Science of PFAS Conference – 4/6/2022

Connecticut's Program to Evaluate AFFF Alternatives & Equipment Decontamination Options

Speaker: Shannon Pociu, CT DEEP Remediation Division

AFFF spill to the Farmington River, Windsor, CT, June 9, 2019

CT AFFF Take-Back Program Background

- Planning for an AFFF Take-Back Program began in 2019 prior to the State's PFAS Action Plan
- June 2019 - Advisory Bulletin issued on AFFF use
- 2020 - Bond funding received for Take-Back Program and private well testing for PFAS
- June 30, 2021 - Alternative Fluorine-Free Foam (F3) identified for use in state fire apparatus
- July 13, 2021 – Public Act 21-191 signed, AAC the Use of PFAS in Firefighting Foam
  - Banned training with AFFF upon passage
  - Banned most AFFF uses as of 10/1/21
  - Directed DEEP to initiate an AFFF Take-Back Program (began in April 2021)

CT Next Generation Foam Committee

Convened March 2019 by the CT Dept. of Emergency Services & Public Protection's Commission on Fire Prevention & Control

- **Objective: Identify a fluorine-free, environmentally friendly replacement for AFFF used in CT's regional foam trailers**

- **Members**
  - CT DESPP, State Fire Administrator
  - CT DEEP, Emergency Response Unit and Remediation Division
  - CT Municipal Fire Department leaders
  - Petroleum Terminal representative
  - Expanded to include representatives of MassDEP, RI DEM, and ME DEP who wished to observe

Fluorine-Free Foam (F3) Evaluation

- Invited vendors of several “fluorine-free” fire-fighting products to speak to the group, answer questions, and in some cases perform a live fire demonstration.
- Reviewed GreenScreen™ (2018) list of certified foams
- Consulted with LASTFire representative

❑ **Replacement Foam Requirements**:

- ✓ Effective on both polar and nonpolar flammable liquids
- ✓ Meet **NFPA 11** – Standard for Low-, Medium-, and High-Expansion Foams
- ✓ Meet **UL-162** GFGV – Foam Equipment & Liquid Conc.
- ✓ Foam trailer equipment compatibility (aeration nozzles)
- ✓ **Favorable laboratory report = Fluorine-free + No regrettable substitutions**

Laboratory Parameters Tested

- Products tested were purchased by CT DEEP and analyzed by MA DEP at Alpha Analytical and subcontracted labs (Harvard Univ. and Sterling Analytical).

Analysis	Method	Lab
PFAS	EPA 537 modified using isotope dilution (24 compounds)	Alpha Analytical
PFAS	TOP Assay (18 compounds)	Alpha Analytical
SVOCs	EPA 8270D (limited analysis)	Alpha Analytical
Inorganic Halides	Ion Chromatography (F/Cl/Br)	Harvard Univ.
Total Halogens	Combustion Ion Chromatography (F/Cl/Br)	Harvard Univ.
*Total Organic Halogens or	EPA 9076	Sterling Analytical
*Extractable Organic Halides	EPA 9023	Sterling Analytical

