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ENGINEERING

Navigating PFAS Piloting: Next Steps for Utilities…

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ADEM

OUTLINE AND AGENDA

INSITE ENGINEERING
HOOVER | TUSCALOOSA

I. PFAS Regulation- Where are we now? Need for Pilot Testing

II. Implementing Solutions & Next Steps for Utilities

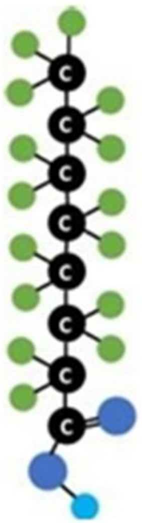
III. Factors to Consider When Starting a Pilot Study & Selecting Equipment

IV. PFAS Treatment Options for Piloting

V. Q & A

WHAT SPECIFIC QUESTIONS WOULD YOU LIKE ADDRESSED?

PFAS – WHAT ARE THEY? WHERE DID THEY COME FROM?

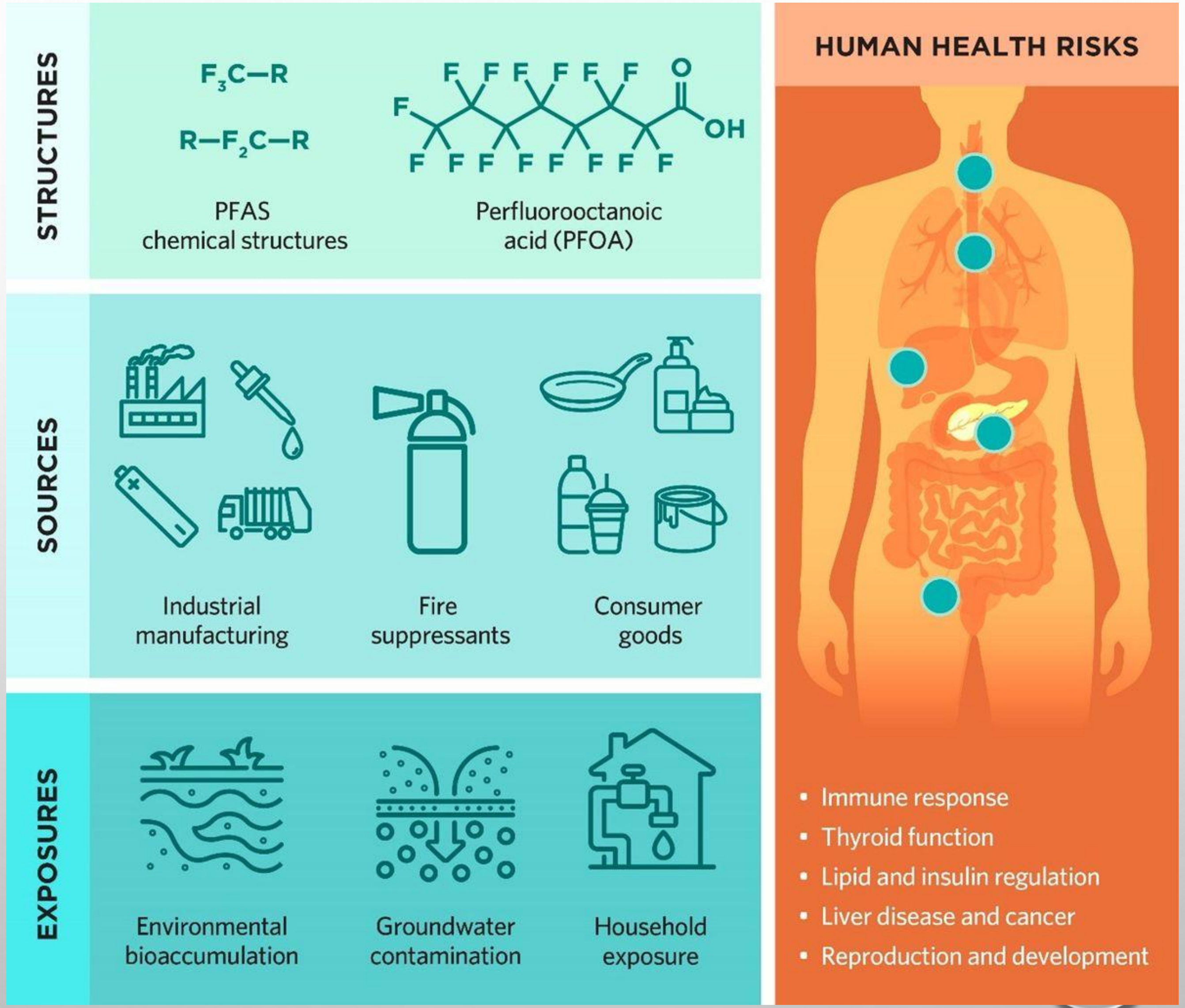


What are PFAS?

