplate kW rating** (whichever is greater)
- Last **at least 4 hours**
- Verify **fuel system performance**, including the operation of fuel transfer pumps

This test ensures that backup power can support critical patient care during prolonged outages for hospitals and healthcare facilities.

Acceptance Tests

You must perform acceptance tests when you install a new generator system or after you make significant repairs. These tests verify that:

- The generator starts within the required **10-second window** (for Type 10 systems)
- The system provides power to essential loads as designed
- Transfer switches function properly under simulated power loss.

Load Bank Testing

You must conduct a **load bank test** if the generator does not reach 30% load during the monthly test. This ensures:

- The generator can handle its rated capacity
- Proper exhaust gas temperature is maintained
- The engine performs efficiently under real-world conditions.

Authority Having Jurisdiction (AHJ)

- Keep **detailed records** of all testing and maintenance activities
- Address any deficiencies identified during inspections
- Ensure testing is performed by **qualified personnel**.

NFPA 110 requires **permanent records** of all testing, inspections, and maintenance. Records should include:

- Dates and times of tests
- Load conditions and test duration
- Any issues encountered and corrective actions taken.

Best Practices for EPSS Management

To maintain an **effective** emergency power system:

- Implement a [preventive maintenance program] based on **manufacturer recommendations**
- Train personnel in **proper testing and troubleshooting procedures**
- Use **remote monitoring** to track generator performance and diagnose issues in real-time

Understanding and adhering to NFPA 110 generator testing requirements is essential for maintaining the reliability of your backup power system. Following NFPA 110 guidelines, healthcare facilities, data centers, and other critical infrastructure can ensure that **power outages do not disrupt essential operations**.

Regular testing, proper documentation, and collaboration with the AHJ are key components of NFPA 110 compliance. By prioritizing **preventive maintenance**, facilities can **avoid costly failures** and ensure the safety and well-being of their occupants.

Post by Danny Chisholm
Feb 26, 2025 7:48:48 PM

Technical committee member NFPA 99, 110, and 111.

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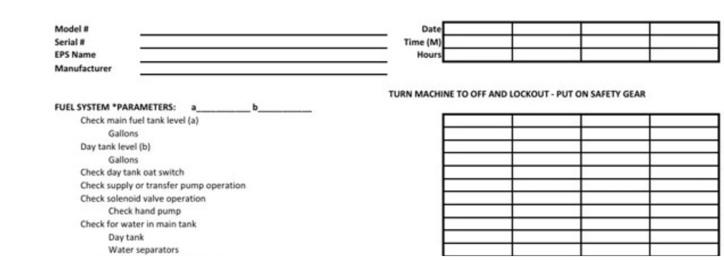
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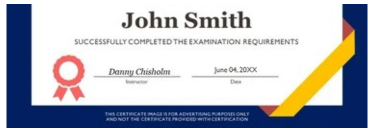

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Ethylene Glycol

107-21-1

Hazard Summary

Ethylene glycol has many uses, including as antifreeze in cooling and heating systems, in hydraulic brake fluids, and as a solvent. Acute (short-term) exposure of humans to ethylene glycol by ingesting large quantities causes three stages of health effects: central nervous system (CNS) depression, followed by cardiopulmonary effects, and later renal damage. The only effects noted in one study of individuals exposed to low levels of ethylene glycol by inhalation for about a month were throat and upper respiratory tract irritation. Rats and mice chronically (long-term) exposed to ethylene glycol in their diet exhibited signs of kidney toxicity and liver effects. Several studies of rodents exposed orally or by inhalation showed ethylene glycol to be fetotoxic. An epidemiologic study on renal cancer mortality did not find an increased risk for workers exposed to ethylene glycol. EPA has not classified ethylene glycol for carcinogenicity.

