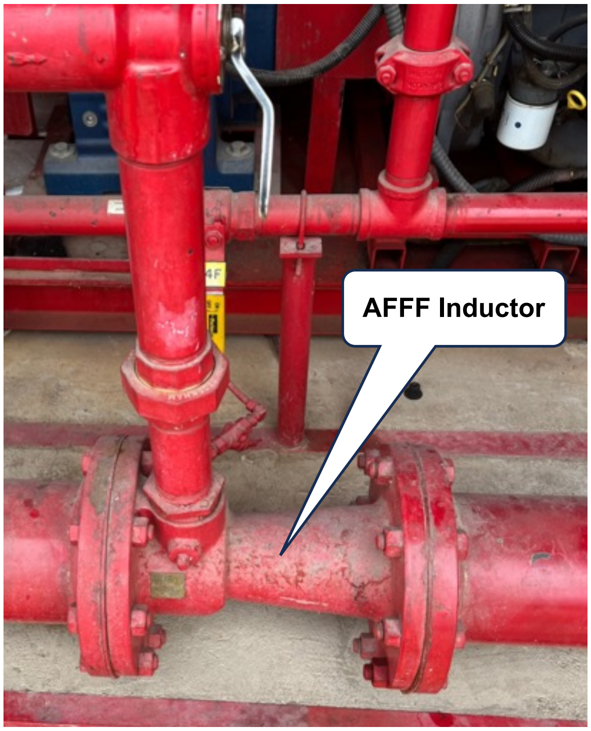
PFAS EQUIPMENT DECONTAMINATION CASE STUDY

- **Problem: Aqueous Film Forming Foam (AFFF) containing Per- and Polyfluoroalkyl Substances (PFAS) was stored in a petroleum facility's firefighting equipment for decades. New regulations on PFAS prompted AFFF removal and replacement. Draining AFFF flowed by a potable water flush left substantial PFAS residual concentrations on equipment surface (342,643 ng/100cm^2).**
- **Solution: A proprietary decontamination process using a heated pressured application of patent pending PFAS-SOL® solution was used to scrub the equipment interior of residual PFAS.**
- **Result: The decontamination process reduced equipment surface residual PFAS contamination an additional 99.99998% (0.0838 ng/100cm^2) beyond AFFF removal and potable water flush.**

Background/Objectives. A petroleum storage facility removed Per- and Polyfluoroalkyl Substances (PFAS) containing Aqueous Film Forming Foam (AFFF) stored in the station's firefighting equipment. The AFFF was removed from the equipment followed by a thorough high-pressure flush with municipally potable water from the fire-fighting system's water supply. Residual PFAS remained on the equipment's interior surface measured by wipe test at 342,643 ng/100cm^2. Geologic Science and Technology Group, Inc. (GST) was contracted to provide decontamination of specified firefighting equipment.



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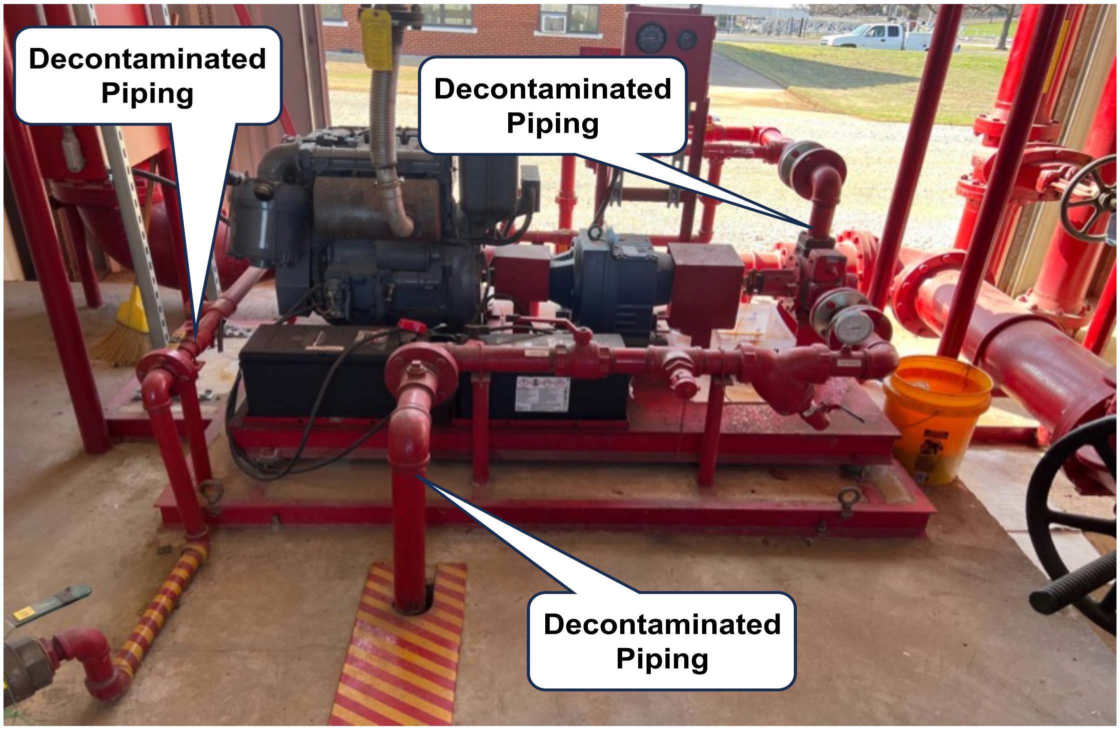
Approach. GST selected a specialty surfactant uniquely formulated for PFAS liberation from solid surfaces. PFAS-SOL® is a patent pending non-ionic surfactant formulation that is pH neutral, non-caustic, non-corrosive, and biodegrade. PFAS-SOL® has the unique capacity for desorbing PFAS compounds, associated with AFFF, from a broad range of impacted surfaces.



Blending tanks were staged next to pipe fittings on the portion of the fire-fighting system to be decontaminated. The blending tanks were connected to the upstream and downstream piping connections to establish a closed-loop re-circulation system. The decontamination was staged in sequential phases. Decontamination fluids were heated to 40^{0}C, recirculated by redundant pumps at high velocity under increased pressure. Heat and pressure were carefully monitored to ensure gasket and fitting tolerances were not exceeded. Each decontamination phase included 1 to 1.5 hours of heated high pressure, high velocity recirculation.

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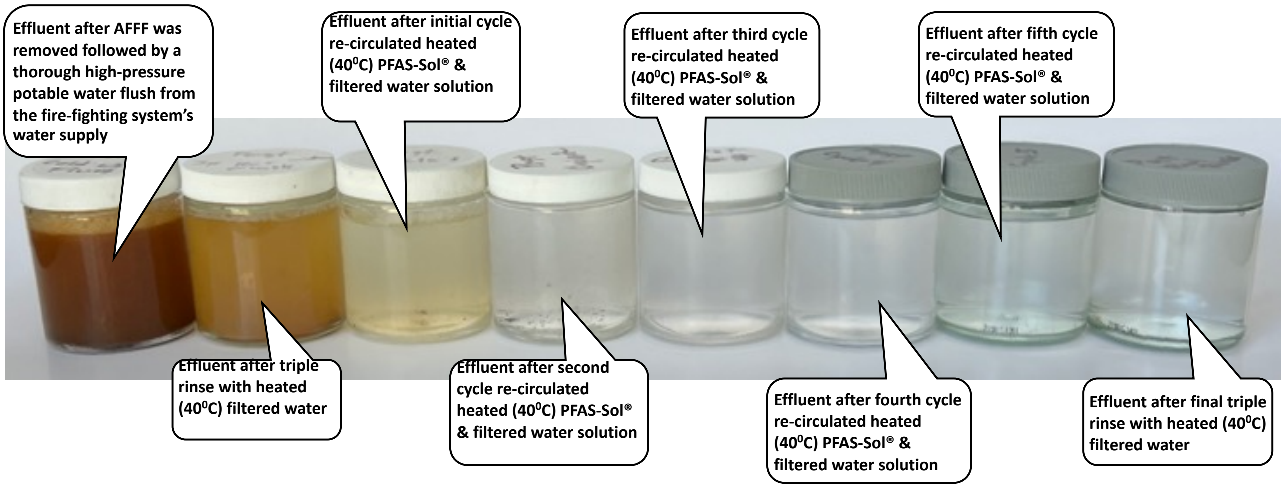

Above Photograph: Fluid effluent collected at piping system discharge point at the end of each decontamination stage. The sample on the left was collected at the end of the initial stage progressing to the sample on the right collected at the end of the final stage. The left two samples were collected after filtered water flush without PFAS-Sol®. The next five samples were collected after each re-circulation and flush with a PFAS-Sol® aqueous solution at decreasing concentration. The last sample on the right was collected after the final filtered water triple rinse.

