PFAS MITIGATION AND ELIMINATION RESEARCH AND DEVELOPMENT

Legislative Update to House Regulatory Reform Committee

Tuesday, March 4, 2025

collaboratory
science. policy. solutions.

Jeffrey Warren, PhD

Executive Director, NC Collaboratory
Professor of the Practice, Department of Public Policy

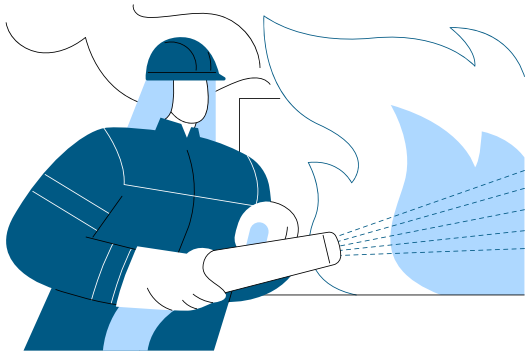
ABOUT US

Established in 2016 by the North Carolina General Assembly, the Collaboratory supports cross-sector research partnerships that seek to transform academic research into evidence-based solutions for environmental, health, and societal challenges faced by people in North Carolina.

Codified as Article 31A of NCGS 116-255

TALK OVERVIEW

PFAS Testing Network



AFFF Take-Back and Destruction

NC Pure

PFAS TESTING NETWORK

Four areas of technology development:

01 **Remediation**

02 **Destruction**

03 **Sensing / Identification**

04 **Replacement**

Duke UNIVERSITY

ECU

FAYETTEVILLE STATE UNIVERSITY

NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY

NCCentral UNIVERSITY

NC STATE UNIVERSITY

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

UNIVERSITY OF NORTH CAROLINA CHARLOTTE

UNC PEMBROKE

UNCW

AFFF PROGRAM

In partnership with:

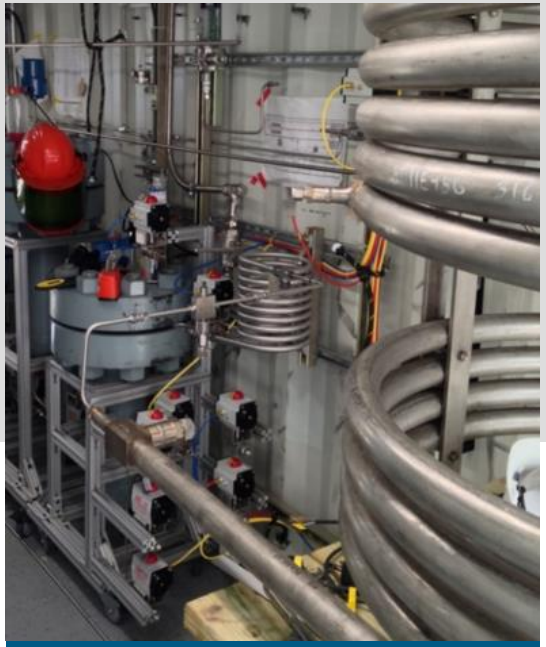
OFFICE OF STATE FIRE MARSHAL
NC DEPARTMENT OF INSURANCE

1st State with an AFFF deployment database

1st State with a free-standing firefighting foam division within OSFM

1st State to undertake a firefighting foam take-back program of this magnitude

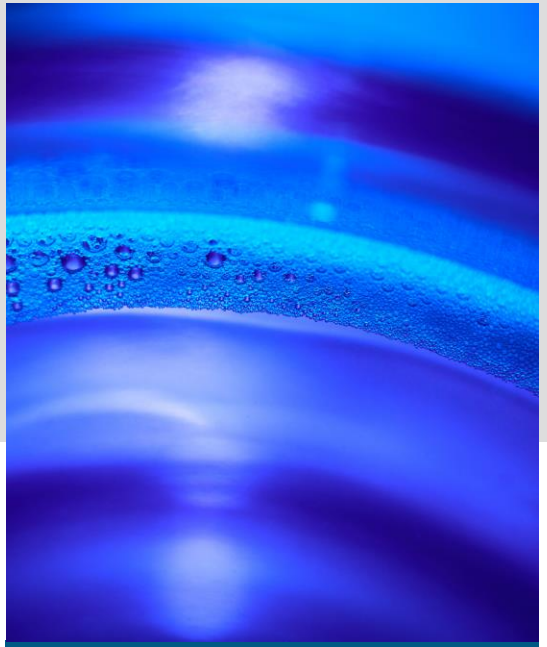
1,200+ fire departments,
~60,000 gallons of AFFF