Please Note: The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS) (7), which contains information on oral chronic toxicity and the RfD, and the carcinogenic effects of ethylene glycol, and the Agency for Toxic Substances and Disease Registry's Toxicological Profile for Ethylene Glycol and Propylene Glycol. (2)

Uses

- Ethylene glycol is used as antifreeze in cooling and heating systems, in hydraulic brake fluids, as an industrial humectant, as an ingredient of electrolytic condensers, as a solvent in the paint and plastics industries, in the formulations of printers' inks, stamp pad inks, and inks for ballpoint pens, as a softening agent for cellophane, and in the synthesis of safety explosives, plasticizers, synthetic fibers (Terylene, Dacron), and synthetic waxes. (4)
- Ethylene glycol is also used to de-ice airport runways and aircraft. (2)

Sources and Potential Exposure

- Dermal or inhalation exposure to workers may occur during the manufacture or use of the chemical. (1)
- Ethylene glycol may be discharged into wastewater from its production and use. It may also enter the environment from its uses in deicing airplane runways and from spills and improper disposal of used antifreeze, coolant, and solvents containing ethylene glycol. (1,2)

Assessing Personal Exposure

- Urinalysis for oxalic acid, an ethylene glycol metabolite, may be useful in diagnosis of poisoning by oral exposure. (3)

Health Hazard Information

Acute Effects:

- Acute exposure of humans to ethylene glycol by ingesting large quantities causes three stages of health effects. CNS depression, including such symptoms as vomiting, drowsiness, coma, respiratory failure, convulsions, metabolic changes, and gastrointestinal upset are followed by cardiopulmonary effects and

later renal damage. (2,4,5)
- Acute animal tests in rats, mice, rabbits, and guinea pigs have demonstrated ethylene glycol to have moderate acute toxicity by inhalation or dermal exposure and low to moderate acute toxicity by ingestion. (6)

Chronic Effects (Noncancer):
- The only effects were noted in a study of individuals exposed to low levels of ethylene glycol by inhalation for about a month were throat and upper respiratory tract irritation. (2)
- Rats chronically exposed to ethylene glycol in their diet exhibited signs of kidney toxicity and liver effects. (5,7)
- Ocular irritation and lesions and pulmonary inflammation have been observed in rats, rabbits, and guinea pigs subchronically exposed by inhalation. (5)
- EPA has not established a Reference Concentration (RfC) for ethylene glycol. (7)
- The Reference Dose (RfD) for ethylene glycol is 2.0 milligrams per kilogram body weight per day (mg/kg/d) based on kidney toxicity in rats. The RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups), that is likely to be without appreciable risk of deleterious noncancer effects during a lifetime. It is not a direct estimator of risk but rather a reference point to gauge the potential effects. At exposures increasingly greater than the RfD, the potential for adverse health effects increases. Lifetime exposure above the RfD does not imply that an adverse health effect would necessarily occur. (7)
- EPA has high confidence in the study on which the RfD was based because it was a well-conducted lifetime study by a relevant route and defined a no-observed-adverse-effect level (NOAEL) and lowest-observed-adverse-effect level (LOAEL); high confidence in the database because it contains another chronic rat study and a monkey study that support the NOAEL and LOAEL and it also contains data that indicate that the RfD is protective of teratogenic and reproductive effects; and, consequently, high confidence in the RfD. (7)
- The California Environmental Protection Agency (CalEPA) has calculated a chronic reference exposure level of 0.4 milligrams per cubic meter (mg/m^3) based on eye and respiratory tract irritation in humans. The CalEPA reference exposure level is a concentration at or below which adverse health effects are not likely to occur. (8)

Reproductive/Developmental Effects:
- No information is available on the reproductive or developmental effects of ethylene glycol in humans.
- Several studies of rodents exposed orally or by inhalation showed ethylene glycol to affect animal fetuses. Fetotoxicity manifested as increased preimplantation loss, delayed ossification, and an increased incidence of fetal malformations were reported. The inhalation study, however, noted continuous grooming of the fur, resulting in a high rate of exposure by ingestion as well. (2,5,7)

Cancer Risk:
- An epidemiologic study on renal cancer mortality did not find an increased risk for workers exposed to ethylene glycol. (2)
- A study by the NTP did not find an increased incidence of tumors in mice exposed to ethylene glycol in the diet. (9)
- EPA has not classified ethylene glycol for carcinogenicity.