	Alpha Labs	Alpha Labs	Alpha Labs	Alpha Labs	Harvard U.	Harvard U.	Sterling Analytical
	PFAS by Isotope Dilution	**Total Oxidizable Precursor (TOP) Assay (Pre-Treatment)**	**TOP Assay (Post-Treatment)**	**Semivolatile Organics by GC/MS (EPA 8270)**	**Inorganic halides by ion chromatography**	**Total halogens by Combustion ion chromatography**	**Total organic halogens/ extractable halides (DL: 50 ppm)**
Universal Green AR	Non-detect	Non-detect	Non-detect	Non-detect	Non-detect	Non-detect	Non-detect (NOTE: SW-846 Method 9076, Total organic halogens)
PhosChek Fluorine Free	Non-detect	Non-detect	Non-detect	Non-detect	Non-detect	Cl	Non-detect (NOTE: SW-846 Method 9076, Total organic halogens)
NovaCool	PFHxDA (J)	Non-detect	PFBA PFPeA (J) PFHxA (J)	Not analyzed	Fl, Cl	Non-detect (Cl not quantified)**	Non-detect (NOTE: SW-846 Method 9076, Total organic halogens)
Knockdown (wetting agent)	PFHxA (J)* - det in field blank	PFHxA (J)*- det in method blank	PFBA (J)* - det in method blank PFHxA (J)* - det in method blank PFHpA (J)	Not analyzed	Cl**	Non-detect	Non-detect (NOTE: SW-846 Method 9023, Extractable organic halides)
F-500 (wetting agent)	PFHxA (J)* - det in field and method blank	PFHxA (J)*	PFBA (J)* - det in method blank PFPeA (J) PFHxA (J)* - det in field/ method blank PFHpA (J)	Not analyzed	Non-detect	Non-detect	Non-detect (NOTE: SW-846 Method 9023, Extractable organic halides)
Firestopper XL Plus FFC (Mil-Spec)	PFBA, PFPeA, 4:2 FTS, PFHxA, 8:2 FTS, 6:2 FTS (dupe), 10:2 FTS	PFBA, 6:2 FTS PFHxA	Non-detect*** Reporting limits very high	Non-detect	Cl**	Fl, Cl	Non-detect (NOTE: SW-846 Method 9076, Total organic halogens)

*Also found with J value in field and/or method blank analysis

**Also found in temperature blank at similar concentration.

Note 1 - "J values" are above the detection limit but below the reporting limit for the analysis. This means that there is high degree of certainty that PFAS are present in the sample but the quantitative concentration values are uncertain.

Note 2 - Knock Down and Fire Stopper had detects of Chlorine in the Harvard Concentration of inorganic halides. Since similar results were detected in the temperature blank, the result is likely to be a false positive.

Take-Aways from F3 Testing/Evaluation

- ❑ F3 products considered were not suitable for LASTs with subsurface injection fire suppression systems
- ❑ Foam concentrate is a tough matrix to analyze!
  - Dilution needed →
  - Detection limits on order of ppm or ppb vs. drinking water advisory levels in ppt
- ❑ Defer to GreenScreen Certified™ for Firefighting Foam
- ❑ CT Fire Services Next Generation Foam Committee identified an F3 product for use in state apparatus – National Foam Universal®F3 Green