Supercritical Water Oxidation (SCWO)

Hydrothermal Alkaline Treatment (HALT)

Plasma-Based Treatment

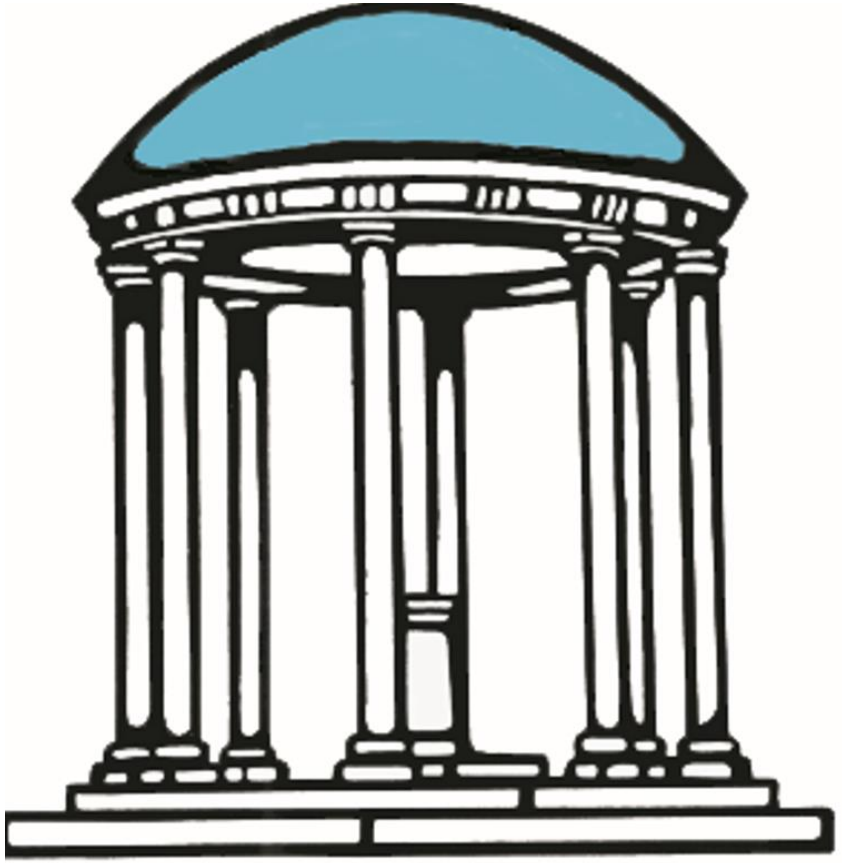


Photoactivated Reductive Defluorination (PRD)

DESTRUCTION TECHNOLOGIES

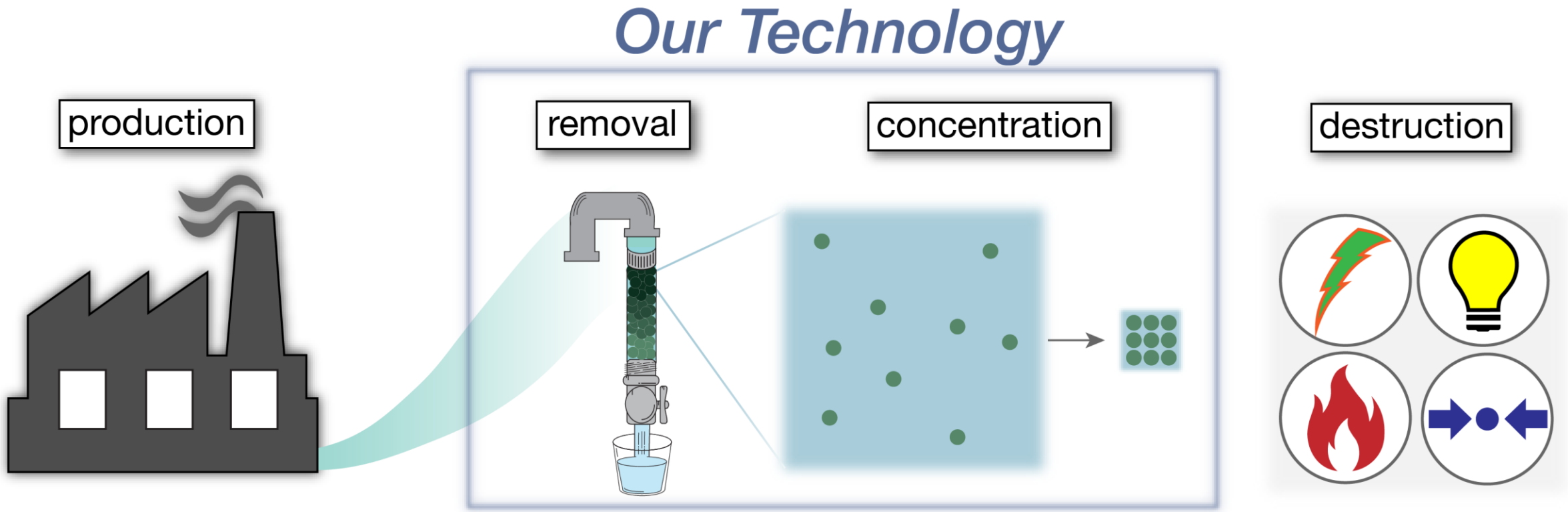
Removing Forever Chemicals (PFAS) From North Carolina Waters

