

# Community impacts resulting from air emissions and wastewater discharges from a PFAS manufacturer

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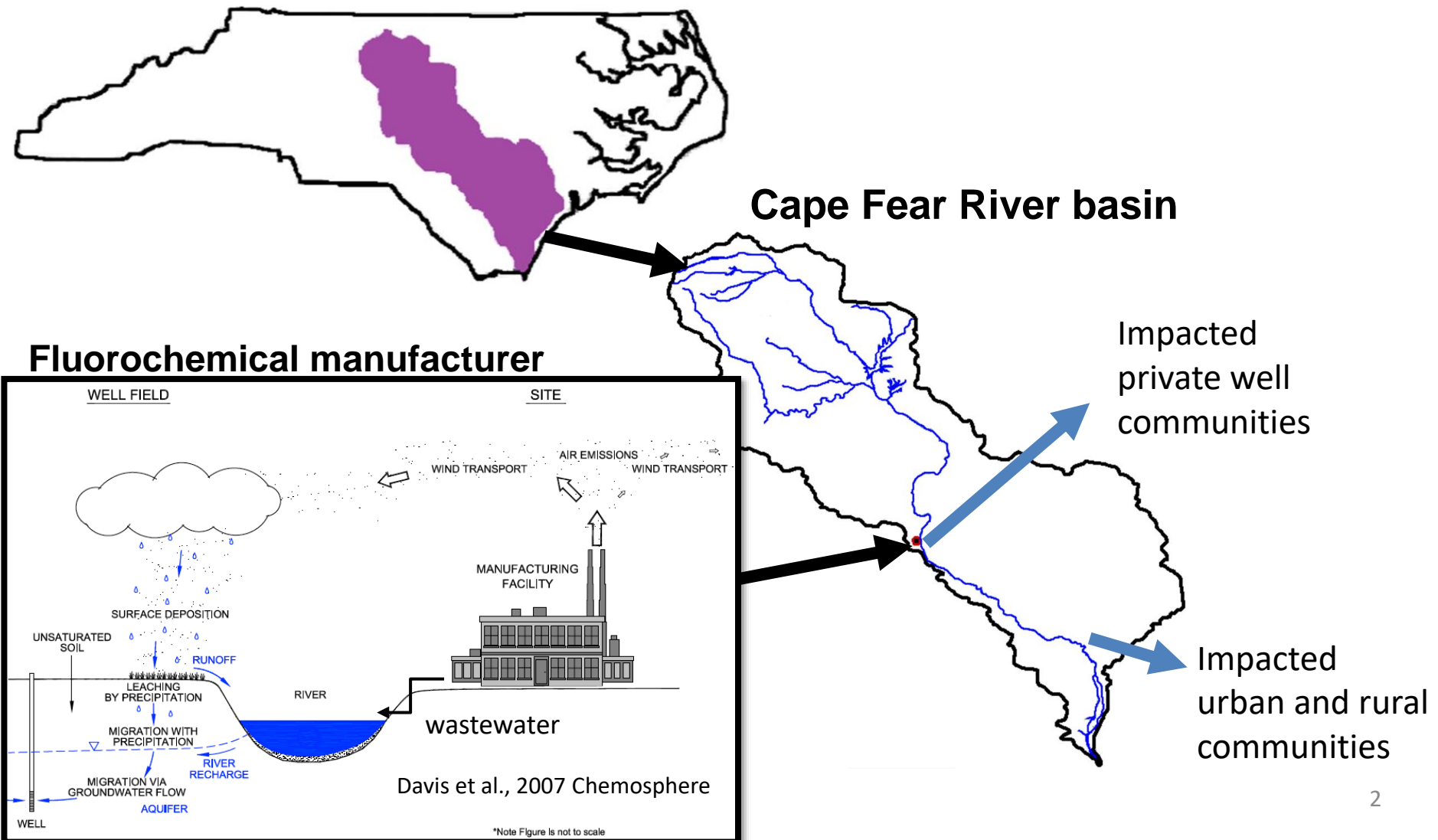
North Carolina State University

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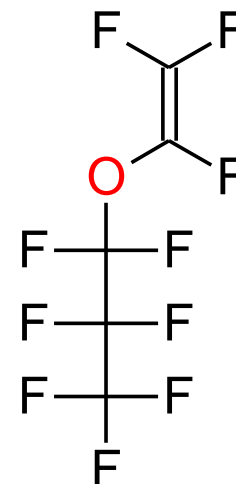
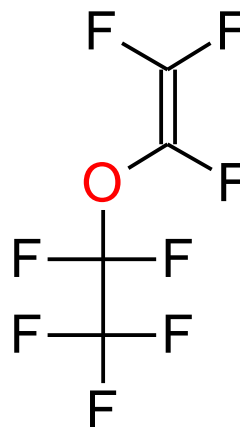
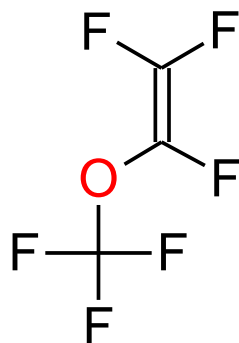
*PEPH Webinar:  
Working with Communities to Understand and Address PFAS Exposures,  
NIEHS, March 25, 2020*

# In NC, both rural and urban communities are impacted by recently identified fluoroethers



# A brief history

Fluorochemical  
production begins  
at DuPont's  
Fayetteville Works



1980

2002

2007

2009

2012

2014

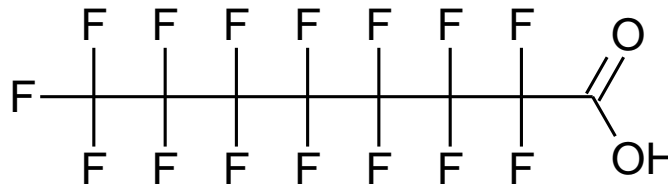
2015

2016



"Vinyl ether" process  
generates building blocks  
for fluoropolymers

# A brief history



**Perfluorooctanoic acid (PFOA = C8)**

Fluorochemical  
production begins  
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2002

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2016

PFOA production  
begins at DuPont's  
Fayetteville Works

By Greg Barnes  
Staff writer

Posted Mar 25, 2018 at 6:07 PM  
Updated Apr 24, 2018 at 6:37 PM

The Fayetteville  
**Observer**

Soon after DuPont started making C8 at Fayetteville Works, the chemical turns up in a well under the plant. The public wouldn't find out for another two years.

# A brief history

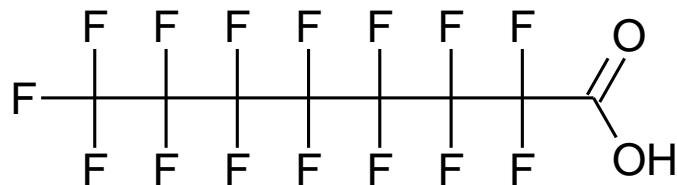


Fluorochemical production begins at DuPont's Fayetteville Works

First publication highlighting PFAS occurrence in the Cape Fear River basin – Nakayama et al. *ES&T*

PFOA production begins at DuPont's Fayetteville Works

Among 10 targeted PFASs, PFOA was dominant in the Haw and Cape Fear Rivers of North Carolina

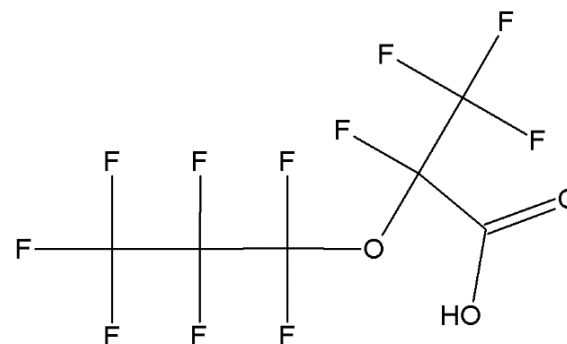


Perfluorooctanoic acid (PFOA = C8)

# A brief history

Fluorochemical production begins at DuPont's Fayetteville Works

First publication highlighting PFAS occurrence in the Cape Fear River basin – Nakayama et al. *ES&T*



**Hexafluoropropylene oxide dimer acid (HFPO-DA, "GenX")**

1980

2002

2007

2009

2012

2014

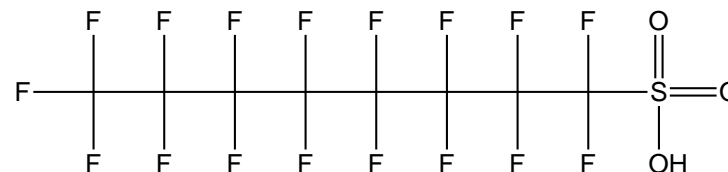
2015

2016

PFOA production begins at DuPont's Fayetteville Works

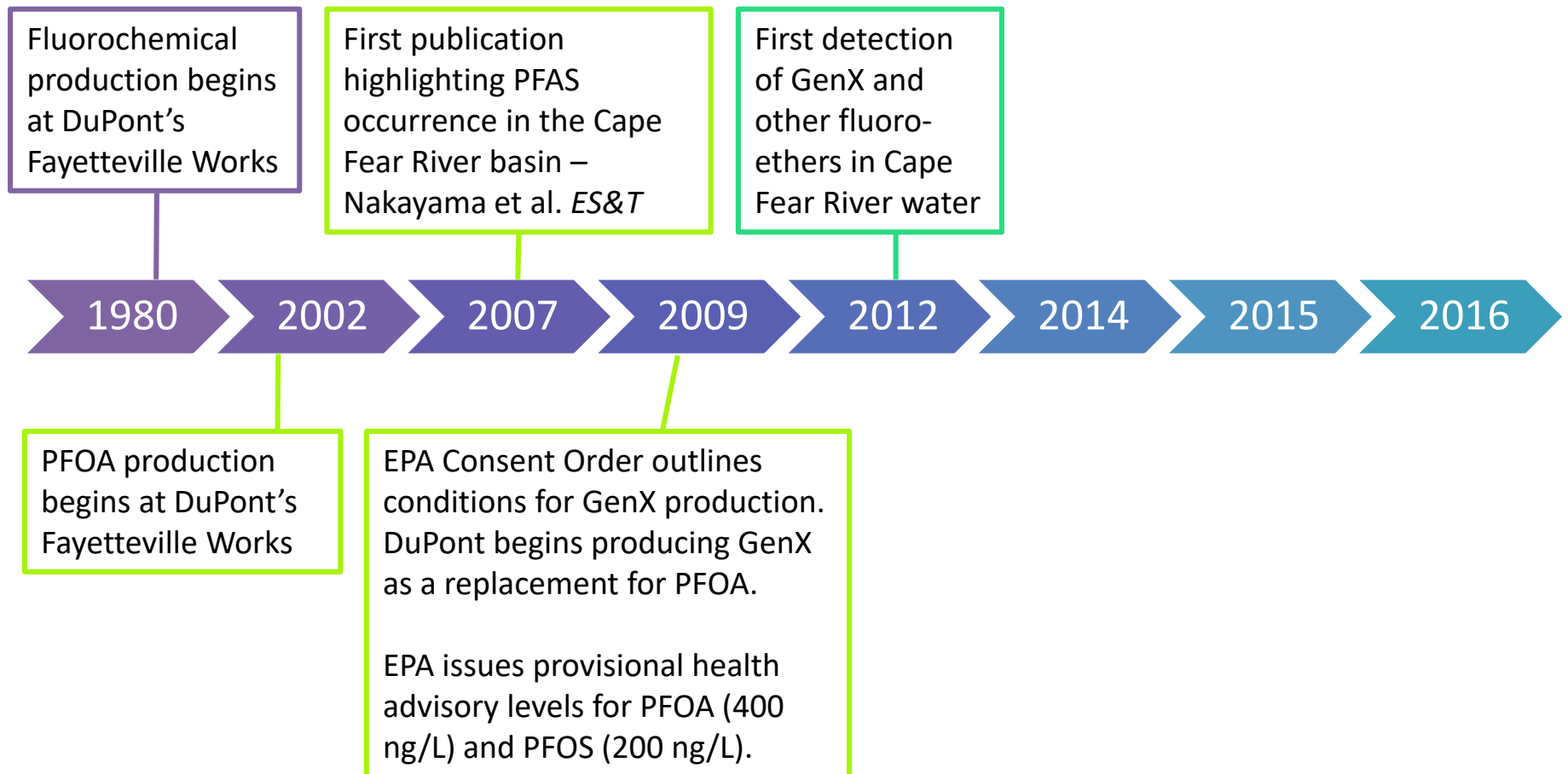
EPA Consent Order outlines conditions for GenX production. DuPont begins producing GenX as a replacement for PFOA.

EPA issues provisional health advisory levels for PFOA (400 ng/L) and PFOS (200 ng/L).

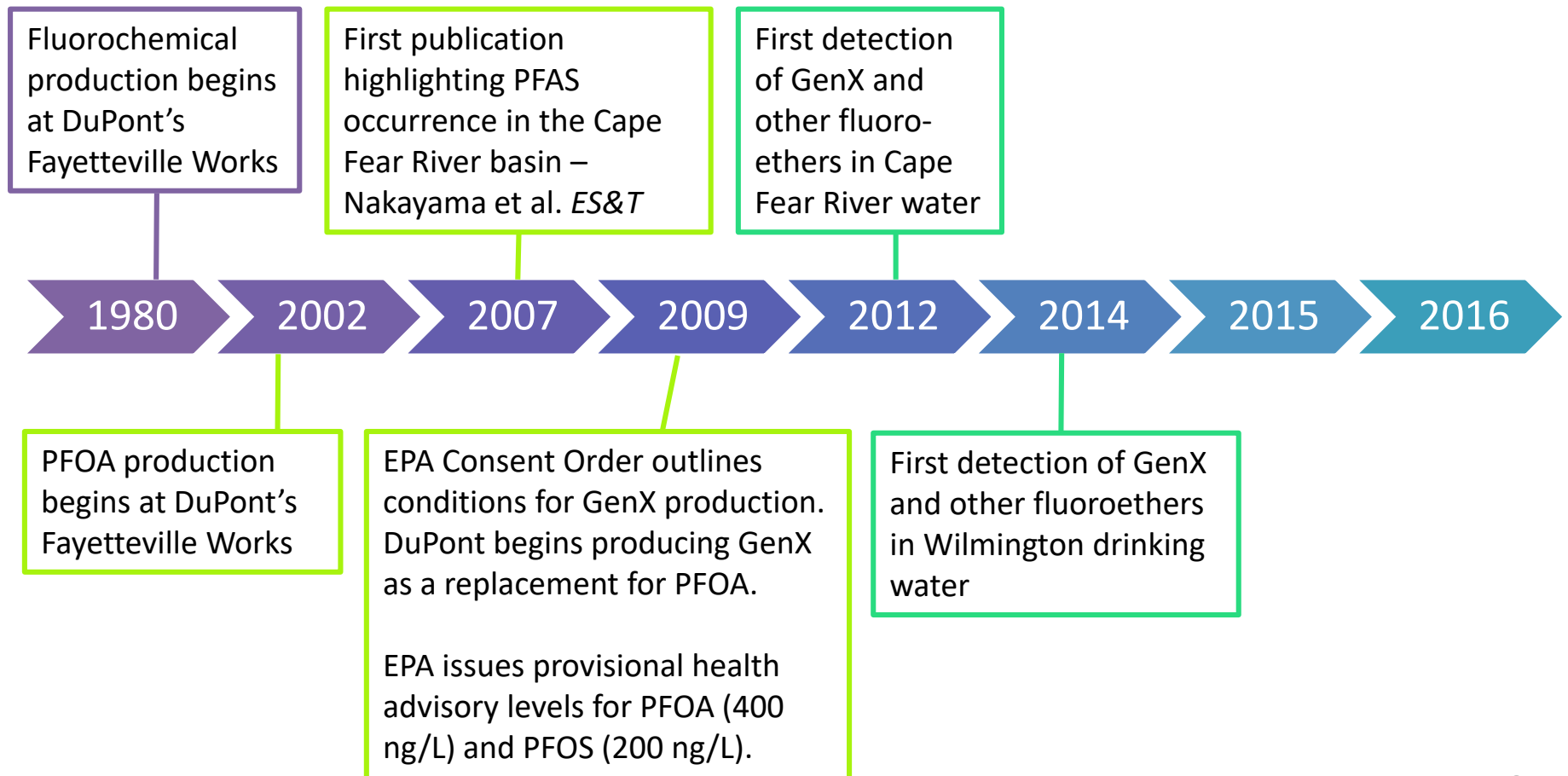


**Perfluorooctane sulfonate (PFOS)**

# A brief history

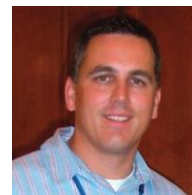


# A brief history





# A brief history



Fluorochemical production begins at DuPont's Fayetteville Works

First publication highlighting PFAS occurrence in the Cape Fear River basin – Nakayama et al. *ES&T*

First detection of GenX and other fluoroethers in Cape Fear River water

Fluoroether structures published - Strynar et al. *ES&T*

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PFOA production begins at DuPont's Fayetteville Works

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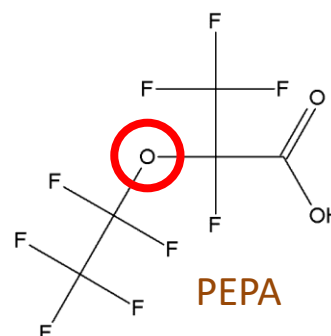
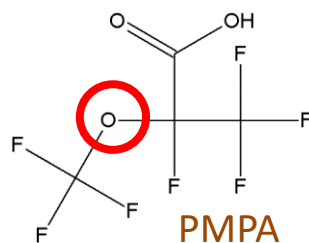
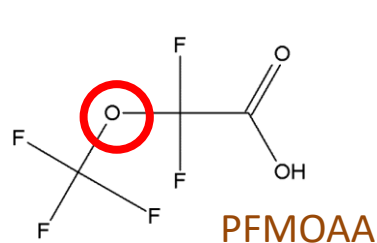
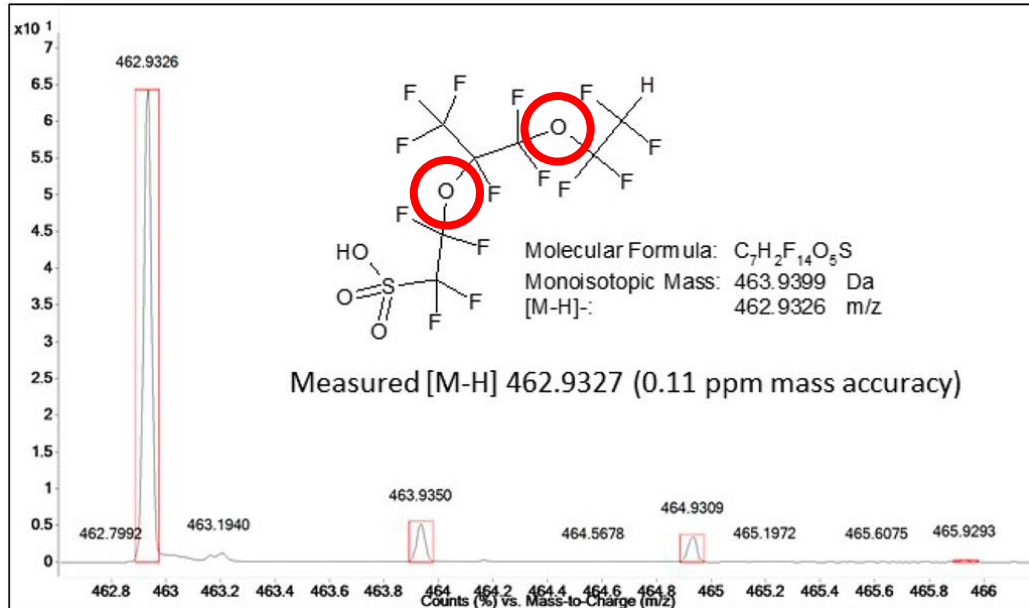
EPA issues provisional health advisory levels for PFOA (400 ng/L) and PFOS (200 ng/L).

First detection of GenX and other fluoroethers in Wilmington drinking water

# Identification of Novel Perfluoroalkyl Ether Carboxylic Acids (PFECAs) and Sulfonic Acids (PFESAs) in Natural Waters Using Accurate Mass Time-of-Flight Mass Spectrometry (TOFMS)

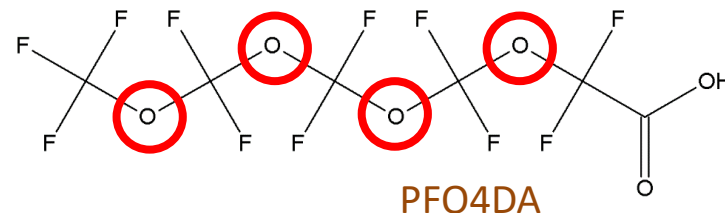
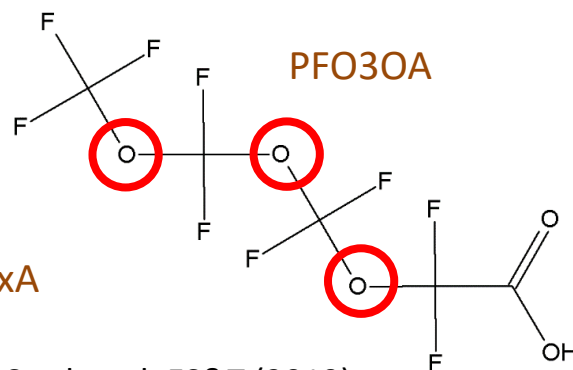
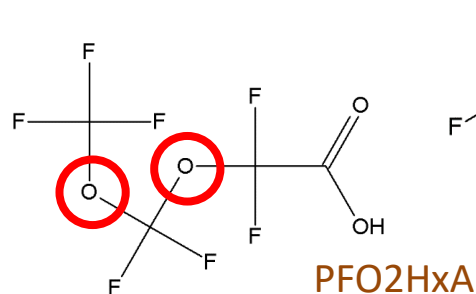
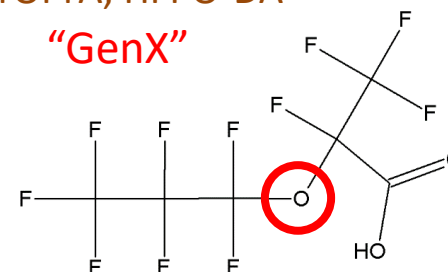
Mark Strynar,<sup>\*,†</sup> Sonia Dagnino,<sup>†,‡</sup> Rebecca McMahan,<sup>†,‡</sup> Shuang Liang,<sup>†,‡</sup> Andrew Lindstrom,<sup>†</sup> Erik Andersen,<sup>†</sup> Larry McMillan,<sup>§</sup> Michael Thurman,<sup>||</sup> Imma Ferrer,<sup>||</sup> and Carol Ball<sup>⊥</sup>

Per- and polyfluoroalkyl ether acids identified by high resolution mass spectrometry

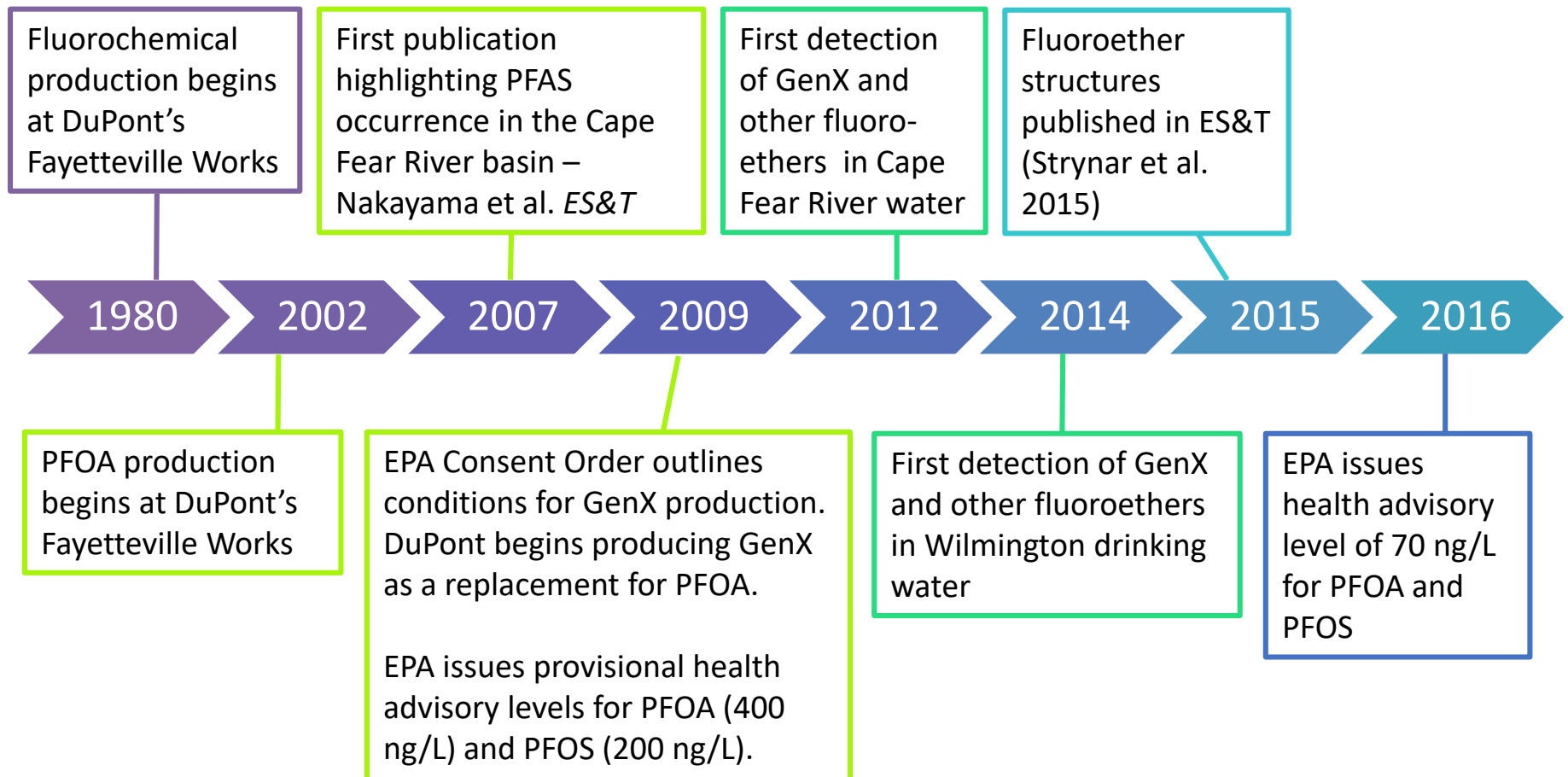


PFPrOPrA, HFPO-DA

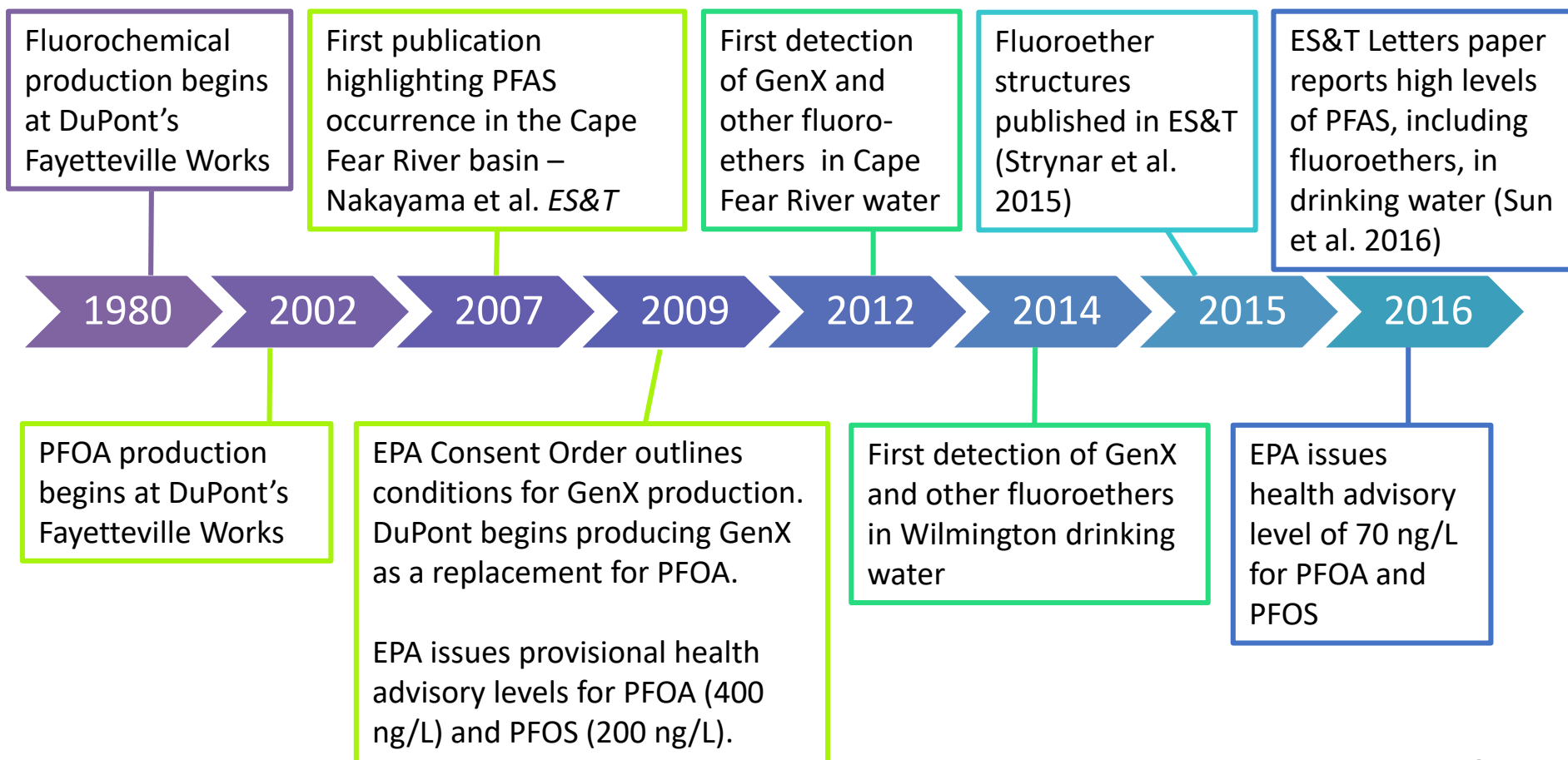
"GenX"



