World's First PFAS Field Kit Tested At West Coast US Airport

October, 2024

The Problem

TRS Group (TRS), a leader in environmental remediation services, was tasked with the removal and cleanout of aqueous film forming foam (AFFF), which contain per- and polyfluoroalkyl substances (PFAS), from Aircraft Rescue and Firefighting (ARFF) trucks at an airport in the Pacific Northwest, USA. PFAS compounds, sometimes called "forever chemicals" because of their known persistence and potential health risks, are difficult to remove, requiring cleanout techniques with multiple rinse cycles to ensure proper decontamination of the trucks before they are put back into service.

During past projects, TRS relied on third-party laboratories to validate the patented cleaning process, the **PerfluorAd™** Technology. The current best practice for determining AFFF presence after a rinse cycle includes a visual inspection where the operator observes foam generation. As operators tend to be cautious, they may decide to continue with another rinse cycle, which may be unnecessary and keeps the trucks out of service longer.

With lengthy PFAS testing turnaround times, generating timely data to make real-time, performance-driven decisions becomes impractical.

Read more about TRS's challenges in optimizing the AFFF removal process here.

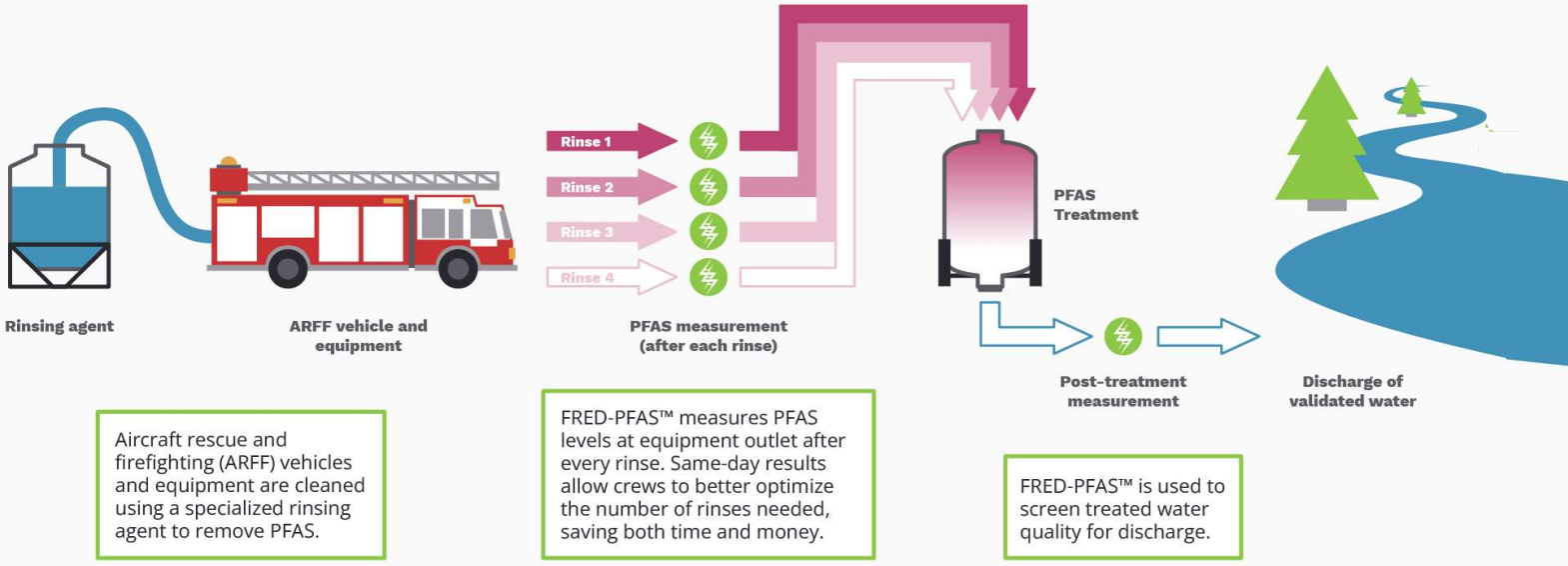
The Solution

FREDsense Technologies developed a cutting-edge, field-deployable sensor technology specifically designed for PFAS detection, FRED-PFAS™, allowing TRS to measure PFAS concentrations on-site and quickly. With quick results in the field, TRS operators immediately assess the PFAS levels in rinse water and the efficacy of the decontamination process.

Thus, TRS can use FREDsense's system to make informed decisions on-site, reducing dependency on external validation and speeding up the project workflow.

Fig. 1 - TRS operator running a field test using the FRED-PFAS kit.

Using FRED-PFAS™ to Optimize AFFF* Cleanouts



Aircraft rescue and firefighting (ARFF) vehicles and equipment are cleaned using a specialized rinsing agent to remove PFAS.

FRED-PFAS™ measures PFAS levels at equipment outlet after every rinse. Same-day results allow crews to better optimize the number of rinses needed, saving both time and money.

FRED-PFAS™ is used to screen treated water quality for discharge.

* **AFFF** = aqueous film-forming foam

= FRED-PFAS™ measurements taken

Fig. 2 FRED-PFAS™ application for ARFF cleanout project

FREDsense® What's in your water?

The Results

During the cleanout of one ARFF vehicle, FREDsense and TRS operators used the FRED-PFAS™ field kit. Samples were collected in parallel and sent to a third-party laboratory for analysis. A total of 28 samples were performed by five different users. The results were made available to TRS on-site, providing real-time insight into the effectiveness of its rinse cycles and supporting decisions on whether additional rinses were needed.

The FRED-PFAS™ results were compared to both EPA method 1633 and Total Organic Fluorine (TOF) methods from an accredited third party laboratory.

Truck Rinse Data

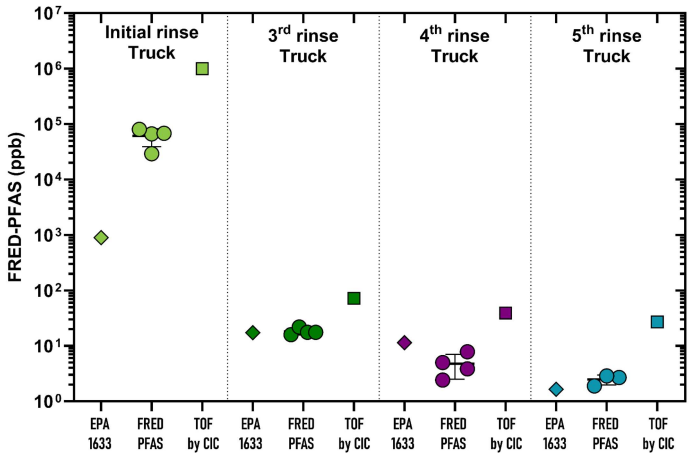


Fig. 3 - FRED-PFAS™ *compared to EPA 1633 and TOF by an accredited third party laboratory for Initial, 3rd, 4th and 5th rinses in a ARFF truck.*

Pipe Loop Data

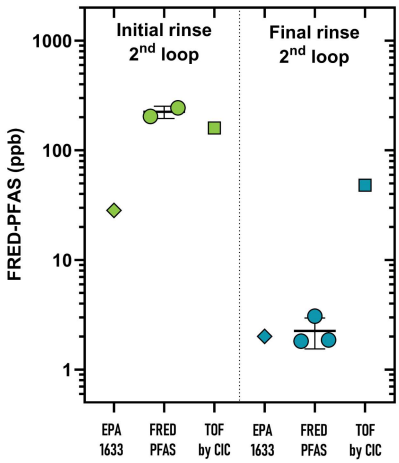


Fig. 4 - FRED-PFAS™ compared to EPA 1633 and TOF by an accredited third party laboratory for Initial, 3rd, 4th and 5th rinses in a piping loop.

	Truck Rinses				2nd Loop Rinses	
Sample	Initial Rinse	3rd Rinse	4th Rinse	5th Rinse	Initial Rinse	Final Rinse
EPA 1633 (ppb) third party	899.17	17.32	11.45	1.645	28.27	2.01
FRED-PFAS (ppb) average*	61,148	18.23	4.78	2.49	224.08	2.25
TOF by CIC (ppb) third party	1,000,000	72	39	27	160	48
FRED-PFAS (ppb) Stdev	22,124	2.53	2.29	0.52	28.41	0.71
FRED-PFAS (ppb) n number	4	4	4	3	2	3
FRED-PFAS Precision (RSD)**	36.18%	13.90%	47.81%	20.85%	12.68%	31.52%

Table 1 - Results of FRED-PFAS™ *compared to EPA 1633 and TOF by an accredited third party laboratory for Initial, 3rd, 4th and 5th rinses.*

** Average of multiple* FRED-PFAS™ *replicates (n number) completed on site.*
*** RSD = Relative Standard Deviation*

In summary, the FRED-PFAS™ correlated closely with third-party laboratory methods. Initial rinses in both the truck and loop rinses showed significant variance between EPA Method 1633 and TOF analysis whereas the average replicate reported value showed high levels of PFAS. These initial rinses showed elevated FRED-PFAS measurement versus 1633, following closer to TOF based method analysis. **The system measured closer to TOF analysis when more complex matrices were analyzed.** This is anticipated due to the elevated levels of fluorotelomers and precursors found

This shows highly promising data that the FRED-PFAS system measured AFFF rinses at various stages of the clean-out project with sufficient accuracy. This would make data useful enough to make process control decisions throughout the various rinsing cycles of the project.

within the initial AFFF rinsate. Subsequent rinses of both the truck and loop showed closer correlation between EPA 1633 analysis versus FRED-PFAS. In some cases, FRED-PFAS reported within single part-per-billion (ug/L) values as reported by the third-party compliance lab report. **Subsequent rinses which would likely contain more 1633 target contaminants tracked closely between the data.**

Replicates between users showed high precision demonstrated through relative standard deviation calculations between 12% - 48% when comparing between 3 - 4 replicate measurements per sample, showing the **reliability of the FRED-PFAS system.**

The Impact

For AFFF cleanout projects, FREDsense's field-deployable sensor technology has the ability to:

- Provide confidence to operators and helps answer the tough question "how clean is clean?" **allowing for faster decisions in the field**.
- Avoid delays in real-time data accuracy, **saving weeks on third party results**.
- Reduce reliance on visual inspections that may lead to over-cleaning - **providing onsite quality control**.

"The FRED-PFAS system gave our operators another tool to use in the field, which leads to faster decision making and improved workflow. This detection kit helps our team quickly determine if additional steps are necessary and help avoid unnecessary work."

— Greg Knight, TRS Group, PerfluorAd Operations Manager