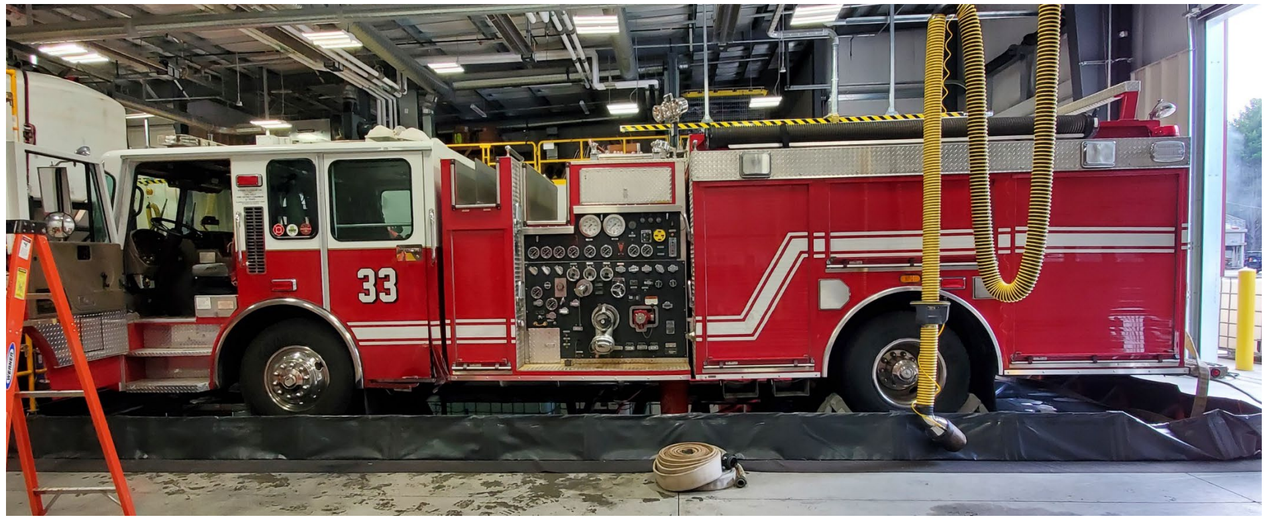
AFFF TAKE-BACK PROGRAM

- **AFFF Take-Back Program** (DEEP/DESPP, supported by $2M bond)
  - ✓ PFAS-free foam selected by DESPP with DEEP input: Feb. 5, 2021
  - ✓ Take-back program for state/municipal AFFF concentrate in containers
    - **35,300 gal.+ collected from >250 fire departments**

✓ Phase 1 – Container collection and disposal: **Launched in May 2021**
✓ Phase 2 – Decontamination study: **Initiated Summer 2021**
❑ Phase 3 – Remove AFFF from and decontaminate apparatus: Pending funding

Decon Demonstration Project Goals

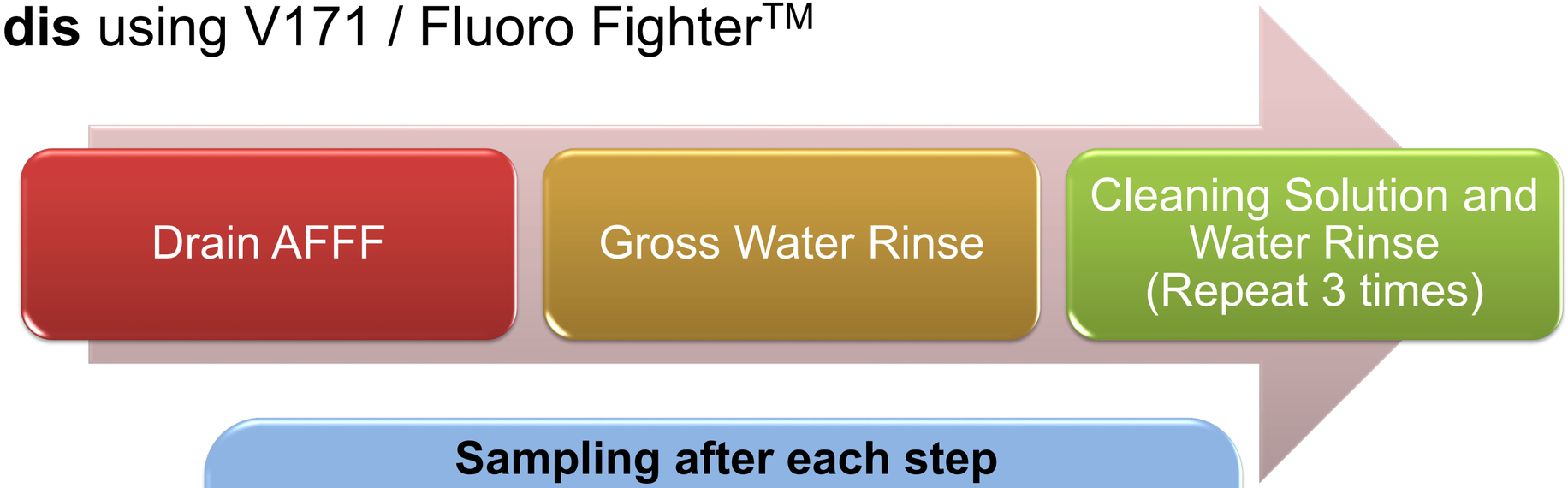
- ❑ Risk reduction rather than elimination
  - Gross PFAS removal
  - How to clean?
  - Clean to what level? ppb? ppt?