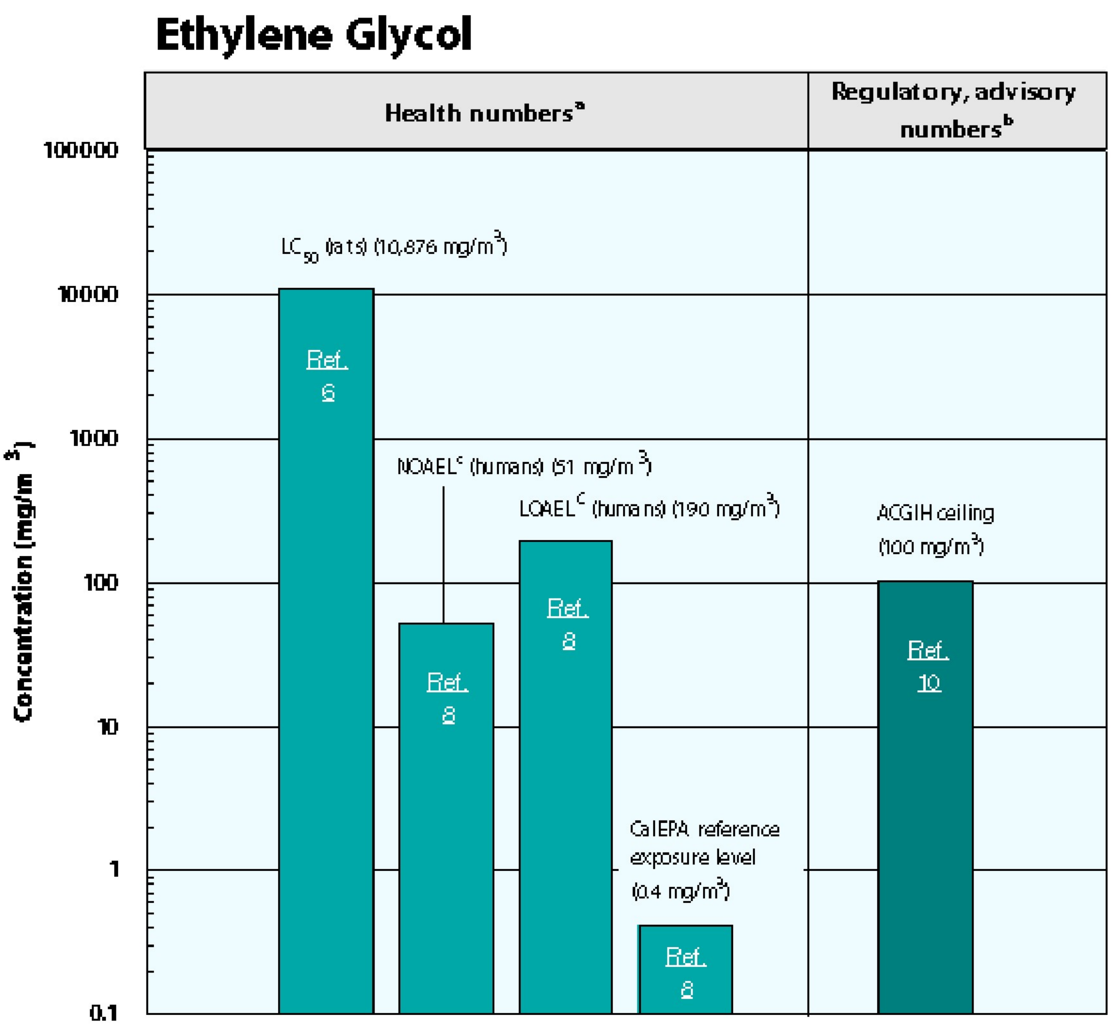
Physical Properties

- The chemical formula for ethylene glycol is $C_2H_6O_2$, and its molecular weight is 62.07 g/mol. (4)
- Ethylene glycol occurs as a clear, slightly viscous liquid that is completely miscible with water. (1,4,5)
- Ethylene glycol is odorless. (3)
- The vapor pressure for ethylene glycol is 0.06 mm Hg at 20 °C, and its log octanol/water partition

coefficient ($\log K_{ow}$) is -1.36. (5)

Conversion Factors:
To convert concentrations in air (at 25 °C) from ppm to mg/m^3: mg/m^3 = (ppm) × (molecular weight of the compound)/(24.45). For ethylene glycol: 1 ppm = 2.54 mg/m^3.

