Installation, Startup, and Operation of World's First Regenerable Resin System for PFAS Removal

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Introduction

- Site background
- Project development
- Full-scale implementation
- Start-up and operation
- Performance to date
- Future plans

FORMER PEASE AIR FORCE BASE
SITE 8 – INTERIM MITIGATION SYSTEM IMPLEMENTATION
GROUNDWATER EXTRACTION AND TREATMENT FACILITY

OWNER: Air Force Civil Engineer Center

AUTHORITIES/STAKEHOLDERS:
Pease Development Authority
United States Environmental Protection Agency
New Hampshire Department of Environmental Services

ARCHITECT/ENGINEER/PRIME CONTRACTOR:
Amec Foster Wheeler Environment & Infrastructure, Inc.

SUBCONTRACTORS:
Maher Services | Ground Water Treatment & Technology | MassBay Electric | ect_2

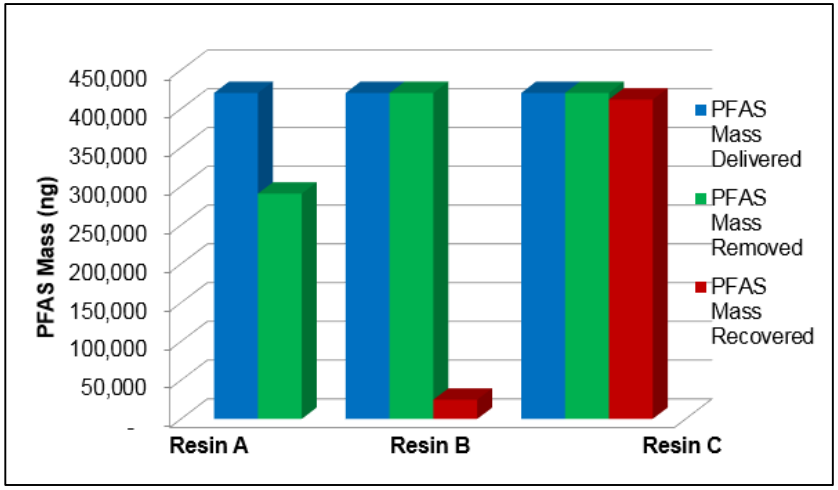
Site background

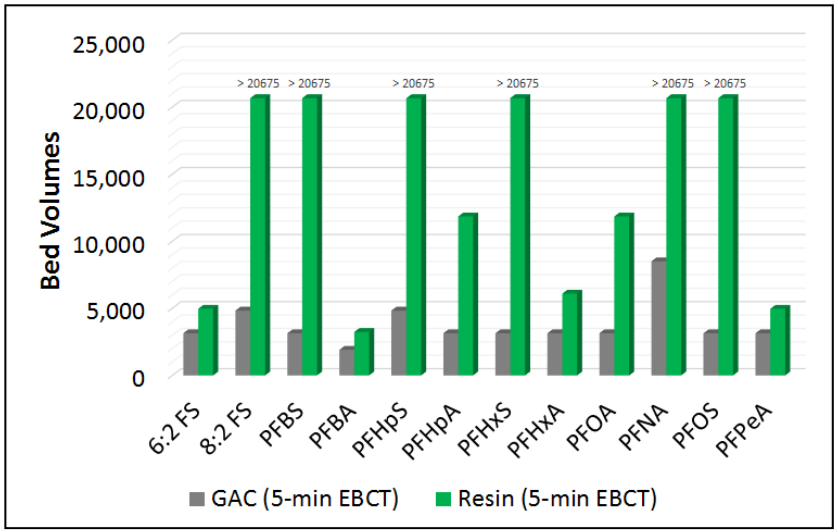
Former Pease AFB

- PFOS and PFOA first identified in 2013
- Drinking water impacts confirmed in 2014
- Base-wide investigations started
- Interim actions initiated

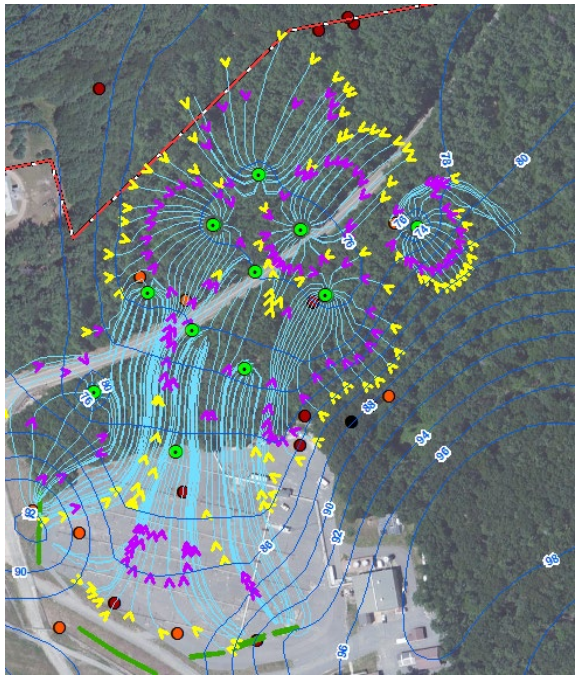
Project development – 2015 bench/pilot testing

- Bench-scale testing identified an IX resin for PFAS removal that could be regenerated
- Wood contracted by the Air Force to perform pilot-scale testing of ECT's regenerable IX resin and coal-based GAC
- After 6-months of testing and five loading cycles
  - IX resin substantially more effective at PFAS removal
  - IX successfully regenerated

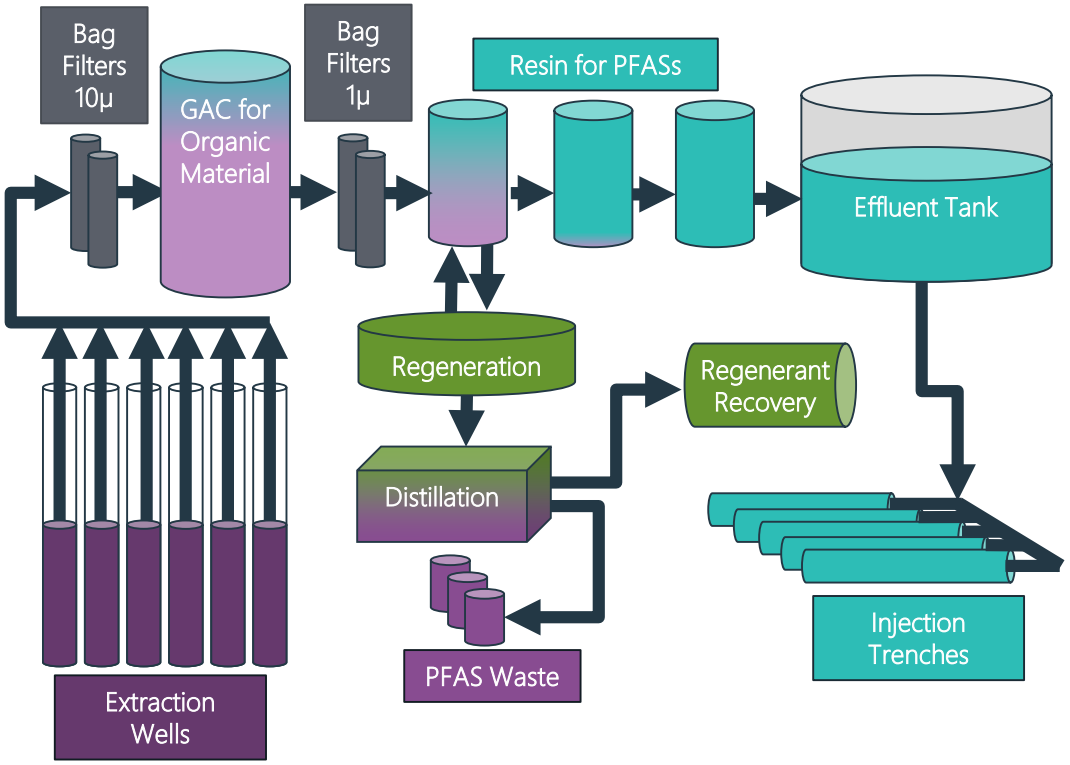




Full-scale implementation - design



- Extraction design: 110 gpm
- Treatment capacity: 200 gpm



Full-scale implementation - construction

Full-scale implementation – construction complete

Commissioning – April 2018

Full-scale implementation – treatment process

Pretreatment bag filters & GAC

IX resin vessel skid

IX resin polish vessels

Full-scale implementation – regeneration process

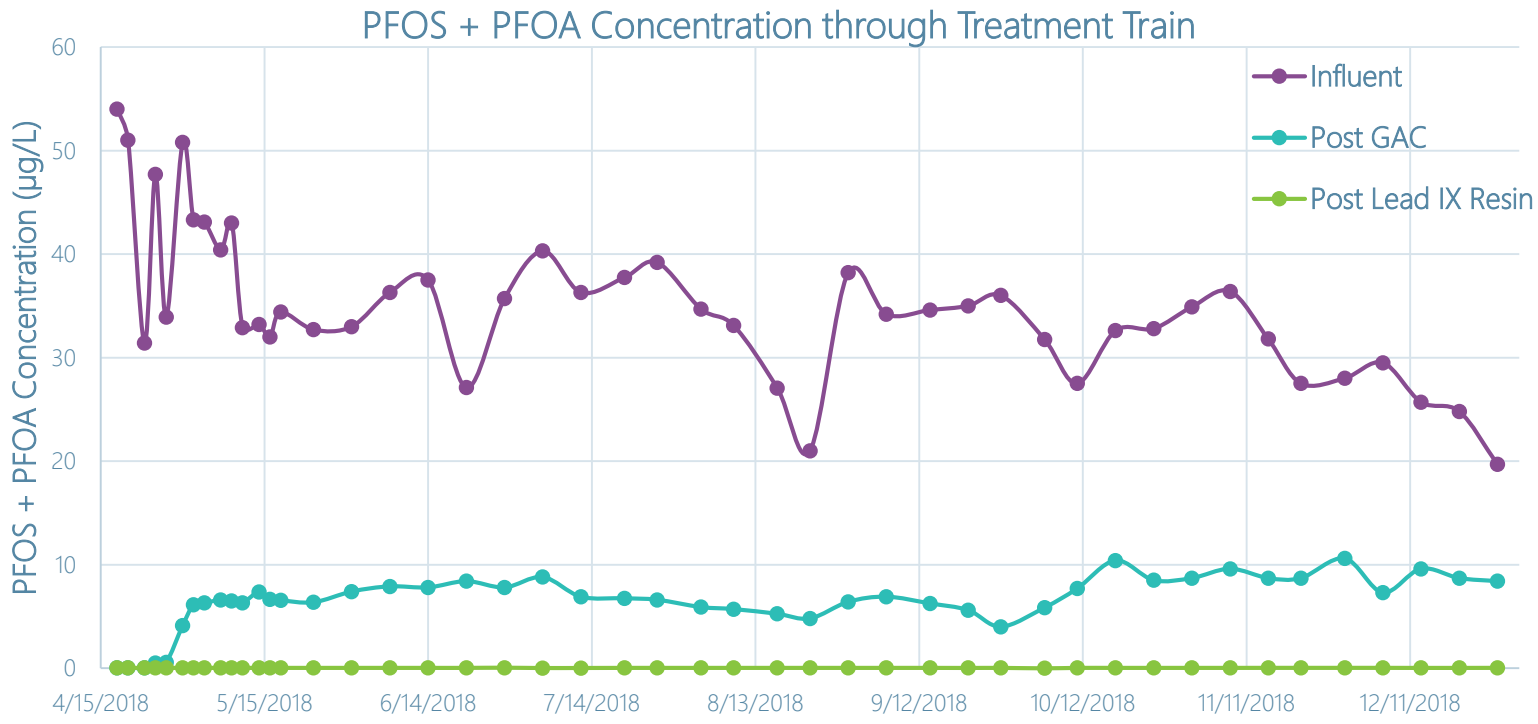
Regeneration skid

Distiller

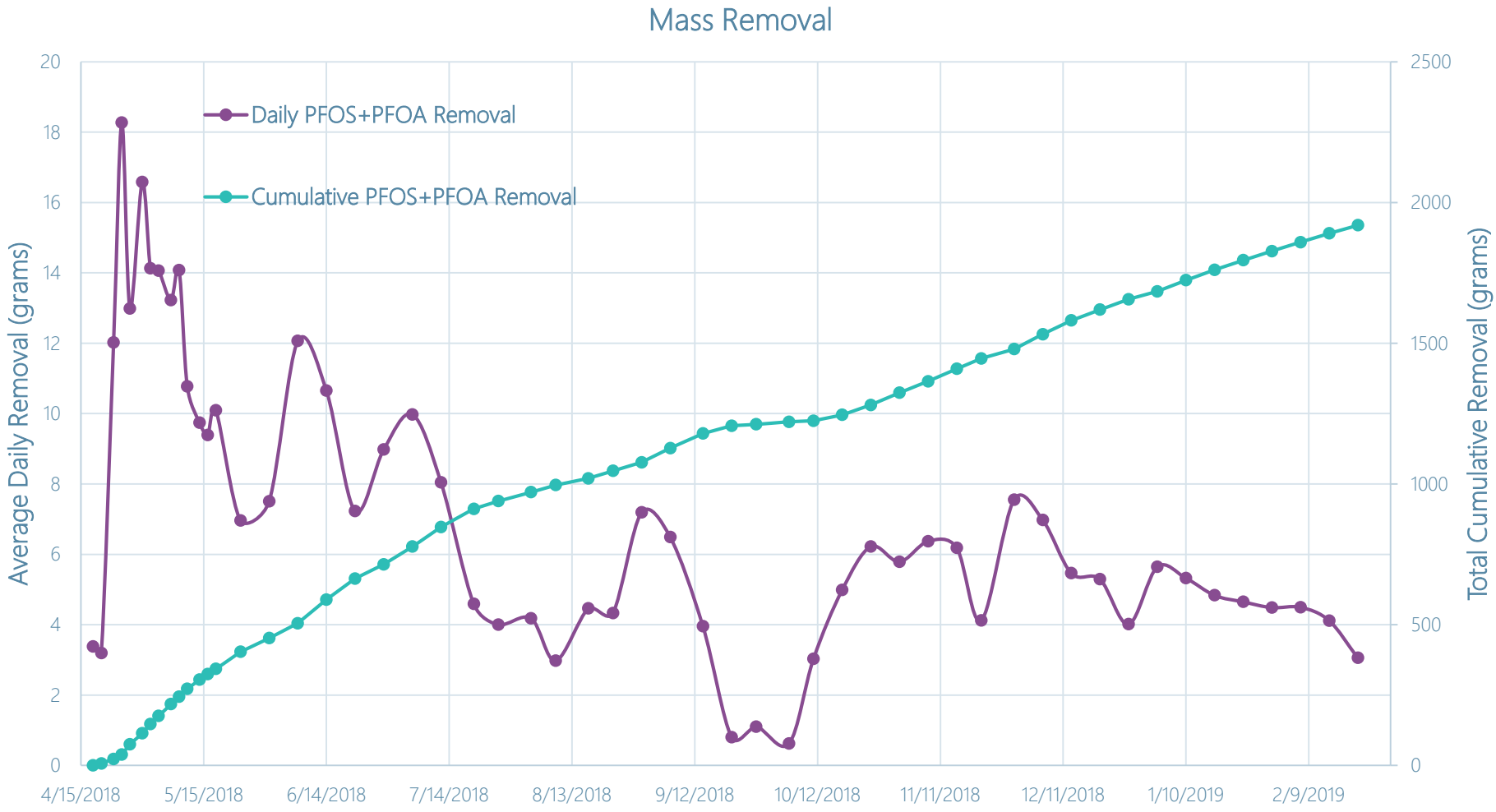
Still bottoms and superloader

Start-up and operations

- IX resin performance
  - 44,000 bed volumes treated
  - 27,300 on the current loading cycle
  - Operating lead resin EBCT ~8 min

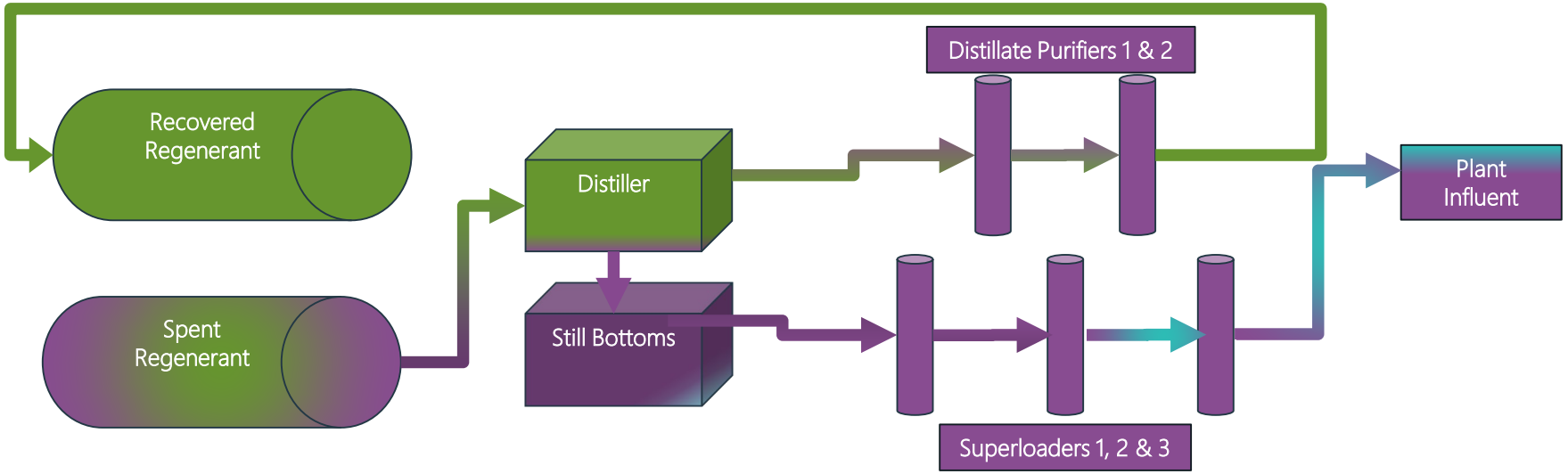


Start-up and operations



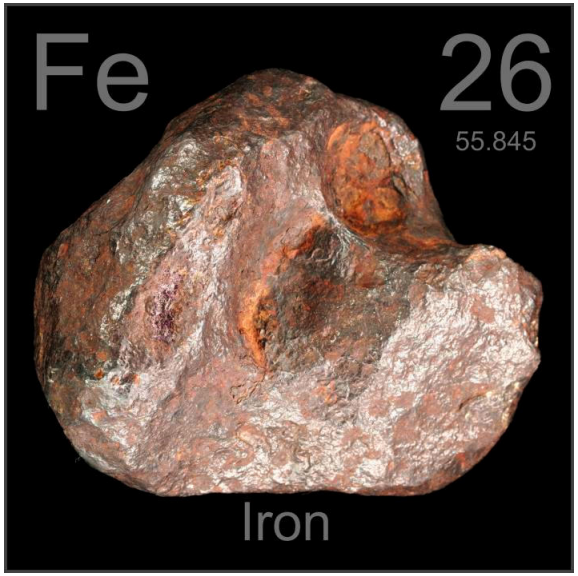
Start-up and operations - regeneration

Sample Location	PFOS (µg/L)	PFOA (µg/L)
P-7200 Effluent - Regenerant Recovery Pump (Distiller Influent)	25	16
Superloader 1 inlet (Still Bottoms)	540	220
Post Superloader 1	0.19	0.010 U
Post Superloader 2	0.12	0.010 U
Post Superloader 3	0.086	0.010 U
T-7420 Influent -Distallate Purifier	0.50	2.9
T-7420 Effluent - Distillate Purifier #1	0.015 U	1.1
T 7430 Effluent - Distillate Purifier #2	0.015 U	0.010 U



Challenges and lessons learned

- Iron fouling at the front end of the plant
- Iron <0.5 mg/L during initial pumping tests of three wells
- Iron >8 mg/L with ten wells operational
- Required shutdown of seven wells



Challenges and lessons learned

- GAC can be a workhorse - rarely is GAC run to full exhaustion during pilot tests or during full-scale operation
- Fire protection requirements can drive project costs and logistics when it comes to regeneration technology
- SOPs to support regeneration have evolved as the project has progressed
- Uncertainties remain with PFAS chemistry and transformation (6:2 FTS in effluent)
- Waste disposal options are becoming increasingly limited whether soil, sludge, or spent media

Conclusions

- The GAC – IX resin combination is very effective at treating waters impacted by PFAS
- The ability to regenerate on-site provides substantial protection against fluctuations in concentrations
- The IX resin regeneration, regenerant recovery, and superloading process is capable of substantially reducing the PFAS waste stream
- The technology provides resiliency against the shifting disposal marketplace
- Technology advances in on-site destruction will further improve waste minimization
  - ESTCP plasma destruction – Wood, ECT, Clarkson University
  - Electrochemical Oxidation – ECT, University of Georgia

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