- ❑ Waste minimization
- ❑ Cost-benefit analysis
  - Clean vs. replace equipment?
  - On-site treatment of waste liquids vs. off-site disposal?
- ❑ Refine SOP for remaining trailers and tailor approach for cleaning municipal fire apparatus

Demonstration Project Approach

- 2 vendors using 2 different cleaning solutions at separate locations
  - **AECOM** teaming with TRS and Hiller using ***PerfluorAd®*** system
  - **Arcadis** using V171 / Fluoro Fighter™



Sampling after each step

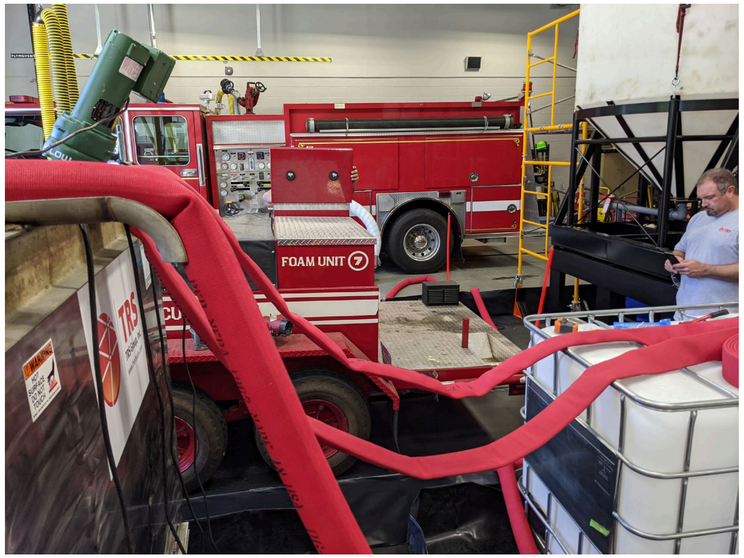
Analysis at Eurofins Lancaster

- PFAS per EPA 537 modified with ID, DoD QSM 5.3 Table B-15, 24 compounds
- TOP Assay on most samples

Foam Trailer Specs

- Approx. 500-gallon foam concentrate capacity, C6 AR-AFFF
- Poly tank with baffles
- 3 foam proportioners and deluge
- 3 sets of on-board hand lines
- Transfer pump assembly

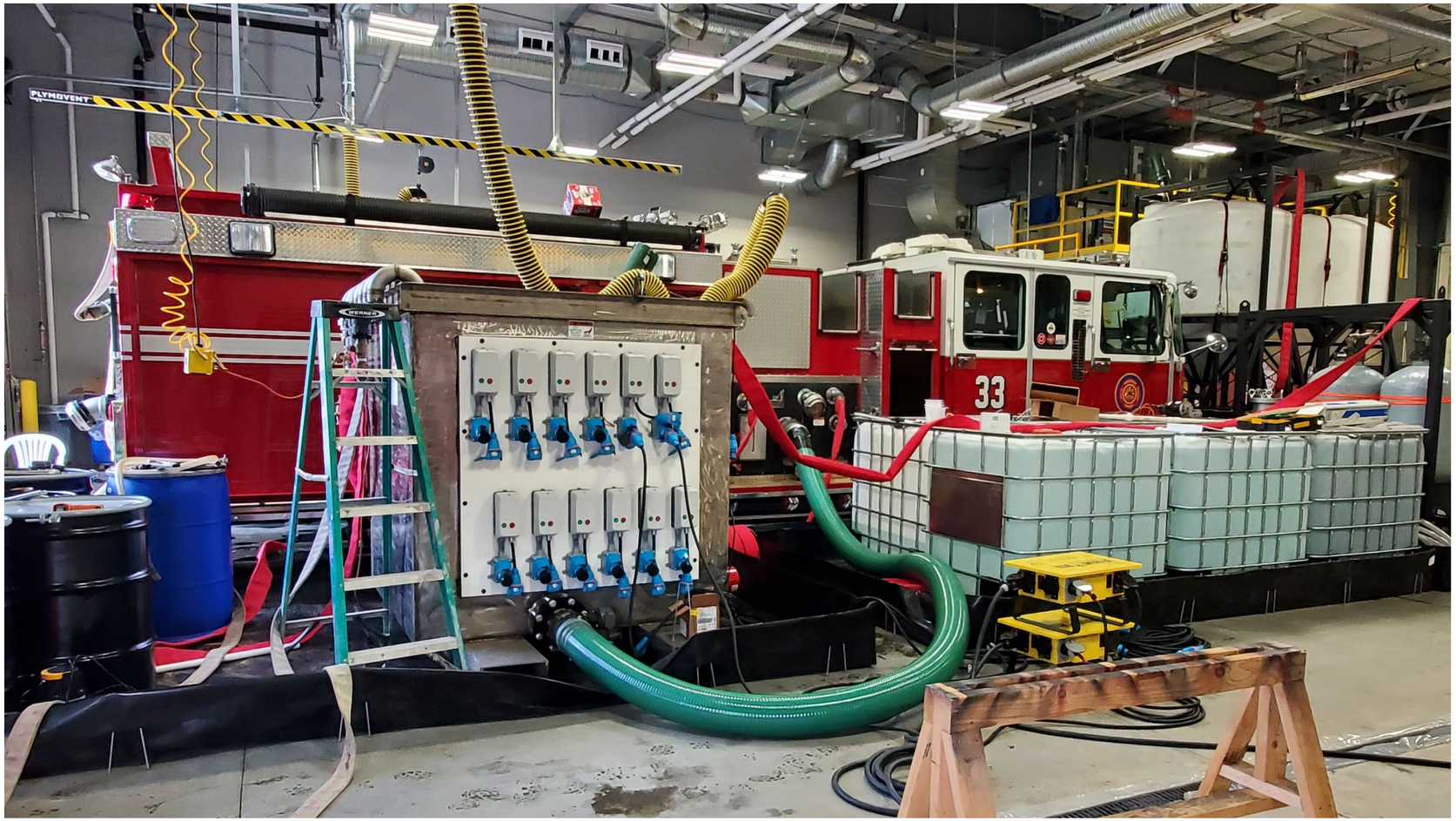
AECOM/TRS/Hiller – Foam Trailer Cleaning