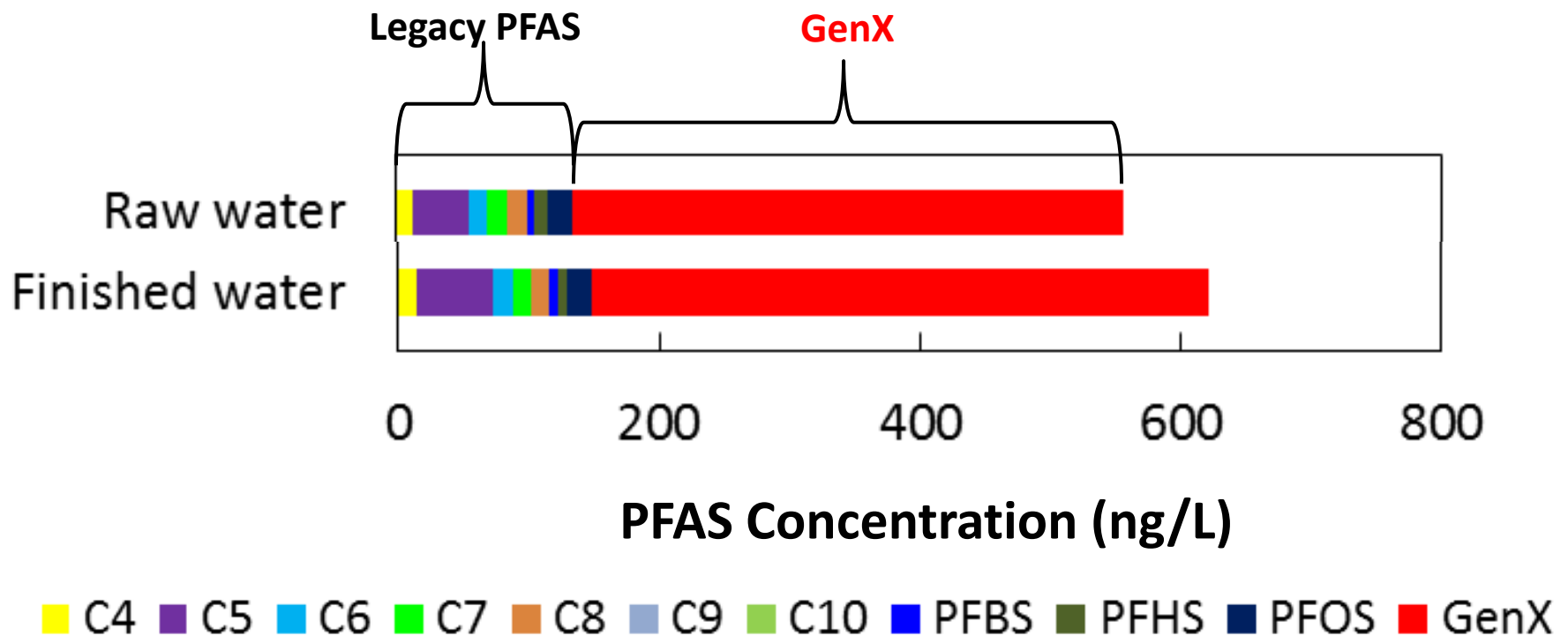
# A brief history



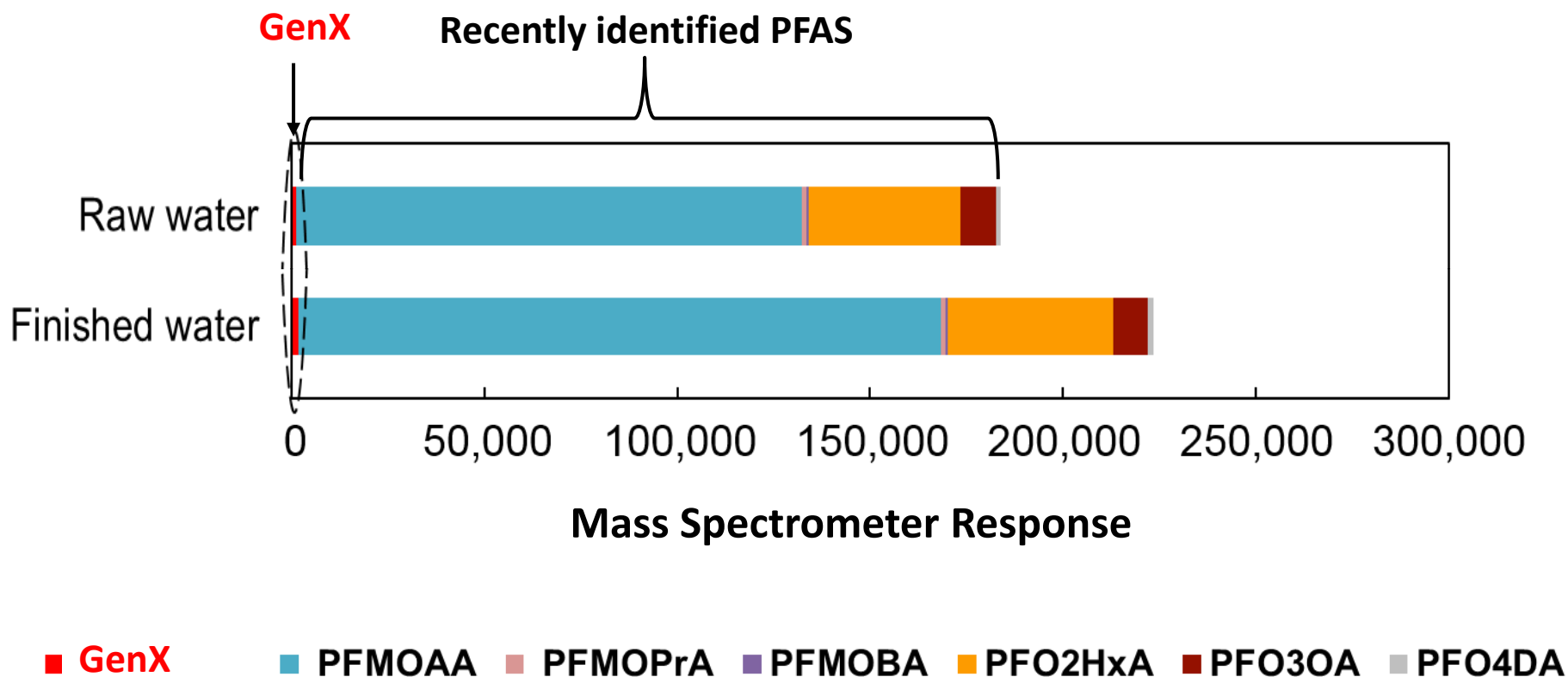
# A brief history



**In Wilmington, only PFHpA (C7) was detected in UCMR3 samples. C7 was only a very small percentage of the total PFAS concentration we could quantify**

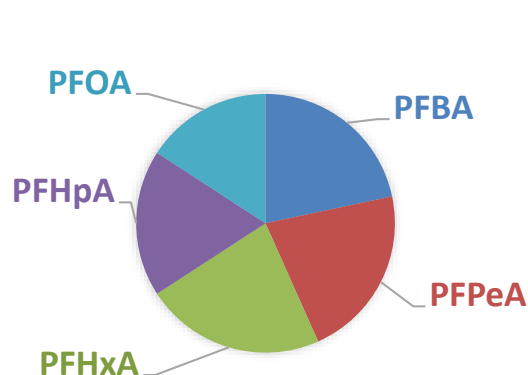
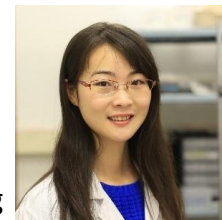


... and GenX was only a small fraction of the total mass spectrometer response associated with PFASs



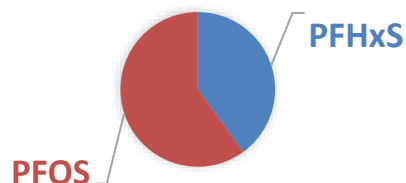
# What were the PFAS levels in Wilmington drinking water?

PhD student  
Chuhui Zhang

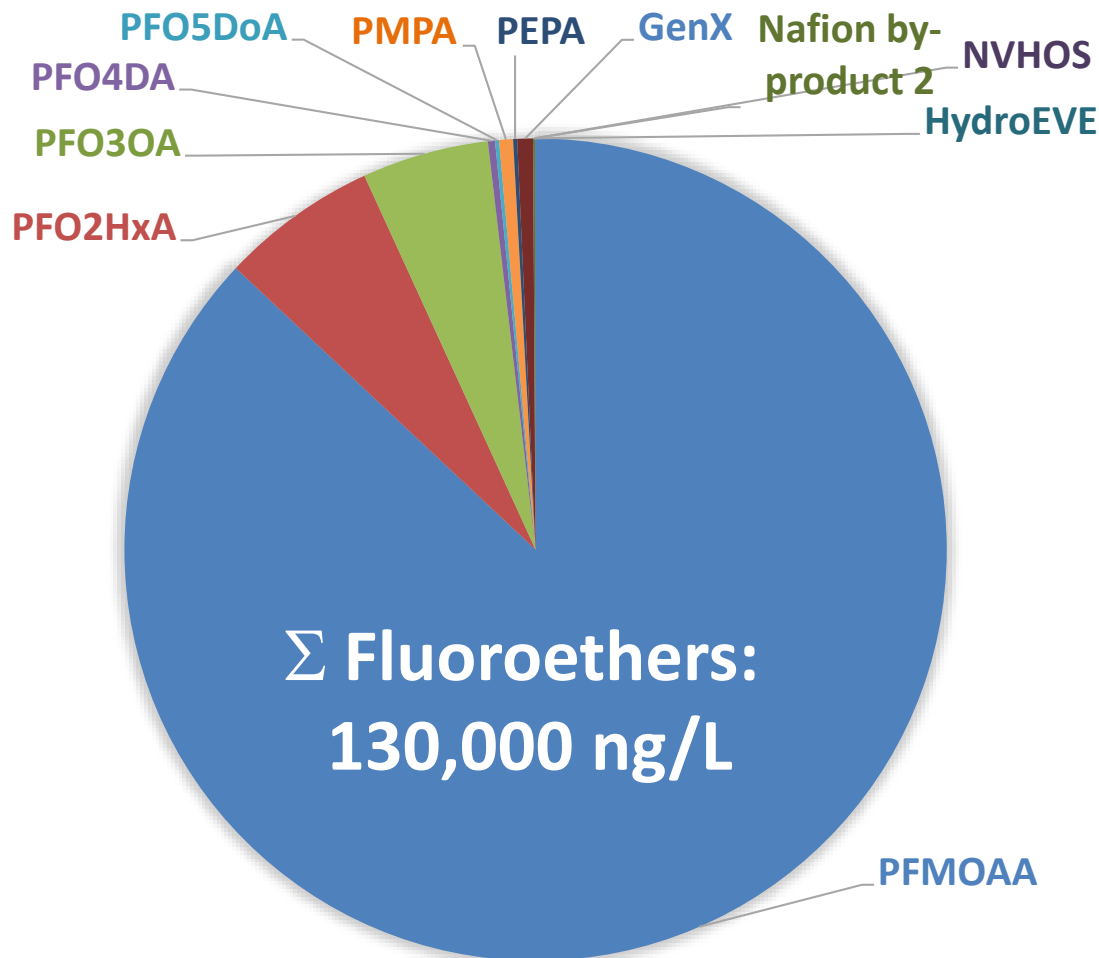


$\Sigma$  PFCAs: 120 ng/L

July 2015 sample



$\Sigma$  PFSAAs: 45 ng/L



# Toxin taints CFPUA drinking water

## MOST POPULAR

- 1** Toxin taints CFPUA drinking water  
Jun 8 at 10:38 AM
- 2** WATER FAQs: What we know and what we don't know  
Jun 8 at 3:35 PM
- 3** GenX fallout: Is my water safe to drink?  
Jun 8 at 5:59 PM
- 4** Local officials respond to GenX report  
Jun 8 at 5:30 PM

• • • •



▲ HIDE CAPTION

A 2000 aerial photo of Fayetteville Works on the Cumberland-Bladen county line. The site, home to several plants, one of which makes GenX, is about 100 miles upstream from Wilmington. [COURTESY OF THE FAYETTEVILLE OBSERVER]

## Utility can't filter out chemical produced upriver at Fayetteville plant

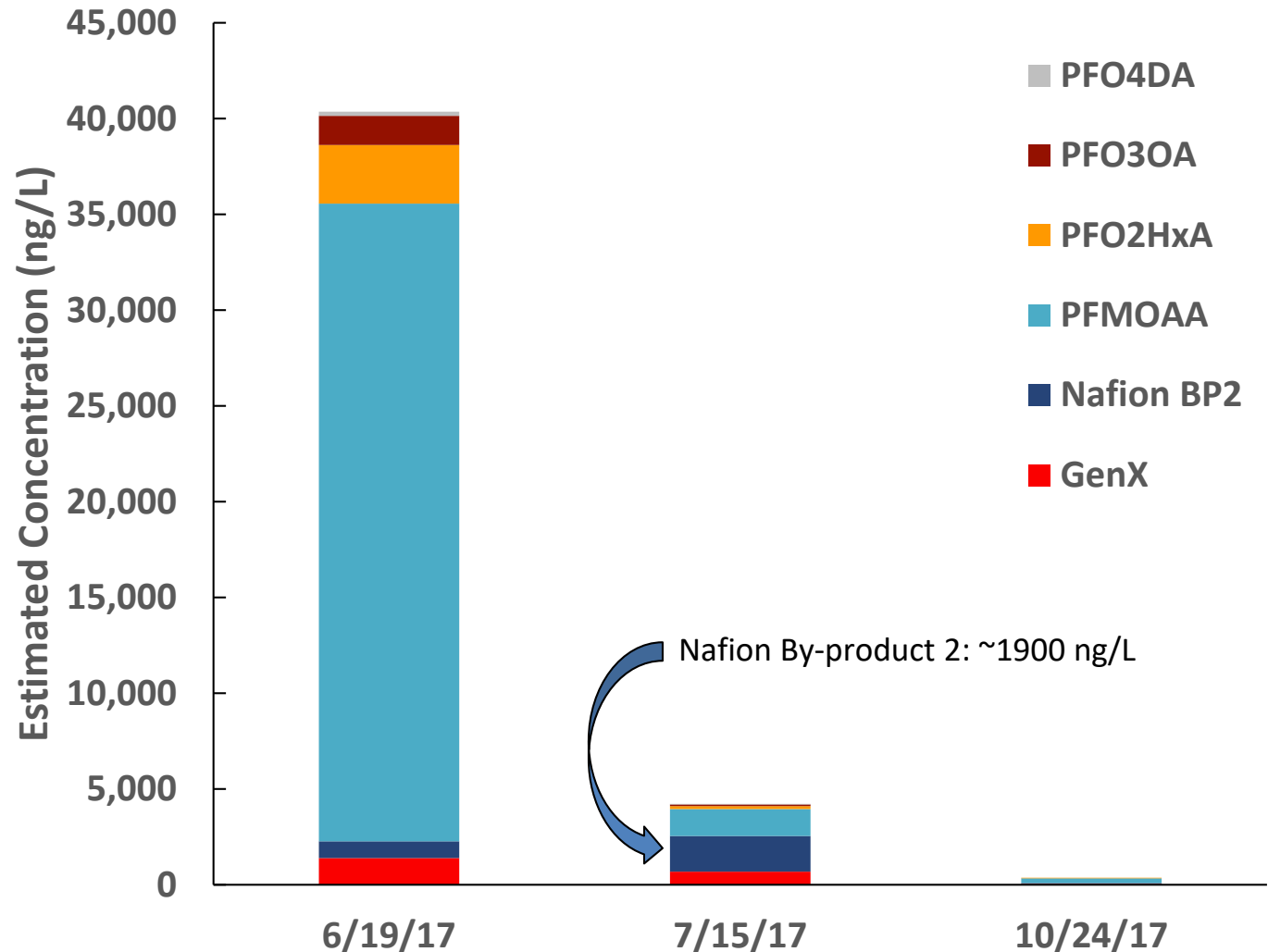
By Vaughn Hagerty StarNews Correspondent

Posted Jun 7, 2017 at 10:31 AM

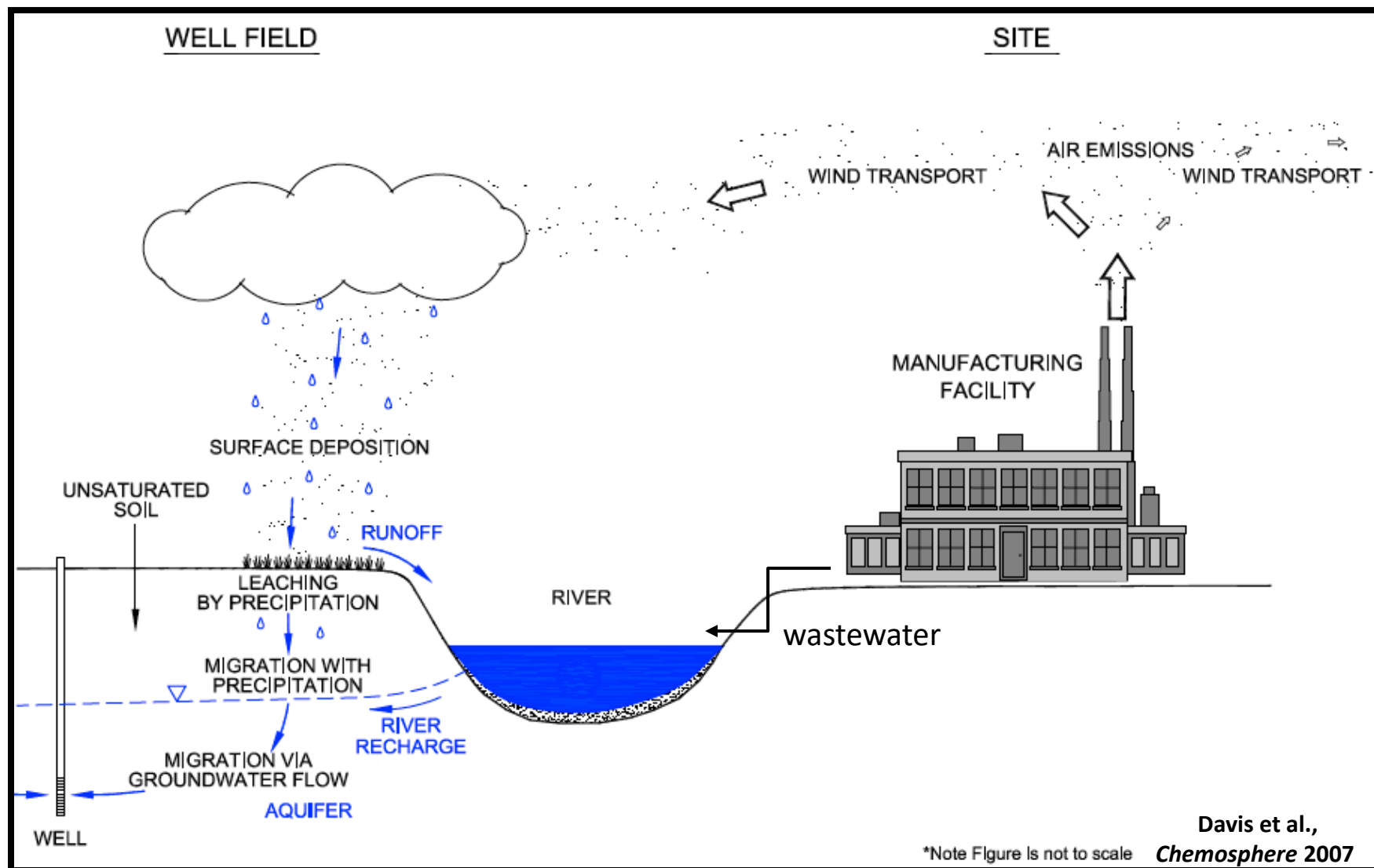
Updated Jun 8, 2017 at 10:38 AM

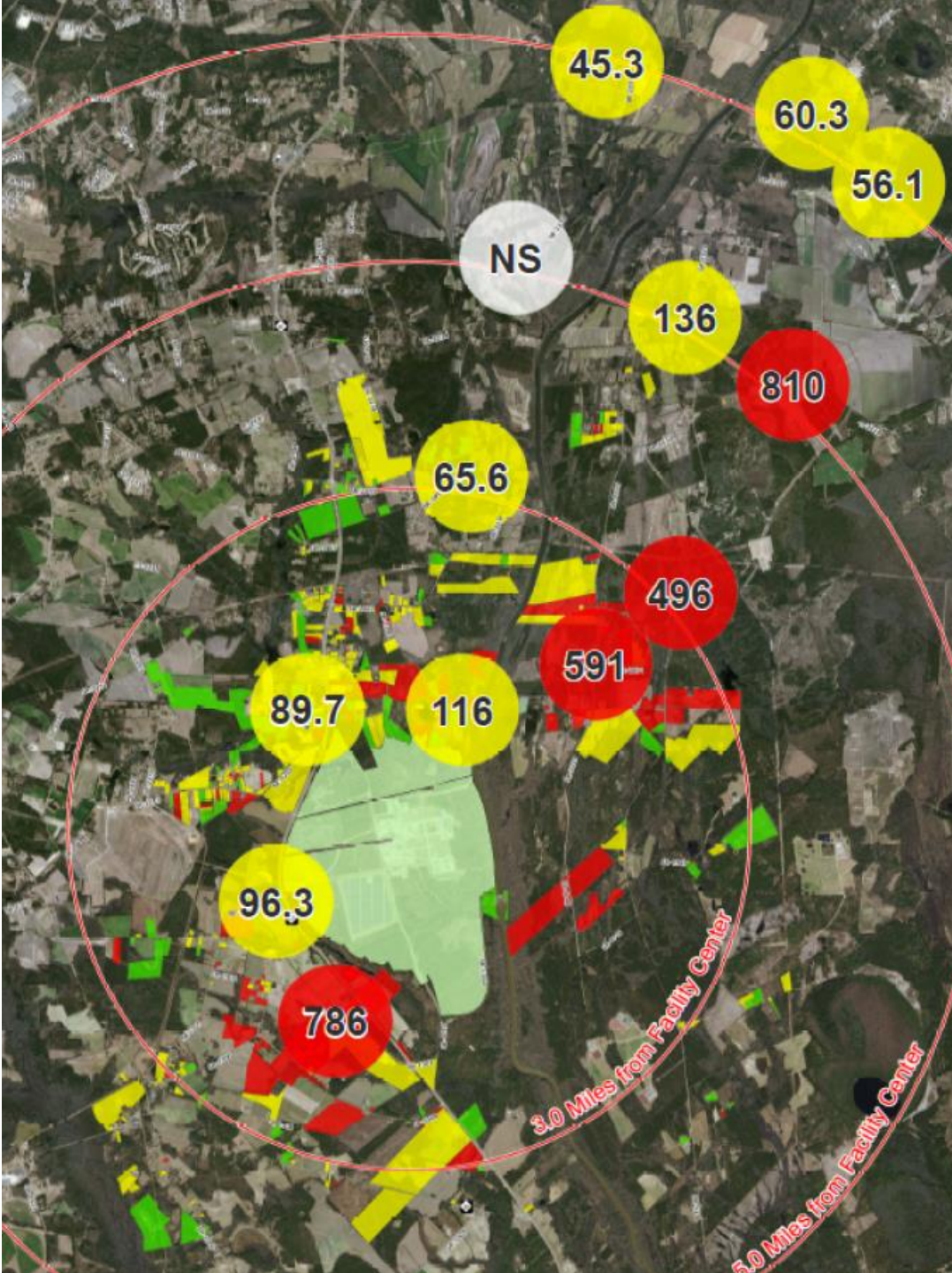


# PFAS concentrations at drinking water intake have dropped dramatically since mid-June 2017



# Fluorochemical manufacturers and industries using fluorochemicals **emit PFAS to air and water**





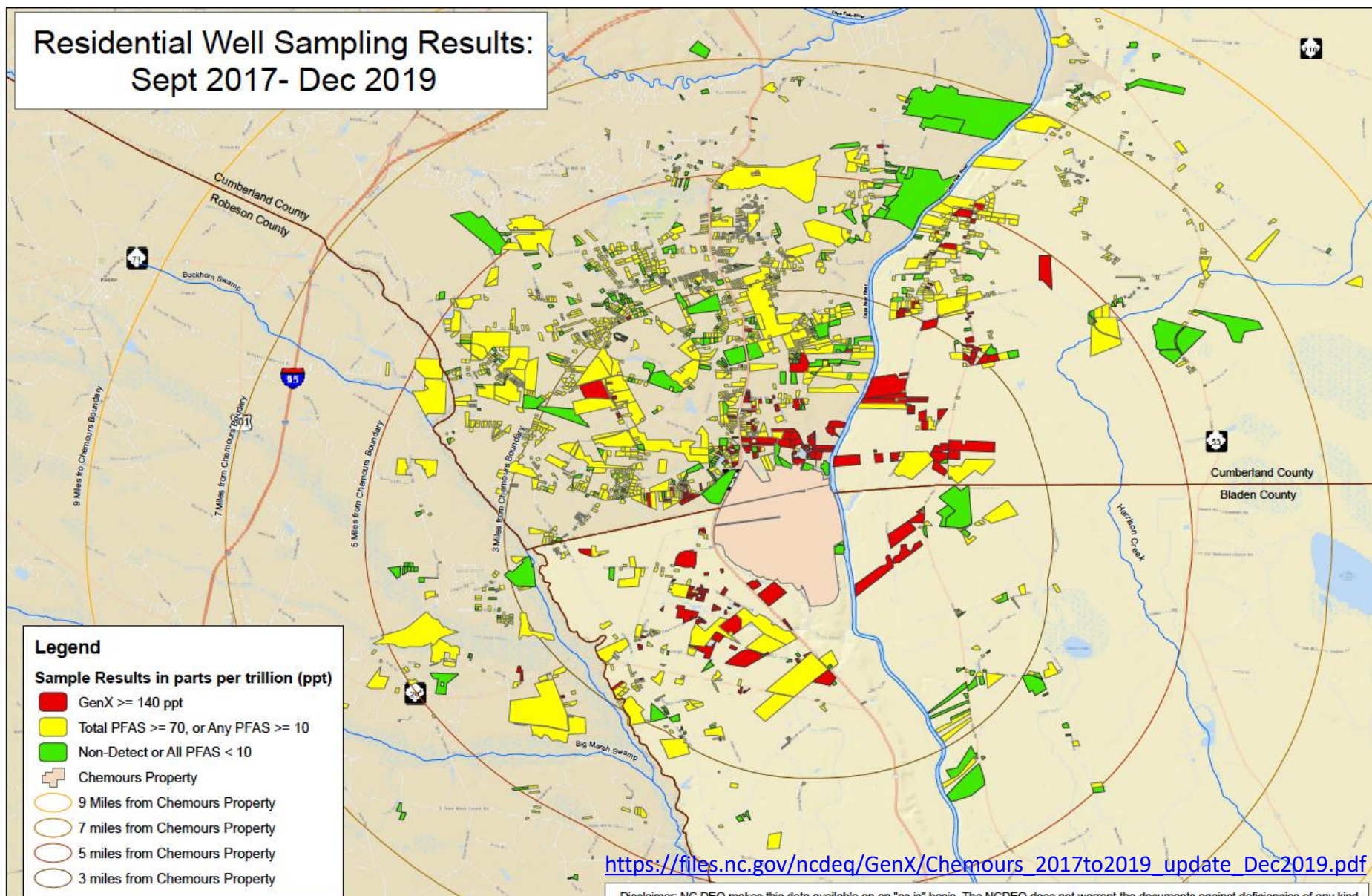
**Rain events return  
GenX (and other  
PFAS) from the  
atmosphere to the  
land surface**

Rain water  
collected  
February 28 –  
March 2, 2018



# GenX detected in private drinking water wells >7 miles from plant

Residential Well Sampling Results:  
Sept 2017- Dec 2019



# The public has many questions

- Are PFAS in my drinking water? Are PFAS in my water that standard methods do not detect?
- Are PFAS in me? At what levels? What are the health effects?
- Are PFAS in the fish I catch? The food I grow in my garden?
- How can I get PFAS out of my water?