Health Data from Inhalation Exposure



ACGIH TLV ceiling --American Conference of Governmental and Industrial Hygienists' threshold limit value ceiling; the concentration of a substance that should not be exceeded during any part of the working exposure.
LC_{50} (Lethal Concentration $_{50}$)--A calculated concentration of a chemical in air to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.
The health and regulatory values cited in this factsheet were obtained in December 1999.
[a] Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.
[b] Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice. ACGIH numbers are advisory.
[c] This NOAEL and LOAEL are from the critical study used as the basis for CalEPA's reference exposure level.

Summary created in April 1992, updated January 2000

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Glycol Contamination: Prevention and Solutions for Industrial Systems

By ClearWater Industries (https://clearwatershelton.com/author/clearwater-industries/) | July 30, 2025 | 0 (https://clearwatershelton.com/glycol-contamination/#respond)

In industrial and commercial water systems, glycol contamination is a critical concern that can compromise both system performance and safety. Glycol is commonly used in process water, chillers, and HVAC loops to provide freeze protection and heat transfer stability. However, when glycol enters unintended areas or reaches improper concentrations, it can introduce toxic substances into otherwise clean systems, disrupt efficiency, and create environmental or health hazards.

Glycols such as ethylene glycol and propylene glycol are widely used for their antifreeze properties, but their presence must be carefully controlled. In regulated industries like pharmaceuticals and food production, even small levels of contamination can result in costly shutdowns or compliance violations. In more general industrial applications, glycol contamination can lead to corrosion, fouling, and degradation of mechanical components.

Understanding how contamination occurs, how to detect it, and how to prevent it is essential for facility managers, water treatment professionals, and operators of any system that uses glycol-based fluids. This article explores the science behind glycol fluids, the risks associated with contamination, and proven solutions to protect your infrastructure and the surrounding environment.

Technician performing maintenance to prevent glycol contamination in an industrial cooling system

Types of Glycol and Their Role in Industrial Systems

Glycol is a class of organic compounds known for its ability to lower the freezing point of water and support efficient heat transfer in closed-loop systems. In industrial settings, glycols are used as coolants, antifreeze agents, and thermal fluids. The most commonly used types are ethylene glycol and propylene glycol, each offering distinct advantages and safety profiles depending on the application.

Ethylene Glycol

Ethylene glycol is a colorless, odorless liquid with a relatively low viscosity and high thermal conductivity. It is widely used in mechanical cooling systems, process chillers, and HVAC operations. Ethylene glycol is favored for its superior thermal properties and low cost. However, it poses significant health and safety concerns. Ethylene glycol toxicity is well-documented and can result in serious medical issues, including kidney damage due to the formation of calcium oxalate crystals after ingestion. Its use is restricted in environments where food, pharmaceutical products, or potable water may be at risk of exposure.

Propylene Glycol

Propylene glycol is considered a safer alternative due to its lower toxicity. It is often used in applications involving pharmaceuticals, food production, and environments with a higher likelihood of human contact. While propylene glycol is less efficient than ethylene glycol in heat transfer performance, its safety profile makes it preferable in sensitive areas. It is also less aggressive to certain materials, reducing the risk of corrosion when properly maintained.

Other Uses and Compounds

Both types of glycol are often formulated with additives, corrosion inhibitors, and dyes to create inhibited glycol blends that extend fluid life and protect system components. These blends are used in a variety of industrial applications, including:

- Glycol coolants in brake fluid and heavy machinery
- Cooling loops in chillers and process equipment
- Fibers and polymers such as polyester fibers
- HVAC systems requiring extended freeze protection

When used properly, glycols are reliable and effective. But as we will explore, their widespread use also increases the risk of glycol contamination if systems are not properly maintained or if incompatible fluids are introduced.

Read more on our blog: **What is a Glycol System: Troubleshooting Common Issues** (https://clearwatershelton.com/what-is-a-glycol-system/)

How Glycol Contamination Happens: Causes and Entry Points

Despite being carefully introduced into closed-loop systems for temperature control and freeze protection, glycols can become contaminants when they migrate to areas where they do not belong. Glycol contamination may occur gradually due to aging infrastructure or suddenly through operational errors or system failures. Understanding the most common causes and entry points is essential for preventing long-term damage.

1. Cross-Contamination with Potable or Process Water

One of the most dangerous scenarios occurs when glycol inadvertently enters potable water lines. This can happen when there is a backflow condition or improper piping design that allows glycol to bypass system boundaries. Facilities that rely on plain water for certain stages of production may be especially vulnerable, particularly if equipment such as chillers, boilers, or hydronic heating systems are not properly isolated.

2. System Leaks and Seals

Glycol-based fluids are often stored and recirculated under pressure. Any failure in valves, joints, seals, or expansion tanks can lead to leakage. When systems lose pressure or are improperly balanced, fluid from a glycol circuit may migrate into an adjacent line. Even minor leaks can cause serious problems if they go undetected, particularly in systems with sensitive sensors or direct food contact.

3. Improper Maintenance or Refilling

Refilling with incompatible coolant, oil, or water during system servicing is a leading cause of accidental contamination. Technicians may unknowingly introduce other chemicals that react negatively with glycol-based inhibitors or destabilize the concentration of additives. Over time, incorrect dilution can lead to loss of freeze protection, degradation of corrosion inhibitors, and bacterial growth within the loop.

4. Material Compatibility Failures

Certain materials, like rubber gaskets, low-grade metals, and some plastics, may degrade when exposed to glycol or its degradation products. This breakdown can lead to internal contamination, corrosion, or the release of insoluble compounds into the system. High temperatures can accelerate these effects and increase the risk of contamination in industrial applications.

5. External Exposure Events

Spills during delivery or misrouted system flushing can lead to environmental release and external contamination. These events not only affect internal system integrity but may also pose regulatory risks if glycol reaches storm drains or the environment. Facilities handling bulk gallons of glycol must have containment plans and proper safety protocols in place to reduce exposure.

Typically Underestimated Risks

Even though glycol is widely used, the potential for contamination is typically underestimated in busy facility operations. It’s not uncommon for systems to run for years with suboptimal glycol mixtures, slowly accumulating corrosive compounds or suffering from reduced efficiency without immediate signs of failure.

Detection and Testing Methods for Glycol Contamination

Detecting glycol contamination early is essential for preventing long-term system damage, protecting health, and maintaining regulatory compliance. Because glycols are colorless, viscous, and often masked by other compounds, identifying their presence in unintended areas requires a combination of field observation, chemical analysis, and laboratory confirmation.

Field Indicators and Visual Signs

Operators may notice symptoms before testing confirms contamination. Early signs include:

- Increased viscosity or stickiness in what should be plain water
- A slight sweet taste in tap water or condensate (a telltale warning sign, especially in ethylene glycol contamination cases)
- Fouling or scaling in piping or heat exchangers
- Fluid foaming or phase separation within expansion tanks
- Slippery residues on surfaces near leaks

While these indicators provide valuable clues, they are not sufficient on their own for accurate diagnosis. Quantitative testing is necessary to determine the exact glycol levels and concentration in the fluid.

On-Site Testing Techniques

Routine monitoring of glycol-based systems typically includes:

- **Refractometers**: These handheld devices measure the freeze protection level of a glycol solution by testing refractive index. While fast and convenient, refractometers cannot detect contamination in systems where glycol should not be present.
- **Density or specific gravity meters**: Useful for determining whether fluid density corresponds with expected glycol mixtures, especially in HVAC and chiller loops.
- **Test strips and titration kits**: These can indicate pH and inhibitor levels, helping determine if a glycol solution is degrading or compromised.

However, when contamination is suspected, more advanced analysis is needed.

Learn more on our blog: **Propylene Glycol Safety: How to Handle Antifreeze Solutions** (https://clearwatershelton.com/propylene-glycol-safety/)

Laboratory Analysis: Gas Chromatography and Beyond

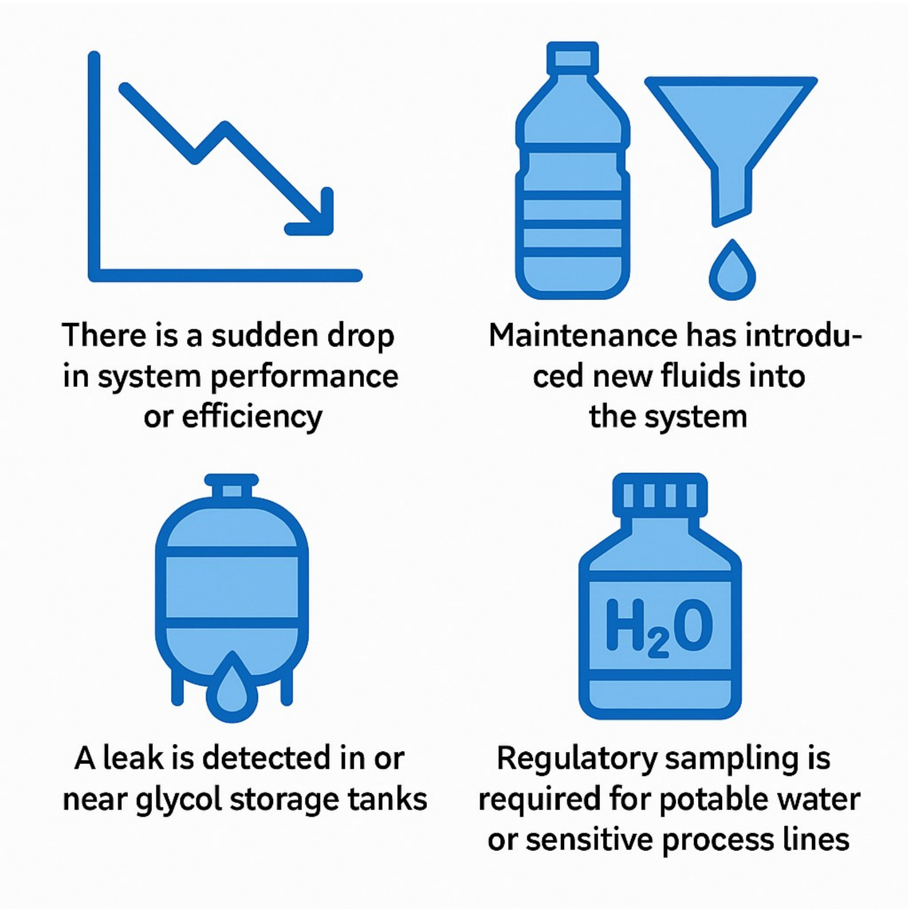
The most definitive way to confirm glycol contamination is through gas chromatography. This technique can:

- Accurately detect even low concentrations of ethylene, propylene, or diethylene glycol
- Differentiate between glycol types, essential for safety evaluations and remediation planning
- Identify co-contaminants, such as solvents, additives, or other unknown chemical compounds

Gas chromatography is typically performed in a lab environment, often as part of a system-wide diagnostic or after a suspected exposure event. In cases involving public water systems, food production, or healthcare environments, lab-based analysis is often required by regulatory bodies to confirm safety.

When to Test

Testing should be performed when:



Regular sampling and recordkeeping can help identify contamination trends before they lead to system failure or safety violations.

Health and Environmental Risks of Glycol Contamination

The presence of glycol contamination in systems not designed to handle it poses significant risks to human health and the environment. While glycol-based fluids are essential in many industrial applications, improper handling, leakage, or cross-contamination can lead to toxic exposure, system corrosion, and long-term ecological damage.

Health Risks: Ethylene Glycol vs. Propylene Glycol

The primary health concern is linked to ethylene glycol, which is highly toxic if ingested. Even small doses can cause severe poisoning, leading to symptoms such as nausea, vomiting, and neurological impairment. Once metabolized, ethylene glycol breaks down into calcium oxalate crystals, which can accumulate in the kidneys and lead to acute renal failure. This makes it especially dangerous in any environment where water could be mistakenly consumed or used in food processing.

In contrast, propylene glycol has a lower toxicity profile and is generally recognized as safe (GRAS) for use in certain pharmaceutical products and food applications. However, high levels of exposure can still cause irritation or systemic effects, particularly in sensitive individuals or when inhaled in vapor form in confined spaces.

Ingestion of either type of glycol, whether intentional or accidental, should be treated as a medical emergency. Safety data sheets (SDS) for all glycol products should be readily accessible to inform first responders and medical personnel of proper treatment procedures.

Environmental Impact and Ecosystem Concerns

Once released into the environment, glycols can affect aquatic life and alter the natural chemistry of surface waters. When ethylene or propylene glycol reaches storm drains or is discharged untreated, microbial degradation may rapidly deplete dissolved oxygen levels in nearby water bodies. This leads to fish kills and disruption of aquatic ecosystems.

The release of hydrogen sulfide, methane, or other byproducts during glycol degradation further compounds these effects, contributing to odor issues and greenhouse gas emissions. In wastewater systems, glycol can interfere with biological treatment processes by overloading microbial populations or skewing nutrient balances.

Facilities that handle glycol must ensure that risk assessments, secondary containment systems, and spill response protocols are in place to avoid accidental discharges. Routine training on proper safety protocols can significantly reduce the likelihood of contamination events that could harm both personnel and the surrounding environment.

Prevention Strategies and Maintenance Best Practices

Preventing glycol contamination begins with thoughtful system design, regular maintenance, and well-trained personnel. Since glycol-based fluids are integral to many thermal control systems, keeping them where they belong (and in the right condition) is the key to avoiding costly contamination and mechanical failures.

Routine Monitoring and Documentation

One of the most effective prevention strategies is the establishment of a consistent monitoring routine. Facilities should track:

- Glycol levels and concentration over time
- Inhibitor effectiveness in inhibited glycol solutions
- System fluid clarity, pH, and particulate content

Documenting test results allows operators to detect trends before they escalate. Any unexpected drop in freeze protection or rise in acidity could signal the early stages of contamination or glycol degradation.

Use of Compatible Materials and Additives

Incompatible materials can cause seal failures, fluid breakdown, and corrosion. Be sure that all components in contact with glycol (pumps, valves, and gaskets) are rated for use with the chosen chemical type. Also, ensure that any additives introduced to the system are approved for compatibility with your base fluid.

Using the correct brand names and specifications for glycol formulations is important. Not all products are interchangeable. Mixing different types of glycol, or substituting with off-brand alternatives, can destabilize the solution and increase the risk of fouling or scaling.

Proper Safety Protocols and Staff Training

Every technician working with glycol must be trained on safe handling practices, correct dilution methods, and system flushing procedures. Proper safety protocols should include:

- Labeling all tanks, drums, and fill ports clearly
- Using dedicated equipment for glycol vs. water systems
- Wearing appropriate PPE during transfer or sampling
- Having emergency spill kits on hand

Training should also cover how to respond to signs of glycol intrusion, such as odor changes, residue formation, or abnormal equipment performance.

Preventive Maintenance Scheduling

Regular inspections can identify small problems before they result in contamination. Maintenance tasks should include:

- Checking for gasket wear or degraded hoses
- Verifying backflow prevention device functionality
- Inspecting expansion tanks for fluid separation or overpressurization

- Ensuring fluid samples match desired concentration and appearance

Preventive maintenance protects the system from premature failure and ensures that glycol continues to provide **protection** and efficiency without compromising adjacent systems.

System Design Considerations

Well-designed systems isolate glycol from potable water and process lines, reducing the likelihood of accidental exposure. Loop separation, physical air gaps, and double-walled heat exchangers are among the process safeguards that help contain glycol within its intended circuit.

Proper system sizing also reduces unnecessary glycol volume, which improves efficiency and reduces the impact if a release does occur. Overfilling, undercirculation, or poor piping layout can all lead to stagnant zones where degradation products form.

Solutions and Remediation for Contaminated Systems

When glycol contamination is detected, swift and thorough remediation is necessary to restore system integrity, ensure safety, and prevent long-term damage. Depending on the severity and location of the contamination, corrective actions can range from simple fluid replacement to full system overhauls. The right approach depends on the type of glycol, the system affected, and the level of contamination present.

Step 1: Identify the Contamination Source

Before any remediation can occur, it's essential to confirm where the glycol entered the system. Common sources include:

- Leaks between heating and potable water loops
- Cross-contaminated refill equipment
- Breakdown of fluid barriers or seals
- Accidental additions during maintenance

Identifying the source helps prevent recurrence and ensures that any repairs made are effective in the long term.

Step 2: Flush and Clean the System

In most cases, the first remediation step is a system flush. This involves:

- Draining all existing fluid from the contaminated circuit
- Flushing the piping and components with clean water or a specialty rinsing solution
- Ensuring the complete removal of residual glycol or degraded compounds

This process must be conducted carefully to avoid environmental releases. In sensitive applications like food processing or pharmaceutical systems, multiple flush cycles and microbial testing may be required to confirm cleanliness.

Step 3: Inspect and Replace Compromised Components

During flushing, any signs of corrosion, buildup, or mechanical wear should be addressed. Replace components such as:

- Corroded piping, valves, or seals
- Fouled heat exchanger plates
- Failed expansion tanks or separators

Replacing damaged components ensures that the new fluid will perform as expected and reduces the risk of further contamination.

Step 4: Refill with the Correct Glycol Solution

Once the system is clean and restored, refill it with the appropriate inhibited glycol blend. Be sure to match the application needs with the right concentration, inhibitor package, and brand name specification.

Most systems require between 20 and 50 percent glycol content depending on the level of freeze protection needed. This volume can range from a few dozen to several hundred gallons. Use refractometers or lab testing to verify that the concentration is within the acceptable range before resuming operation.

Step 5: Resume Monitoring and Maintenance

After remediation, establish a more frequent testing schedule to ensure that the issue has been resolved. Tracking fluid condition and system efficiency in the weeks following a contamination event helps verify long-term stability.

ClearWater's Glycol System Services

ClearWater Industries provides end-to-end glycol system solutions that help prevent glycol contamination and maintain system performance in critical environments. With decades of experience, our team supports facilities across HVAC, industrial, and data center applications.

We offer:

- **System Analysis and Monitoring**
  - Glycol concentration testing
  - Volume studies for proper system charging
  - Laboratory analysis and performance optimization
- **Professional Installation and Maintenance**
  - Precise glycol mixing and system purging
  - Regular inspections and concentration adjustments
  - Filtration system support and equipment monitoring
- **Specialized Glycol Blends**
  - Safe-T-Therm HD for industrial and commercial use
  - Safe-T-Therm AL for aluminum components
  - Safe-T-Therm GRAS for food-sensitive environments

Whether you're managing a new installation or remediating a contaminated loop, ClearWater delivers the expertise and solutions needed to protect your system and reduce downtime.

Learn more about our Glycol Systems (https://clearwatershelton.com/glycol-systems/)

Take Control of Glycol Contamination Risks

Glycol contamination can compromise your system's safety, performance, and compliance—but it's entirely preventable with the right strategies in place. From proper fluid selection to routine testing and system design, proactive management makes all the difference.

ClearWater Industries offers expert support for glycol system optimization, contamination prevention, and emergency response. **Contact our team today** (https://clearwatershelton.com/contact/) to evaluate your system and keep it running safely and efficiently.

Frequently Asked Questions (FAQs)

How does glycol work in industrial cooling systems?
Glycol works by lowering the freezing point of water, making it ideal for use in HVAC, chiller, and process cooling systems where freeze protection is critical. It also enhances heat transfer and provides corrosion resistance when combined with the right additives. In industrial applications, glycol is commonly used in

closed-loop systems to maintain consistent thermal control across seasonal temperature shifts.

What is diethylene glycol, and how is it different from ethylene or propylene glycol?
Diethylene glycol is another type of glycol compound, often used in manufacturing solvents, lubricants, and plastics. Unlike ethylene glycol and propylene glycol, it is not typically used in heat transfer systems due to its higher toxicity and different chemical structure. Accidental use or mislabeling can lead to dangerous contamination, making proper product identification and handling critical.

Are there specific methods to identify glycol contamination?
Yes. Methods include field testing with refractometers or density meters, as well as laboratory techniques like gas chromatography, which can detect the presence of glycol and distinguish between glycol types. These tools help identify the specific contaminant and guide remediation strategies, especially in sensitive environments like food or pharmaceutical production.

Why is brand name glycol important for contamination prevention?
Using verified brand names ensures that your glycol product meets performance, purity, and toxicity standards. Off-brand or generic formulations may lack proper corrosion inhibitors or have inconsistent concentration levels, increasing the risk of formation of scale, deposits, or microbial growth. Using the wrong blend or mixing incompatible types can lead to serious system damage and contamination.

Is glycol contamination a widely recognized problem in commercial systems?
While glycol contamination is a well-documented issue in technical literature, it's widely underestimated in day-to-day facility operations. Many systems operate with outdated fluids, inconsistent monitoring, or no clear maintenance records, making them vulnerable. Recognizing the risks and investing in preventive care is essential to minimize operational risk and regulatory exposure.

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