Synthetic Media as a Sustainable Treatment Solution for PFAS

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Why Test Ion Exchange (IX) Resin for PFAS?

By the early 2010s, per- and polyfluoroalkyl substances (PFAS) were emerging as significant contaminants of concern, especially in water, needing innovative treatment solutions.

The historically used treatment solution of granular activated carbon (GAC) was not the preferred long-term solution due to its low capacity to remove PFAS and resulting high volumes of waste.

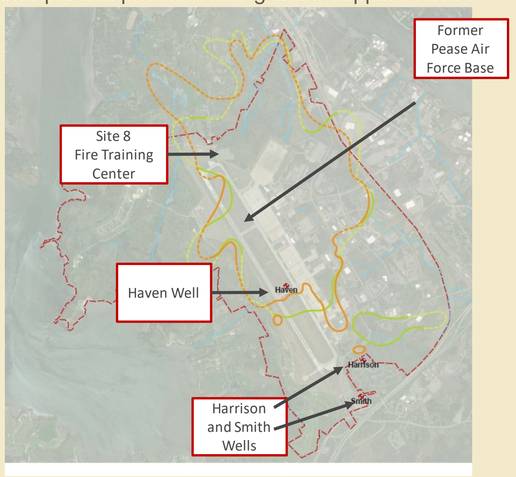
The USAF recognized the limitations of GAC and potential advantages of ion exchange resins and therefore requested ECT2 to test their regenerable SORBIX RePURE resin for the removal of PFAS from contaminated groundwater at the former Pease Air Force Base.

IX resin benefits:

1. Kinetically faster than GAC resulting in a smaller system footprint
2. Capitalize on a dual mechanism of PFAS removal, serving as an adsorbent with ion exchange functionality, thereby taking full advantage of the unique properties of PFAS compounds to maximize treatment capacity and efficiency
3. Can be regenerated on-Site, thereby minimizing waste

Background to Pease Pilot

The use of aqueous film-forming foam (AFFF) at the former Pease Air Force Base Fire Training Center contaminated groundwater with PFAS. Nearby municipal and private drinking water supplies have been impacted.

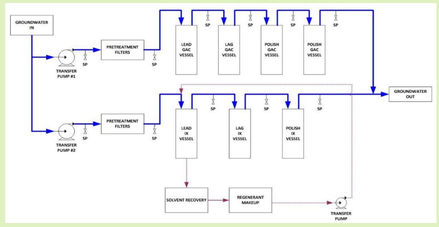


Map courtesy of Air Force Civil Engineering Center

Pilot Trial Data & Results

Project highlights

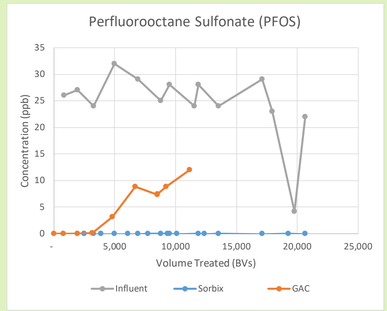
A comparative trial using groundwater from the same location was performed with GAC and SORBIX. Four GAC vessels in series with a 5-minute empty bed contact time (EBCT) per vessel (total GAC system EBCT = 20 minutes), and three resin vessels in series with a 2.5-minute EBCT per vessel (total resin system EBCT = 7.5 minutes). Media volume was the same for all vessels (1.2 cubic feet/vessel); flows were adjusted to achieve the desired EBCTs.

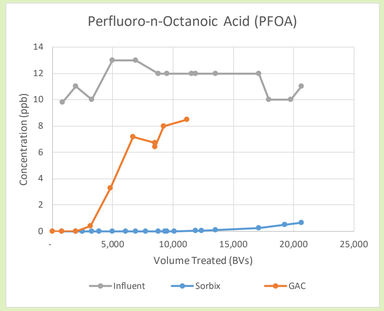


Pilot Skid – Block Flow Diagram

IX vessels in front, GAC vessel in rear

Routine samples from both trains were analyzed for PFOS, PFOA, and 21 other PFAS compounds.

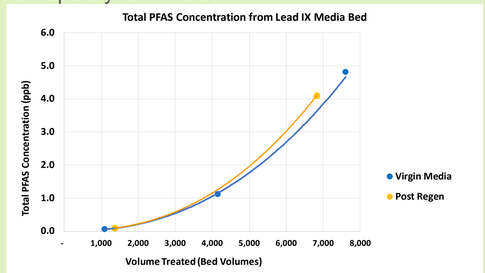




All data in these charts are from the lead GAC vessel and lag SORBIX vessel to compare breakthrough characteristics at the same EBCT of 5 minutes.

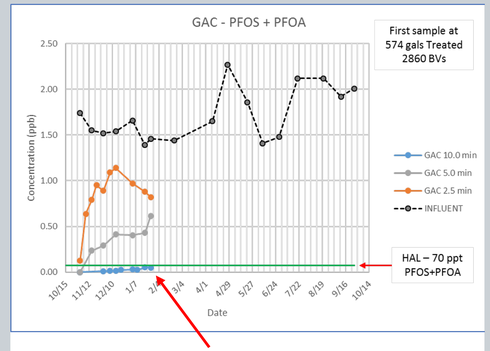
SORBIX RePURE outperformed GAC on all PFAS compounds in the groundwater matrix, demonstrating 5 to 6 times the removal capacity for PFOA and more than 8 times the removal capacity for PFOS.

SORBIX was also successfully regenerated on-site using an in-situ method to restore the resin's capacity for PFAS.



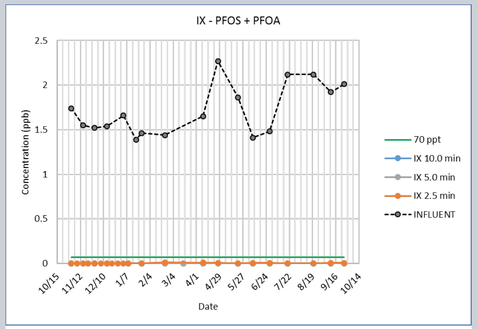
2nd Pilot at Pease

Based on the successful pilot test, ECT2 was asked by the City of Portsmouth, New Hampshire, to conduct a second pilot test on a PFAS-impacted potable water production well using one of ECT2's single-use SORBIX PURE resins.



City stopped GAC at 10,400 gal treated

The IX resin substantially outperformed the GAC on all 12 PFAS that were present at detectable levels. These results clearly demonstrate the appreciably higher treatment capacity and faster kinetics associated with ECT2's PURE line of IX resin, compared to GAC for drinking water applications.



IX Resin is ND after 171,000 BVs or 34,300 gal treated

Results & Conclusions

- ECT2's regenerable or single-use IX resin outperforms GAC for PFAS removal.
  - Higher capacity (6x to 20x)
  - Shorter EBCT equating to a smaller system footprint
- SORBIX is more sustainable then GAC
  - Higher capacity and smaller adsorbent volume results in less waste
  - Regenerable SORBIX media can be regenerated in-situ with near full restoration of capacity
  - Spent regenerant can be recovered for reuse, waste minimization

Both pilot tests resulted in a 200 gpm regenerable resin groundwater remediation unit at the first site and a full-scale, 1200 gpm, drinking water plant (under construction) to treat PFAS-impacted groundwater from the Haven, Harrison, and Smith wells.