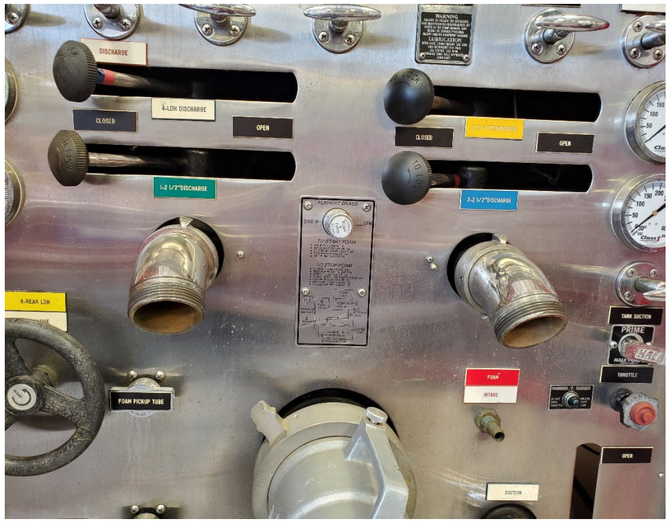


Foam Trailer Cleaning using ***PerfluorAd®*** system

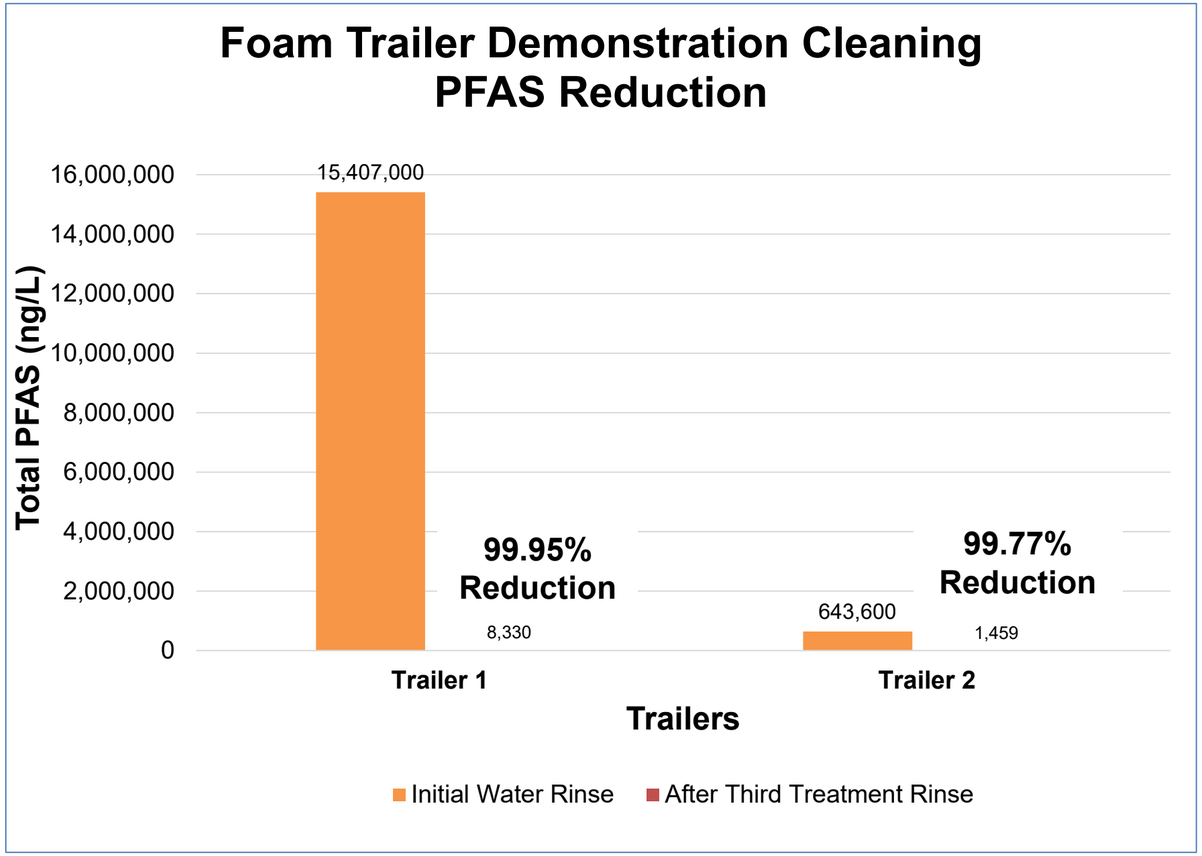
AECOM/TRS/Hiller – Fire Truck Cleaning

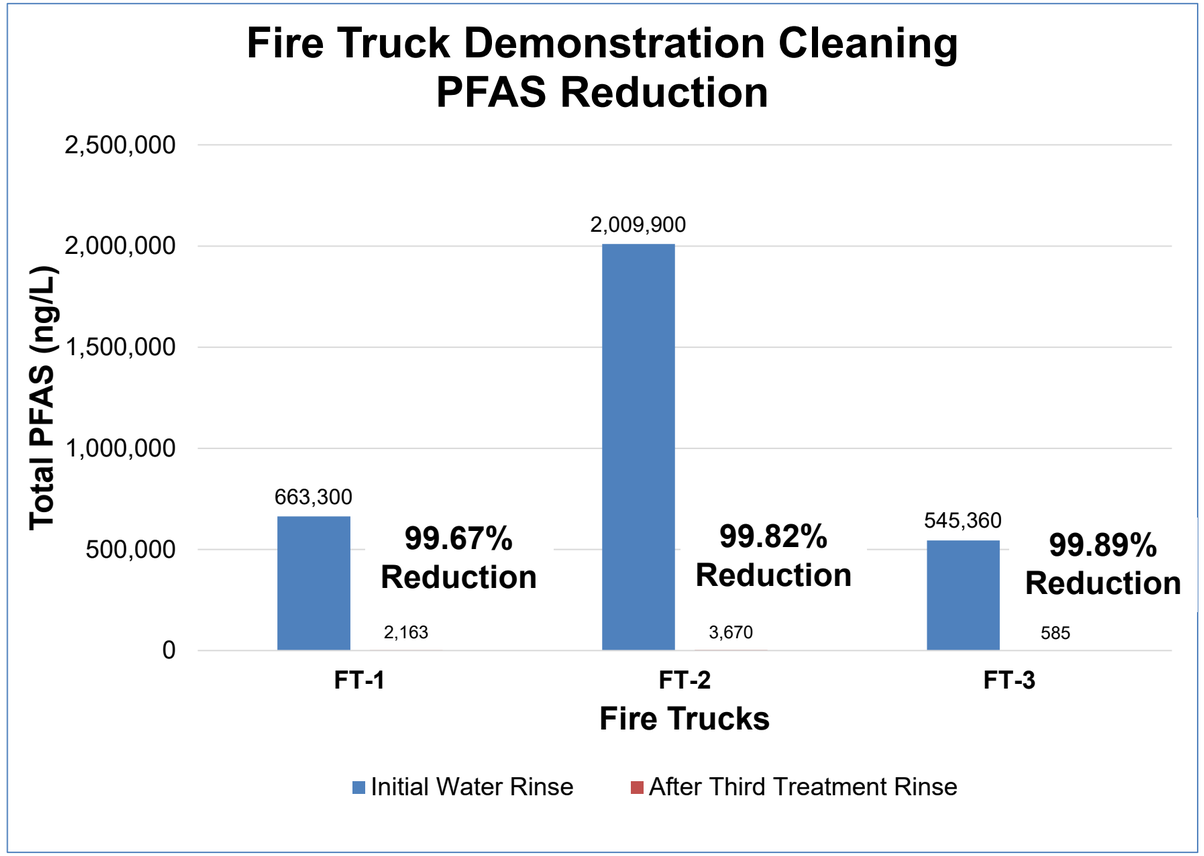
Fire Truck Cleaning using ***PerfluorAd®*** system