PFAS are manufactured chemicals that have been used in industry and consumer products since the 1940s.
Because of their widespread use and their persistence in the environment, many PFAS are found in the blood of people and animals all over the world.
There are thousands of different PFAS, some of which have been more widely used and studied than others.

- INSITE ENGINEERING FIRST BECAME FAMILIAR WITH PFAS IN 2009, WHEN THEY WERE CALLED “PFCS” OR PERFLUORINATED COMPOUNDS.
- “BIO-ACCUMULATIVE” & “FOREVER CHEMICALS”

PFAS – HOW DOES EXPOSURE OCCUR?



EPA's MCLs & NPDWR Summary

- In March 2023, EPA proposed to add limits for six PFAS compounds to the National Primary Drinking Water Regulation (NPDWR).
- On April 10, 2024, the final rule was published. This gave public water systems (PWS) that are in violation until 2029 to get a PFAS remediation system online.
- On May 14, 2025, the agency announced it will keep current MCLs for PFOA and PFOS at 4 ppt, but intends to rescind the three MCLs for PFHxS, PFNA, & GenX and the Hazard Index, additionally extend the compliance timeline from 2029 to 2031.

COMPOUND	FINAL MCLG	FINAL MCL (enforceable level)
PFOA	Zero	4.0 parts per trillion (ppt)
PFOS	Zero	4.0 ppt
PFHxS	10 ppt	10 ppt
PFNA	10 ppt	10 ppt
HFPO-DA (GenX)	10 ppt	10 ppt
Mixtures containing two or more of PFHxS, PFNA, HFPO-DA, and PFBS	1 (unitless) Hazard Index	1 (unitless) Hazard Index

Latest UCMR-5 Data

Table 4. July 2025 Comparison of UCMR 5 Averages and the MCLs from the April 2024 NPDWR

The agency intends to rescind the regulations and reconsider the regulatory determinations for HFPO-DA (commonly known as GenX), PFHxS, PFNA, and the Hazard Index (HI) mixture of these three plus PFBS. Please refer to the EPA's Press Release for more information.

PFAS in April 2024 NPDWR	MCL (µg/L)[1]	UCMR 5 PWSs with full set(s) of results[2]			UCMR 5 PWSs with average(s) greater than MCL			% UCMR 5 PWSs with average(s) greater than MCL[3]		
		large PWS (>10,000)	medium PWS[4] (3,300–10,000)	small PWS (<3,300)	large	medium	small	large	medium	small
PFOS	0.0040	3,446	3,407	512	410	216	34	11.9%	6.3%	6.6%
PFOA	0.0040	3,447	3,407	512	359	181	25	10.4%	5.3%	4.9%
HFPO-DA (GenX chemicals)	0.01	3,448	3,407	512	1	1	0	0.03%	0.03%	0%
PFHxS	0.01	3,445	3,407	512	37	14	3	1.1%	0.4%	0.6%
PFNA	0.01	3,447	3,407	512	2	3	0	0.1%	0.1%	0%
Hazard Index (HI) (HFPO-DA, PFHxS, PFNA, PFBS)	1 (unitless)	3,445	3,407	511	40	18	3	1.2%	0.5%	0.6%
% UCMR 5 large PWSs (serving >10,000) with average(s) greater than MCL = 15.0% (517/3,448)										
% UCMR 5 medium PWSs[4] (serving 3,300-10,000) with average(s) greater than MCL = 8.4% (286/3,407)										
% UCMR 5 small PWSs (serving <3,300) with average(s) greater than MCL = 8.0% (41/512)										
Estimated weighted % of PWSs nationwide with average(s) greater than MCL[5] = 8.5%										

UCMR-5 Data Highlights

Table 3. July 2025 UCMR 5 Data Summary for Unregulated Contaminants[1]

