

# Corrosion Inside Ball Float Valve Risers and on Surfaces of Poppet Valves in Underground Storage Tanks Not Storing Diesel: Is This an Emerging Problem for USTs?

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## Abstract

Underground storage tank (UST) inspectors conducting inspections in the Region 7 states of Kansas and Nebraska since 2013 have observed occurrences of corrosion inside ball float risers, in vapor recovery ports, and on the surfaces of poppet valves in USTs storing gasoline-ethanol blends.

The corrosion observed inside these areas looks comparable to interior corrosion noted in the July 2016 EPA research report "Investigation of Corrosion-Influencing Factors in Underground Storage Tanks With Diesel Service." (See report highlights, next column.) In that report, acidic conditions in the vapor space of diesel tanks are thought to be responsible for some of the corrosion on metal components inside USTs storing diesel nationwide.

Nationally, corrosion of this type in these locations has not generally been reported outside of diesel UST systems. Anecdotes of corrosion in UST systems storing gasoline-ethanol blends have generally been reported in containment sump areas, but not within the tank (See EPA report, column 4.) But inspectors recently have noted repeated observations of this corrosion type in various non-diesel blends, including in gasoline with varying blends of ethanol and in USTs storing denatured ethanol (E98).

Might acidic conditions similar to the type observed in the vapor space of diesel be responsible for the corrosion on the surfaces of poppet valves used for Stage II vapor recovery and the insides of ball float risers of the non-diesel USTs in Region 7? Might it also be occurring in other parts of the country?

Determining how often these instances of internally corroded ball float valve risers and corroded poppet valve surfaces are observed across the country will help us understand the scope and prevalence of the issue.

## Highlights from the 2016 EPA Diesel Corrosion Study

Investigation of Corrosion-Influencing Factors in Underground Storage Tanks With Diesel Service, U.S. Environmental Protection Agency, Office of Underground Storage Tanks, EPA 510-R-16-001, July 2016  
[https://www.epa.gov/sites/production/files/2016-07/documents/diesel-corrosion-report\\_0.pdf](https://www.epa.gov/sites/production/files/2016-07/documents/diesel-corrosion-report_0.pdf)

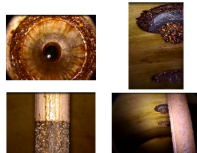


Figure 8. UST Sumps With Fiberglass Tank With Severe Metal Corrosion (E-98). ETC Installed 1986, Age Of Filter Unknown. Top Left: ATC Opening. Top Right: Tank Top Opening. Bottom Left: Dip Tube. Bottom Right: STP Shell And Tank Top Opening.

Here are some key takeaways from the report:

- Corrosion of metal components in UST systems storing diesel appears to be common.
- Many owners are likely not aware of corrosion in their diesel UST systems.
- The corrosion is geographically widespread, affects UST systems with steel tanks and with fiberglass tanks, and poses a risk to most internal metal components.
- Ethanol was present in 90 percent of 42 samples, suggesting that cross-contamination of diesel fuel with ethanol is likely the norm, not the exception.
- Microbially Induced Corrosion could be involved, as hypothesized by previous research.
- EPA recommends owners visually inspect USTs storing diesel as part of routine monitoring.

## Corrosion Observed Inside Ball Float Valve Risers and Poppet Valves

Vapors inside USTs move freely into ball float valve (BFV) risers. Corrosion potentially due to exposure from acidic vapors can be observed in some of these risers. These areas are commonly corroded in USTs storing diesel, but inspectors have recently identified similar corrosion in some USTs storing gasoline-ethanol blends.

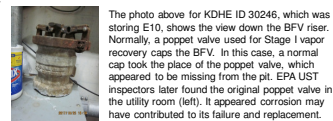
**Quick Quiz:** What products are stored in the USTs associated with the ball float valve (BFV) risers pictured below?



- (1) EPA-R7-USTFacID-411, Powhattan, Kansas  
(2) KDHE ID 30246, Leawood, Kansas  
(3) KDHE ID 06340, Lawrence, Kansas

Above: Similar levels of severe corrosion in the BFV risers for several USTs.

**Quiz Answer:** 1) Diesel, 2) Premium Unleaded E10 gasoline, and 3) B99 Biodiesel.



The photo above for KDHE ID 30246, which was storing E10, shows the view down the BFV riser. Normally, a poppet valve used for Stage I vapor recovery caps the BFV. In this case, a normal cap took the place of the poppet valve, which appeared to be missing from the pit. EPA UST inspectors later found the original poppet valve in the utility room (left). It appeared corrosion may have contributed to its failure and replacement.

## Corrosion of External Vapor Recovery Riser and Poppet Valves

Poppet valve surfaces come into contact with vapors inside USTs during the operation of Stage I vapor recovery. In some USTs, it appears the vapors are sufficiently acidic to cause these surfaces to corrode.



Regular unleaded E10 gasoline NSFMD FID 238, Omaha, Nebraska

Premium unleaded E10 gasoline NSFMD FID 238, Omaha, Nebraska



E98 Ethanol, KDHE ID 06430, Lawrence, Kansas



Regular unleaded gasoline, KDHE ID 27864, Wichita, Kansas



Regular unleaded E10 gasoline KDHE ID 27862, Wichita, Kansas



Midgrade unleaded E10 gasoline KDHE ID 27862, Wichita, Kansas

## Submersible Turbine Pump (STP) Corrosion in USTs Storing Gasoline-Ethanol Blends

EPA UST inspectors saw varying degrees of corrosion of metal components in STP sumps in addition to the observations of poppet valve and ball float valve corrosion previously described. Additionally, varying quantities of water were observed in these sumps. Some examples of STP sump corrosion are shown below. These observations of STP corrosion are similar to nationally reported trends.



Premium unleaded E10 gasoline, NSFMD FID 238, Omaha, Nebraska



Regular unleaded E10 gasoline, KDHE ID 27862, Wichita, Kansas



Biodiesel B99 sump at KDHE ID 06430, Lawrence, Kansas



Ethanol E98 sump at KDHE ID 06430, Lawrence, Kansas

Below is a link to EPA's earlier work on the subject of common corrosion in STPs:

Wilson, John and others, 2013, **Corrosion in STP Sumps: What Causes It and What Can Be Done About It**; PEI Journal, Third Quarter, p. 26-34.

<https://archive.epa.gov/ada/web/pdf/corrosion-in-stp-sumps-2.pdf>

Wilson and his associates in the EPA Office of Research and Development (ORD) used passive diffusion samplers to assess acidic conditions causing corrosion inside STP sumps.

These samplers could potentially be placed inside USTs containing gasoline-ethanol blends to check for corrosion potential in these areas where inspectors have started to note corrosion occurrences.

## Tracking Corrosion in USTs

<http://astswmo.org/astswmo-corrosion-observations-tool/>

The Emerging Fuels Team of the Association of State and Territorial Solid Waste Management Officials (ASTSWMO) has developed an **Corrosion Observations Tool** to facilitate the reporting of corrosion issues affecting USTs. Using the tool, stakeholders can identify occurrences of corrosion, describe the severity, and provide a location. One enhancement of the tool would be the ability to upload images to the website.



## Key Takeaways and Potential Corrosion Reducing Approaches

- Corrosion of metal components in internal areas of UST systems storing gasoline-ethanol blends has been reported in some areas.
- Anecdotes to date of corrosion in these areas of USTs with gasoline-ethanol blends are much less common than in the same areas in USTs storing diesel fuel, where they have become very common since the time of changes to diesel fuel formulation around 2006.
- Changes to fuel formulations are often accompanied by unintended impacts to UST systems. In January 2017, 15 ppm sulfur gasoline was phased out and all gasoline was required to be 10 ppm (average) ultra-low sulfur gasoline going forward.
- Given recent changes to the gasoline formulation, it is prudent for inspectors and owners and operators to be aware and on the look out for any emerging trends in UST gasoline infrastructure.
- Reporting occurrences of poppet valve or ball float valve riser corrosion, or other instances of corrosion, to the ASTSWMO Corrosion Observations Tool will potentially help understand the geographic extent and prevalence of these issues.