WHITE PAPER

Helping Airports Identify and Mitigate PFAS Risks

Liz Denly, VP, PFAS Initiative Leader & Chemistry and
Tina Millan, Vice President, Aviation Market Director

Introduction

In the aviation industry, PFAS-containing aqueous film-forming foams (AFFF) are used in fire responses and training. PFAS are a group of more than 12,000 man-made chemicals that can be found in a variety of products. The regulatory framework and science of PFAS are rapidly evolving, creating business and environmental risks related to AFFF storage, management and use. Emerging issues for airports include new regulatory requirements for sampling and characterization, impacts of AFFF releases to the environment and the transition from legacy to modern or fluorine-free foams. In our extensive experience working to mitigate and remediate the impacts of PFAS, we have encountered a variety of unique situations at airport sites, requiring innovative solutions to address. This paper highlights our successful strategies and best practices for identifying and mitigating PFAS risk at airports.

Modifying Airport Infrastructure to Control PFAS: Thinking Outside the Box

TRC began assisting a public agency in the New York City metropolitan area with challenges related to discharges of PFAS from stormwater sewer outfalls at a commercial airport. TRC's responsibilities included stormwater compliance sampling in response to a Request for Information from the New York State Department of Environmental Conservation (NYSDEC); surface water sampling for PFAS at off-site areas that contribute to on-site drainage networks; locating, identifying and mapping of storm sewers and contributing drainage areas; preparation of an investigation plan to further identify and isolate the potential source(s) of PFAS; and implementation of focused stormwater sewer sampling for PFAS.

We responded to the airport's request for sampling data and a solution to the contamination problem, which posed potential long-term liabilities. When the subsequent stormwater compliance sampling detected PFAS discharge from a stormwater sewer outfall, a comprehensive investigation was undertaken to identify and isolate the source. Following the investigative efforts, TRC concluded that an on-site source of PFAS was impacting discharges from the stormwater sewer system. Accordingly, TRC developed a sampling strategy to pinpoint the location of the PFAS source.

Following the identification of the PFAS source, TRC led the development of a remedial strategy (emergency re-engineering of sewer infrastructure) that involved installation of sewer pipe lining to prevent PFAS-impacted water from infiltrating the sewer system and discharging off-site. Our remedial strategy was easy to implement, would be permanently effective and was less expensive when compared to alternatives.

Our ability to accurately identify the contamination source and follow through with a low-cost engineering solution brought both short- and long-term benefits to our client as well as the environment, including bringing an emergency hazardous materials problem under control and providing an effective barrier to stop PFAS discharges. Based on stormwater outfall sampling completed since implementation of the TRC-recommended strategy, the mitigation efforts have been successful, and PFAS mass discharge rates have been reduced by 100 percent (i.e., outfall PFAS concentrations are equivalent to or less than background upstream surface water PFAS concentrations). Based on the pilot test success, a similar program is currently being implemented for all 15 airport outfalls that are impacted by PFAS-contaminated stormwater.

Treating PFAS-Contaminated Recovered Deicing Solutions

TRC has designed and is overseeing the operation of a PFAS treatment system that is effectively treating a complex waste stream with similar properties of landfill leachate. The system is in the second successful year of operation treating PFAS-contaminated recovered deicing solutions characterized by total organic carbon concentrations in excess of 1% (chemical oxygen demand >10,000 milligrams per liter [mg/L]) and total dissolved solids concentrations up to 5,000 mg/L. The deicing fluid is collected in underground storage tanks and surface lagoons prior to discharge. Deicing fluid is difficult to process as the high glycol and biological activity can easily foul conventional systems. The system has operated consistently during the deicing season and has reliably produced effluent water below the treatment standard of 10 parts per trillion for PFOS and PFOA. During the first year of operation, the system treated over 600,000 gallons of recovered deicing solution; the PFAS-free water is discharged to the local publicly owned treatment works (POTW).

Forensic PFAS Markers Help AFFF Source Identification

PFAS-based surfactants have been used in firefighting foams, known as AFFF, since the mid-1960s. AFFF is responsible for some of the largest and most complex, costly and difficult releases of PFAS in the environment to investigate and remediate.

PFAS in AFFF and subsequently released in the environment are almost always present as mixtures of individual PFAS that may or may not be able to be identified and quantified by discrete analyses. The formulations of AFFF have changed throughout the years. Chemical signatures from these mixtures can provide forensic markers to assist in the determination of the source of an AFFF release, and specifically the type of AFFF released.

TRC has provided forensic evaluation of PFAS surface water results at airports. The initial evaluation has stormwater samples associated with both known and unknown sources. Based on the baseline forensic characterization, a sampling plan was implemented to identify responsible parties and delineate areas of previously unknown AFFF releases. TRC delineated several sources at the site by fingerprinting various PFAS mixtures associated with perfluorooctane sulfonic acid (PFOS)-rich AFFF (C8-AFFF), including segregating sources that may be associated with our client's site from a nearby source that has impacted a drinking water reservoir. This included the segregation of a DoD facility as a PFAS source. PFAS fingerprinting and mass flow calculations were also used to prioritize the design of targeted remedial actions to aggressively minimize off-site migration.