Results/Lessons Learned. Pre-decontamination equipment wipe sample testing did indicate that AFFF removal followed by high-pressure water flushing alone was inadequate to achieve the facility's goals. Removing AFFF and thoroughly flushing with high-pressure municipal potable water left a significant concentration of residual PFAS (342,643 $ng/100cm^2$). Leaving behind a significant PFAS residue would have re-contaminated replacement non-PFAS synthetic AFFF, negating the reason for changeout.

GST's proprietary decontamination process using a heated pressured application of patent pending PFAS-SOL® solution was highly successful in achieving the facility's decontamination goals. **The decontamination process reduced equipment surface residual PFAS contamination an additional 99.99998% (0.0838 $ng/100cm^2$) beyond AFFF removal and potable water flush alone.**

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SUMMARY OF PFAS COMPOUNDS DETECTED ON INTERIOR SURFACE OF FIFREFIGHTING PIPING SYSTEM AFTER AFFF REMOVAL FOLLOWED BY WATER FLUSH

DETECTED PFAS			AFTER SYSTEM AFF PURGE & WATER RINSE		AFTER HEATED PFAS-SOL® WASH and HEATED WATER RINSE		
Type	Compound	CAS	Pre-Decon		Post-Decon		% Reduction
Acids	**Perflurobutanoic acid (PFBA)**	375-22-4	**365.0 ng**		<0.288 ng	U	> **99.96055%**
	Perfluoropentanoic acid (PFPeA)	2706-90-3	**336.0 ng**		<0.0424 ng	U	> **99.99369%**
	Perfluorohexanoic acid (PFHxA)	307-24-4	**2,800.0 ng**		<0.0245 ng	U	> **99.99956%**
	Perfluoroheptanoic acid (PFHpA)	375-85-9	**311.0 ng**		<0.0497 ng	U	> **99.99201%**
	Perfluorooctanoic acid (PFOA)	335-67-1	**1,260.0 ng**		<0.0312 ng	U	> **99.99876%**
	Perfluorononanoic acid (PFNA)	375-95-1	**108.0 ng**	J	<0.0156 ng	U	> **99.99278%**
	Perfluorodecanoic acid (PFDA)	335-76-2	**472.0 ng**		<0.0330 ng	U	> **99.99650%**
	Perfluoroundecanoic acid (PFUnDA)	2058-94-8	**39.9 ng**	J	<0.0296 ng	U	> **99.96291%**
	Perfluorododecanoic acid (PFDoA)	307-55-1	**151.0 ng**		<0.0349 ng	U	> **99.98844%**
Sulfonates	**Perfluorooctanesulfonic acid (PFOS)**	1763-23-1	<10 ng	U	**0.0209 ng**	J	N/C
	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	**284,000.0 ng**		**0.0629 ng**		**99.99998%**
	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	**82,800.0 ng**		<0.0190 ng	U	> **99.99999%**
		Sum of detected PFAS	**372,643 ng**		**0.0838 ng**		**99.99998%**

NOTE: 1. A surrogate value = 1/2 of the reporting level was used for Non-Detects in calculating percent reduction. N/C = not calculatable.
2. Laboratory analysis was performed by Enthalpy Analytical Ultra Trace Testing Laboratory in Wilmington, North Carolina using a modified EPA method 1633 by adding laboratory grade PFAS standards labeled with Carbon 13 (C13) isotope, allowing lowered reporting levels and minimizing re-extraction for high concentration samples.

For an equipment decontamination quote, please contact us at the email or phone number below. Equipment decontamination offers a tremendous cost advantage over replacement with new, unused equipment. We typically are able to mobilize quickly to your site and complete decontamination on an expedited basis.

GST
GEOLOGIC SCIENCE & TECHNOLOGY
P.O. Box 1209
Prosper, Texas 75078

J. Scott Poynor, P.G.
spoynor@gstg.net
214-837-9587

For additional information on
PFAS-SOL® select QR code below: