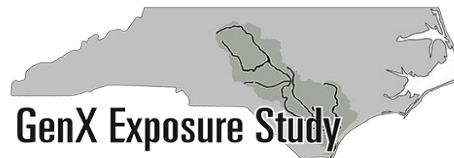




Center for Environmental  
and Health Effects of PFAS

NC STATE | ECU



# GenX Exposure Study: PFAS blood levels in Pittsboro, NC 2021, 2023

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Professor, NC State  
Principal Investigator

September 11th, 2024



# Agenda

Welcome

Introduction to PFAS and GenX Exposure Study

Overall study findings for PFAS blood levels

Overview of results for Pittsboro

Future Plans

Q&A Panel

*If you have questions, we will pass around notecards and pens for you to submit before and during the Q&A.*

# GenX Exposure Study Mission

The purpose of the GenX Exposure Study is to understand how PFAS chemicals in drinking water may impact human health of residents of the Cape Fear River Basin.

# Tonight's Topic

PFAS levels in blood samples collected in 2023.



# Background

*PFAS, and PFAS in the Cape Fear River Basin, & The GenX Study*

# Per- and Polyfluoroalkyl Substances (PFAS)

## Resistant to:

- Water
- Stains
- UV radiation

## Used in consumer products since the 1950s:

- Surfactants, lubricants, adhesives
- Carpet, upholstery, clothing
- Car interiors
- Food packaging, nonstick cookware
- Cleaning products
- Personal care products
- Fire-fighting foam

## Chemical Properties Lead to:

Persistence and bioaccumulation

Ubiquitous in indoor environment and blood (e.g., NHANES)

Transport around globe in ocean currents and atmosphere

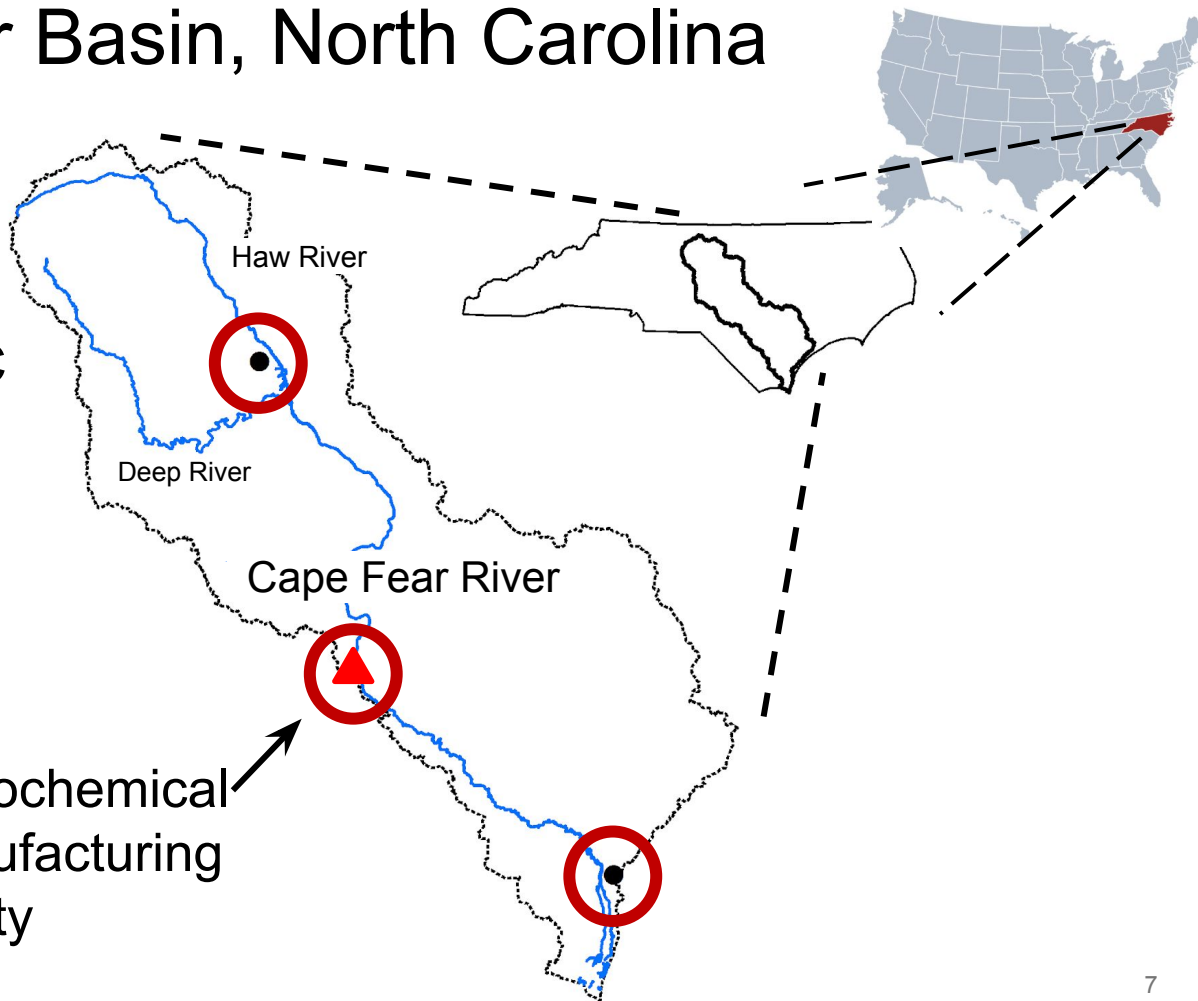


# Cape Fear River Basin, North Carolina

Largest watershed in NC

Supplies ~1.5M people with drinking water

fluorochemical  
manufacturing  
facility



# GenX Study Background: Exposure Study 2017-2019

In 2017, we started in Wilmington, NC.

In 2019, we included the Fayetteville private well community.

Found high levels of PFAS in people's blood.

Identified new PFAS associated with the Chemours.