1. At one airport, we were able to identify five different AFFF sources.
2. At this airport, there had been an emergency response in 1996 in the area of the runway where AFFF was used. We were able to show comparable PFAS fingerprints going down from the runway through a creek to a lake: a 4-mile-long plume, all one source, same signature and same relative concentrations. This source was old but was still persistent and impacted lakes and recreational ponds for 4 miles. The recreational pond was a direct pathway to secondary human consumption as this was a catch and release pond; remediation was put in place to prevent the impacted surface water from leaving the site.
3. The second AFFF source was from a nozzle training area; this source also eventually went to the creek and lake.
4. A third AFFF source was in a different area of the site and was associated with the long-chain (C8) fluorotelomer-based foams (e.g., 8:2 fluorotelomer sulfonic acid).
5. There was also a hangar release on site from a new modern foam (the C6 fluorotelomer-based foam [e.g., 6:2 fluorotelomer sulfonic acid]).

Another potential source was from a release of concentrated AFFF. These were similar to the fingerprints from the 1996 emergency response but there were differences between these releases based on the ratio of PFOS to Perfluorohexane sulfonic acid (PFHxS). It is important to note that different lots of AFFF had different ratios of PFOS to PFHxS.

We were able to not only identify five different sources of AFFF and identify responsible parties but were also able to show that all these AFFF signatures were very different from the signatures of groundwater in residential private wells close to the site. These private well signatures were associated with their own development, likely from an upgradient construction and demolition landfill or possibly from a septic system but conclusively not similar to the emergency response signature. Using these forensics, we were able to save our client a lot of money by demonstrating which source of PFAS contamination was due to their AFFF.

Guidance for Identifying and Mitigating PFAS Risk

Based on our experience at airports and other types of PFAS-related sites, how you answer the following questions can help determine if you need risk mitigation plans in place and can guide you in developing those plans. Careful attention to these key areas will set you up for success:

- Do you or have you ever used AFFF at your site?
- Do you have fuel storage tanks onsite that require fire suppression equipment?
- Are you involved with property transfers that may require testing for PFAS?
- Are due diligence activities being performed on your site that require PFAS testing, sometimes by state regulation?
- Are you prepared for the potential PFAS federal regulations (e.g., ASTM Phase I, National Pollutant Discharge Elimination System [NPDES], CERCLA Hazardous substance designations, Maximum Contaminant Levels [MCLs], Toxic Substances Control Act [TSCA], Resource Conservation and Recovery Act [RCRA], etc.)?
- Is your site downgradient of a potential PFAS source?
- How can you provide a defense that the PFAS is not yours?
- Are you or will you be required to monitor for PFAS as part of wastewater discharges to POTWs?
- Do any of the operations involve the use of products containing PFAS that are not listed in the safety data sheet?
- What are the current procedures for the storage, use, and disposal of materials?
- Will you be required to monitor PFAS air emissions?
- Are you including PFAS in your Toxics Release Inventory (TRI) reporting?
- Have you determined if your site is a low or high-risk site?

Determining the PFAS Signature

With a proprietary analyte comparison mapping tool, TRC can help determine the source of PFAS and chemical trends across large spatial areas. PFAS signatures, however, cannot be evaluated in isolation. TRC uses a multiple-lines-of-evidence approach and provides careful consideration to differentiate complex mixtures of PFAS and distinguish sources of PFAS in environmental media.

TRC considers the following:

- Chemical signatures/fingerprints
- Hydrogeologic data, site operational history, timing of releases and other site data
- Unique fate and transport properties of PFAS
- Transformation products of common AFFF precursor components
- Mixing, dilution and comingled plumes
- Diagnostic ratios that can help distinguish legacy AFFF from modern fluorotelomer AFFF sources, for example.
- TRC has nationally recognized PFAS experts who understand the various targeted and non-targeted PFAS analyses as well as the laboratory procedures that greatly impact the final reported data. TRC's experts help you determine the following:
- Appropriate PFAS analysis for a given site.
- Specific PFAS to select for signature evaluation.
- Impact of differences in laboratory methodologies from standard operating procedures
- Effect of PFAS transformation on chemical concentrations/fingerprints
- Effect of PFAS sorption to solids on chemical concentrations/fingerprints

Leverage Our Airport Experience for Your PFAS Projects

TRC is engaged with large and small airports nationwide, advising managers on how to quantify and manage AFFF, developing response strategies to releases, and remediating impacts to the environment. We are active members of the PFAS work group for the American Association of Airport Executives (AAAE) and Airports Council International (ACI).

We use our industry-leading expertise in characterization, remediation, toxicology, forensics, regulations, and strategic planning to deliver practical and creative solutions for mitigating the business and environmental risks related to PFAS.

Let us help you navigate PFAS sources at your AFFF-impacted site through thoughtful analyses and expert interpretation to minimize your potential liability.

Contact Liz Denly, Vice President, PFAS Initiative Leader & Chemistry Director (EDenly@trccompanies.com) or Tina Millan, Vice President, Aviation Market Director (TMillan@trccompanies.com).