AECOM/TRS/Hiller – Preliminary Results



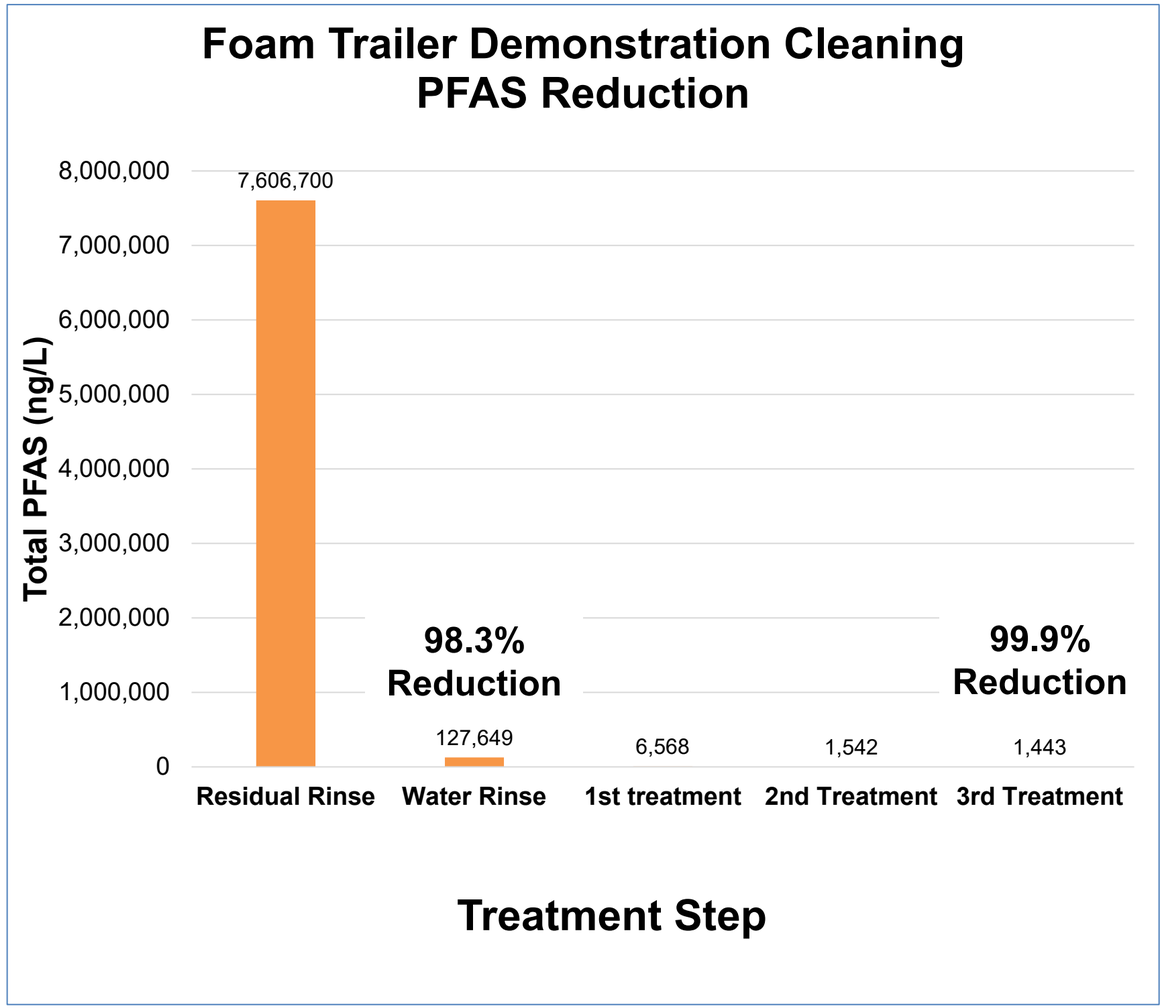


Notes: 1. Results shown for reduction after 3 treatment applications with ***PerfluorAd***® system
2. Total PFAS represents list of 24 PFAS compounds, EPA 537 modified with isotope dilution

Arcadis – Trailer Cleaning

Foam Trailer Cleaning using Fluoro Fighter™

Arcadis – Preliminary Results



Notes:

1. Results shown for reduction after 3 treatment applications with Fluoro Fighter™
2. Total PFAS represents list of 24 PFAS using EPA Method 537 modified with isotope dilution

Lessons Learned so far…

- **Expect Delays**
  - COVID impacts, supply chain issues, and lab delays are REAL.
- **Significant Logistics Effort!**
  - Selection of vehicle cleaning location
  - Coordination with fire departments
  - Vehicle draining and cleaning
  - Certified testing of non-fluorinated foam system
  - Determine need to upgrade equipment for compatibility with non-fluorinated foam
  - Rinsate treatment vs. offsite disposal
  - Laboratory testing and coordination
- **Fire Apparatus Are Custom**
  - Not a “one-size fits all” approach
- **Disposal of AFFF and PFAS waste liquids and solids can be challenging.**
  - Need multiple potential disposal options with early acceptance of waste stream
  - Consider onsite treatment/reuse of rinsate after treatment to reduce waste generated
  - Consider state regulatory requirements for wastewater discharges
- **Economy of Scale**
  - More cost effective to clean multiple apparatus at the same time

Risk Reduction

Transitioning to Fluorine-Free Foam and cleaning fire apparatus is collectively a significant environmental improvement over continued use of AFFF.

- However, residual PFAS remaining in fire apparatus, even after rinsing, can cross-contaminate the new foam. Deployment of the new foam may still pose a potential environmental and/or human health risk.

Next Steps…

- ❑ Refine cleaning SOP for remaining foam trailers and municipal fire apparatus

- ❑ Cost-benefit analysis
  - Will likely perform only 2 cleaning rinses on remaining 5 trailers.
  - Compare to a triple-water rinse.
  - On-site treatment of waste liquids vs. off-site disposal?

- ❑ Future funding & logistics

For more information

CT DEEP PFAS Webpage
PFAS Task Force Webpage
CT PFAS Action Plan

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