Nafion byproduct 2, PFO5DoA, PFO4DoA in almost everyone from Wilmington

Nafion byproduct 2 and PFO5DoA in some people from Fayetteville.

We did not find GenX in people's blood.



# GenX Cohort Health Study: 2020 – date

**In 2020-21**, we enrolled 1020 people throughout the Cape Fear River Basin to measure PFAS exposure in blood and to follow them for up to 20 years to learn about health effects.

We included Pittsboro to characterize PFAS upriver from the chemical plant.

**In 2023**, we resampled 519 people and enrolled 72 new people to improve the representation of people in the sample.

**In 2024**, we plan to resample the people who did not participate in 2023.

# Study Design: GenX Cohort Study

Enroll people ages 6 and older from 3 regions in the Cape Fear Basin

Lower Cape Fear

Fayetteville

Pittsboro

Started in 2020-21

Enrolled >1000 people

Resampled in 2023

Plan to follow people for up to 20 years

Collect blood

Analyze for GenX and other PFAS

Analyze for lipids, thyroid hormones, and comprehensive metabolic panel

Report back results to community, individuals

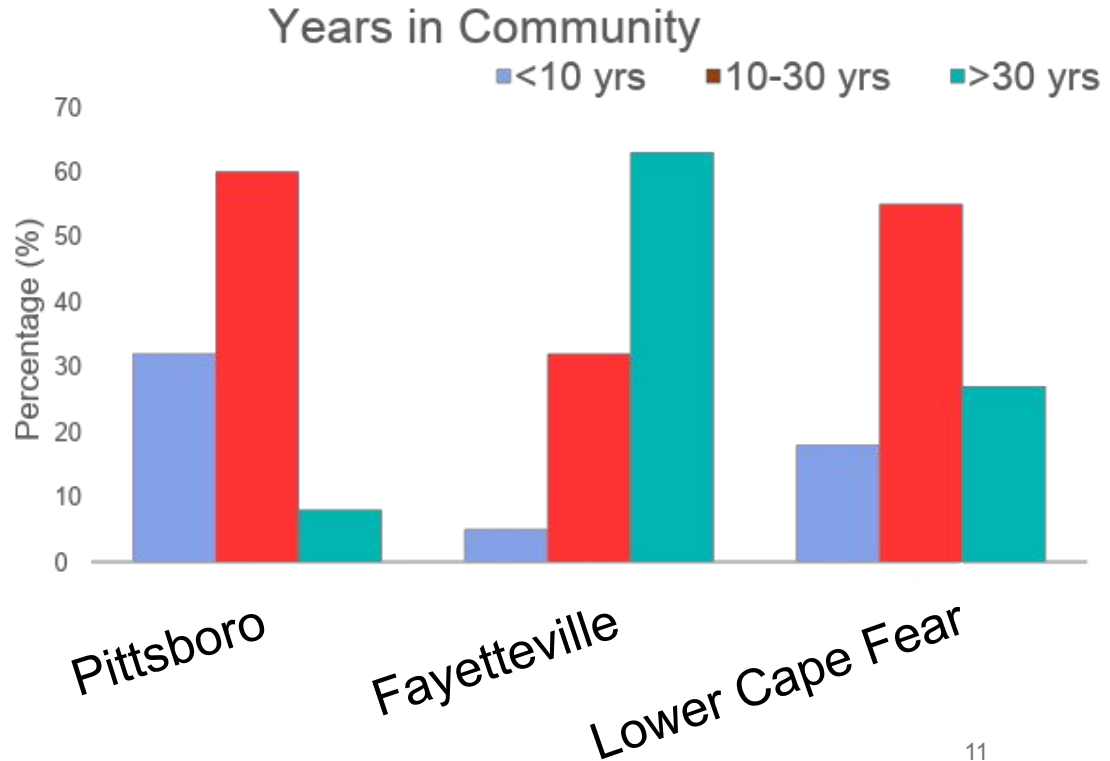


# Who is in the study?

People range in age from 6 to 92 years old.

Most people are 60 and older

About 55% female



# Sample Collection: Summer-Fall 2023

## Blood sample

### Clinical measures

- lipids,
- comprehensive metabolic panel,
- thyroid hormones
- Results returned in December 2023

### Serum PFAS

- 41 analytes in 2023
- Results returned in April-May 2024

## Body composition

## Questionnaire

Update health history

# Sample Collection 2023

Collected blood from 591 people

118 Pittsboro

126 Fayetteville

347 Lower Cape Fear

Resampled 523 of original 1019 (~50%)

Enrolled 72 new people

Mostly in Lower Cape Fear Region

# Two Letters to Study Participants about 2023 results

## Individual PFAS Results

Your individual PFAS values for 2023 and 2020/21

Your individual NASEM recommendations

## Community PFAS results

Shows where your PFAS results fit in your community

# Key Overall Findings

We measured blood samples from over 500 people for 41 different PFAS.

On average, levels of PFAS in blood are lower in 2023 than 2020-21

Not all people's blood levels went down

PFAS blood levels are still higher than most people in the US

People throughout the Cape Fear River Basin from Pittsboro to New Hanover and Brunswick Counties are adversely impacted by a variety of PFAS.

## Sampling in 2021

Collected blood from 1,019 people  
across the entire study area

206 of those were from Pittsboro

We tested for 44 different PFAS

## Sampling in 2023

Collected blood from 591 people  
across the entire study area

118 of those were from Pittsboro

4 new people

We tested for 41 different PFAS



# Tested blood samples for 41 PFAS in 2023

## 7 PFAS commonly found in people

PFOS
PFOA
PFHxS
PFNA
PFDA
PFUnDA
MeFOSAA

## Other perfluoroalkyl carboxylic acids

PFBA
PFPeA
PFHxA
PFHpA
PFTTrDA
PFDoA
PFTeDA
PFHxDA
PFODA

## Other perfluoroalkyl sulfonic acids

PFBS
PFPeS
PFHpS
PFNS
PFDS

## Perfluoroether carboxylic acids

PEPA
GenX
PFO3OA
PFO4DA
PFO5DoA
NaDONA

## Perfluoroether sulfonic acids

Nafion byproduct 1
Nafion byproduct 2
F53B Major (9CI-PF3ONS)