# The GenX Exposure Study: Characterizing PFAS exposure in the Lower Cape Fear River Basin

Funding: NIEHS 1R21ES029353-01



**Fluorochemical plant,  
Fayetteville, NC**

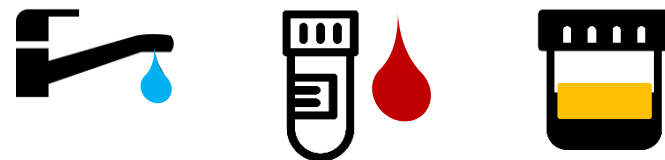


Jane Hoppin,  
CHHE, NCSU



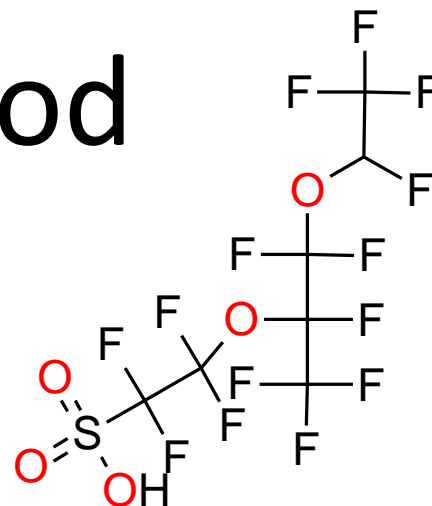
Nadine Kotlarz,  
CHHE, NCSU

**Wilmington, NC**

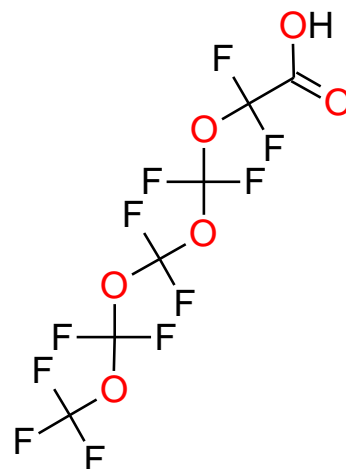


# Long chain fluoroalkyl ether acids in Wilmington blood

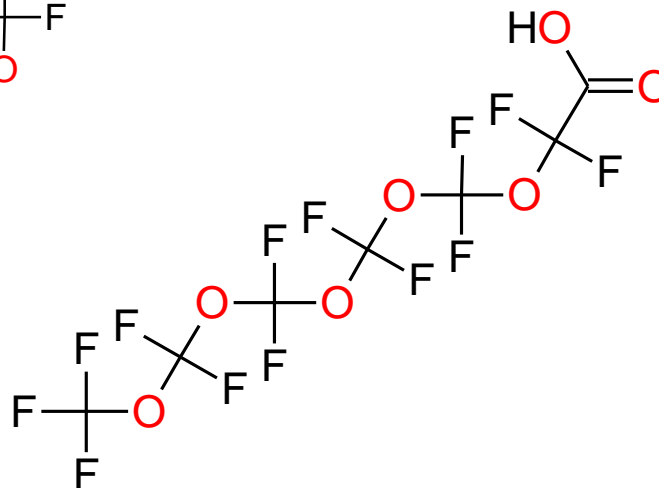
1. Nafion byproduct 2 (99%)



2. PFO4DA (99%)

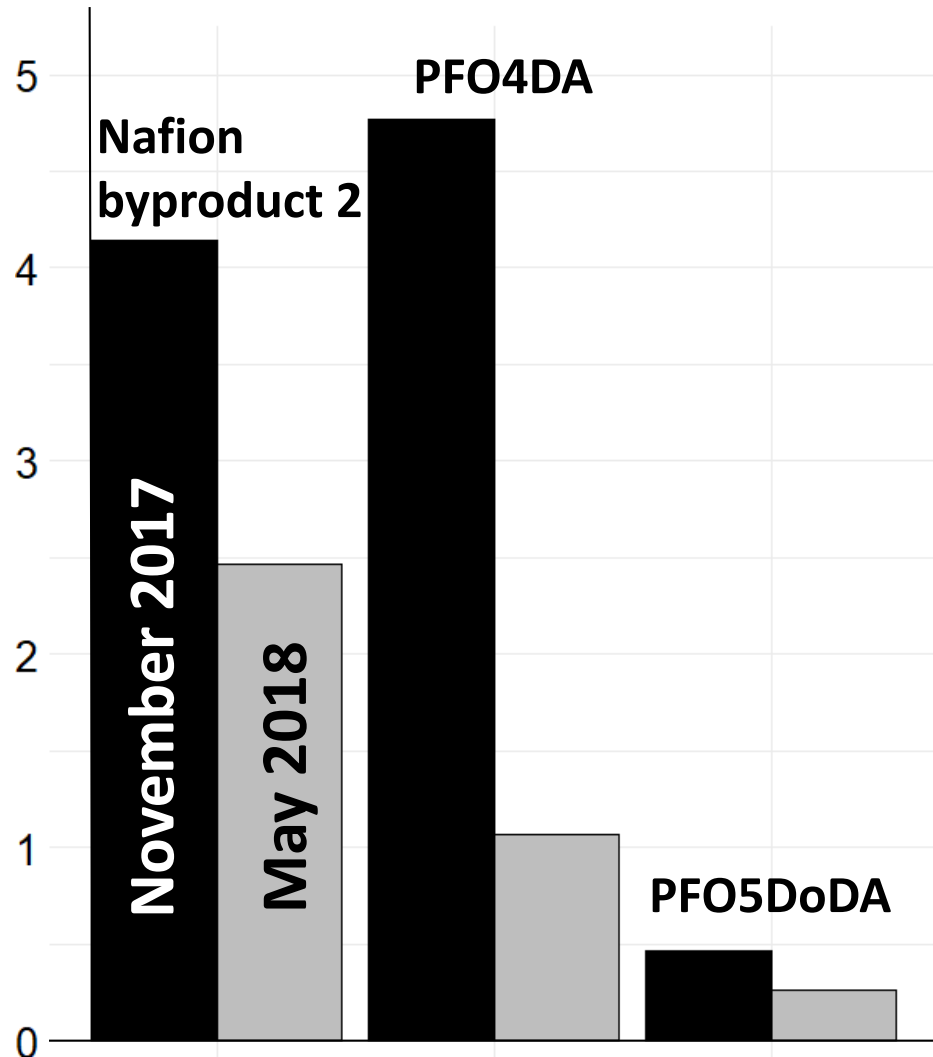


3. PFO5DoDA (88%)



# Blood concentrations of newly identified PFAS decreased after six months

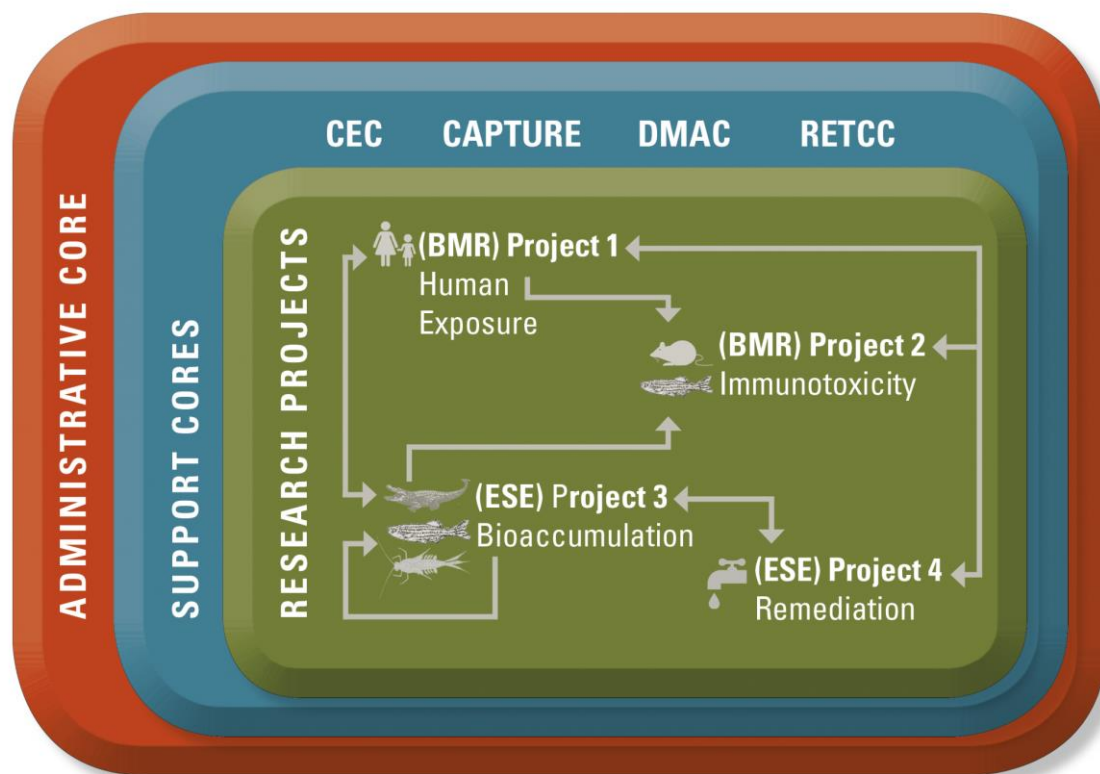
**Median blood concentration for 44 participants (ng/mL)**





# Data Gaps and Community Questions led Researchers at NCSU and ECU to develop a Superfund Research Program Center Application

*Center for Environmental and Health Effects of PFAS* funded as of February 27, 2020 (<https://superfund.ncsu.edu/>)



# Thank you!

Questions:

[knappe@ncsu.edu](mailto:knappe@ncsu.edu)