RSSCT and Field Pilot-scale adsorption columns for PFAS removal: A comparative Study

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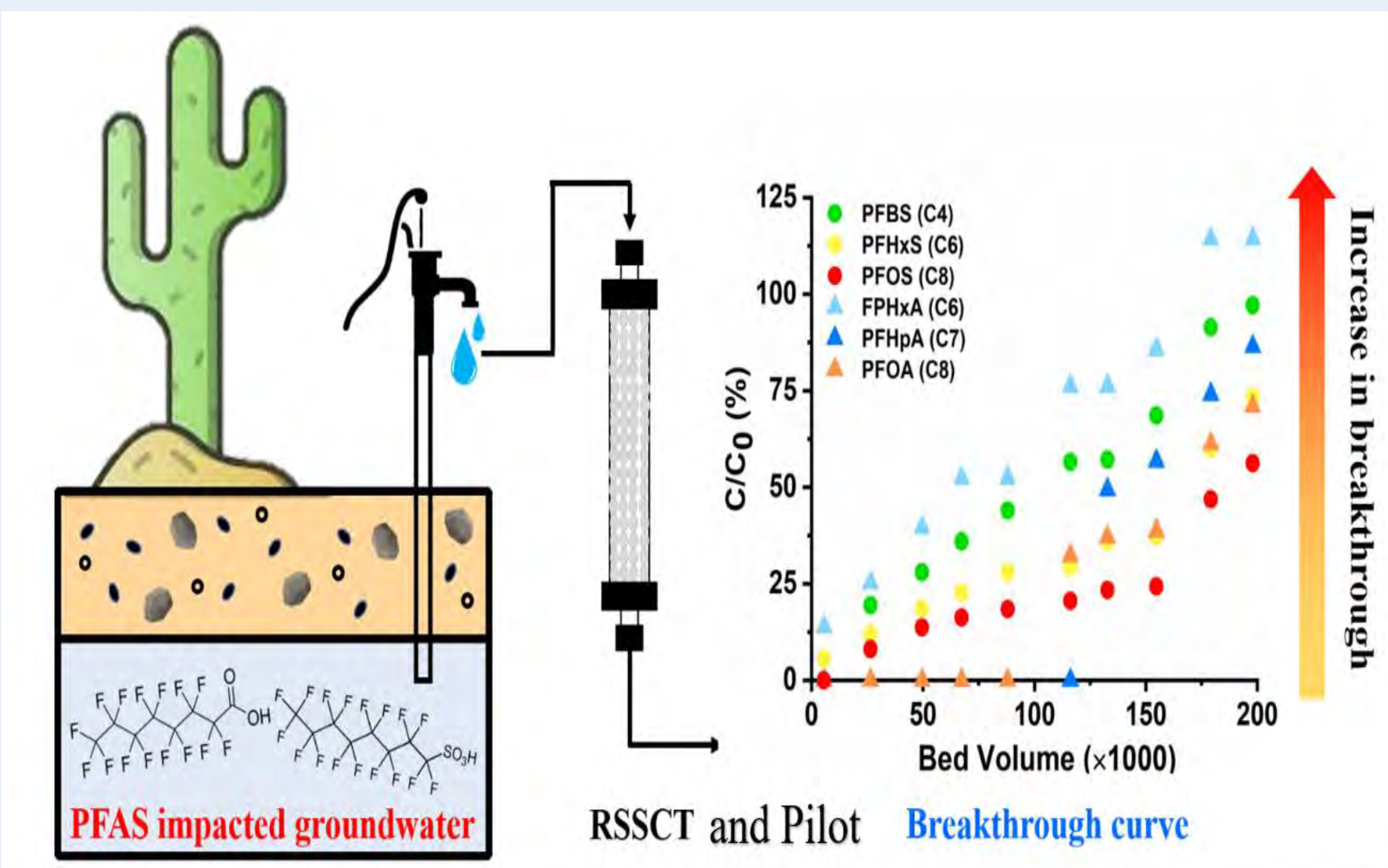
Background

Physical removal via adsorption is a preferred solution for many drinking water utilities using groundwater containing parts-per-trillion (ppt) levels of PFAS. However, it is a challenge to select the right adsorbent that treats a range of higher- to lower- chain length PFAS.

Overview of our project



Methods

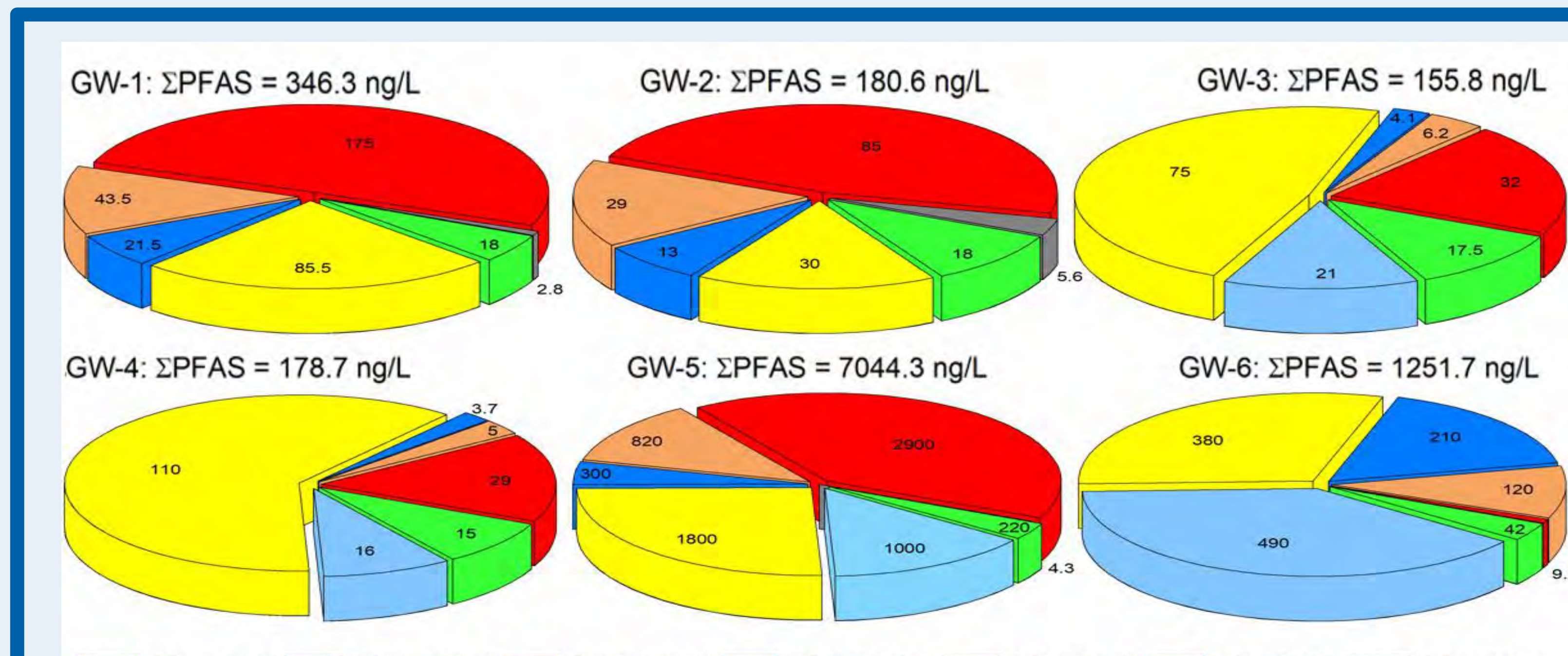
Rapid Small Scale Column Tests (RSSCTs)

1. 18 different RSSCTs were performed on six Arizona groundwaters to evaluate capacity of GAC and IX Resins in removing PFAS
2. To evaluate the effects of carbon chain length and functional groups on PFAS breakthrough behavior.
3. Validate constant diffusivity (CD) versus proportional diffusicity (PD) RSSCT approach to field scale results.

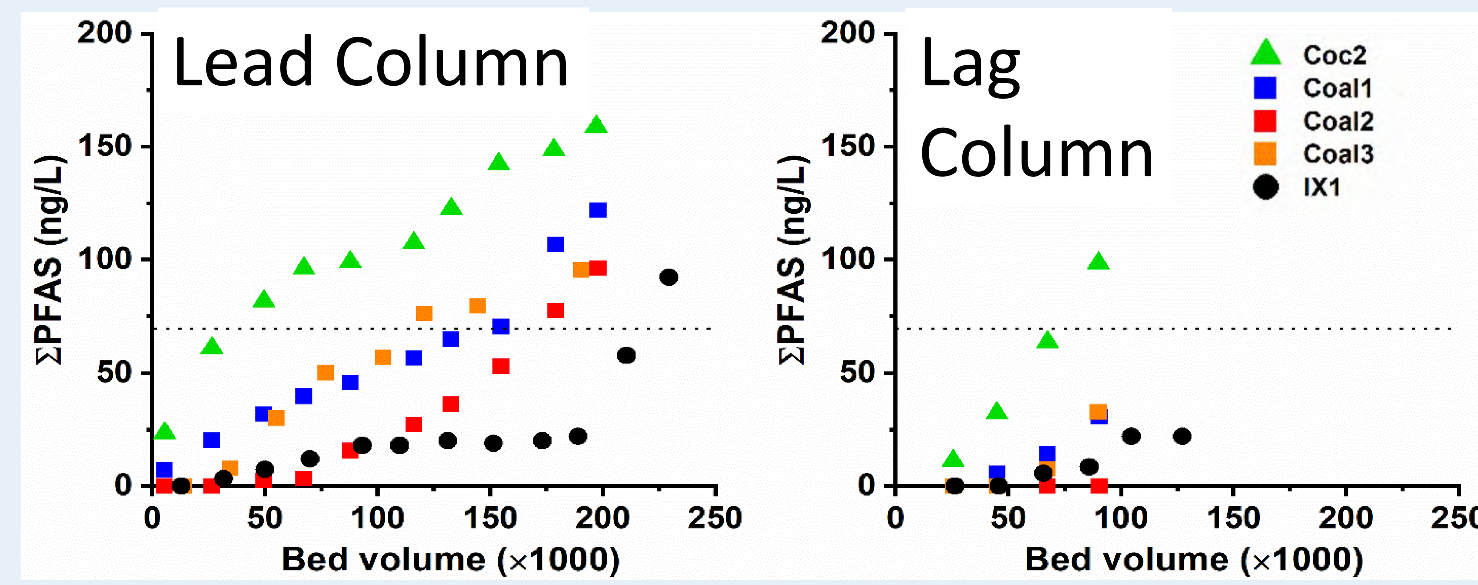
Field Pilot Scale

1. Two GACs and an IX Resin Packed Bed Columns
2. Two RO units: silver NP coated comparing silver sulfidation to control silver ion release.

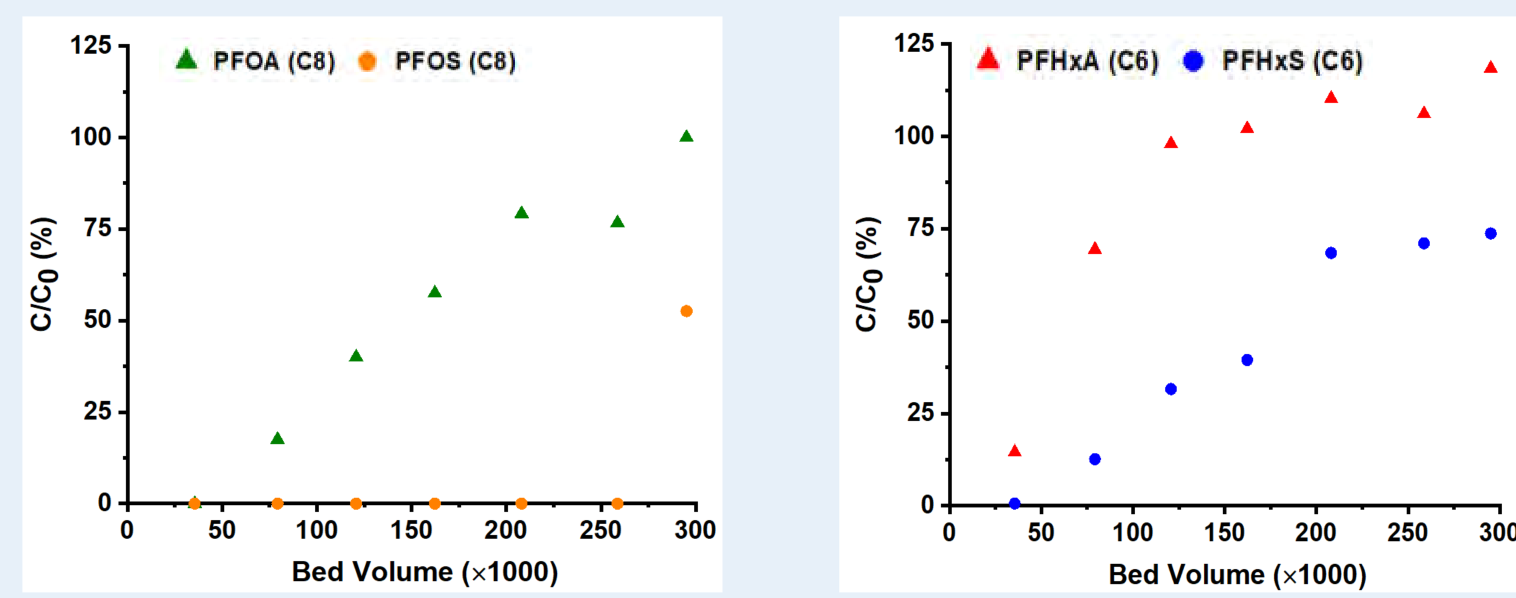
RSSCT Results



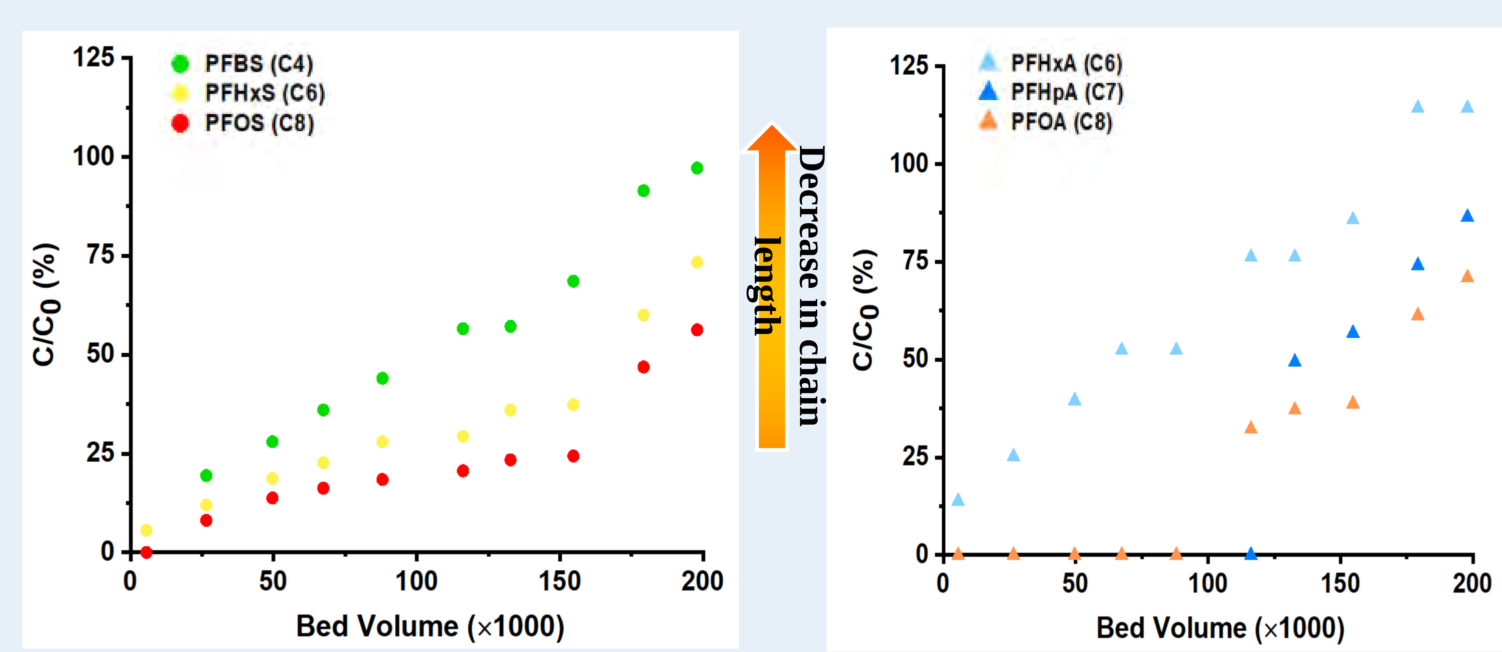
Capacity of different packing materials on ΣPFAS removal



PFAS Adsorption based on functional group



PFAS Adsorption based on chain length

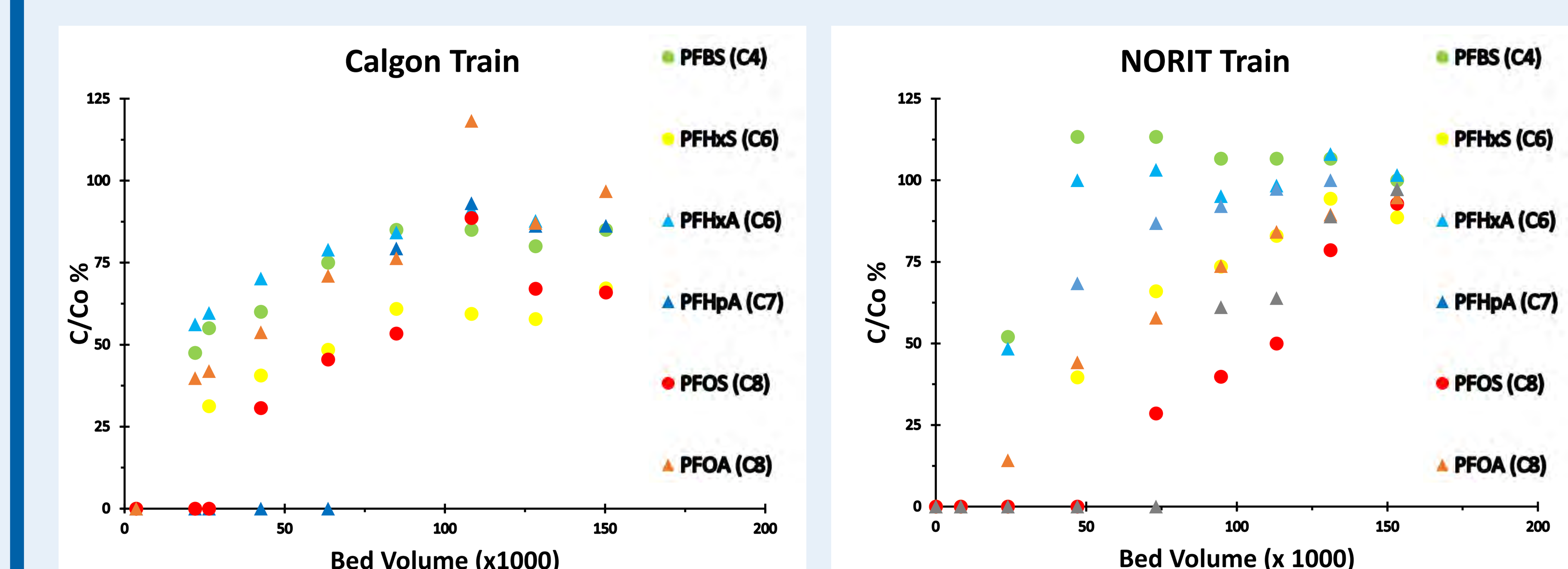


Field Pilot Testing

MobileNEWT deployed to Tempe's Wellsite

Treatment Modules Currently in operation

Preliminary RSSCT Results



This site has rapid breakthrough vs other GW sources

Conclusion and Next Steps

- Coal based GAC had higher capacity for PFAS removal;
- IX resin had higher efficiency for the adsorption of PFAS than GAC.
- More hydrophobic PFAS adsorb more readily
- The order of PFAS breakthrough s controlled by carbon chain length and functional group.
- Short-chain PFAS are adsorbed less efficiently by IX sorbents, which should encourage research on technologies targeting their removal.
- CD-RSSCT give “more conservative” estimates of PFAS breakthrough compared with PD-RSSCTs
- Pilot versus CD- and PD-RSSCTs are underway
- Currently evaluating low-pressure point of use RO units, CDI and destructive PFAS technologies in MobileNEWT – which is part of our NSF Nanotechnology Enabled Water Treatment Center

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