## Perfluoroalkyl sulfonamides

6:2 FTS
FHxSA
FOSA
MeFOSA
F53B Minor (11CI-PF3OUdS)
FBSA
NEtFOSAA

## Fluorotelomer carboxylic acid

7:3 FTCA
----------

## Fluorotelomer sulfonic acids

10:2 FTS
8:2 FTS
4:2 FTS

Samples analyzed at Eurofins laboratory in Sacramento, CA

# Focus today on **these PFAS**

## 7 PFAS commonly found in people

PFOS  
 PFOA  
 PFHxS  
 PFNA  
 PFDA  
 PFUnDA  
 MeFOSAA

## Other perfluoroalkyl carboxylic acids

PFBA  
 PFPeA  
 PFHxA  
 PFHpA  
 PFTTrDA  
 PFDoA  
 PFTeDA  
 PFHxDA  
 PFODA

## Other perfluoroalkyl sulfonic acids

PFBS  
 PFPeS  
 PFHpS  
 PFNS  
 PFDS

## Perfluoroether carboxylic acids

PEPA  
 GenX  
 PFO3OA  
 PFO4DA  
 PFO5DoA  
 NaDONA

## Perfluoroether sulfonic acids

Nafion byproduct 1  
 Nafion byproduct 2  
 F53B Major (9Cl-PF3ONS)

## Perfluoroalkyl sulfonamides

6:2 FTS  
 FHxSA  
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 MeFOSA  
 F53B Minor  
 (11Cl-PF3OUdS)  
 FBSA  
 NEtFOSAA

## Fluorotelomer carboxylic acid

7:3 FTCA

## Fluorotelomer sulfonic acids

10:2 FTS  
 8:2 FTS  
 4:2 FTS

# Four PFAS were found in almost everyone:

PFOS

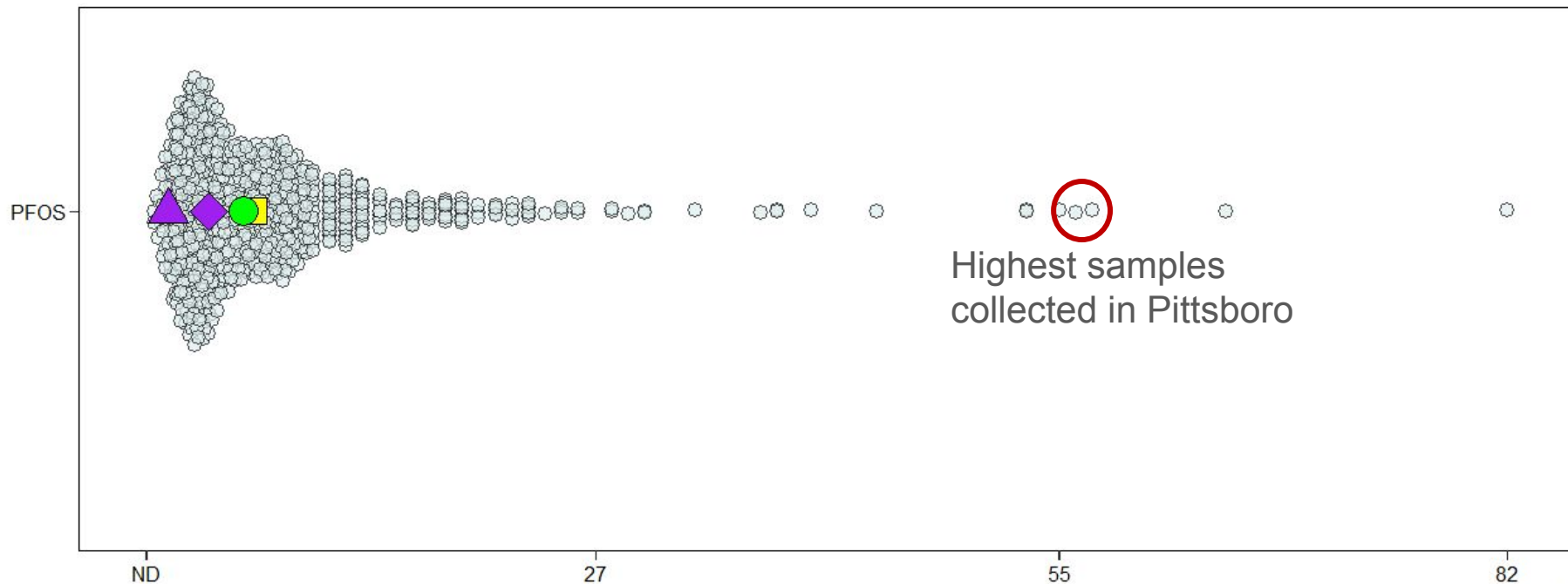
PFOA

PFHxS

PFNA

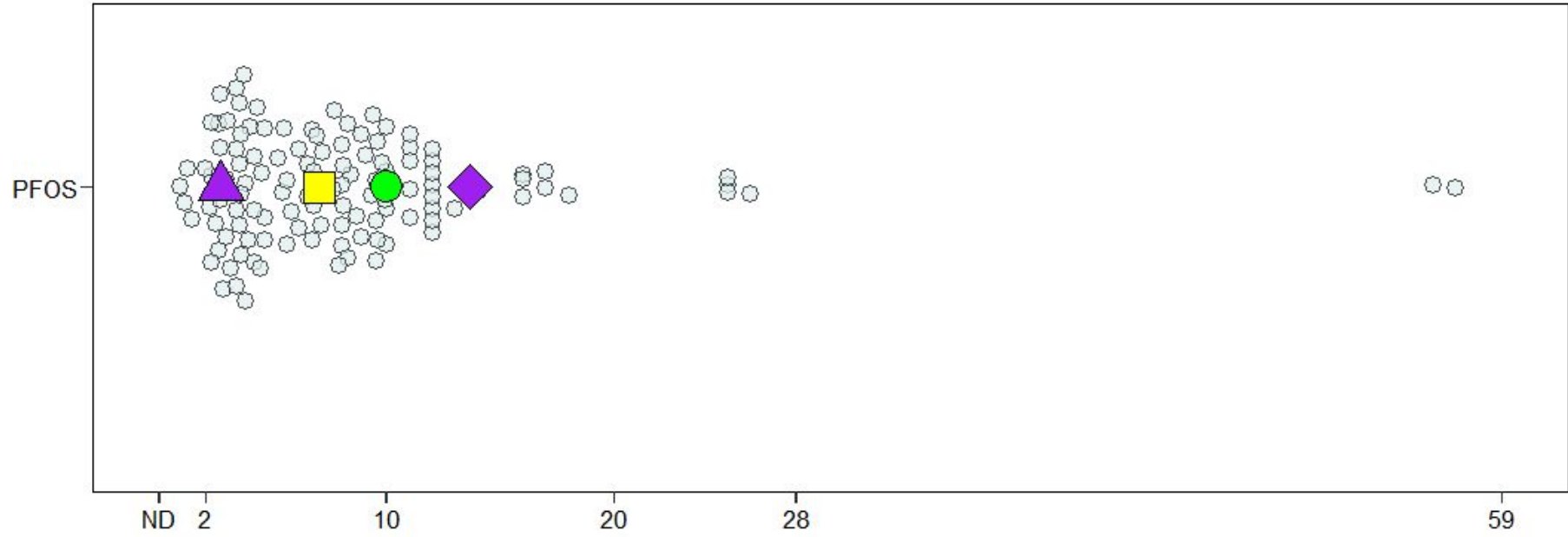
# Stripchart for PFOS for entire study, 2023

○ Individual Samples   ● Your Sample   ■ 2023 Sample Median   ▲ United States Median   ◆ United States 95th Percentile



# Stripchart for PFOS for Pittsboro, 2023

○ Individual Samples   ● Your Sample   ■ 2023 Sample Median   ▲ United States Median   ◆ United States 95th Percentile



N=118



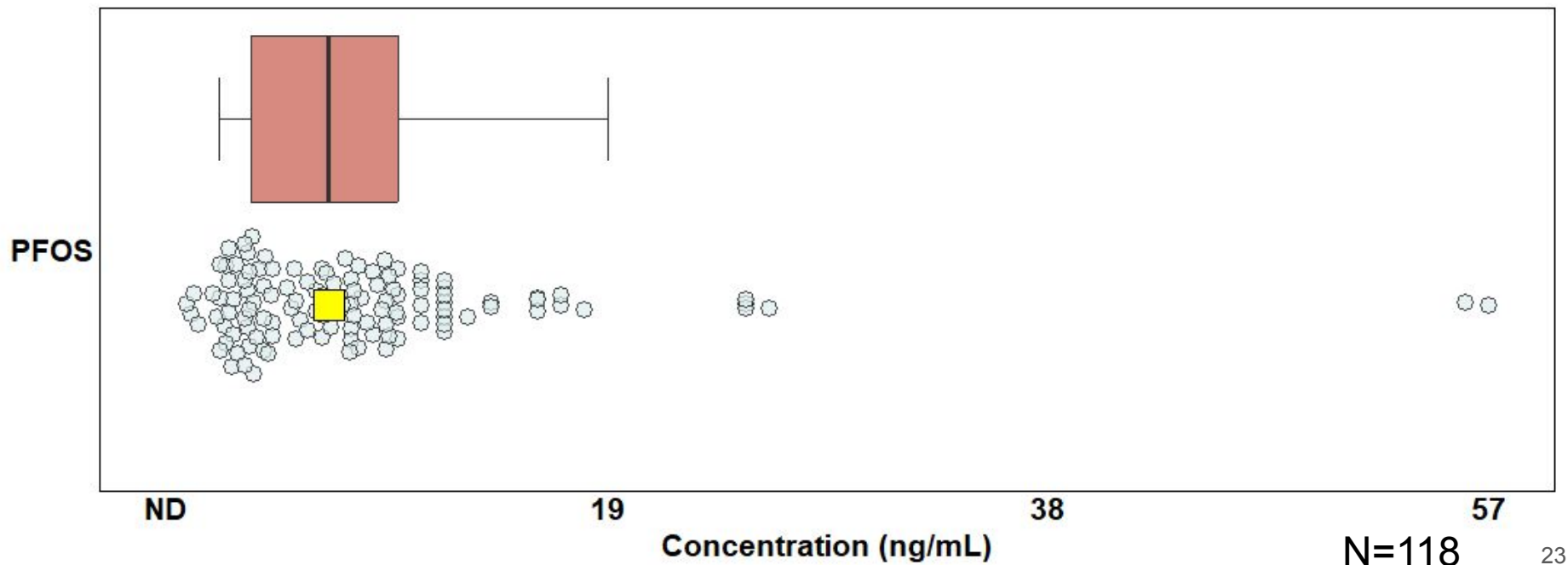
# Strip Charts of Individual PFAS Across Pittsboro Samples 2023

○ Individual Samples   ● Your Sample   ■ 2023 Sample Median   ▲ United States Median   ◆ United States 95th Percentile

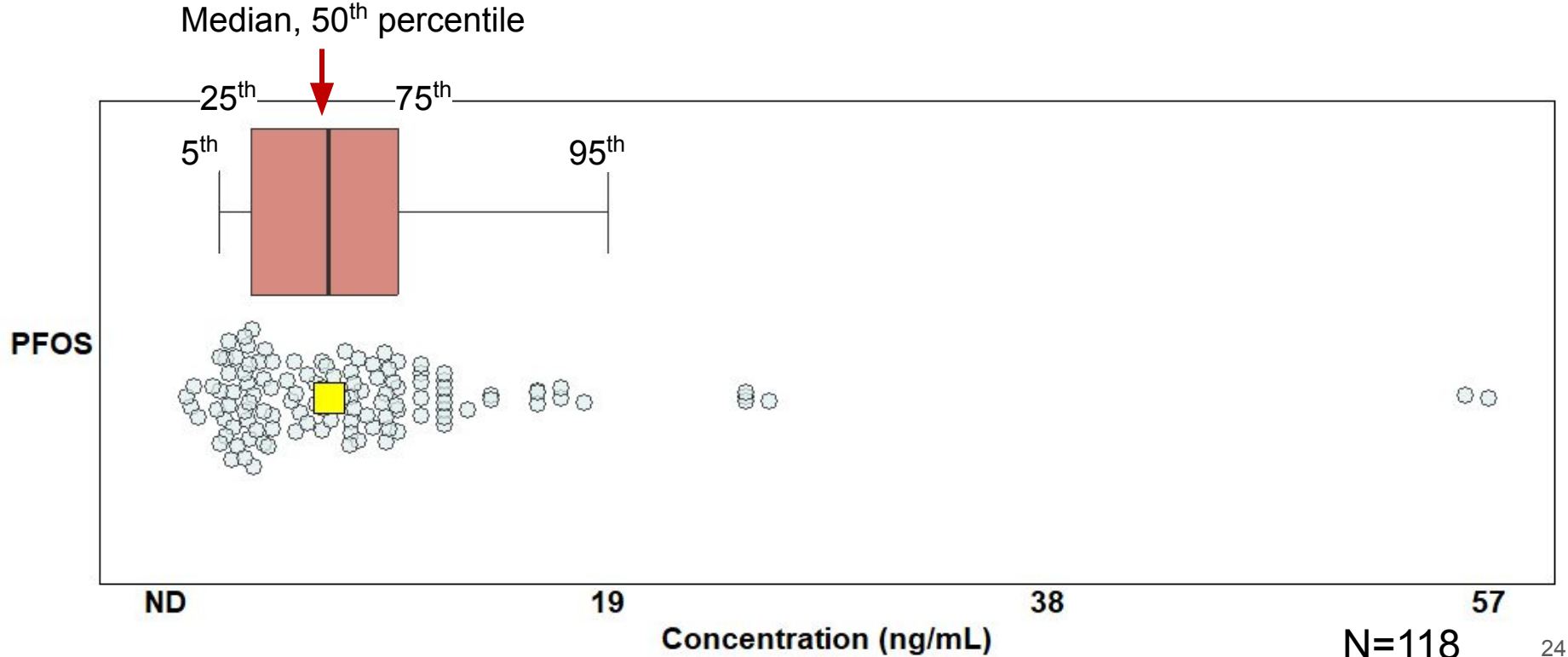


N=118

# Pittsboro 2023 PFOS Stripchart to Boxplot

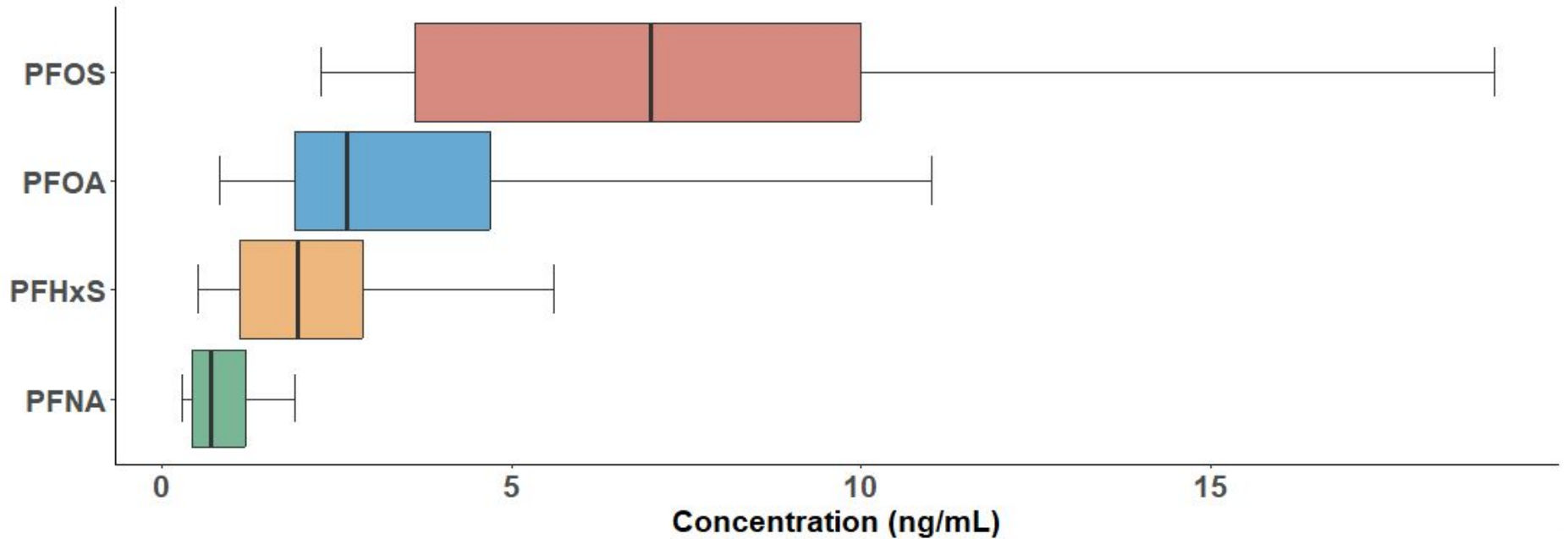


# Pittsboro 2023 PFOS Stripchart to Boxplot



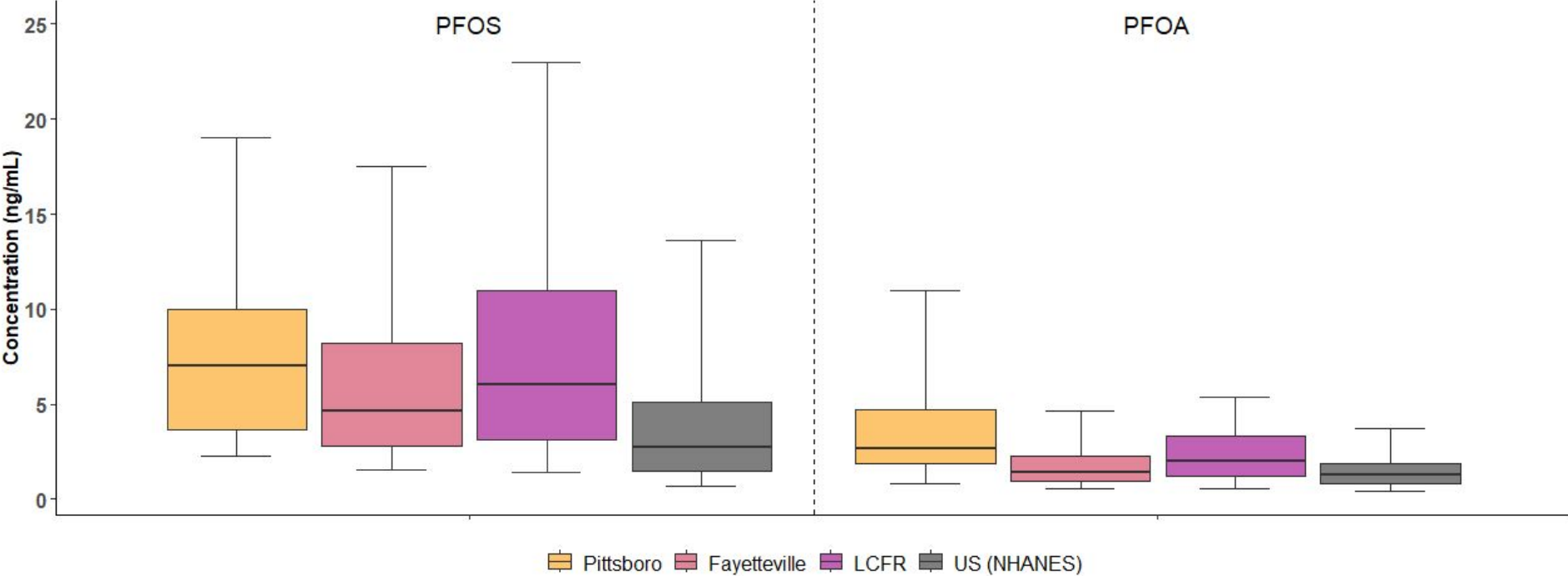


# PFAS Levels for 4 most common PFAS in Pittsboro 2023



N=118

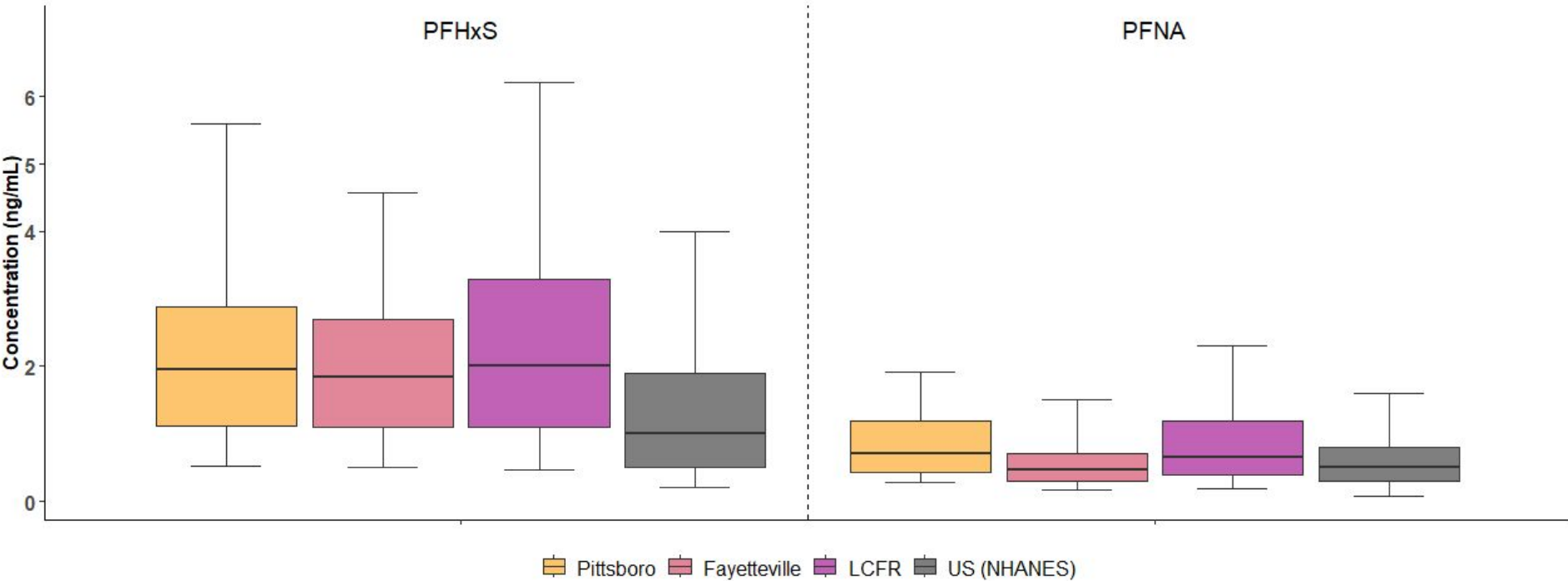
# PFOS & PFOA Levels in 2023 by community compared to US population for 2017-2020



2023 GenX Samples



# PFHxS and PFNA Levels from 2023 by community compared to US population for 2017-2020



2023 GenX Samples



# How have PFAS blood levels changed over time?

For the common PFAS (PFOS, PFOA, PFHxS, PFNA), the levels in blood have decreased over time

In people with two measurements (N=519)

PFOS dropped 1.7 ng/mL (24%)

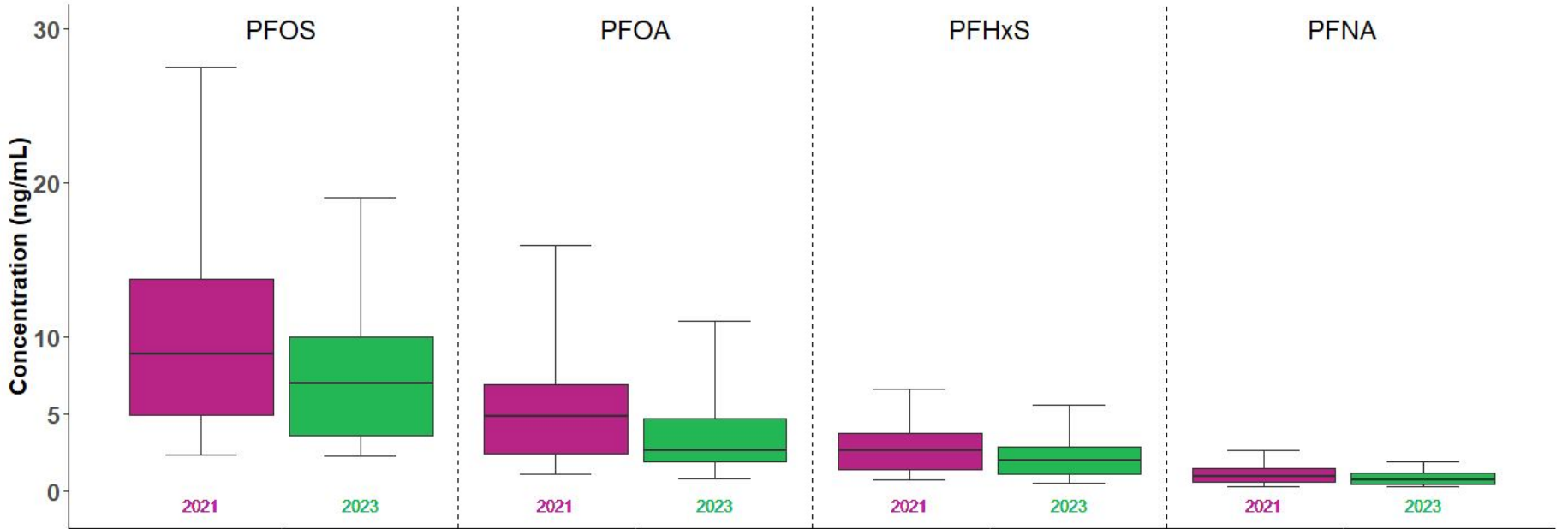
PFOA dropped 1 ng/mL (32%)

PFHxS dropped 0.5 ng/mL (21%)

In a 2-3 year period

Results are similar over all communities.

# PFAS Blood Levels in 2021 vs 2023 in Pittsboro samples



N=114

N=114

# Not all people's PFAS levels went down

We measured 41 PFAS in people's blood

Some individuals had one or more PFAS increase

We are working to understand why?

- Maybe a different exposure source than water

  - Food, cleaning products, occupational exposures?

- Change in body composition

  - We're measuring chemicals in people's bodies, so changes in your body may affect the concentration we measure

- Analytical variability

  - Some levels are really low and may bounce around a bit.

Reach out to us if you want help identifying why your levels changed.

# Chemours-related PFAS

# What about the Chemours-related PFAS

In 2023, we continued to find PFO5DoA and Nafion byproduct 2 in the blood of most people from the Lower Cape Fear Region & about 20% of the people from Fayetteville.

Overall, the levels continue to decrease over time.

	Lower Cape Fear Region	Fayetteville
PFO5DoA	90%	18%
Nafion byproduct 2	57%	21%

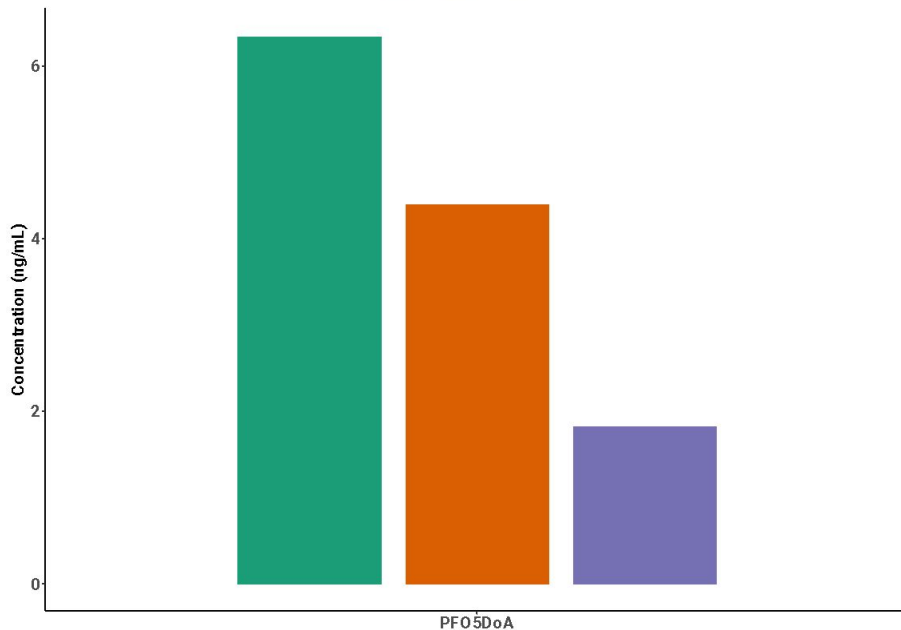


# Change in median levels in blood samples (ng/mL) since 2020

## PFO5DoA

Change in Median PFO5DoA concentrations in LCFR

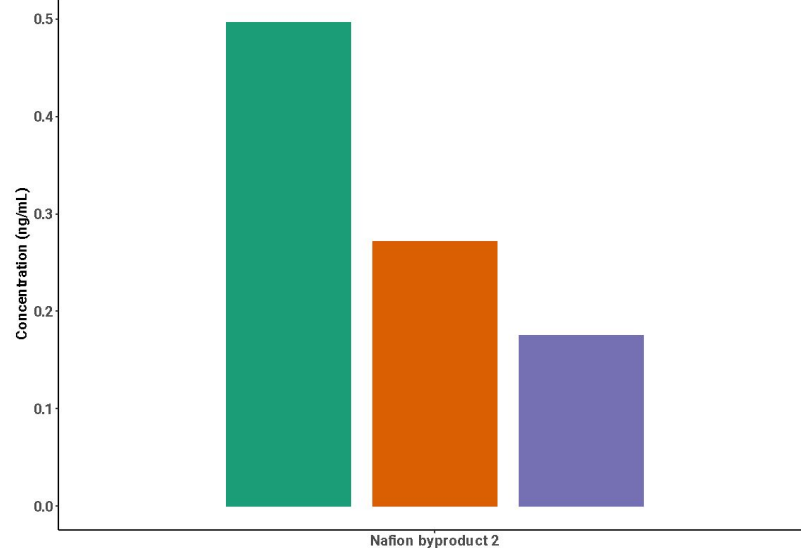
2020 2021 2023



## Nafion byproduct 2

Change in Median Nafion byproduct 2 concentrations in LCFR

2020 2021 2023



# Key Findings

We measured blood samples from over 500 people for 41 different PFAS.

1. On average, levels of PFAS in blood are lower in 2023 than 2020-21
2. Not all people's blood levels went down
3. PFAS blood levels are still higher than most people in the US
4. People throughout the Cape Fear River Basin from Pittsboro to New Hanover and Brunswick Counties are adversely impacted by a variety of PFAS.

# What can I do with this information?

*NASEM Recommendations, Study Retention,  
and Exposure Control*

# Guidance on PFAS Exposure, Testing, and Clinical Follow-Up

July 2022

# NASEM 7 in 2023



Sum of 7 serum PFAS  
(PFOS, PFOA, PFHxS, PFNA, PFDA,  
MeFOSAA, PFuNDA)

Does not include  
PFHps, Nafion byproduct 2, PFO5DoA

Overall ~20% exceed 20 ng/mL

The fact that levels are now lower doesn't  
negate the fact that levels were higher.

## **$\geq 20$ ng/mL summed PFAS**

Higher risk of adverse effects  
Reduce exposure  
Also test for thyroid function, kidney and testicular  
cancer, ulcerative colitis

## **2 - <20 ng/mL summed PFAS**

Potential for adverse effects in sensitive populations  
Reduce PFAS exposure  
Screen for dyslipidemia, hypertensive disorders of  
pregnancy, and breast cancer

## **< 2 ng/mL summed PFAS**

Adverse health effects not expected. Recommend  
usual standard of care.



# What can you do about PFAS exposure and health effects?

If you're in the study, please stay in the study. This lets us learn how the chemicals are moving through our bodies and potential health effects.

If your PFAS levels have increased, think about potential ways you might come into contact with PFAS

- Home grown fruits and vegetables, eggs

- Occupational Exposures

and consider potential changes in your body.

- Weight change

- New medication

# What can you do about PFAS exposure and health effects?

If you live in a region in the Cape Fear River, consider your potential for PFAS exposure. Because almost all people in the study were classified at some potential adverse risk, talk to your health care provider about actions you can take to protect your health.

Think about how you may be exposed to PFAS.

- Home grown fruits and vegetables, eggs

- Occupational Exposures

# If you want to test for PFAS in your blood:

There are resources on the GenX Study website to help you find the testing you want.



# What is next?

*Resampling and Scientific Papers*

# What's next for study? 2024

We plan to resample anyone who enrolled between 2020 and 2023 to ensure that we have two measurements per person.

If we missed you last year, we will be contacting you to make sure we include you this year.

If you've moved, changed your email or phone, please let us know.

[genx-exposure-study@ncsu.edu](mailto:genx-exposure-study@ncsu.edu) or call us at (855) 854-2641

We'll be sampling those we missed in 2023 in Pittsboro on Oct 4 and 5, 2024.

You can schedule with us at the end of the meeting.

# What's next for the Study: Health effects evaluation

We are currently working on scientific papers looking at how PFAS may affect

Thyroid hormones

Liver enzymes

We hope to publish these by early 2025 and share these results with you.

If you have ideas for things we should look at, please reach out.

# If you want to learn more: invite your friends

Attend our in-person meetings (details on website)

Fayetteville, September 17th

Gray's Creek Community Building

6:00 - 8:00 p.m.

Wilmington, end of September/early October

Details available soon

Check out our website ([genxstudy.ncsu.edu](http://genxstudy.ncsu.edu))

Follow our Instagram! [@ncsu\\_genx\\_study](https://www.instagram.com/ncsu_genx_study)

# Thank you to our funders and partners!

- NC State
- ECU
- Cape Fear River Watch
- Haw River Assembly
- Sustainable Sandhills
- New Hanover County Health Department
- Cumberland County Health Department
- Chatham County Health Department
- New Hanover County NAACP
- Warner Temple AME Zion Church
- Town of Navassa
- Our wonderful study participants

Funding: NIEHS R21 R21ES029353, P42ES031009  
CHHE P30ES025128  
Matching Funds from NC Policy Collaboratory

# Q&A Session

*Notecards and pens are being passed around if you would like your questions to be anonymous.*

# Welcome to our panelists!

Detlef Knappe, PhD

S. James Ellen Distinguished Professor, NC State

Cindy Perry

Former Mayor of Pittsboro

Kyle Shipp

Current Mayor of Pittsboro

Heather Stapleton, PhD, MS

Ronie-Richele Garcia-Johnson Distinguished Professor, Duke University

Co-Chair, Ecotoxicology and Environmental Health

Emily Sutton

Executive Director & River Keeper, Haw River Assembly