



Destructive Technologies Overview for Complete PFAS Treatment



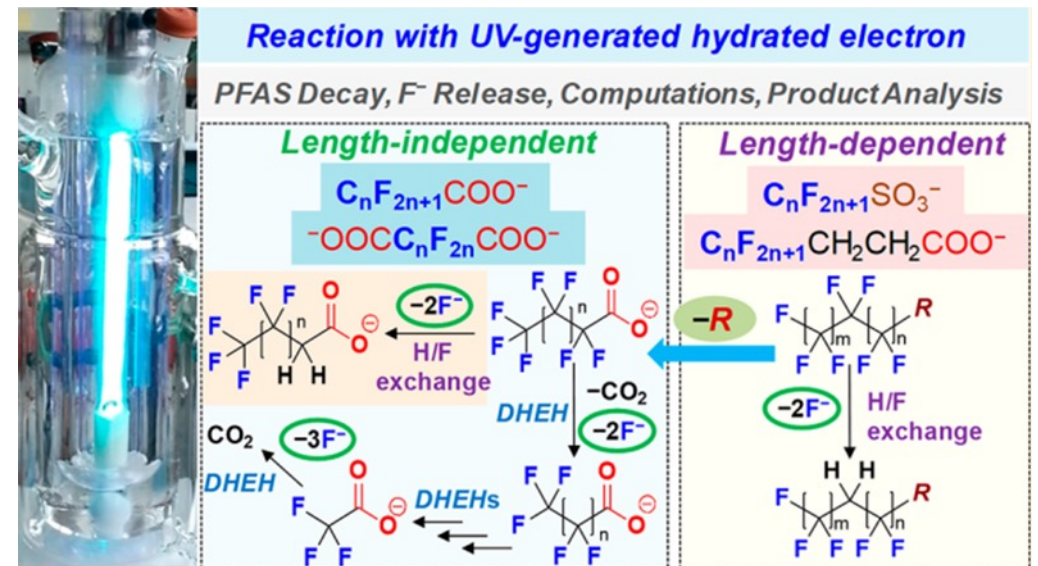
NEW ENGLAND WATER ENVIRONMENT ASSOCIATION

NEWEA

WORKING FOR WATER QUALITY

10-Minute Overview

- What are the onsite PFAS destruction technologies?
- What's the key to making them practical?
- Which technologies are most advanced?
- How do they work?
- Real-life examples



Onsite PFAS Destruction Technologies

- Plasma
- Electrochemical oxidation
- Supercritical water oxidation
- Hydrothermal alkaline treatment
- Micelle-assisted photocatalytic reduction
- Electron beam
- Advanced oxidation processes
- Sonolysis
- UV-sulfite
- Zero-valent iron
- Alkali metal reduction
- Biodegradation

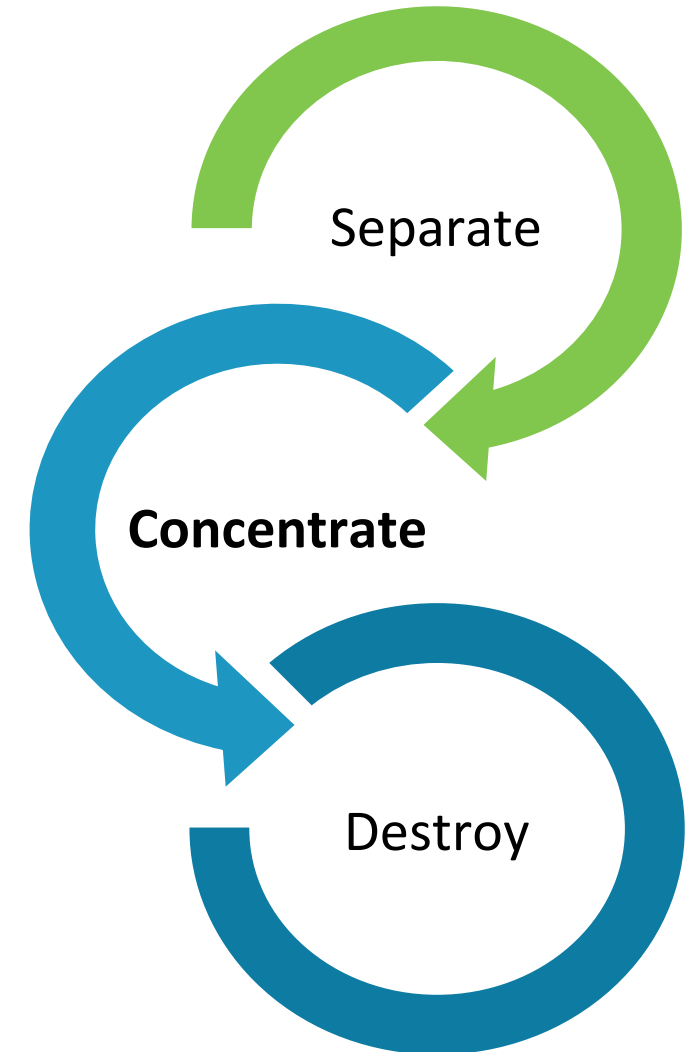
Lots of progress in last 5 years, as incineration is falling out of favor



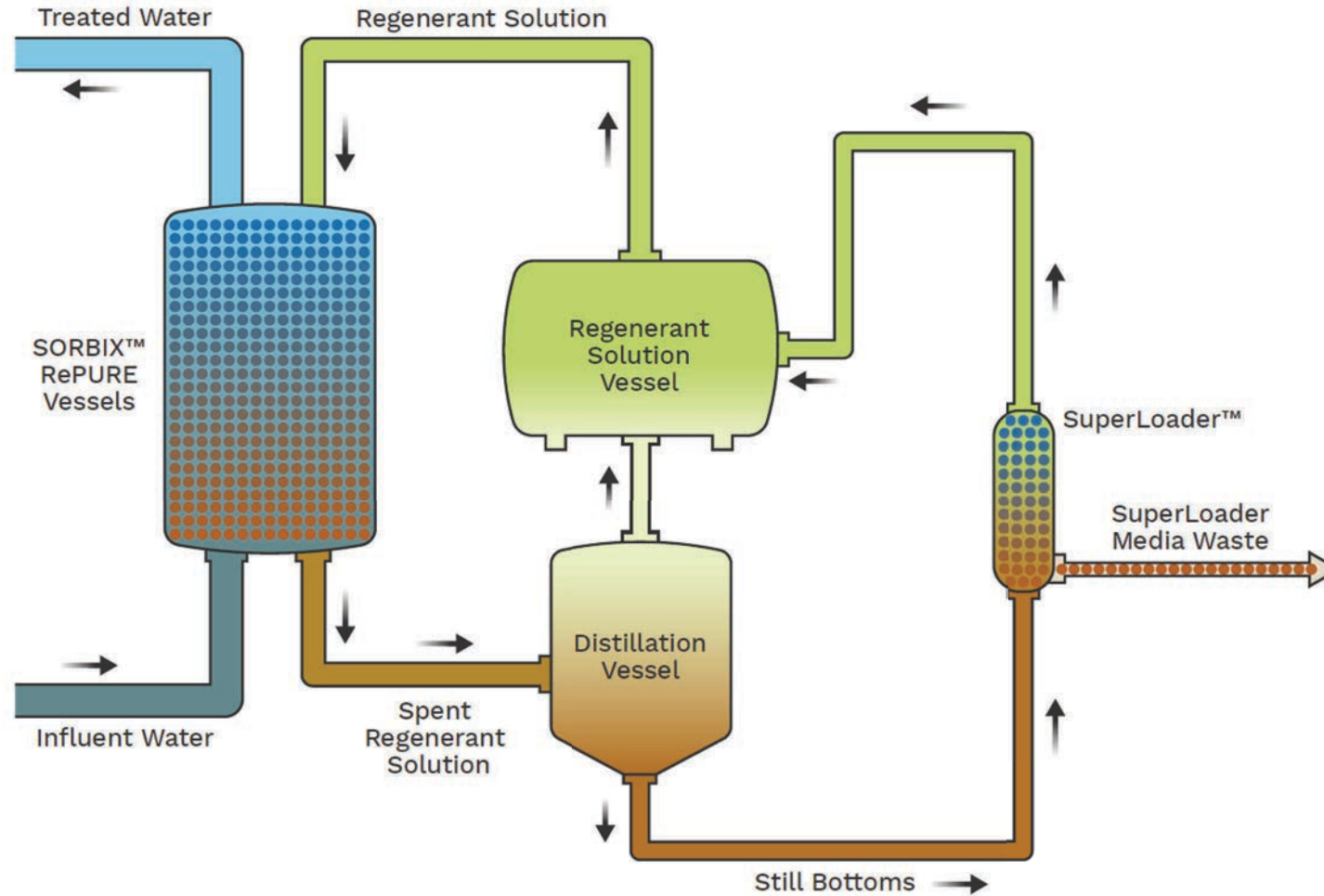
What's the Key to Making them Practical?

- Reduce liquid volume to be treated
- Increase concentration of PFAS
- PFAS concentration options:
 - Membrane treatment-
 - Still too much volume
 - Foam fractionation-
 - Effective on PFOS and PFOA
 - Partially effective on short chains
 - Regenerable Ion Exchange (IX) Resin

Complete PFAS Treatment



SORBIX™ RePURE Regenerable IX PFAS Treatment



Benefits of the technology

- Patented waste reduction technology
- Ability to treat short-chain PFAS to non detect for complete PFAS removal
- Combines well with onsite PFAS destruction technologies



Plasma

- Ionized gas destroys PFAS by promoting powerful reduction and oxidation reactions
- Emerging as one of the most promising technologies for PFAS destruction
- Has demonstrated greater than 99% destruction of PFAS at multiple sites in combination with ECT2's regenerable IX resin technology
- **DMAX/Clarkson University**
 - Electrical discharge plasma
- **OnVector**
 - Plasma vortex
- **Inentec/MIT**
 - Plasma melter
- **Drexel, U. of Michigan**
 - Cold plasma

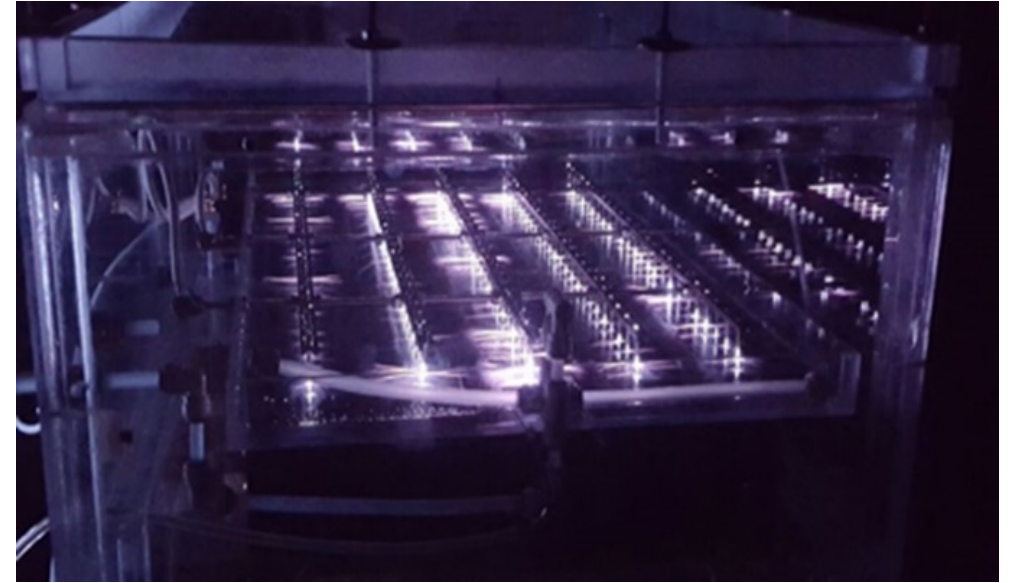


Photo credit: DMAX



Electrochemical Oxidation (EO)

- Direct and indirect anodic oxidation
- EO is emerging as one of the most successfully demonstrated technologies for PFAS destruction
- **AECOM/ U. Georgia**
 - DE-FLUORO™ Process
 - Successfully demonstrated in combination with ECT2's regenerable resin technology (onsite USAF pilot)
- **Fraunhofer USA**
 - Center for Coatings and Diamond Technologies manufactures Boron Doped Diamond (BDD) electrodes



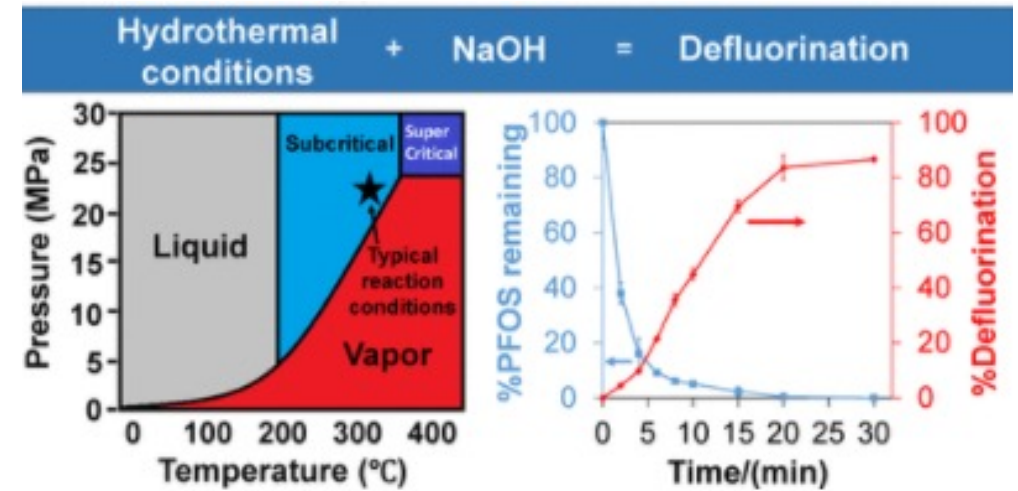
Photo credit: AECOM



Hydrothermal Alkaline Treatment (HALT)

- Sub-critical water oxidation process at high pH
- Nucleophilic substitution of carboxylate with OH⁻, leading to decarboxylation and defluorination
- Have demonstrated complete mineralization, including short chains
- Simpler than supercritical water oxidation; operated at lower temperature and pressure

Colorado School of Mines and Aquagga collaboration to bring the technology to market

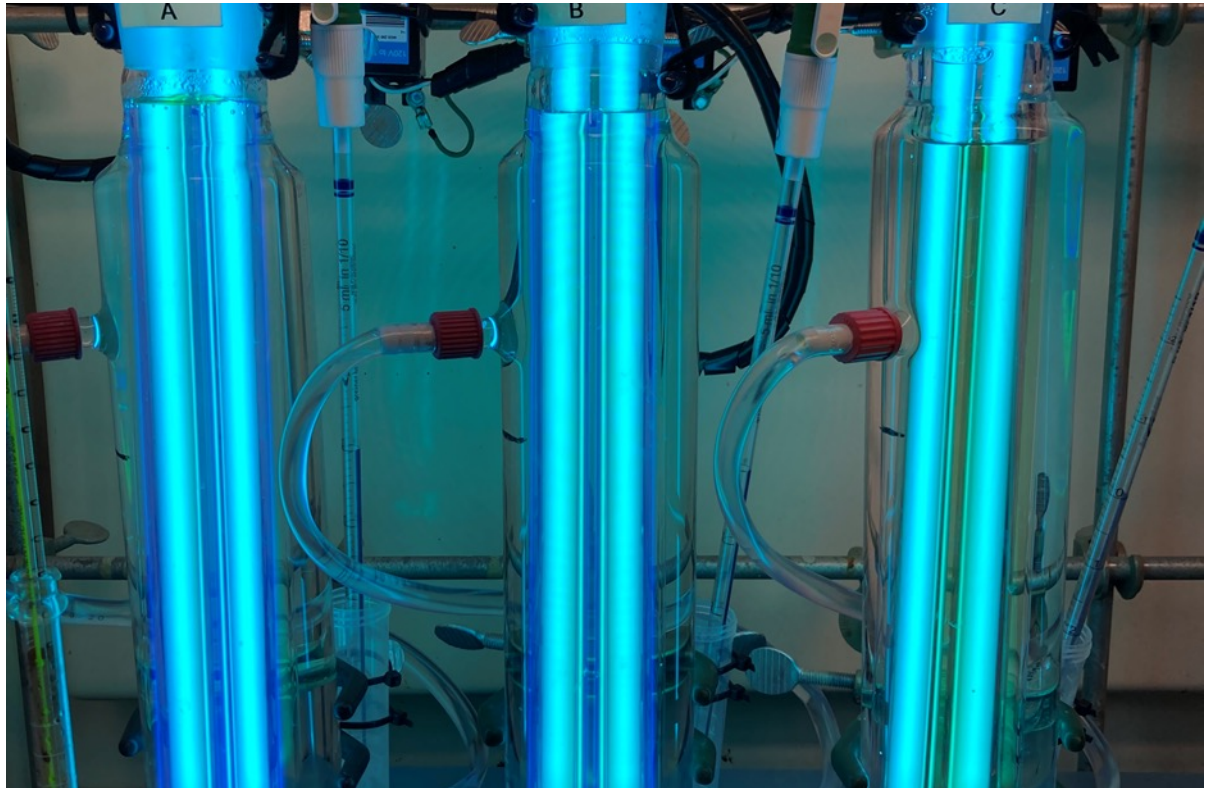


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Micelle-Assisted Photoactivated Reductive Defluorination

- New technology, showing promise
- Formation of the micelle reactive cage accelerates the reaction rate
- Reaction rate claimed to be approximately 40 times faster than competing technologies
- Low energy use
- **Enspired Solutions** is commercializing the technology





Thank you!



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