

# **Guidance for Petroleum Underground Storage Tank (UST) Sites with Per- and Polyfluoroalkyl Substances (PFAS)**

## **Introduction**

State Water Resources Control Board (State Water Board) staff prepared this guidance document for petroleum USTs that may have PFAS chemicals present and provides guidance to the Regional Water Quality Control Board (Regional Water Board) case workers, regulators, responsible parties (RPs), consultants, and stakeholders and direction from UST Cleanup Fund (Fund) when PFAS could be a contaminant of concern at underground storage tank sites so that investigative approaches are consistent across the regions. This guidance documents steps to determine whether and how to conduct sampling for PFAS at a petroleum UST release site. Consideration must be taken when evaluating design remediation techniques so as not to mobilize PFAS nor increase toxicity.

## **Background**

Per- and/or polyfluoroalkyl substances (PFAS) are a class of synthetic compounds that are used extensively in a variety of industrial, commercial, and consumer products. Several automotive products utilize PFAS chemicals, called fluorinated surfactants, that lower the surface tension and improve wetting and rinse-off, including motor oil additives and automotive greases (Herzke, et al., 2009; Zhu and Kannan, 2020). Additionally, industrial and household cleaning products utilized in car wash products often contain PFAS compounds (Gaines, 2022; POPRC, 2016), such as windshield wiper fluids, windshield and automotive waxes, and automotive polishes, which aid spreading and improve the resistance of the polish to water and oil (Kissa, 2001).

Many petroleum UST release sites may have, or previously had, waste-oil USTs and/or drive-through car washes that use or used products known to contain PFAS. Previous and current remedial activities at sites with petroleum hydrocarbon contaminants commingled with PFAS contaminants can change PFAS properties, including distribution and mobility in groundwater (McGuire, et al., 2014). Some remedial alternatives typically utilized on petroleum UST release sites may adversely alter PFAS compounds, increasing their risk to human health, safety, and the environment. As such, it is important for consultants and regulators to understand when PFAS sampling is necessary to appropriately plan remediation at petroleum UST sites.

## **State Water Board's Fund Coordination**

Should RPs and the Cleanup Oversight Agency believe PFAS sampling is warranted at a petroleum UST cleanup case, please communicate and coordinate with Matt Pavelchik ([Matthew.Pavelchik@waterboards.ca.gov](mailto:Matthew.Pavelchik@waterboards.ca.gov)) with the Fund to ensure resources are available. The Fund may reimburse claimants for limited PFAS sampling to guide corrective action at petroleum UST release sites where it is appropriate. Determinations on reimbursement for sampling PFAS at UST sites must be made on a site-by-site basis, as further described below. Sampling is best conducted before remedial activities

begin, to obtain accurate characteristics of the site without the influence from remedial technologies, and because the use of remedial technologies may adversely affect the properties of any PFAS present.

## **Site Considerations**

Prior to conducting PFAS sampling at sites with active Fund claims, the Fund should be contacted at [ustcleanupfund@waterboards.ca.gov](mailto:ustcleanupfund@waterboards.ca.gov) to determine whether PFAS sampling at the UST site is reasonable and necessary.

PFAS sampling should be conducted, preferably prior to remedy selection and implementation, at petroleum UST cleanup sites that meet one or more of the following criteria:

- The site supports or supported waste-oil USTs and/or car washes.
- The site is located downgradient, immediately adjacent to, or cross gradient of a potential current or historical PFAS source.
- The site contains one or more comingled plumes consisting of both petroleum and chlorinated hydrocarbons.
- The RP or the RP's consultant is in the process of planning new or modified remediation at the site.
- The proposed cleanup activities or discharges from the facility that could affect California's surface, coastal, or ground waters, will require a Waste Discharge Requirements (WDR) permit.

## **Pre-Remediation PFAS Sampling Planning**

Soil and groundwater samples collected for remediation planning purposes should be analyzed for PFAS using the most current analytical testing methods approved by the United States Environmental Protection Agency (USEPA). Sampling for PFAS should occur before pilot studies and results should be considered in the Corrective Action Plan.

The appropriate location and number of soil and groundwater samples collected will vary from site to site. Generally, samples should be collected from around source areas and along potential contaminant transport routes, including:

- Down- and cross-gradient of any potential PFAS source;
- Near current and/or former waste-oil USTs and associated piping;
- Along French drains and other drainage inlets;
- At oil-water separators;
- Along associated piping in and around car wash facilities; and
- At the discharge points into storm sewers or storm water conveyance ditches, as well as upgradient, downgradient, and cross-gradient points.

