

**SOLID & HAZARDOUS WASTE DIVISION  
STORAGE TANK PROGRAM  
GUIDANCE DOCUMENT #16**

**SUBJECT: INVESTIGATION REQUIREMENTS FOR ETHANOL-BLENDED FUEL RELEASES**

**SCOPE:** This guidance document describes site investigation requirements for ethanol-blended fuel releases for the Wyoming Department of Environmental Quality (WDEQ) Storage Tank Program (STP). An ethanol-blended fuel is defined as a fuel containing greater than 10 percent ethanol by volume (E10). This would include E85, denatured fuel grade ethanol (E85), and other fuel blends greater than E10 such as E15 or E20.

These requirements are for sites that had a confirmed ethanol-blended fuel release and for releases at facilities that store or have stored ethanol-blended fuel where the released product is unknown (potential release). However, for releases of ethanol-blended fuels with less than 85 percent ethanol by volume not all requirements contained herein may be necessary. The investigation and sampling requirements for releases of ethanol-blended fuels with less than 85 percent ethanol by volume will be developed by the consulting engineer in conjunction with, and the approval of, the STP project manager.

For potential ethanol releases, ethanol release-specific data collected during the subsurface investigation (SSI) will be used to determine the need for additional investigation.

**INTRODUCTION:**

**1.** The requirements contained herein are necessary due to additional risk factors associated with ethanol and the influence ethanol has on subsurface fate and transport of petroleum hydrocarbons. Ethanol poses additional environmental risks not typical or inherent with petroleum releases, such as:

**A.** Ethanol degradation in the subsurface has the potential to produce large quantities of methane gas that could lead to explosive conditions. Methane generation may be delayed for months to years after a release and may persist for years after the ethanol is no longer present in groundwater. At some sites, methane might be the primary contaminant of concern and the risk driver for corrective action or long-term monitoring.

**B.** Unlike conventional petroleum fuels, ethanol is miscible in water and, as a result, has implications for the distribution of contamination and occurrence of light non-aqueous phase liquid in the subsurface.

**C.** Releases of ethanol-blended fuels to surface waters present several issues. These include phase separation and extreme dissolved oxygen demand that occurs during ethanol degradation, which could quickly lead to anoxic conditions resulting in significant fish and wildlife mortality. Extreme dissolved oxygen demand can also be an issue with disposal of recovered liquids.

**2.** The effect of ethanol on the fate and transport of petroleum hydrocarbons may affect site investigation and risk evaluation in the following ways:

**A.** Natural attenuation of petroleum hydrocarbons can be delayed due to preferential biodegradation of ethanol. This may result in delayed aqueous phase plume stabilization or longer plumes, which could increase risk to groundwater receptors.

**B.** Elongated petroleum plumes in groundwater may serve as a vapor source and present increased risk for the vapor intrusion pathway.

**C.** The increased production of methane and carbon dioxide may strip petroleum hydrocarbons from groundwater and provide a pressure gradient to move vapor into receptors.

**D.** Ethanol can remobilize pre-existing, stable petroleum contamination, thus potentially increasing the risk.

## **GUIDELINES:**

### **1. Investigation considerations**

**A.** General considerations: For confirmed releases, long-term monitoring of groundwater via permanent monitoring points or wells is required because: 1) the appearance of methane may be delayed, and 2) ethanol degradation can prolong (or inhibit) attenuation and, thus, stability of the aqueous phase petroleum plume. In these cases, an SSI would not be sufficient because long-term monitoring is needed to assess potential methane generation, persistence, and associated risk as well as characterize the stability of the petroleum fraction.

**B.** Historical product storage: Prior to initiating SSI activities, the current and past storage of ethanol-blended fuels should be determined.

**C.** Drilling safety: Due to the potential for elevated methane gas levels, care should be exercised when drilling into areas with potentially high methane concentrations.

**D.** Monitoring well installation and sampling: Research has shown that ethanol-blended fuels will eventually phase separate after contact with soil water, and that the ethanol fraction can move into and disperse within the capillary fringe. In addition, the high degradation rates and associated products will make monitoring well installation and sampling critical. Shorter screen lengths and multi-level wells may be required, and documentation of well installation and sampling methods may be critical to interpret results. Special care in groundwater sampling is critical to avoid volatilization losses, especially for methane.

**E.** Soil sample analysis: The Storage Tank Program does not support the analysis of ethanol from soil samples; therefore, no additional soil analyses are required.

**F.** High methane concentrations: The consultant must contact the STP Project Manager immediately if either of the following conditions are met:

**i.** Groundwater: Aqueous methane concentrations exceed 10,000 µg/L.

**ii.** Soil gas: Methane concentrations exceed 10 percent of the lower explosive limit, or 0.5 percent methane by volume (5000 ppmv), within 100 feet of a receptor.

**G.** Future requirements: Acetate is a degradation product of ethanol and can be used to assess the potential long-term generation of methane in groundwater. Acetate and/or dissolved organic carbon analysis may be required by the STP.

## **2. Subsurface investigation requirements**

These requirements pertain to both confirmed and potential ethanol-blended fuel releases. Samples will typically be collected from soil borings, temporary wells, and preliminary soil gas assessment probes.

**A.** Groundwater investigation: All groundwater samples must be analyzed for ethanol and methane. Quantify ethanol along with volatile organic compounds (VOCs). Quantify methane along with ethane and ethene. Acetate may be required on a site-specific basis. Specific parameters may be dropped from routine analysis from all or some wells based on investigation results.

**B.** Soil gas investigation: Soil gas sampling may be required regardless of whether or not receptors are present.