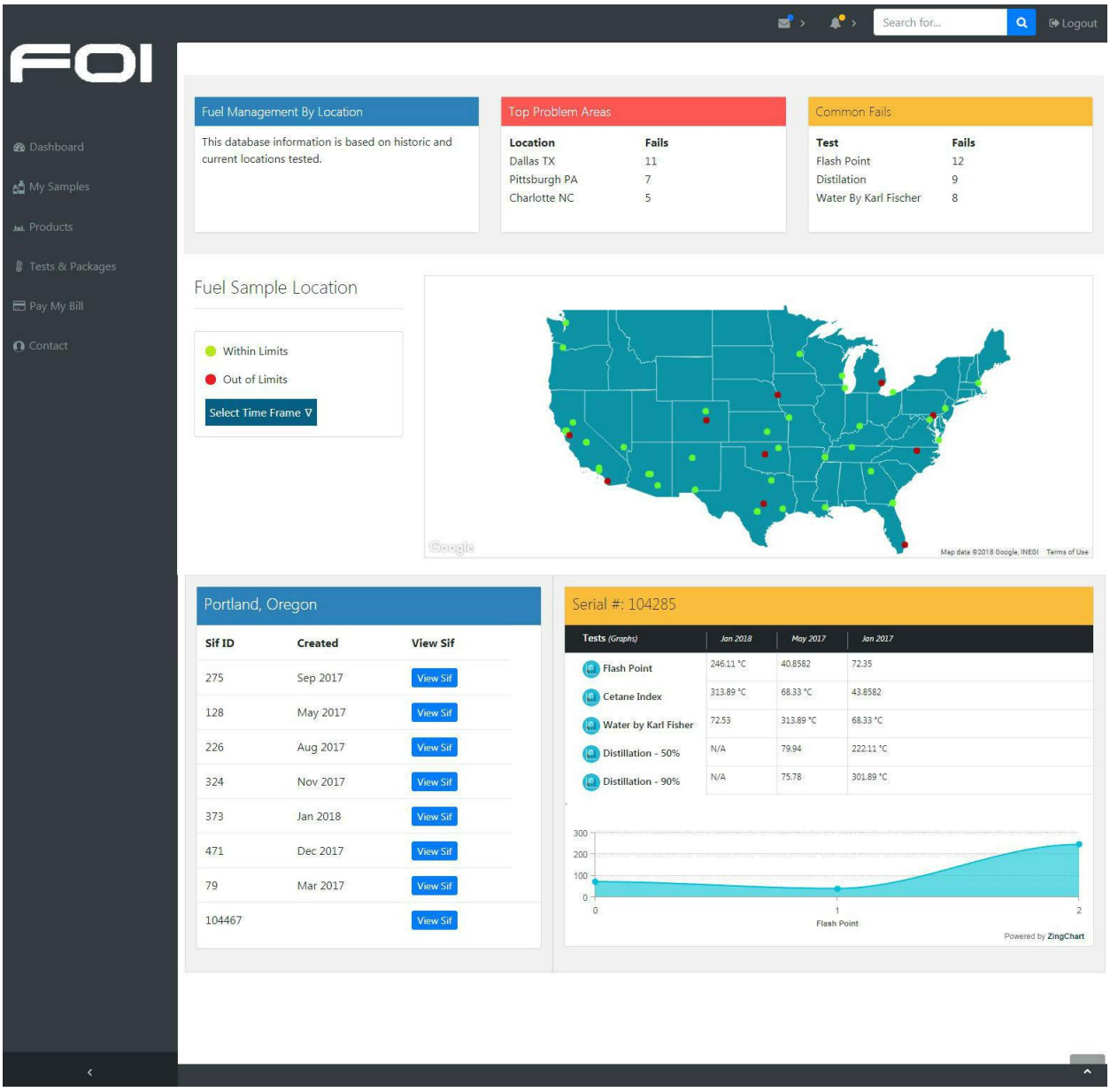
FOI Laboratories (FOILAB.com) is a production laboratory that provides fuel testing services for many industry fuel streams worldwide. **FOI** has developed a Fuel Management Portal (**FMP**) or portal that provides many valuable fuel management perspectives. (**FMP**) custom tracks, trends and organizes fuel testing data, maps historical site information, tracks and interfaces with technician activity, adds notes and attachments (see map below). We can (upon request) adapt historical testing data to serve the (**FMP**). **All FOI** clients have access to this value-added portal at no charge.



In July 2016, the EPA released its study on the corrosion issues of metal components in tanks storing diesel fuel. The study was a result of increased incidences of rapid & severe corrosion appearing due to the changes in the national fuel supply that have occurred since the mid 2000's. EPA's objective was to quantify the potential risks to human health and the environment caused by the evolving corrosion issues.

Internal corrosion in UST's are known to be direct pathways that lead to environmental and groundwater contamination. EPA's 2016 corrosion study "Investigation of Corrosion-Influencing Factors in Underground Storage Tanks with Diesel Service" https://www.epa.gov/ust/investigation-corrosion-influencing-factors-underground-storage-tanks-diesel-service revealed that internal corrosion of metal components in UST's storing diesel fuel is widespread and largely unknown to the UST owner and operator. Many of these system components are designed for leak prevention or detection and corrosion could impact the estimated life of the system's ability to function appropriately. The EPA's study of 42 steel and fiberglass reinforced (FRP) tanks, fewer than 25% of owners reported knowing that they had corrosion issues; however, 83% of the tanks inspected had moderate to severe corrosion. Additionally, fuel testing identified ethanol in 90% of the diesel fuel samples (the presence of ethanol indicates gasoline contamination within the diesel fuel).

Prior to 2007, corrosion risks in tanks storing diesel fuels were generally thought to be limited to the bottom of tanks and were not observed in upper portions of tanks. The risk of corrosion in the bottom was usually considered to be easily addressed with good tank maintenance procedures such as monitoring the fuel, removing water, treating the fuel with inhibitors and filtering the fuel. As a result of this study, more enhanced measures will be necessary to limit water and oxygen in the tanks in order to prevent the growth of microorganisms.

The onset of corrosion reports began around 2006 when the EPA standards required diesel fuel contain no more than 15 parts per million (ppm) down from 500 ppm sulfur. The change was to introduce a cleaner burning diesel to help reduce atmospheric pollution from diesel powered engines. At the same time, Congress directed EPA to require the volume of ethanol and bio diesel available for blending into petroleum-based fuels to increase significantly. The existing storage/ distribution infrastructure for handling petroleum at that time was not designed for the dynamics of these alternative fuel constituents as they were being introduced, substituted, and diluted into the system. Consequently, a new phenomenon/trend of severe corrosion issues on metal surfaces in the upper vapor space began to be reported. The study suggests that the reduced sulfur in diesel could be allowing microbial life to proliferate in ultra-low sulfur diesel tanks. This corrosion mechanism is referred to as microbiologically-influenced corrosion (MIC). The study concluded that the corrosion was caused by low molecular weight acids that were metabolic by products from microbial life. In

the presence of oxygen and water, Acetobacter bacteria living in the aqueous phase of the tanks created the acids that could then volatilize into the vapor space, coating

metallic equipment and tank walls. Condensation produced by high humidity in the diesel tanks allowed the acids in the vapor space to sustain contact with metal as an aggressive electrolyte and liquid condensate. Furthermore, when the liquid condensate evaporated, the acids concentrated on all surfaces. Other studies aligning with the EPA report have focused on high sodium (sodium hydroxide) that forms metal soaps. Several refinery and distribution system partners recently found that microbial-induced corrosion was inducing the presence of low-weight acids and low acidic pH in terminal storage tanks. They say this was a key discovery, and eliminated ethanol as the sole key component necessary that fostered MIC in ULSD storage. Acidic corrosion inhibitors that combine with sodium ions to form fatty acid soaps. It the corrosion inhibitors added at the refinery to protect terminals and pipelines is involved in forming these soaps, then the corrosion protection expected from the inhibitor can get depleted. Its testing found that **23%** of the ULSD samples taken at the dispenser did not meet NACE fuel corrosion test ratings for fuel leaving the refinery, and in the pipeline.

Objective:

To develop a better understanding of aging UST Infrastructure by evaluating a representative subset of steel and fiberglass tanks for signs of internal and external corrosion and equipment degradation. The data quality objective (DQO) of this project is to develop a current baseline of the UST infrastructure and a procedure for evaluating the influence of emerging fuel blends (biofuels), specifically ethanol or biodiesel on UST equipment and its functionality.

Scope:

FOI recommends a baseline of testing of all the aging UST Infrastructure utilizing the Fuel Management Portal (FMP) to establish a systematic testing approach that will allow custom flexible monitoring of the aging infrastructure. FOI recommends aligning with the EPA fuel protocols used in the 2016 report to compare/trend and share the infrastructure data with other state comparisons. Having this data available in real time will allow AZDEQ to assess and closely manage many trends at once in the fuel as well as environmental site changes.

Economical Step:

“We see water at the top of the list of causes of contamination, corrosion and fuel failure. There are many reasons fuel experiences degradation during storage and use. Environmental conditions, refining, human error, origin of fuel. Storage tanks receive water from delivered products, condensation, damaged fill boxes, bad gaskets, loose fittings, and various other non-water/ vapor tight openings. Aerobic fungus, bacteria, and yeast hydrocarbon utilizing microorganisms need water to survive.” FOI

FOI has user friendly water and acid “field test kits” that would economically produce immediate results. Start with the diesel, have your Technician or FOI) pull the samples under frequency. The kit has an info card that your tech can take a picture and send it to FOI either electronically, snail mail or data entry direct online.

Partnering with FOI gives you and your clients a data base of UST Infrastructure information available on the (FMP) portal. This would immediately establish a baseline of beta tank monitoring information for real time data access. From there annual testing and all tank activity, could be added to the (FMP) portal for trending and monitoring.