Soil samples should be collected at five-foot intervals (0-6 inches below ground surface (bgs), 5.0-5.5 feet bgs, 10.0-10.5 feet bgs, etc.) for all new soil borings and new groundwater monitoring wells. All groundwater monitoring wells within the area of influence of the planned remediation should be sampled and analyzed for PFAS.

Collection of water samples from all drinking water supply wells on the site is also recommended.

The Regional Water Board or Local Oversight Program (LOP) agency reviewing the work plan for PFAS sampling should verify that the details outlined above are incorporated. The work plan also should include PFAS-specific sampling procedures, including preventative measures to avoid sample contamination. Regional Water Board staff and LOP staff should use the State Water Board's *Per- and Polyfluoroalkyl Substances (PFAS) Sampling Guidelines for Non-Drinking Water* (State Water Board, 2020) when reviewing the work plan.

## **PFAS Sampling**

The State Water Board recommends utilizing USEPA-approved PFAS analytical test methods. These standardized methods ensure consistency in analytical testing and are discussed below along with protocols to follow when collecting PFAS samples.

## **PFAS Sampling Observations – Regulatory Oversight**

### **Agencies**

Regulatory agency staff should review the *PFAS Sampling Guidelines for Non-Drinking Water* to understand the specific field procedures that should be administered while observing soil and groundwater sampling. The Guidelines provide information on PFAS-compatible equipment, sampling instruments, containers, and personal protective equipment that should be utilized during sampling. The Guidelines also provide information regarding sampling methods and suggestions for sampling timing.

### **Analytical Methods**

The State Water Board recommends utilizing the following USEPA-approved analytical methods when analyzing PFAS in soil and non-potable water (groundwater, surface water, and wastewater) at the time of this guidance:

- **EPA Method 1633A.** This method was developed through collaboration of USEPA and the Department of Defense and measures 40 PFAS chemicals.
- **EPA Method 1621.** This method measures absorbable organofluorine (AOF) compounds in aqueous matrices and results are reported as a concentration of AOF per liter. This method screens for a wide range of PFAS and AOF compounds, providing a cost-effective way to identify significant site issues. Knowing AOF concentrations can help the RP's consultant design a more effective and economical treatment system for remediation, as PFAS fate and transport are complex.

The following USEPA-certified analytical methods are recommended for analyzing PFAS in drinking water:

- **EPA Method 533.** This method measures 25 PFAS chemicals. This method targets a broader range of “long chain” and “short chain” PFAS (none greater than C<sub>12</sub>), including replacement PFAS analytes that were phased out in the

2000s, specifically some ethers and fluorotelomers that older drinking water methods (i.e. EPA Method 537.1) did not include.

The USEPA produced a Technical Brief (USEPA, 2019) on the current analytical methods and guidance for sampling and storage of water and soil samples.

Guidelines for sample collection of groundwater, drinking water, and soil for analysis of PFAS include:

- State Water Board *PFAS Sampling Guidelines for Non-Drinking Water*; and
- State Water Board *Drinking Water Sample Collection Guidance for Per- and Poly-Fluoroalkyl Substances (PFAS)* (State Water Board, 2022).

## **Waste Profiling**

PFAS sampling of investigation derived waste may be required to characterize and classify solid waste to ensure proper handling, treatment, and disposal at an appropriate facility. Current groundwater monitoring and sampling that generates excess water during purging and sampling will also require waste profiling for PFAS. All waste profile samples should be analyzed using EPA Method 1633A.

## **Remediation Technology Concerns When PFAS Are Present**

Some oxidants and oxidant systems are found to have the potential to transform certain PFAS chemicals (Crimi, 2016). Polyfluorinated precursors may transform during in-situ chemical oxidation (ISCO) into oxidation-resistant perfluoroalkyl carboxylates (PFAC) (Place and Field, 2012), such as perfluorooctanoic acid (PFOA). These transform products are more mobile and toxic in the environment. If PFAS are present on a site, then selection of appropriate remediation technology that will not affect PFAS is recommended.

The following are common oxygenating remediation technologies utilized at petroleum UST cleanup sites that could cause adverse effects when PFAS are present in the subsurface:

- Air sparge;
- ISCO;
- Oxygenating systems (super-oxygenated water, oxygen releasing compounds); and
- Electrochemical oxidation.

Should these types of remediation techniques be selected for a facility with PFAS chemicals present, then measures and controls will need to be implemented to lower PFAS transport and risk.

## **Mitigation Technology Considerations When PFAS Are Present**

Consider impacts of PFAS when selecting mitigation measures such as vapor barrier material (Royal Society of Chemistry, 2020) and geological tracers for groundwater flow

direction and nonaqueous phase liquids detection (Gaines, 2022), which may transform or introduce PFAS during post-remedial activities.

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