Contaminant	UCMR 5 MRL[2] (µg/L)	Ref Conc[3] (µg/L)	Total number of results	Number of results ≥MRL	Number of results >Ref Conc[4]	% of results >Ref Conc	Total number of PWSs with results	Number of PWSs with results ≥MRL	Number of PWSs with results >Ref Conc[4]	% of large PWSs (>10,000) with results >Ref Conc	% of small PWSs (≤10,000) with results >Ref Conc
lithium	9	10	56,923	16,016	11,140	19.6%	9,938	3,534	2,554	23.9%	27.1%
PFBA	0.005	6	56,363	4,649	0	0%	9,876	1,752	0	0%	0%
PFHxA	0.003	3	56,375	5,252	0	0%	9,876	1,681	0	0%	0%
PFDA	0.003	-	56,380	28	-	-	9,876	14	-	-	-
11Cl-PF3OUdS	0.005	-	56,381	0	-	-	9,876	0	-	-	-
8:2 FTS	0.005	-	56,371	10	-	-	9,876	9	-	-	-
4:2 FTS	0.003	-	56,380	2	-	-	9,876	2	-	-	-
6:2 FTS	0.005	-	56,365	223	-	-	9,876	163	-	-	-
ADONA	0.003	-	56,380	4	-	-	9,876	3	-	-	-
9Cl-PF3ONS	0.002	-	56,353	1	-	-	9,876	1	-	-	-
NFDHA	0.02	-	56,374	5	-	-	9,876	4	-	-	-
PFEESA	0.003	-	56,380	0	-	-	9,876	0	-	-	-
PFMPA	0.004	-	56,379	3	-	-	9,876	2	-	-	-
PFMBA	0.003	-	56,379	2	-	-	9,876	1	-	-	-
PFDoA	0.003	-	56,370	4	-	-	9,876	4	-	-	-
PFHpS	0.003	-	56,379	5	-	-	9,876	4	-	-	-
PFHpA	0.003	-	56,379	1,343	-	-	9,876	526	-	-	-
PFPeS	0.004	-	56,379	95	-	-	9,876	50	-	-	-
PFPeA	0.003	-	56,361	6,021	-	-	9,876	1,891	-	-	-
PFUnA	0.002	-	56,376	10	-	-	9,876	6	-	-	-
NEtFOSAA	0.005	-	56,762	1	-	-	9,914	1	-	-	-
NMeFOSAA	0.006	-	56,763	1	-	-	9,914	1	-	-	-
PFTA	0.008	-	56,763	0	-	-	9,914	0	-	-	-
PFTrDA	0.007	-	56,762	0	-	-	9,914	0	-	-	-

[1] This data summary represents approximately 83% of total results that the EPA expects to receive by completion of data reporting in 2026. Analytical results from the UCMR program are reported by laboratories and provided by the agency in micrograms/liter (µg/L, or parts per billion). To convert results in µg/L to nanograms/liter (ng/L, or parts per trillion), multiply the value by 1,000. The UCMR results represented by this table are single measurements and do not represent a running annual average (RAA). For information on results to date for the NPDWR PFAS, see the PFAS NPDWR section of this document. The total number of results and total number of PWSs with results for the NPDWR PFAS are similar to the other EPA Method 533 PFAS (*i.e.*, approximately 56,375 results from 9,880 PWSs).

[2] UCMR MRL – EPA-established UCMR Minimum Reporting Level. Based on laboratory capability; not related to contaminant health effects information.

[3] Ref Conc – Reference Concentration. Based on contaminant health effects information; non-regulatory and non-enforceable. The EPA CCL 5 Health Reference Level (HRL) for lithium and the USGS Health-Based Screening Levels (HBSLs) for PFBA and PFHxA. See Terms and Definitions.

[4] The HRL and the HBSLs are expressed with one significant digit; comparison of UCMR results to those levels is therefore based on one significant digit. Results >15 µg/L for lithium round to 20 µg/L; results >6.5 µg/L for PFBA round to 7 µg/L; and results >3.5 µg/L for PFHxA round to 4 µg/L and are identified as above the reference concentrations.