Prof. Orlando Coronell
Environmental Sciences and Engineering
Prof. Frank Leibfarth
Chemistry

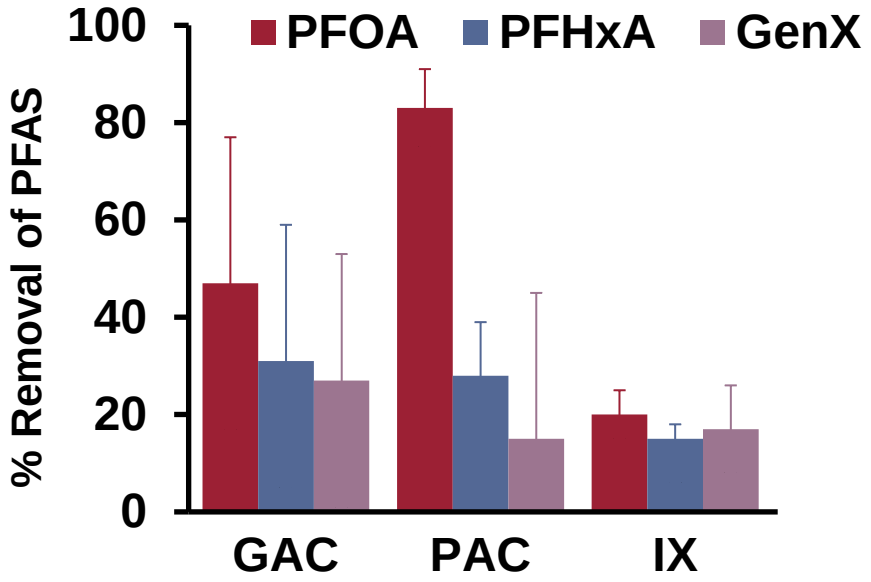


The University of North Carolina at Chapel Hill

Novel Sorbents as a Holistic PFAS Solution



Our Sorbents Demonstrate Higher Affinity for PFAS



[Resin] = 10 mg/L	$[PFAS]_0$ = 1 μg/L
GAC: Filtrasorb 400	[NaCl] = 200 mg/L
PAC: Picahydro MP23	[Humic Acid] = 20 mg/L
IX: PFA 694E	pH = 6.4

ACS *Cent. Sci.* **2020**, *6*, 487–792.

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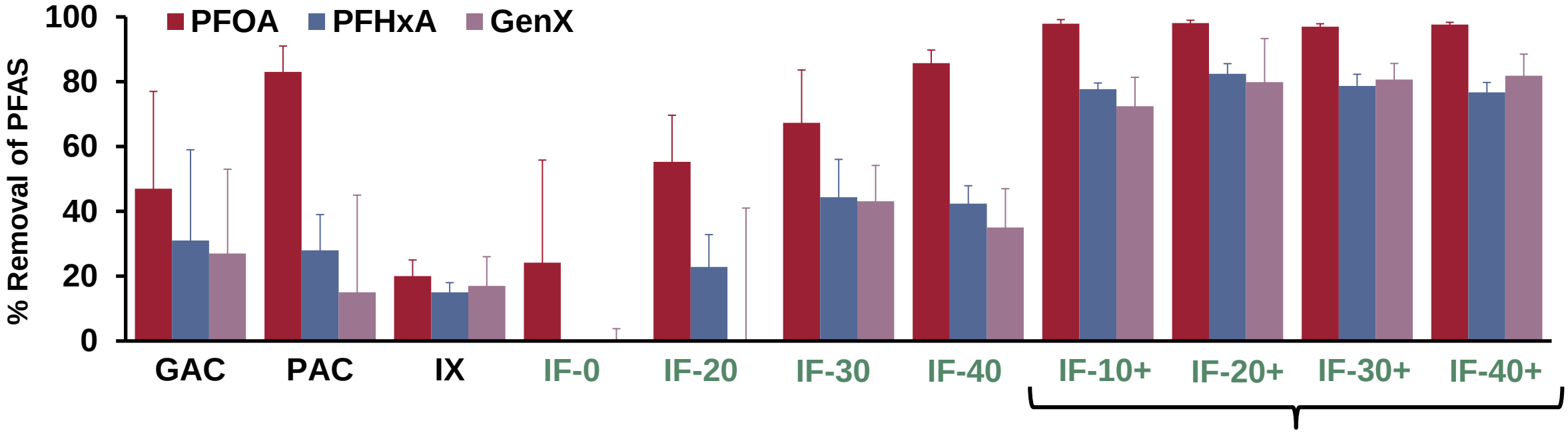

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Improved Performance

ACS *Cent. Sci.* **2020**, *6*, 487–792.

Does this End as an Academic Advance?

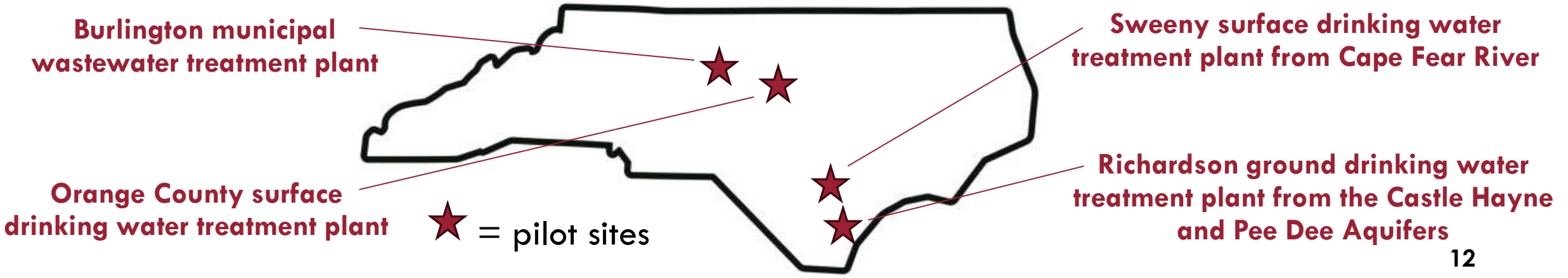
We published a paper and submitted a patent application…
is that the end?

collaboratory
science. policy. solutions.

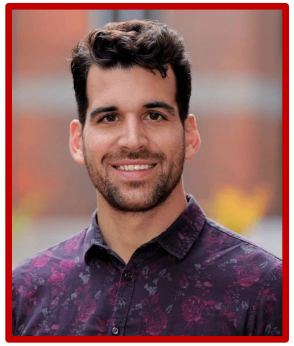
Question posed by Legislators from New Hanover & Brunswick Counties: What would it take to test this in our water treatment plants?

NC PURE

- **NC Pure** is developing and evaluating novel materials to remove PFAS from water
- This includes upscaling manufacturing and performance testing of novel sorbents alongside benchmark commercial sorbents



NC Pure Project Team



Prof. Frank Leibfarth
Co-Project Leader

Prof. Orlando Coronell
Co-Project Leader

Dr. Mark Nosiglia
Lead Research Chemist

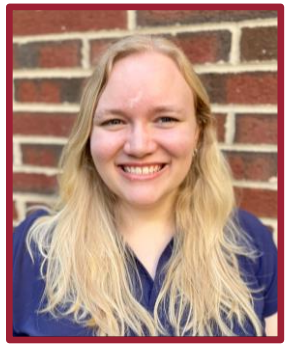
Dr. Alexander Gorzalski
Engineering Consultant

Dr. Nick Chew
Water Process Engineer

Sontia Gaither
Synthetic Chemist

Jenna DeMartino
Analytical Chemist

Emily Watts
Chemical Engineer



Abigail Sveen
Water Process Scientist

Graham Parker
Graduate Student

Dr. Jim Bray
Engineering Consultant

Elias Arroyo
Research Scientist

Hypothesis-Driven Rationale Improves Performance

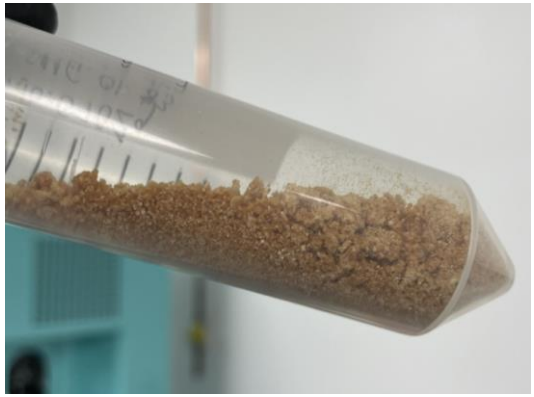
Generation I:

Perfluoropolyether-based Ionic Fluorogels

High-performing at the bench scale

Regenerable, broad-spectrum PFAS removal performance

Challenging to scale up due to environmental, cost, & supply chain concerns



Generation II:

Fluoroolefin-vinyl ether- based Ionic Fluorogels

Accessible starting materials at competitive price point

Bench-scale column testing revealed lower performance under realistic conditions

Scale-up beyond 50-gram scale proved challenging

Generation III:

Functionalized Novel Sorbents

Accessible starting materials at competitive price point

Modular synthetic platform enables quick iteration & scale-up

High-performing in real waters

Non-fluorinated backbone

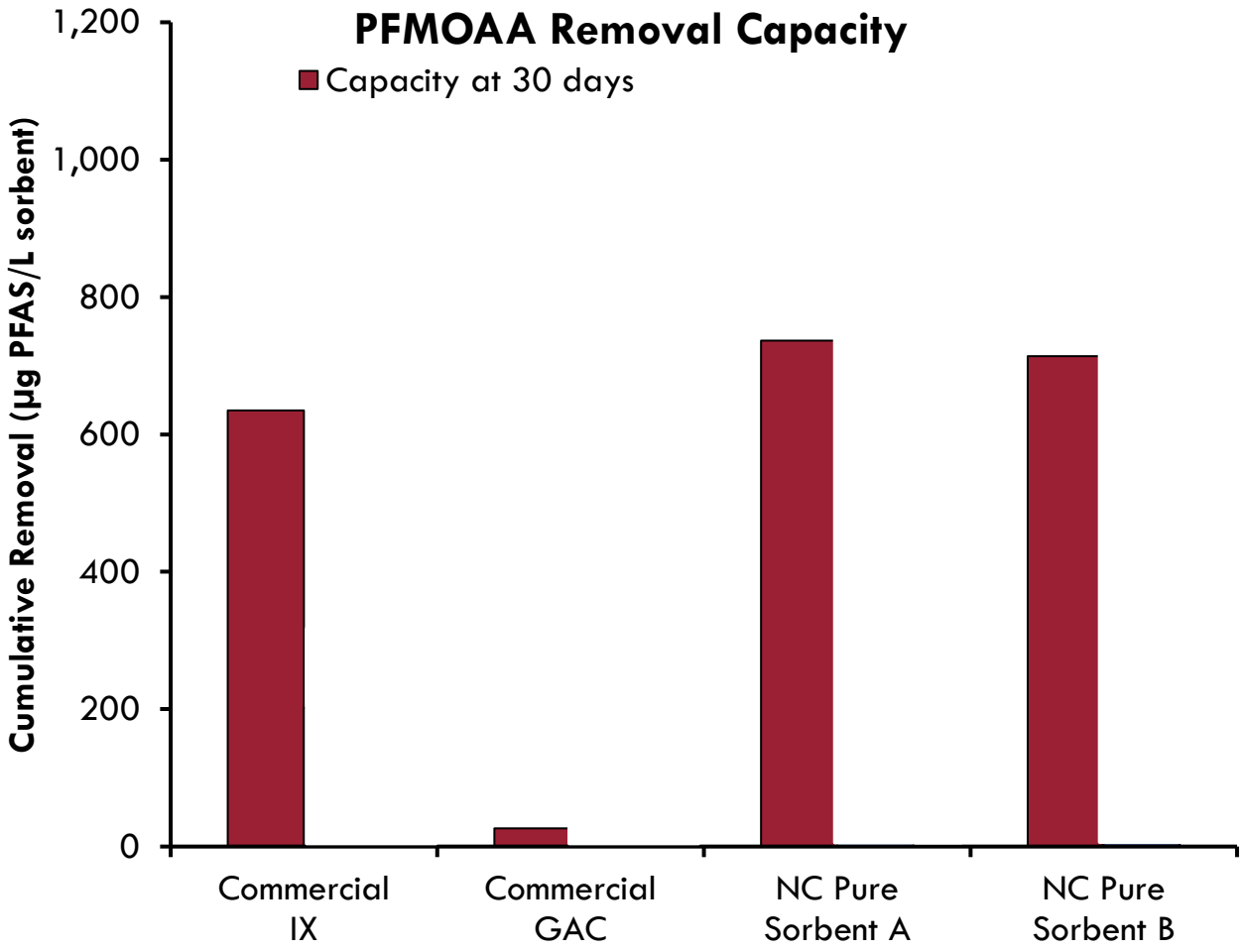
Pilot-Scale Tests

Pilot-Scale Tests

- Initial results indicate NC Pure sorbents last 40% longer than a commercial ion-exchange resin for short chain PFAS
- When paired with GAC at Sweeny, the combination extends the time to breakthrough (i.e., lifetime) of GAC
- We are testing on-site regeneration, which could enhance sustainability and potentially reduce lifetime cost

Capacity for Short-Chain PFAS of Concern in Eastern NC

- After 30 days, NC Pure Sorbents had similar capacity to commercial ion exchange resins (and much more than GAC)
- After 100 days, commercial ion exchange resins had *released* most PFAS back into the water
- After 100 days, NC Pure sorbents continued removing PFAS



SORBENTA

Sorbenta, Inc.

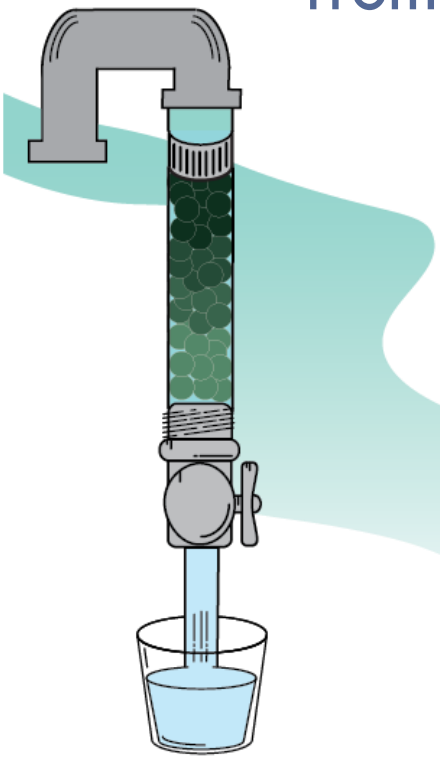
Removing forever chemicals from our waters

Our vision: manufacture and supply the world's best sorbents for PFAS removal and concentration

Frank Leibfarth
Co-Founder
Chemistry Lead

Orlando Coronell
Co-Founder
Engineering Lead

Robin Weitkamp
Co-Founder & Advisor
30-year chemical industry exec



Unique Patent License allocation of ALL gross revenue:

- 10% to the General Fund
- 10% to Collaboratory to fund further PFAS research
- 40% to UNC
- 40% to the inventors

Irene Mulloy
Formulations advisor
Polymer industry scientist

Alex Gorzalski
Applications advisor
10-yr water sector experience

- Raised >$400,000 non-dilutive funding
- Have lab space to conduct R&D

THANK YOU & QUESTIONS

collaboratory.unc.edu
collaboratory@unc.edu

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL