Technical Bulletin

ETHANOL BLENDED GASOLINE – PHASE SEPARATION in RETAIL STORAGE TANKS

Background

Phase separation is a condition where two layers are formed in ethanol blended gasoline. Excess water causes ethanol and water to separate out of the gasoline, forming a separate ethanol-water layer at the tank bottom. If this ethanol-water mixture is introduced into a vehicle's fuel system, it will cause poor driveability and may completely disable the vehicle. Likewise, if the remaining fuel phase (now lower in octane) is introduced, low octane performance problems and engine damage can occur.

If observed, there will typically be two distinct layers – a gasoline top phase (that may be hazy due to suspended water) and an ethanol-water bottom phase. The ethanol-water bottom phase could possibly look murky/dirty if the underground storage tank (UST) was dirty. If water-absorbing filters are installed, one of the early indicators that phase separation has occurred is that dispenser filters may become blocked, or partially blocked, leading to fuel "slow flow" – it may also render gasoline dispensers inoperable.

Water in Gasoline with Ethanol

If gasoline containing 10 vol% ethanol comes in contact with very small amounts of water, the water will be fully dissolved in the gasoline-ethanol mixture and there should be no water at the bottom of the tank. At the level where the gasoline-ethanol mixture can no longer hold the water into solution, typically around 0.5 vol%, the ethanol will preferentially go to the excess water and cause the fuel to separate into two layers: a top, ethanol-deficient gasoline layer and a bottom, ethanol-rich water layer.

Once phase separation occurs, the ethanol-water tank bottom level will increase typically from zero to several inches or more. When this happens, the water-ethanol layer can often be higher than the submersible pump and the water-ethanol mixture may be pumped into vehicles. This can cause poor performance or damage to vehicles. Ethanol has higher octane; removing it from the gasoline layer can lower the octane, often to a point where damage from engine knocking can occur. Vehicles filling up with either the ethanol-water mixture or the lower octane gasoline will often not make it out of the station before stalling. Phase separation can affect a single motorist (known as a one-off) or multiple vehicles at a single site. Additionally the gasoline product layer may not meet regulatory standards due to insufficient ethanol content and related vapor pressure regulations.

Preventing Phase Separation in Tank

Phase separation when transitioning from "clear" gasoline (gasoline containing 0 vol% ethanol) to 10 vol% ethanol gasoline is a concern due to the possibility of water in the storage tank. This excess water must be removed from the UST prior to the first delivery of ethanol-blended gasoline. Phase separation can occur without a transition from clear gasoline to 10 vol% ethanol gasoline, from water leaking into the tank or from a contaminated delivery.

Retail sites should stick underground storage tanks with an ethanol compatible water finding paste periodically, such as Gasoila All Purpose (AP) Water Finding Paste. The automatic tank gauging (ATG) systems typically are not reliable for measuring water or water-ethanol levels accurately in ethanol-gasoline blends. Since no water level should be detected under normal conditions, any level of water should be considered a possible phase separation and should be further investigated by proper personnel.

Procedure for Remediating Phase Separated Tank

If a water bottom level (phase separation) is detected, immediately stop sales from the tank and contact your account manager. Check product clarity at the nozzle. Hazy or cloudy product indicates further separation. Determine the source of water contamination, i.e. if water leaked into the tank or if a recent delivery was contaminated. Have the entire volume of tainted product (both the ethanol-water phase and the ethanol-deficient gasoline phase) removed and disposed of properly. If you need additional assistance, please call the BP Q&TS hotline at +1.800.841.5255. Although there are after-market products that claim to reverse phase separation, BP has tested these products and does not recommend them for use in any incidents.

Once new fuel has been delivered, the tank should be stuck with an ethanol compatible water finding paste, such as Gasoila AP Water Finding Paste to ensure that no water is present. The fuel lines to the dispensers should be flushed clear of bad product and all dispenser filters should be changed.

For further information on BP fuels, contact:

BP Quality & Technical Service
Phone: +1.800.841.5255
BP Naperville Complex
150 West Warrenville Road
Naperville, Illinois 60563

Website: www.bp.com

12/18/2012