



Emerging Per- and Polyfluoroalkyl Substances: The North Carolina Experience

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Outline

- **Timeline of GenX response and scope of issue**
- **Public health responses**
- **Challenges and data gaps**
- **Ongoing and future activities**

Wilmington, North Carolina



Timeline of Response to GenX in Drinking Water

• June 2017

- News coverage brings GenX to the forefront
- N.C. DHHS contacted by local health departments



Toxin taints CFPWA drinking water

By Vaughn Hagerty StarNews Correspondent

Posted Jun 7, 2017 at 10:31 AM

Updated Jun 8, 2017 at 10:38 AM



Letter

pubs.acs.org/journal/estlcu

Legacy and Emerging Perfluoroalkyl Substances Are Important Drinking Water Contaminants in the Cape Fear River Watershed of North Carolina

Mei Sun,^{*,†,‡,§} Elisa Arevalo,[‡] Mark Strynar,[§] Andrew Lindstrom,[§] Michael Richardson,^{||} Ben Kearns,^{||} Adam Pickett,[⊥] Chris Smith,[#] and Detlef R. U. Knappe[‡]



Local officials respond to presence of GenX in Cape Fear water

By Robbie Greenspan StarNews Correspondent

Posted Jun 8, 2017 at 4:34 PM

Updated Jun 8, 2017 at 5:30 PM

Fingers pointed at Chemours, regulators

WILMINGTON -- Shock. Surprise. Anger. Frustration.



NC starts Chemours investigation over GenX

By Adam Wagner GateHouse Media

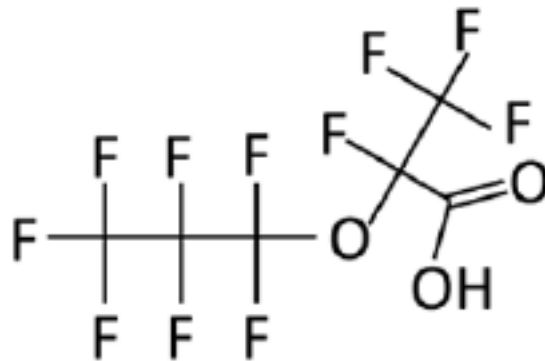
Posted Jun 14, 2017 at 5:25 PM

Updated Jun 14, 2017 at 9:22 PM

Chemical company agrees to foot water sampling and testing costs

What is GenX?

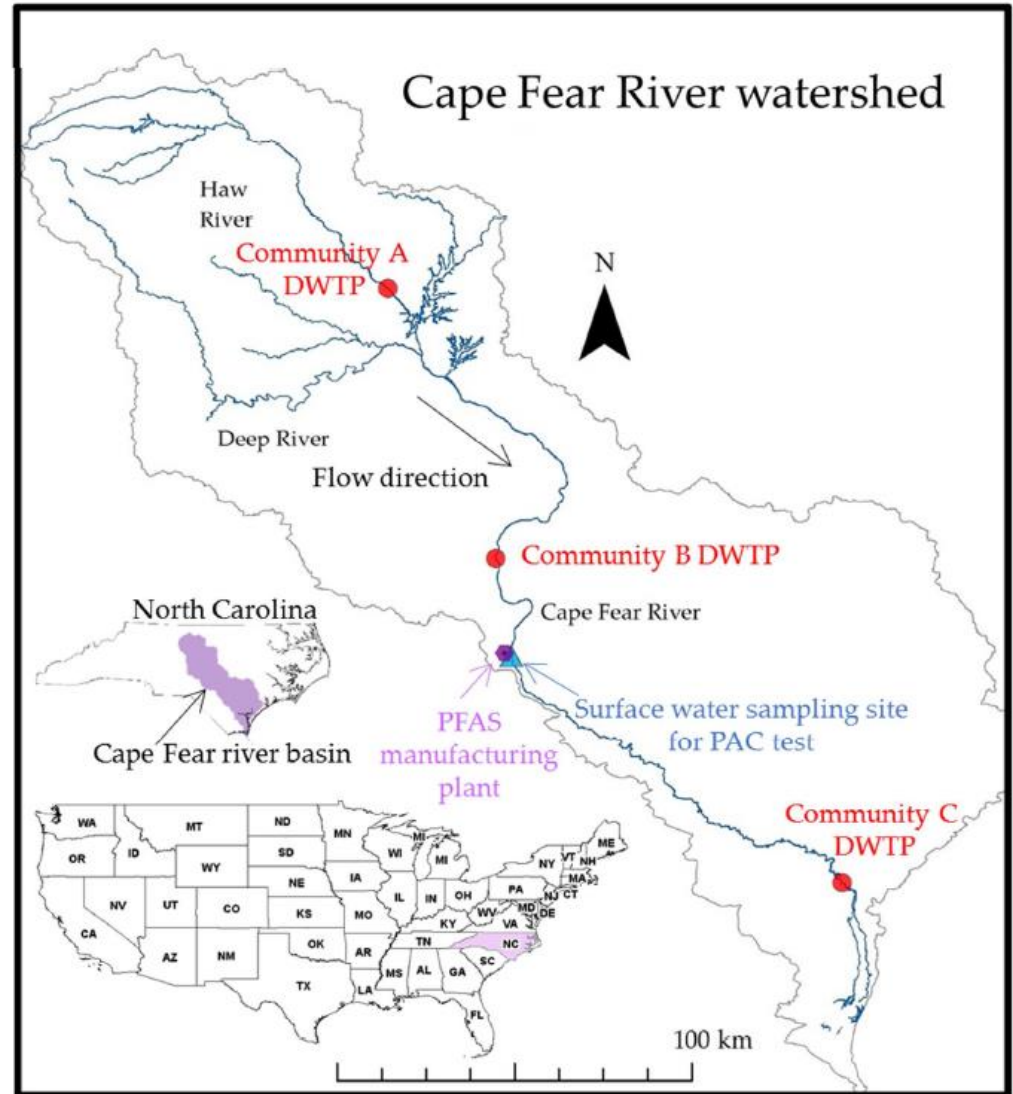
- Replacement chemical for PFOA
- Perfluoroalkyl Ether Carboxylic Acid (PFECA)
- Manufactured since 2009
- Byproduct of other manufacturing processes since ~1980



PFPrOPrA ("GenX")

Scope of Problem – Surface water sourced public water

- Hundreds of thousands public water customers affected by GenX and other PFAS in Cape Fear River



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- Chemours stops discharge of GenX to Cape Fear River

• July 2017

- N.C. DHHS updates assessment and issues a provisional health goal of 140 ng/L (ppt)

• August 2017

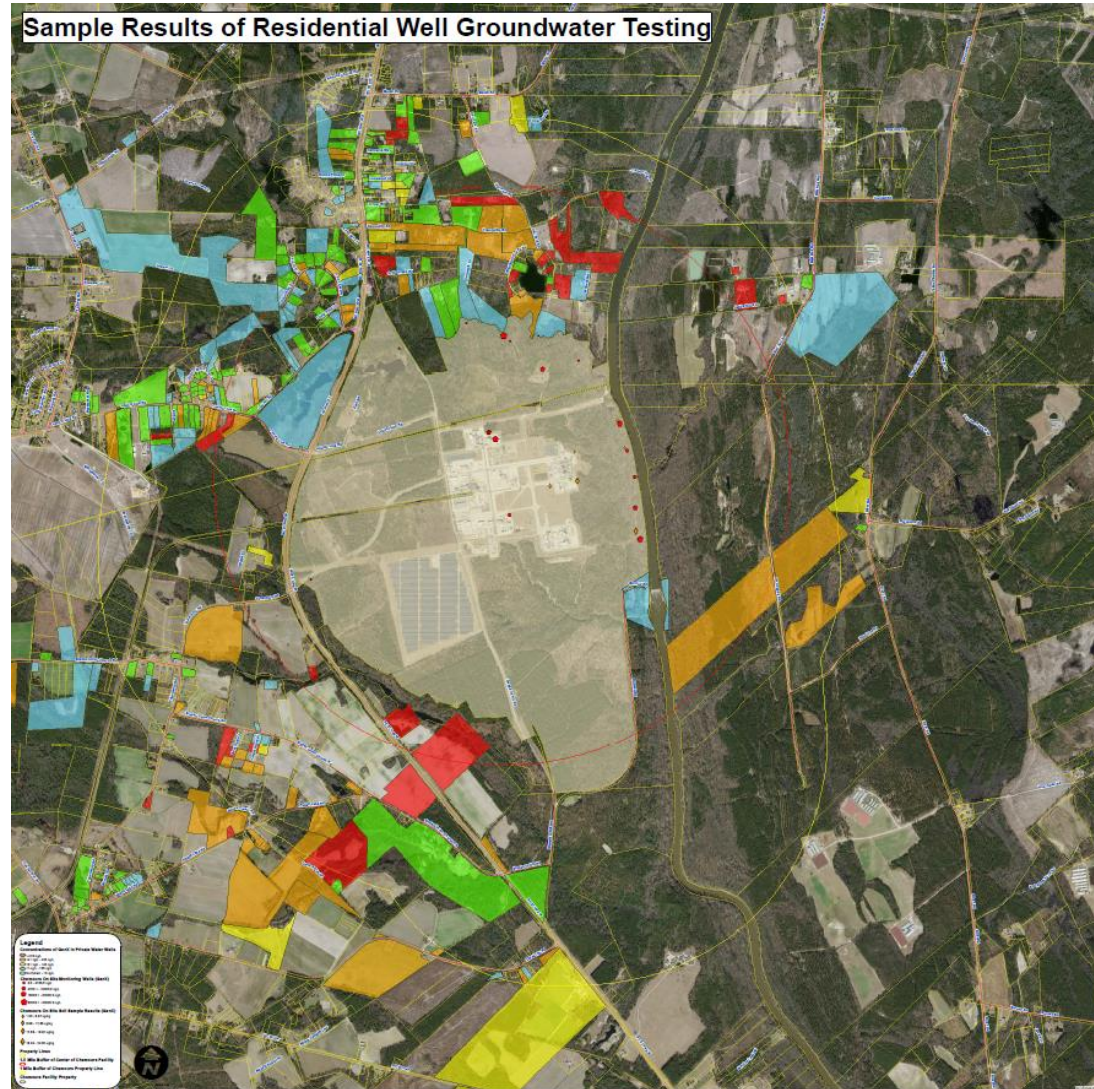
- GenX detected in monitoring wells on-site

• September 2017

- Private well sampling near the facility begins

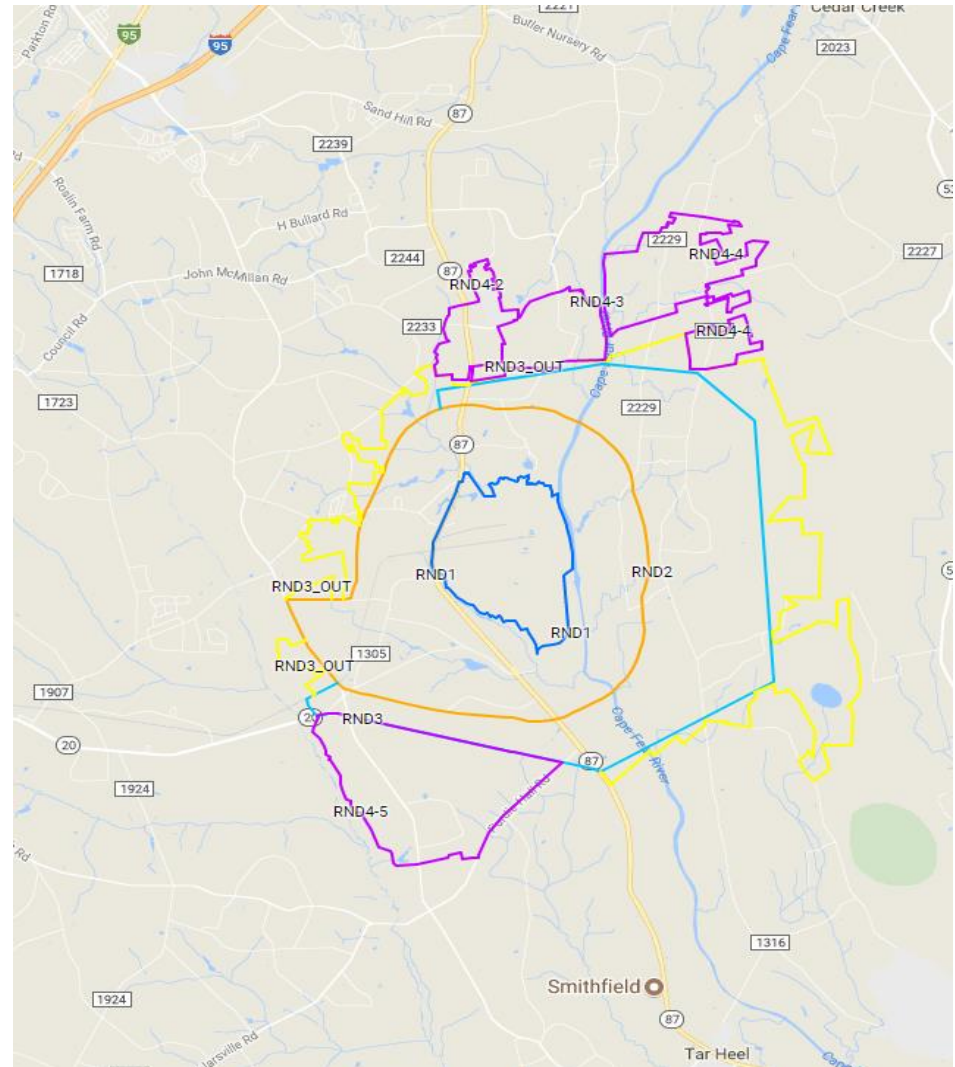
Scope of Problem – Groundwater sourced private wells

- Hundreds of parcels with private wells near the facility potentially impacted by GenX and other PFAS
- Phase 1 & 2 GenX results
 - **Blue:** ND
 - **Green:** 11-100 ng/L
 - **Yellow:** 101-140 ng/L
 - **Orange:** 141-420 ng/L
 - **Red:** >420 ng/L

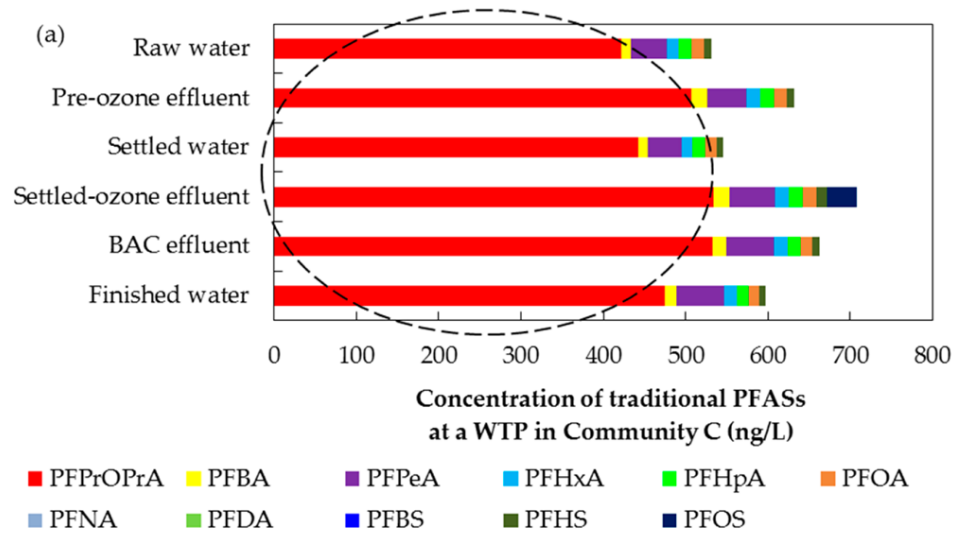


Scope of Problem – Groundwater sourced private wells

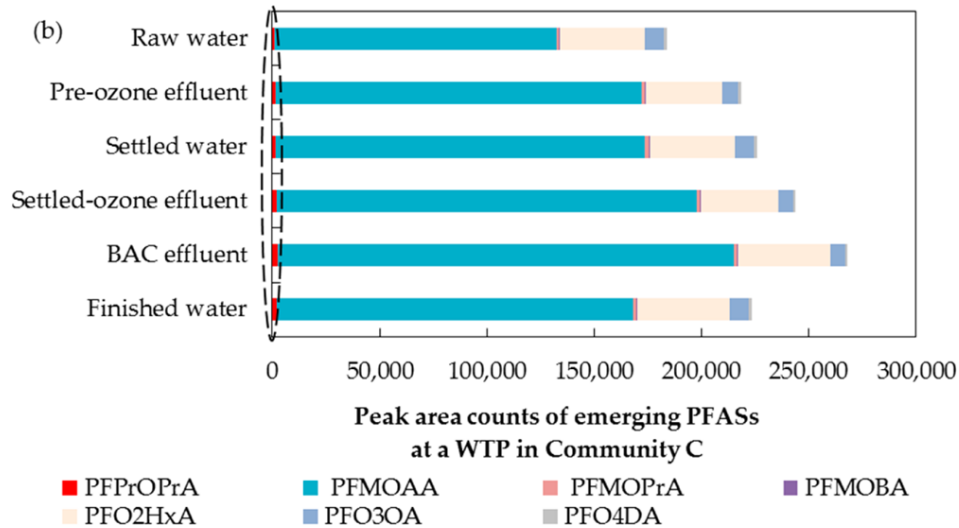
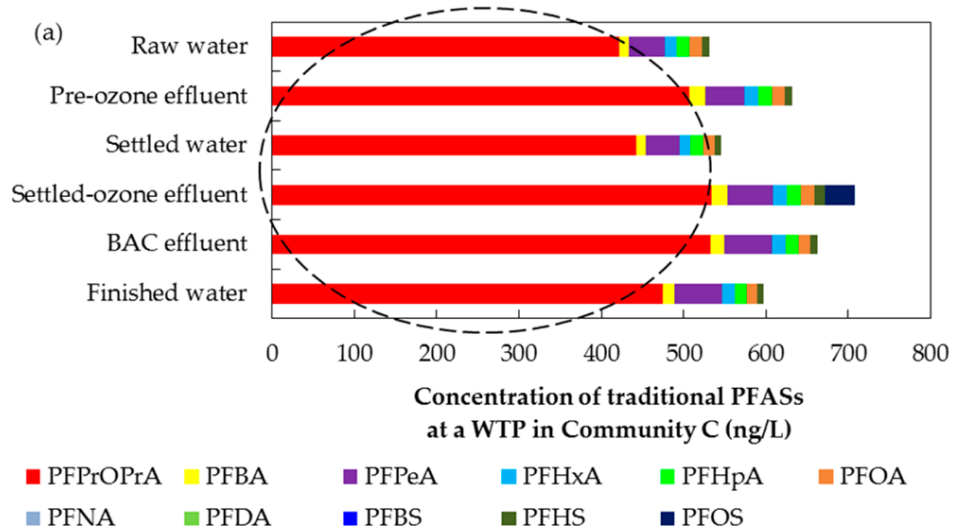
- Sampling will continue until full extent of contamination is determined
 - Dark blue: phase 1
 - Orange: phase 2
 - Light blue/yellow: phase 3
 - Fuchsia: phase 4



Scope of Problem – Other Compounds



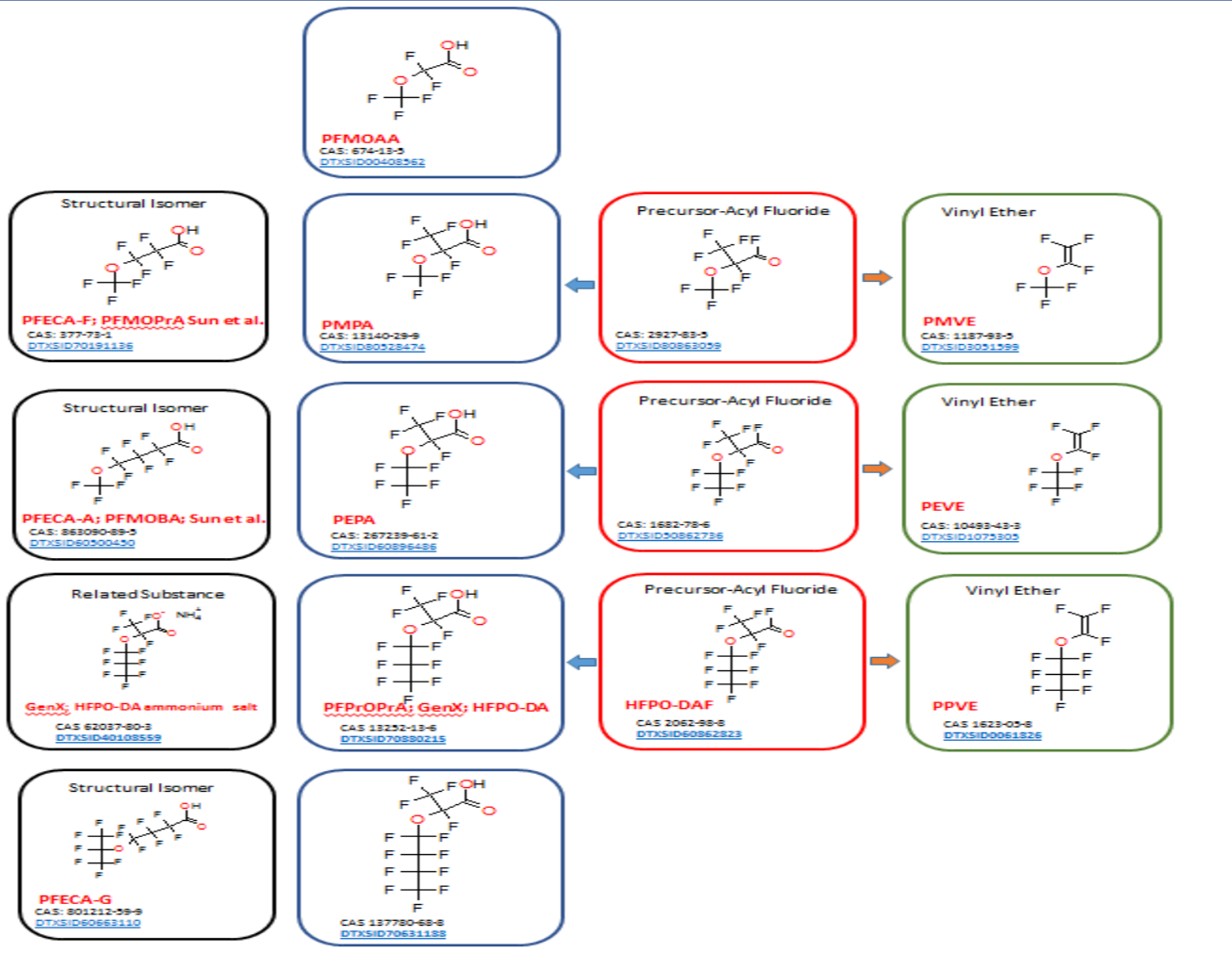
Scope of Problem – Other Compounds



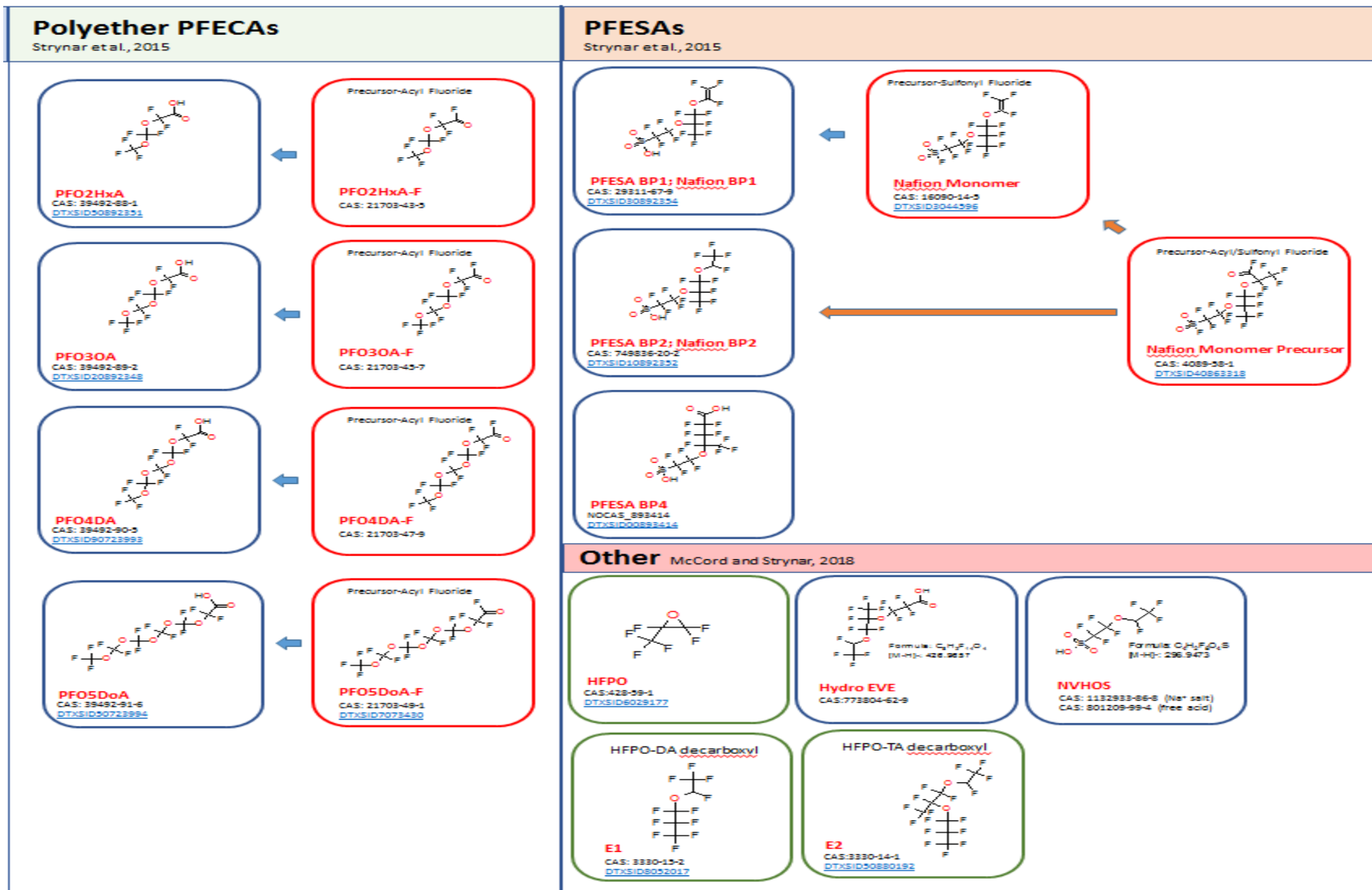
PFAS Associated with the Cape Fear River (1 of 2)

Monoether PFECAs

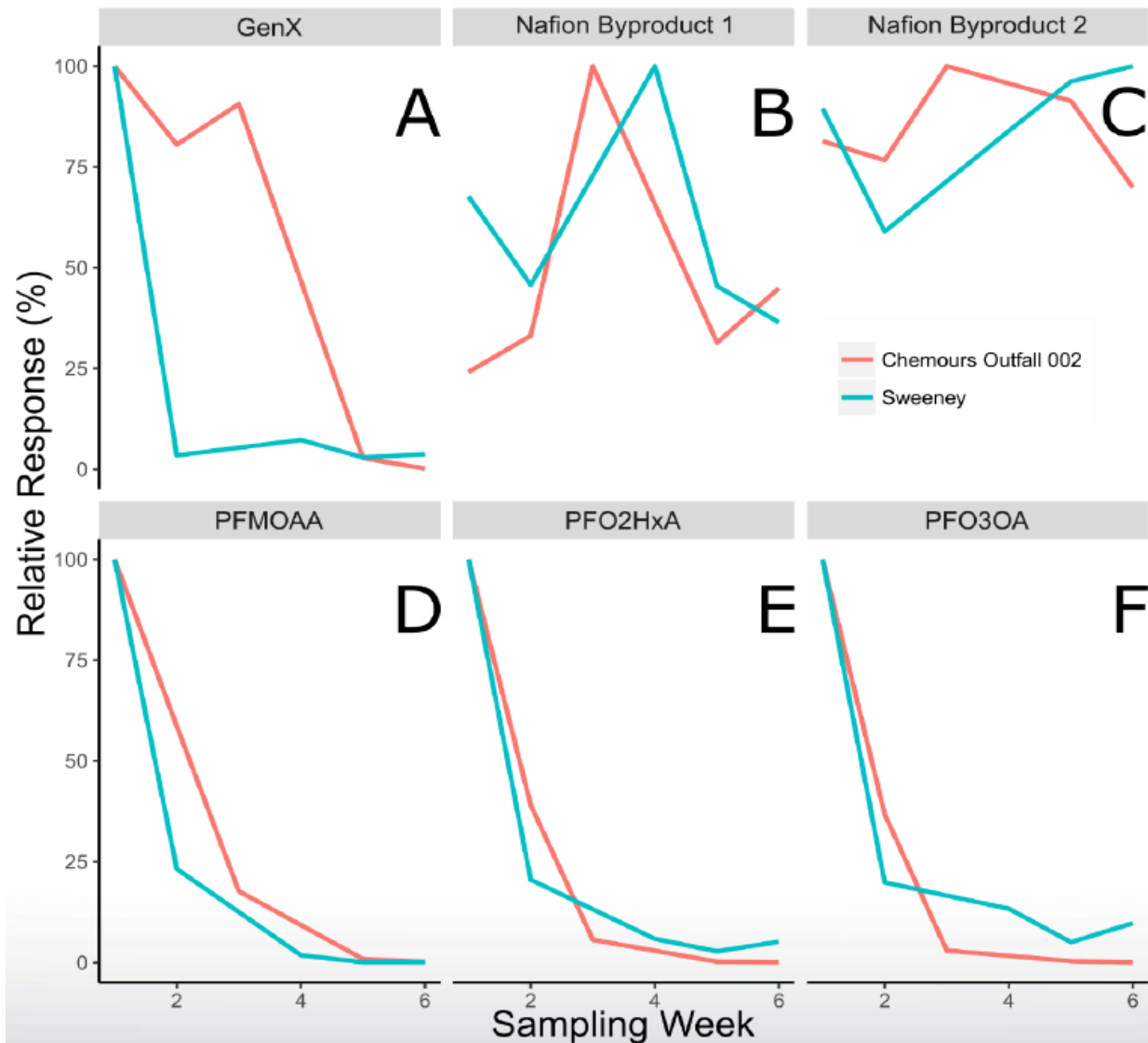
Strynar et al., 2015



PFAS Associated with the Cape Fear River (2 of 2)



PFAS Levels: Before and After Discharge Stopped



Public Health Role – Drinking Water

- **For private drinking water wells, PH provides**
 - Information about the contaminant
 - Recommendations for use or treatment options
 - Recommendations for repeat sampling
- **Guidance on public water supplies provided if requested from DEQ or local authorities**
 - Assistance with health risk evaluations, use recommendations

Usual Sources for Health-Based Guidance

- 1. National regulatory standards (EPA)**
- 2. State Standards (DEQ/Environmental Management Commission)**
- 3. National health advisories or other health values (EPA, CDC)**
- 4. Other governmental guidance**
 - Standards from other states or countries**
 - World Health Organization, European Union values**
- 5. If guidance not available from 1–4, can consider establishing state-specific health goal**

What is a Health Goal?

- **Level of contamination below which no adverse health effects would be expected over a lifetime of exposure**
- **Calculated based on the most vulnerable population**
- **Non-regulatory, non-enforceable**
- **Change as new information becomes available**

Health Goal: Data Types and Requirements

- **Must have sufficient health-related information**
 - Animal studies (*required*)
 - Epidemiologic studies
 - Other laboratory studies
- **Some health-related information not in public domain**
- **Health-related information often lacking for emerging compounds**

Repeated Oral Dose Studies ≥ 28 Days Submitted by Registrant

Study	Lowest NOAEL (mg/kg/day)	Effect
28-day study in rats	30 (male)	Highest dose tested
28-day study in mice	0.1 (male)	Adverse effects in the liver
90-day study in rats	10 (male)	Regenerative anemia
90-day study in mice	0.5 (both sexes)	Indicators of liver toxicity
Chronic toxicity / oncogenicity study in rats (2 years)	1 (male)	Adverse effects in the liver; increases in certain tumors
Reproduction / Developmental screen in mice	0.1 (F0 male) 0.5 (offspring)	Adverse effects in the liver; body weight decreases in offspring
Prenatal and Developmental study in rats	10 (maternal and fetal)	Early delivery and lower fetal weights

GenX Provisional Drinking Water Health Goal: 140ppt

- **Recommend not using well water for drinking, cooking, or preparing baby formula if exceeds 140ppt**
- **Can continue to use well water for bathing, washing dishes and laundry**
 - Per CDC, only a very small amount can get into the body through the skin
 - Little exposure expected during swimming, bathing, or showering

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• October 2017

- External Science Advisory Board begins review of health goal

• October 2018

- Board approves current health goal

• November 2018

- EPA draft RfD released

Other Public Health Actions

Summary of Selected Cancer Rates for Bladen, Brunswick, New Hanover and Pender Counties, 1996–2015, and Comparison to Statewide Rates

Background and Summary

This summary was prepared to answer questions about cancer rates in four counties that have arisen during the ongoing investigation of cancer in Bladen, Brunswick, New Hanover and Pender Counties. It includes information about causes of cancer and conclusions can be drawn about the findings described here.

Prevalence of Selected Birth Defects, 2003–2014

Bladen, Brunswick, Cumberland, New Hanover and Pender Counties and North Carolina

Summary

What is the purpose of this report?

Biological sampling for GenX and other Per- and Polyfluoroalkyl Substances (PFAS)—North Carolina, 2018

Summary

What is the purpose of this report?

This report presents results of an investigation conducted to improve understanding of exposure to GenX and other PFAS among people living near a manufacturing facility in Bladen County, NC. It describes concentrations of 17 PFAS in the blood and urine of 30 people with evidence of exposure to GenX through their private drinking water wells.

investigation of GenX and other PFAS. The prevalence of selected birth defects were obtained from the NC Birth Defects Registry. Information on all major birth defects and potential environmental

NC PFAS Biomonitoring Project

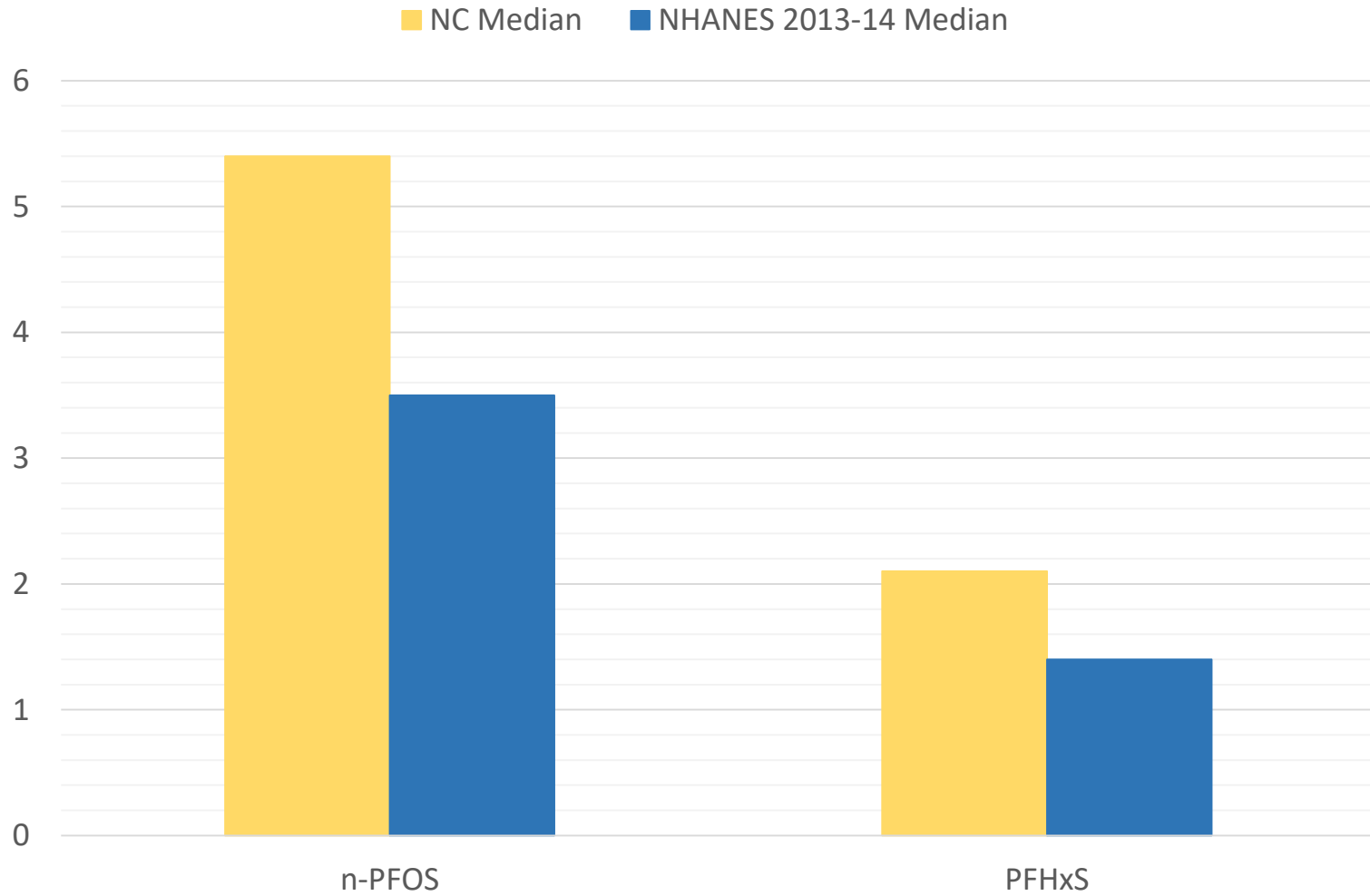
- 30 residents
 - NC DEQ well testing list
 - Highest GenX concentrations
 - Up to 2 people per house—one adult, one child
- Measured 17 PFAS in blood and urine

PFAS Abbreviation	
GenX	PFHxS
PFBS	n-PFOA
PFHxA	Sb-PFOA
PFBA	PFDA
PFHpA	PFUnDA
PFPeA	Sm-PFOS
ADONA	n-PFOS
9Cl-PF3ONS	PFNA
MeFOSAA	

NC PFAS Biomonitoring Project: Results

- GenX and 7 other PFAS not detected
- Nine other PFAS detected in at least one participant
 - PFHpA, MeFOSAA, PFHxS, n-PFOA, PFDA, PFUnDA, Sm-PFOS, n-PFOS, PFNA
- Four PFAS detected in all participants
 - PFHxS, n-PFOA, Sm-PFOS, n-PFOS
- Median levels of PFHxS and n-PFOS higher than US population

NC PFAS Biomonitoring Project Results (cont.)



NC PFAS Biomonitoring: Conclusions

- **Most PFAS not detected (including GenX) or detected at levels similar to US population**
 - May indicate GenX doesn't stay in body long
- **Two legacy PFAS median levels higher than US population**
 - Long half-lives
 - Unclear if ongoing or past exposure

NC State University GenX Exposure Study : Wilmington

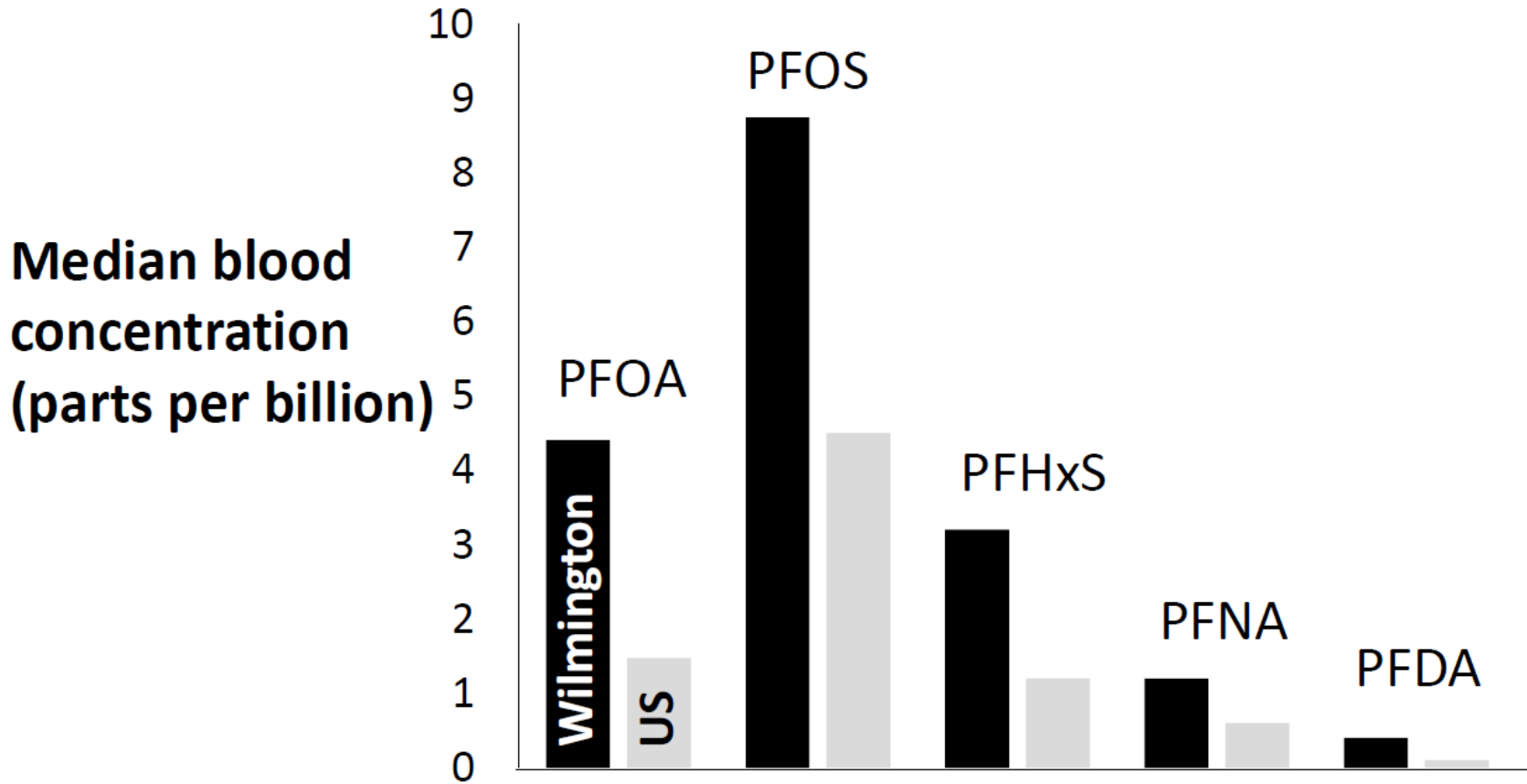
- **345 participants (56 children)**
 - 310 enrolled in November 2017
 - 35 enrolled in May 2018

- **Collected tap water, blood and urine**
 - 44 participants gave two blood samples
 - Measured 23 PFAS in blood

NC State University GenX Exposure Study : Wilmington

- GenX was NOT detected in blood
- Found four “new” PFAS in blood
 - Nafion byproduct 2 (99% of samples)
 - PFO4DA (98%)
 - PFO5DoDA (87%)
 - Hydro-EVE (76%)
- Levels decreased after six months
- Levels of historically-used PFAS higher in Wilmington than United States

NC State University GenX Exposure Study : Wilmington



Challenges/Knowledge Gaps

- **Traditional toxicology approach may not be suitable**
 - Thousands of PFAS
 - Health effects unknown for many emerging PFAS
- **Risk from exposure to PFAS mixtures unknown**
- **Limited information about other exposure routes**
 - Food, household exposures
- **Limited information about treatment/removal technologies**

Ongoing DHHS Activities and Next Steps

- **Review new and ongoing environmental testing results**
- **Provide communities with information and assist with outreach and health education**
- **Conducting community survey around facility to identify new or ongoing health concerns**
- **Ongoing coordination with CDC, EPA, and NIEHS to review new and updated health and toxicology information**

Questions?