REMOVAL OF PERFLUORINATED COMPOUNDS FROM POST-EMERGENCY WASTEWATER BY ADVANCED OXIDATION PROCESS AND GRANULAR ACTIVATED CARBON ADSORPTION

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Background/Making the Case

The AFIT of Today is the Air Force of Tomorrow.

- At the end of 2014, there were 290 documented military fire training areas, which included a total of 664 point-release sites (DoD, 2015; Hu et al, 2016).
- PFAS have very low volatility and are stable and mobile in soil, and have half-life degradations in the environment up to 92 years (EPA, 2012).

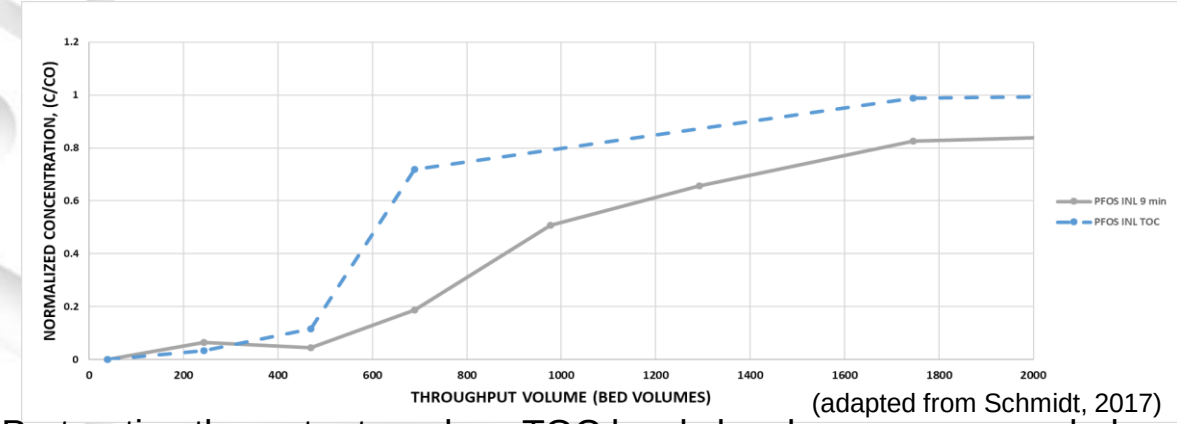
Aqueous Film-Forming Foam, or AFFF, fills Hangar 211 at Mountain Home Air Force Base, Idaho, Dec. 21, 2012. Photo: U.S. Air Force

Firefighters from the 7th Civil Engineer Squadron and the Abilene Fire Department participate in live fire training exercise April 2, 2014, at Dyess Air Force Base, Texas. (U.S. Air Force photo by Senior Airman Kia Atkins/Released)

Downtown Rockford pictured over the Rogue River on Thursday, Aug. 10, 2017. (Garret Ellison | MLive.com)

Previous Research

- Source water starts with a TOC of ~3 mg/L and increases to ~100 mg/L (Schmidt, 2017).
- TOC may have a higher affinity for adsorption in the GAC, leaving fewer sites for PFAS to adsorb to (Schmidt, 2017).



(adapted from Schmidt, 2017)

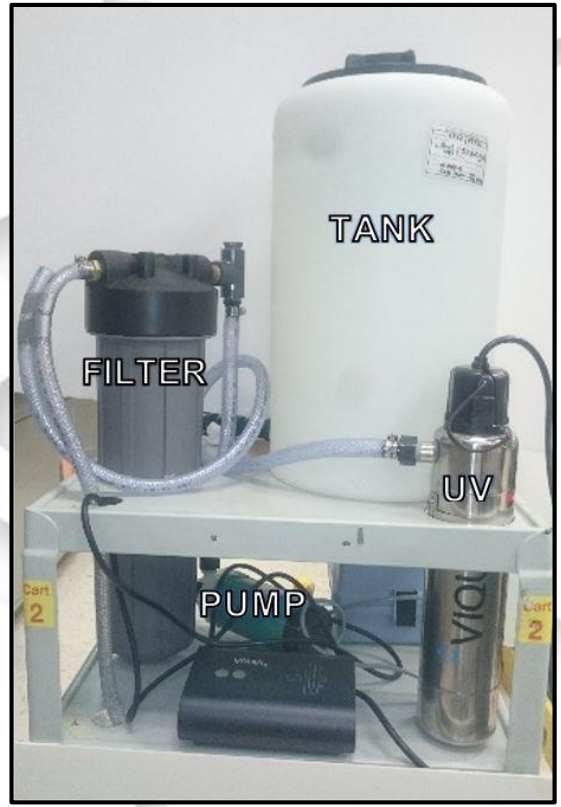
- Pretreating the water to reduce TOC levels has been recommended as an area of further research (Schmidt, 2017).

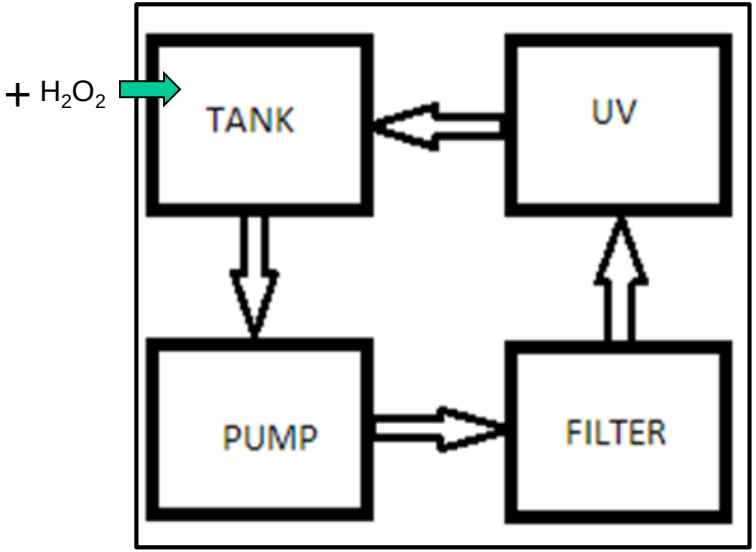
Research Objectives

The AFIT of Today is the Air Force of Tomorrow.

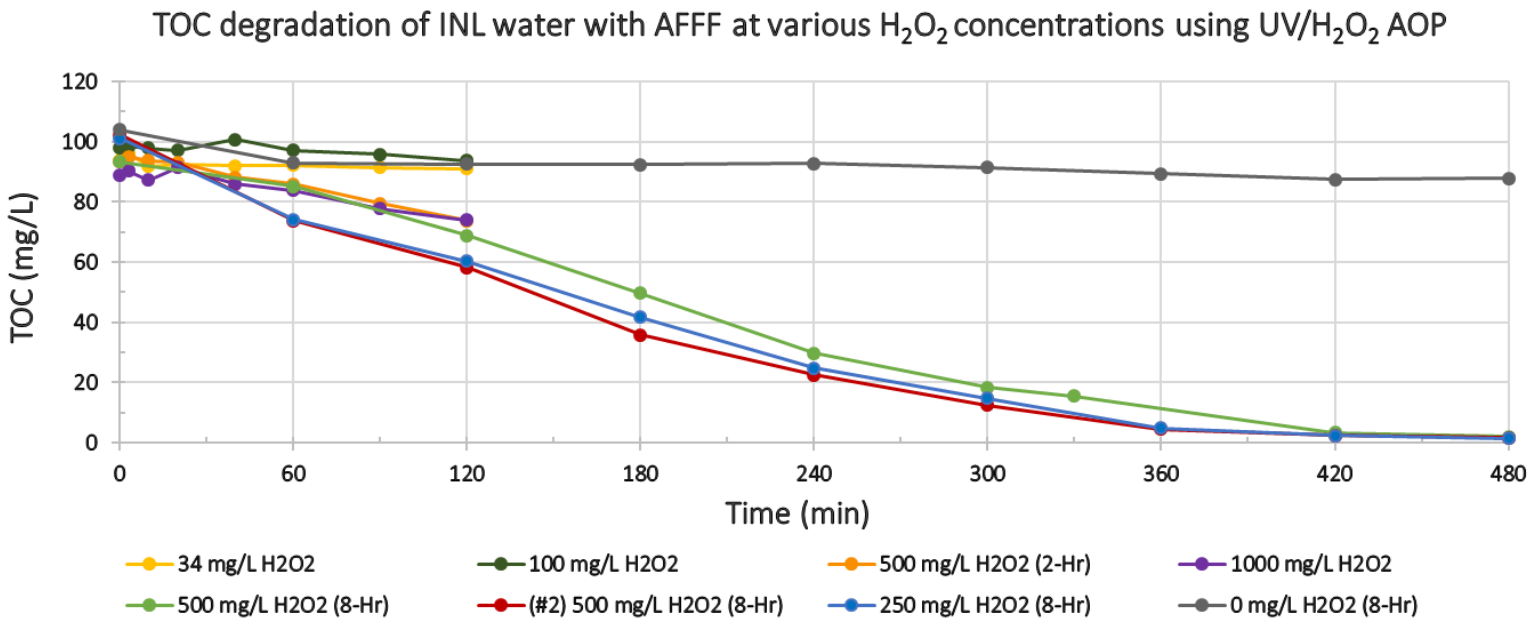
- The **first research objective** was to determine whether UV/H_2O_2 AOP reduces TOC in contaminated AFFF-groundwater.
- The **second research objective** was to determine whether pretreatment with AOP affects PFAS GAC adsorption capacity

Advanced Oxidation Process

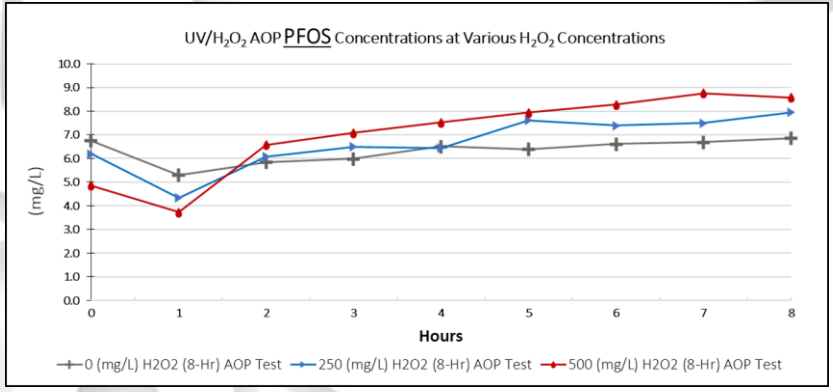


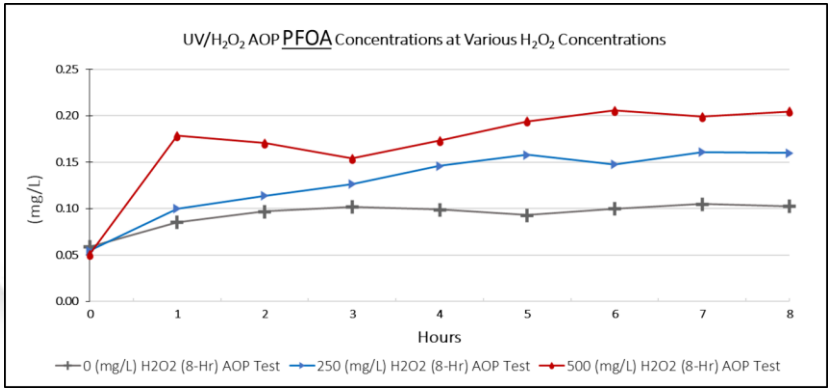


AOP Data – TOC



AOP Data – PFOS & PFOA





AOP Data – PFPeA & PFHxA

Background/ Making the Case

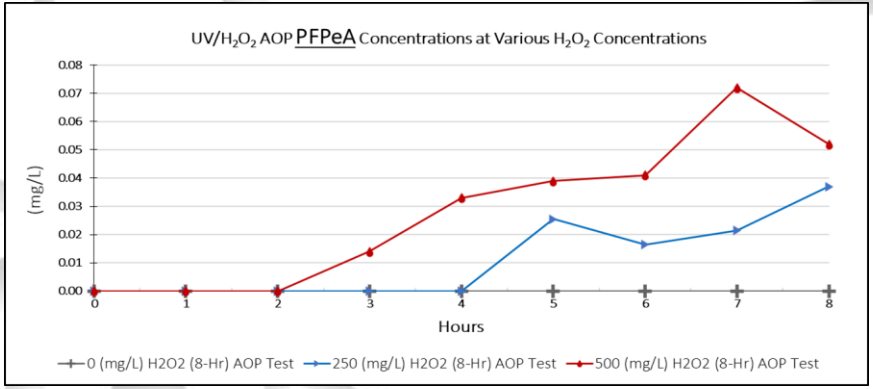
Previous Research

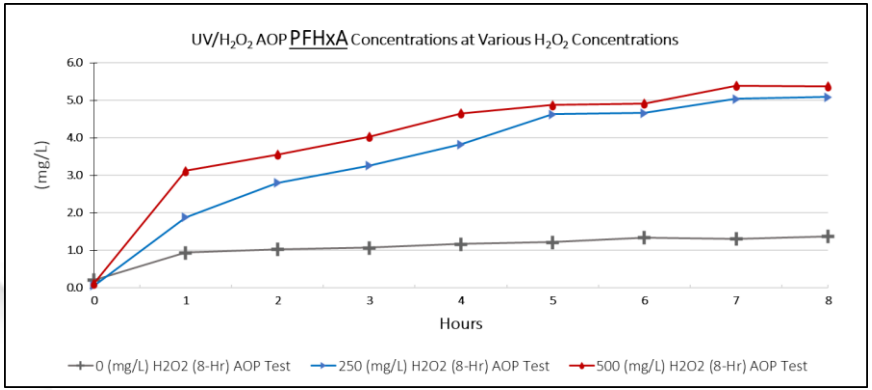
Research Objectives

Current Data
- **AOP**
  - TOC
  - **PFAS**
- RSSCT
  - PFOS
  - PFOA
  - PFAS

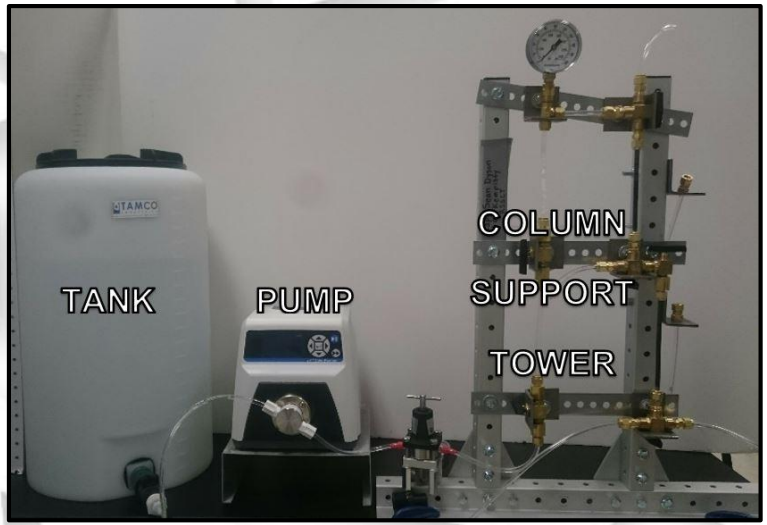
Future Research Needs

Questions

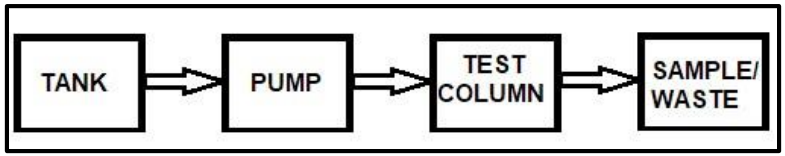




Rapid Small Scale Column Test



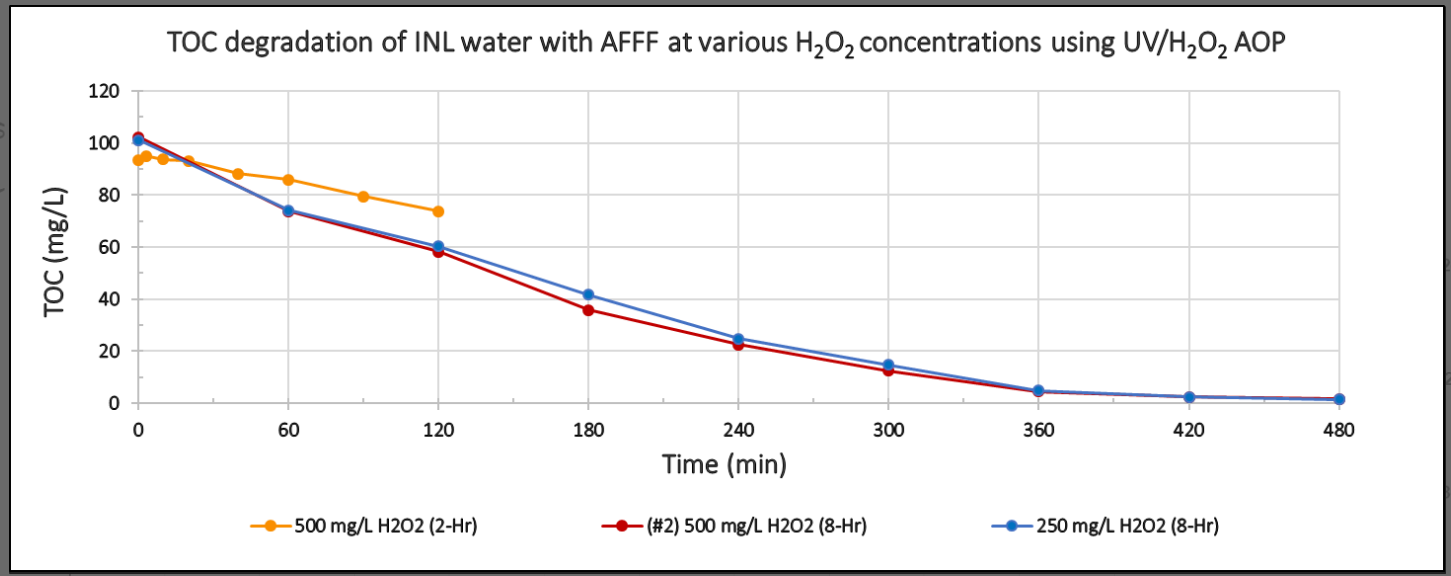
Rapid Small Scale Column Test (RSSCT)



RSSCT Process Flow Diagram

Current Data - RSSCT PFOS

RSSCT results for 9 minute EBCT with and without pre-AOP treatment



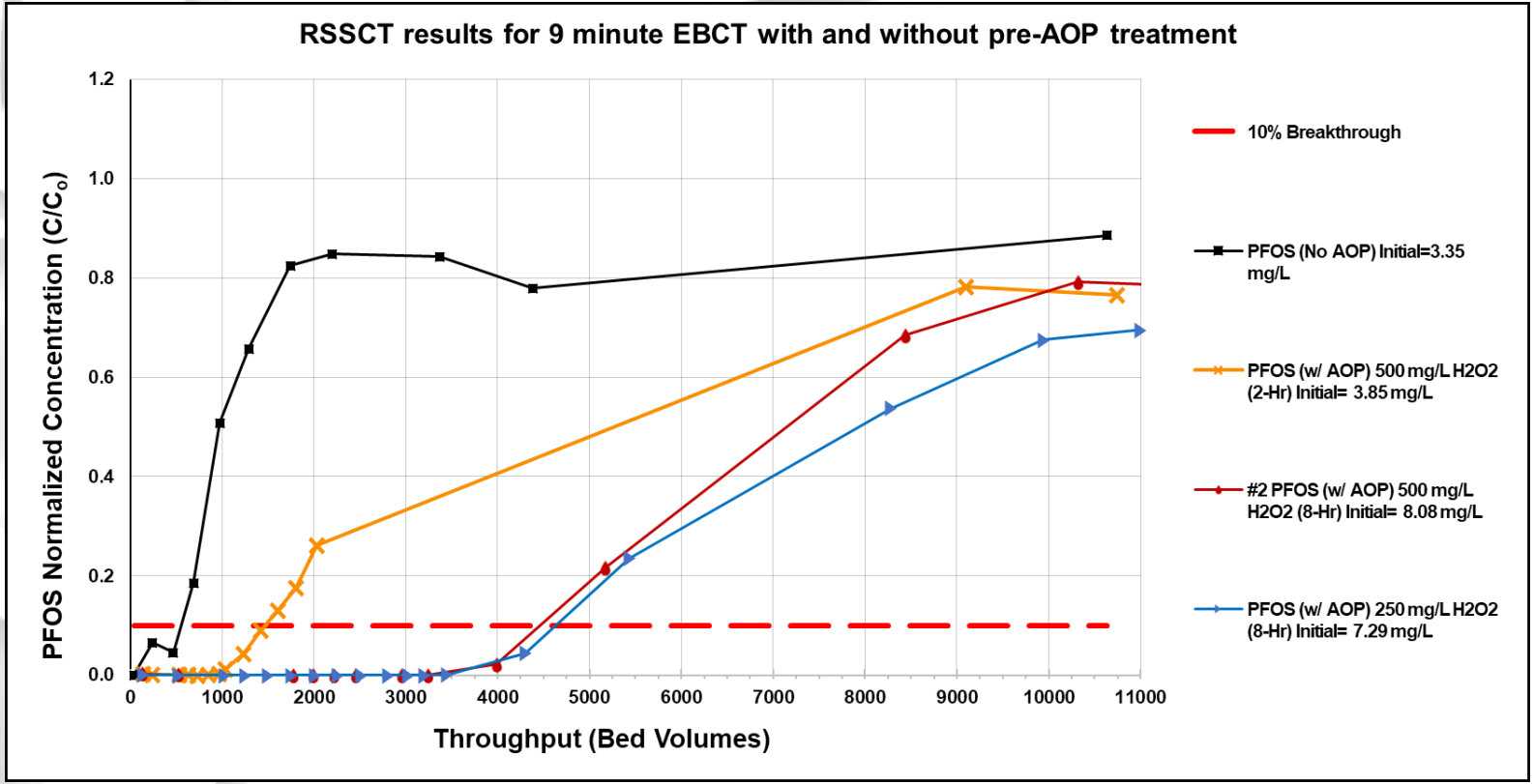
PFOS Normalized Concentration (C/C_o)

0.0

0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 11000

Throughput (Bed Volumes)

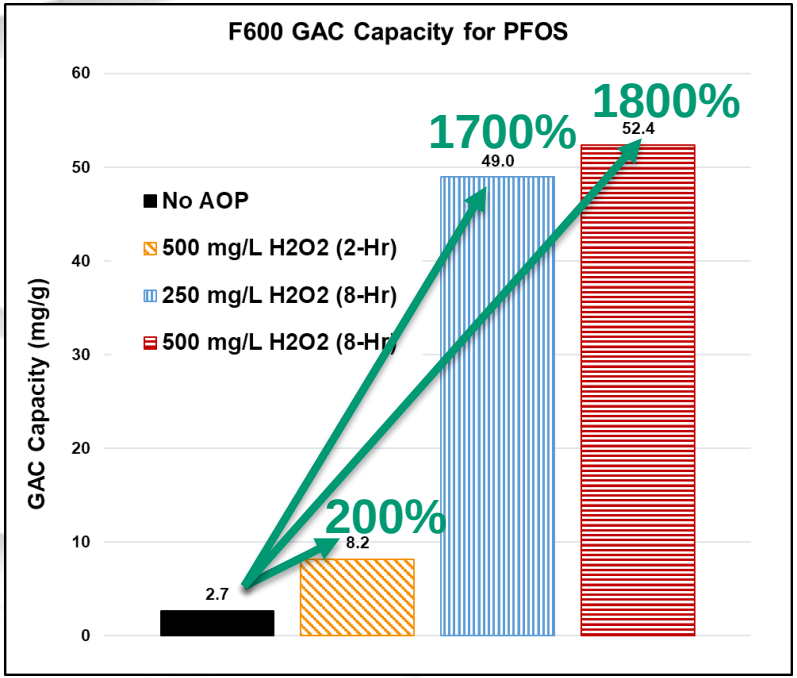
RSSCT PFOS



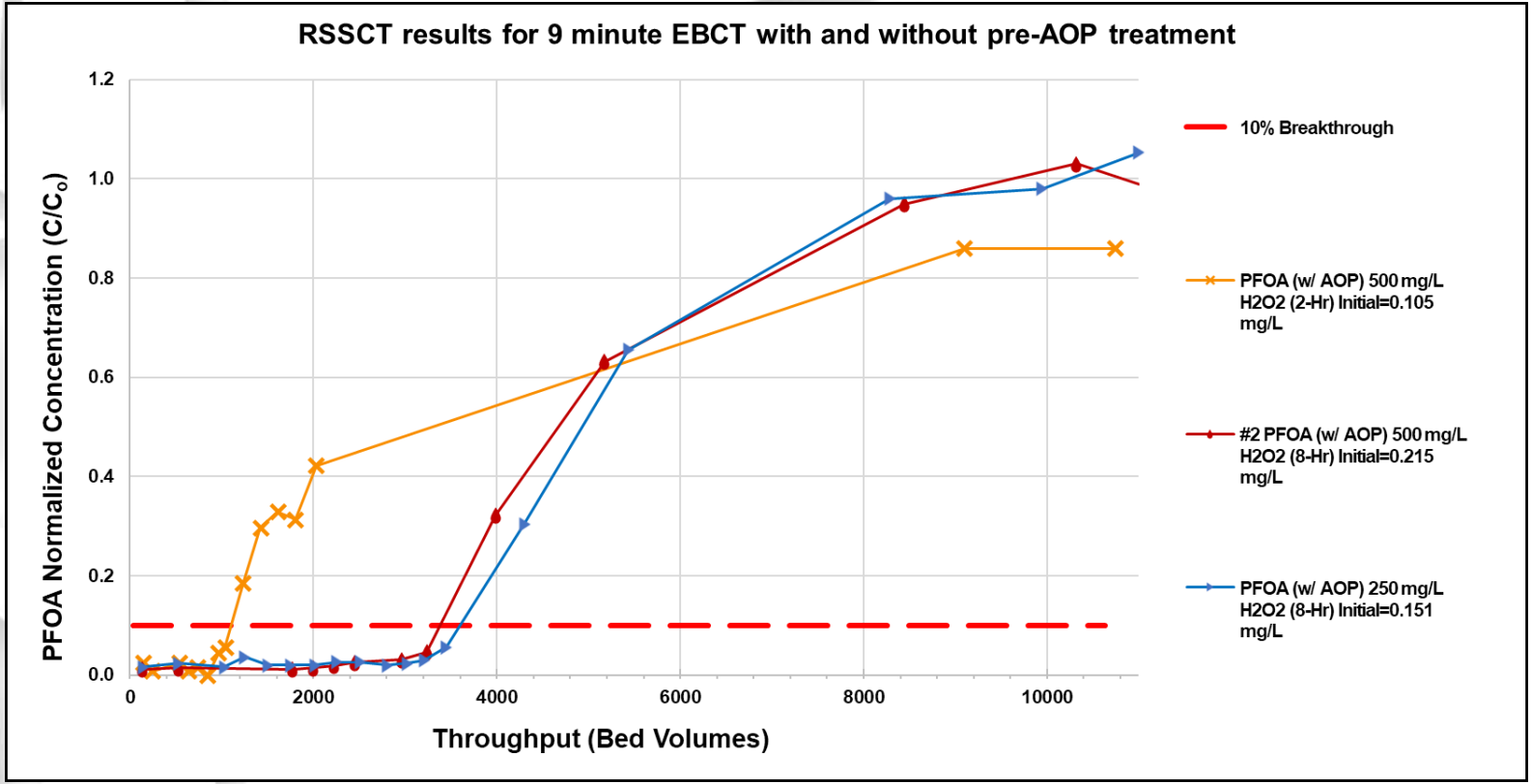
PFOS GAC Capacity

The AFIT of Today is the Air Force of Tomorrow.

- Background/ Making the Case
- Previous Research
- Research Objectives
- Current Data
  - AOP
    - TOC
    - PFAS
  - **RSSCT**
    - **PFOS**
    - PFOA
    - PFAS
- Future Research Needs
- Questions



RSSCT PFOA



PFOA GAC Capacity

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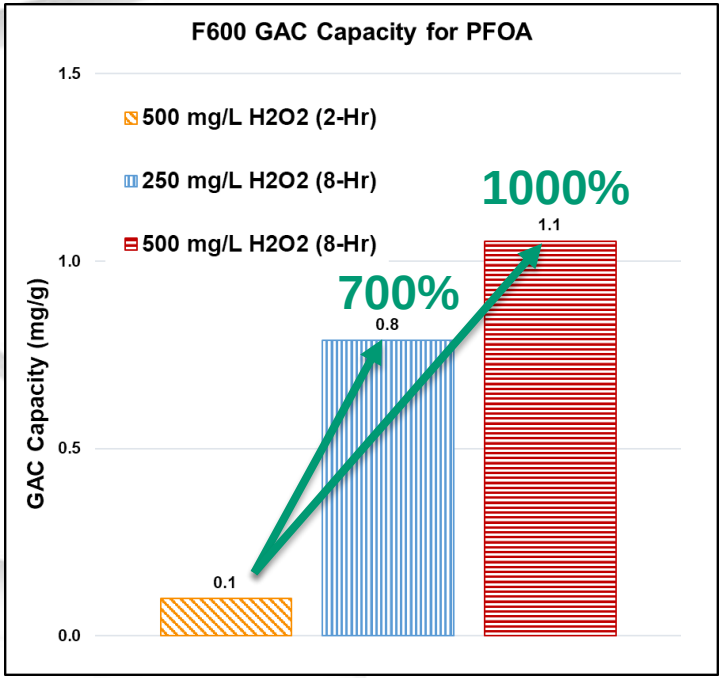

RSSCT PFAS

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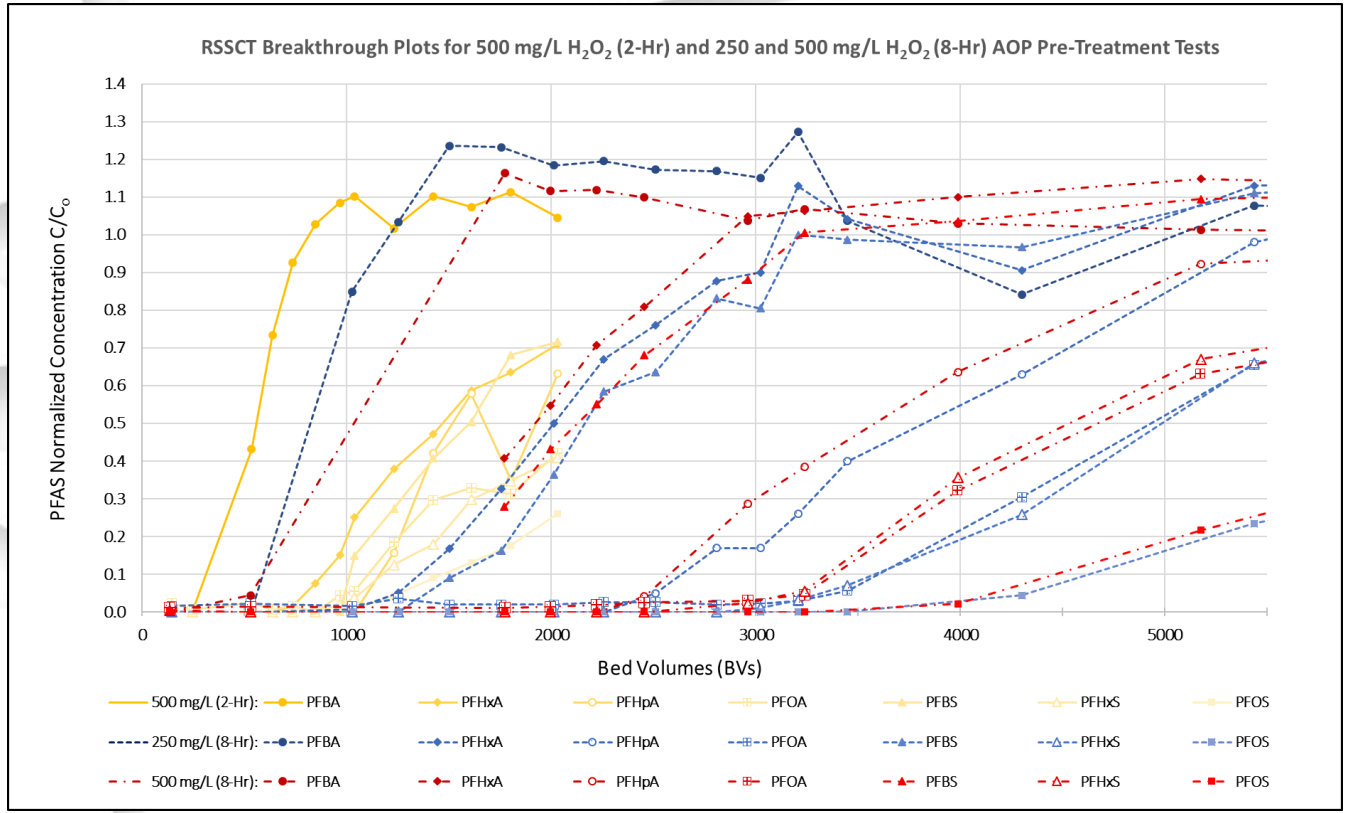

Future Research Needs

- To determine the optimal H_2O_2 concentration and UV contact time during the AOP process, and to further understand the impact to the formation of other PFAS
- To determine the characteristics of the TOC in the INL groundwater, and the characteristics of the TOC once AFFF is in solution
- To conduct a life-cycle cost analysis on implementing the proposed treatment-train

Questions

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