IMPLEMENTING SOLUTIONS – WEST MORGAN-EAST LAWRENCE WATER AND SEWER AUTHORITY

- In 2016, PFAS issue came to their attention
- Temporary solution came online in 90 days
- Through pilot testing determined high recovery reverse osmosis was the most effective technology at consistently reaching “non-detect” on 30+ PFAS.
- J.D. Sims – R.M. Hames water treatment facility came online in 2021

PROACTIVITY WHEN IMPLEMENTING SOLUTIONS

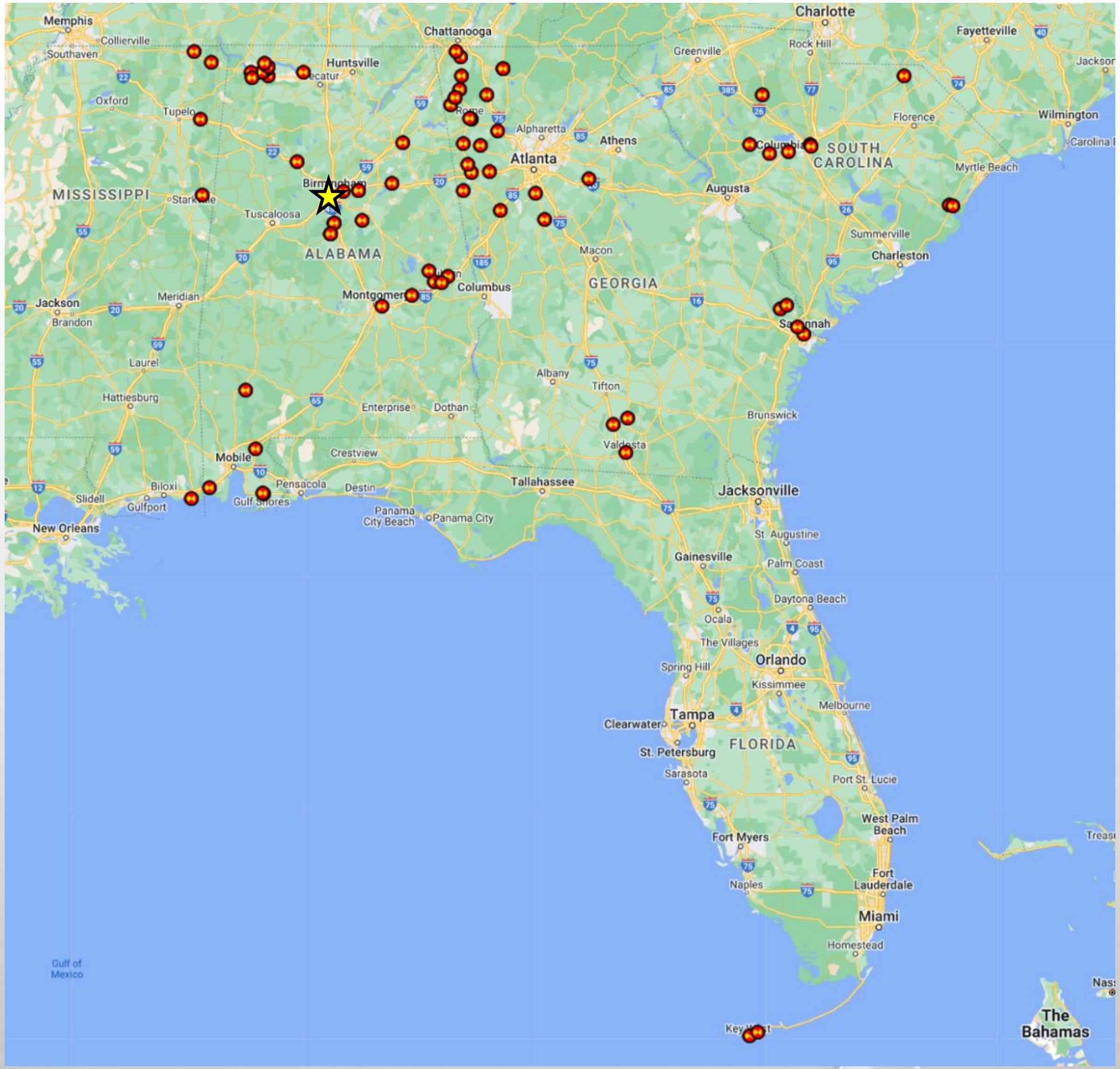
- Current Regulations vs. What Is Coming Down The Line
- Where Do You Stand Now? What Are The Trends In Your PFAS Data?
- Know What's Out There!
- Solutions Online by 2029? 2031? Remember the Compliance Deadline!

PILOT TESTING

PILOT STUDY BACKGROUND

- InSite started full-scale PFAS Pilot Studies in 2016.
- We currently have 4 InSite Gravity Media Pilots in use, with a 5th currently being fabricated.

InSite PFAS Projects



PILOT PLANNING

- What is the goal of the pilot study? What results are owners looking to achieve? Important factors for equipment selection.
- Full-scale or bench scale study?
- Organization is key!
- Good communication with a laboratory will help ensure smooth pilot testing. 90-day pilot study? Not much time!
- After the length of the pilot study is established, determine sampling frequency. How many samples will be taken each week? How many samples in total? What do you need the sample turn-around time to be?

DIFFERENCE IN FULL-SCALE & BENCH SCALE PILOT STUDIES

★ FULL-SCALE ★

- MOST ACCURATE SIMULATION OF WHAT A FULL-SCALE INSTALLATION WOULD LOOK LIKE (FOOTPRINT/LAYOUT/WEATHER CONDITIONS)
- ANY OPERATORS/STAFF HAVE A CHANCE TO INTERACT WITH THE TECHNOLOGY AND THE MANUFACTURERS

BENCH SCALE

- MORE AFFORDABLE
- LESS WORK ON OPERATORS/PLANT STAFF
- MORE GEARED TOWARD RESEARCH & EXPLORATION OF DIFFERENT TECHNOLOGIES

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PFAS TREATMENT TECHNOLOGIES TO CONSIDER

- **Reverse Osmosis**
- **Granular Activated Carbon**
- Powdered Activated Carbon
- **Ion Exchange**
- Regenerable Ion Exchange
- Aqueous Electrostatic Concentrators
- Advanced Oxidation Processes
- Surface Foam Fractionation
- Ceramic Membranes with PAC Cake Layer
- **Sorbent Suspension Technology**
- Chemical Precipitation
- Heterogeneous Photocatalysis
- Supercritical Water
- Nano Bubble Oxidation Technology
- GAC + IX in Series
- Electrochemical Oxidation

#1 APPROACH FOR TECHNOLOGY SELECTION

EVERY WATER SOURCE IS DIFFERENT

There is no one-size-fits-all solution for the removal of PFAS from drinking water.

EPA's BEST AVAILABLE TECHNOLOGIES: *"The Big 3"*

What treatment options are most effective in removing PFAS from drinking water?

As part of the final PFAS National Primary Drinking Water Regulation (NPDWR), granular activated carbon, anion exchange, reverse osmosis, and nanofiltration were identified by the EPA as the "Best Available Technologies" (BATs) for meeting the PFAS Maximum Contaminant Levels (MCLs). This is based on six criteria: removal efficiency, historical full-scale operation, geographic applicability, compatibility with other treatment processes, ability to bring the entire water system into compliance, and a reasonable cost to large as well as medium sized systems. Water systems may use any technology or practice to meet the PFAS MCLs and are not limited to the BATs.

"EMERGING" TECHNOLOGIES

"Water systems may use any technology or practice to meet the PFAS MCLs and are not limited to the BATs."

IMPORTANT CONSIDERATIONS WHEN SELECTING EQUIPMENT

EVEN WITHIN THE SAME SYSTEM, IF THOSE WATER SOURCES ARE DIFFERENT THE TECHNOLOGY MAY RUN DIFFERENTLY!

Through our experience with full-scale PFAS pilot studies, we have seen different results at each site, even if two studies appear to have similar set-ups and influent concentrations.

POSSIBILITY OF VARIABLE PERFORMANCES BETWEEN DIFFERENT WATER SOURCES

SURFACE WATER

- Expect Spikes:
  - Droughts
  - Storms
  - Barges/Kick up of settlement
- Organics play a larger factor
- Mixed media filtration currently installed or updated membrane filtration?

GROUNDWATER

- More consistent
- What aquifer does is pull from? Will there be high mineral content?
- Does the existing well or spring site have pre-treatment?
- Is there a well under the influence of surface water?

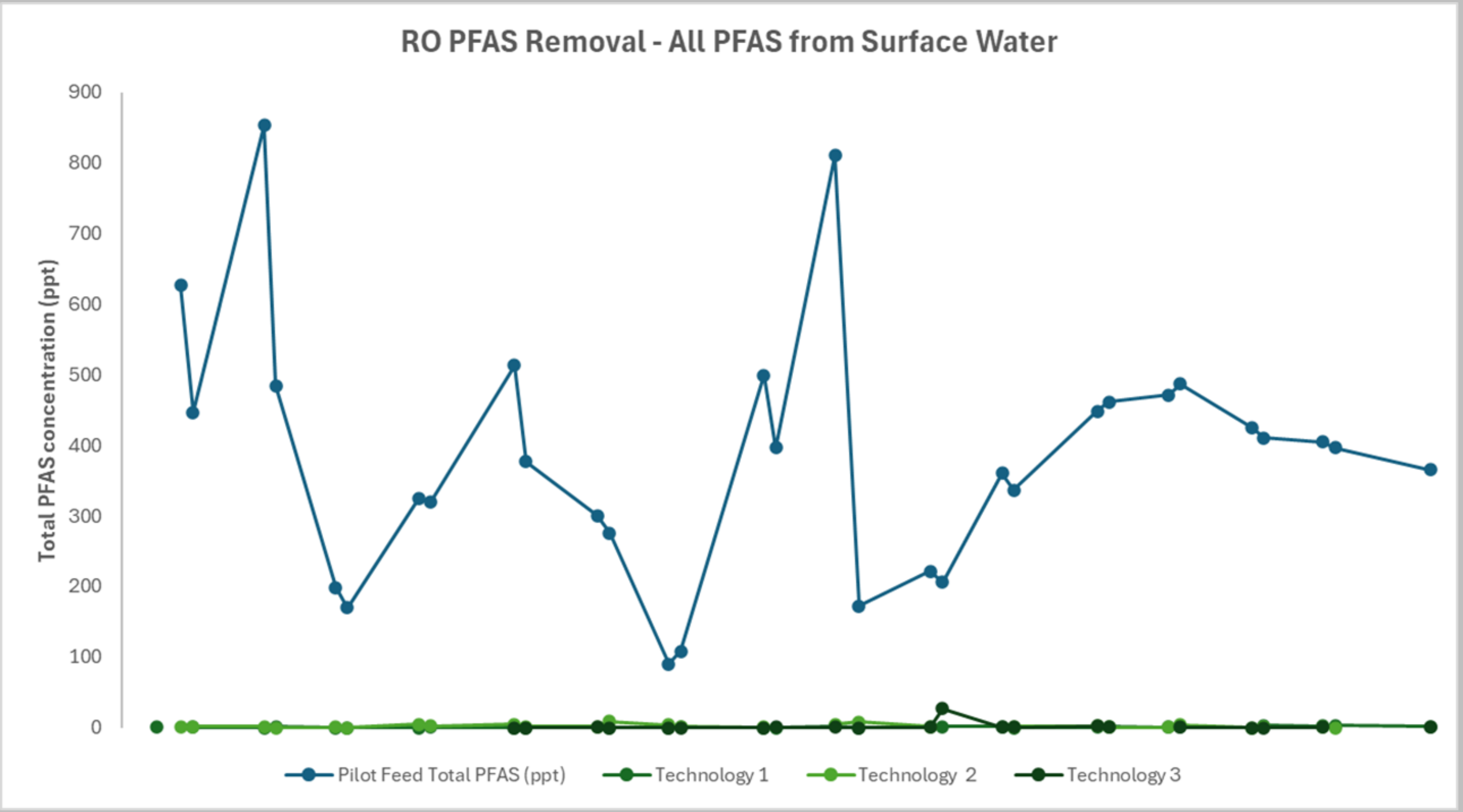
DECISION CONSIDERATIONS WHEN SELECTING EQUIPMENT

1) PFAS Removal Efficiencies
2) Capital Cost
3) **Operational Cost**
4) Ease of Operation
5) By-Product/Waste Streams Treatment
6) Media Regeneration/Disposal Costs
7) Other Local Issues

HIGH RECOVERY REVERSE OSMOSIS

- Separation Technology
- Produces Concentrated Waste Stream
- As Low as 3% Water Waste
- High Energy Consumption

HIGH RECOVERY REVERSE OSMOSIS

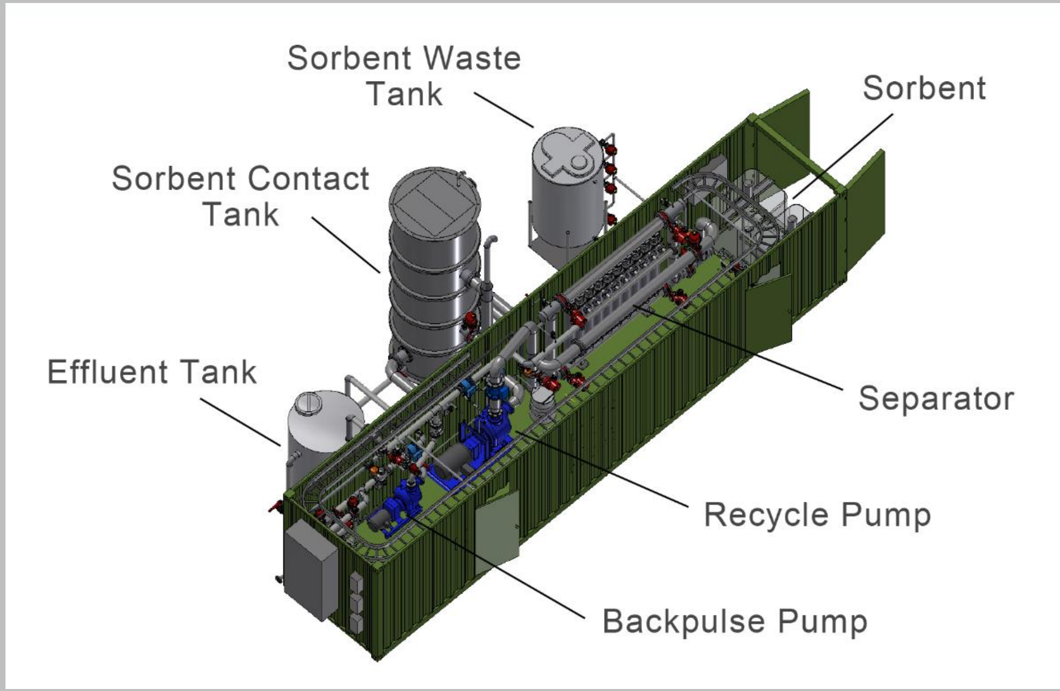


GRANULAR ACTIVATED CARBON & ION EXCHANGE

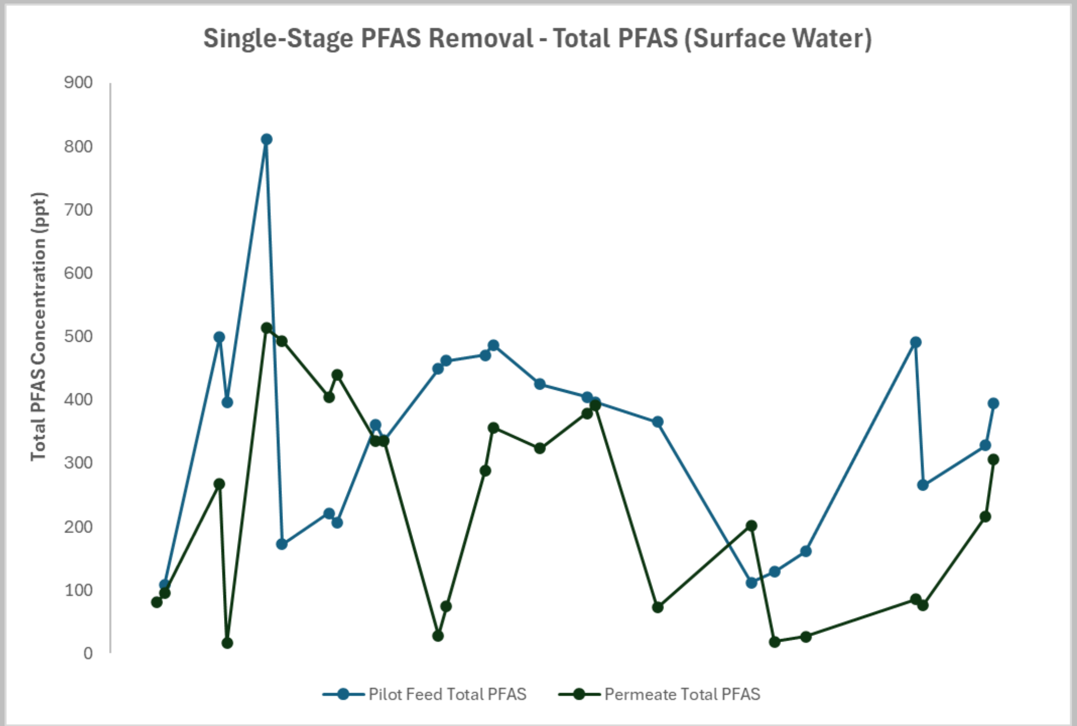
- Adsorption Technology
- GAC is an adsorptive media that is moderately selective.
- Ion Exchange is a selective exchange media that has an affinity for charged particles.
- Low Energy Consumption
- Media Exchange Frequency
- Reactivation & Regenerable Processes to reduce waste
- Concentrated Waste Stream Treatment

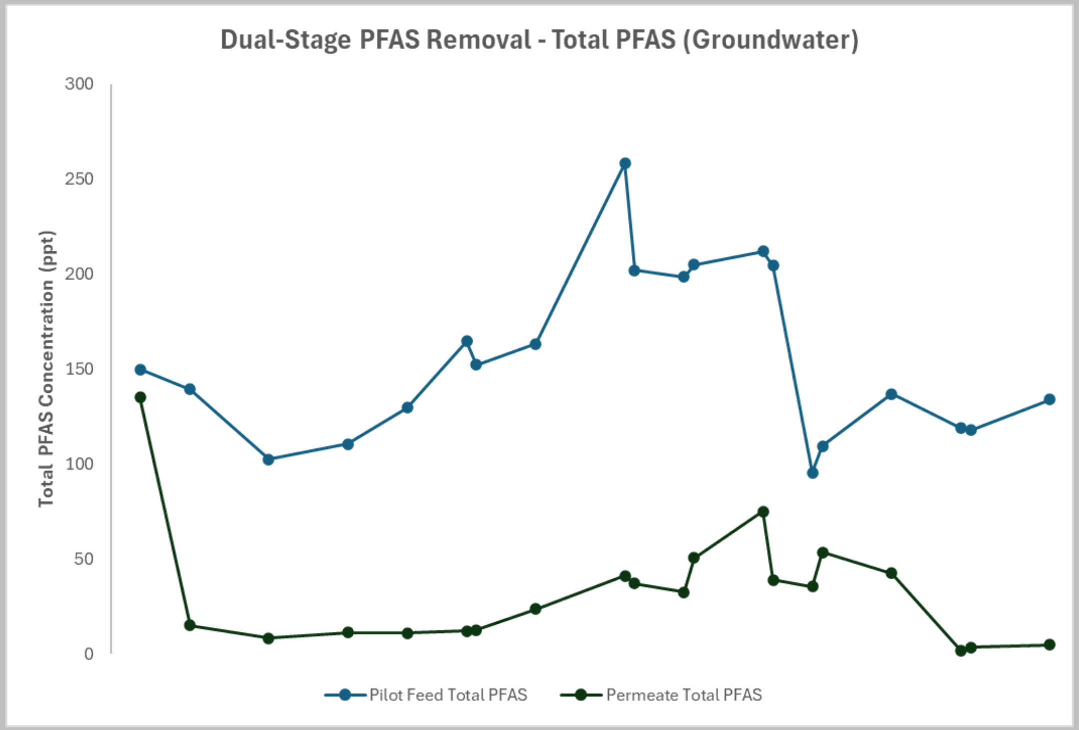
SORBENT SUSPENSION TECHNOLOGY

- Multiple Adsorbents
- High PFAS Removal
- Low Waste Volume
- Small Footprint
- Single-Stage vs. Dual Stage Pilot



SORBENT SUSPENSION TECHNOLOGY





AFTER PFAS TECHNOLOGY SELECTION:

- Keep an open line of communication with consultant and lab.
- The quicker a problem is communicated, the quicker a solution can be implemented. ESPECIALLY when regarding analytical.
- Re-evaluate timeline midway through pilot.

IMPORTANT TAKEAWAYS:

- There is no “One Size Fits All” for the removal of PFAS from drinking water.
- Pilot studies are a must!
- Communication is Key
- Remember Your Objectives
- Think of the Future!

QUESTIONS?

THANK YOU!

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