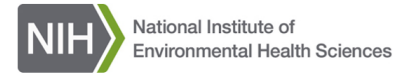




Center for Environmental  
and Health Effects of PFAS  
NC STATE | ECU



# Welcome!

# Thank you for joining.

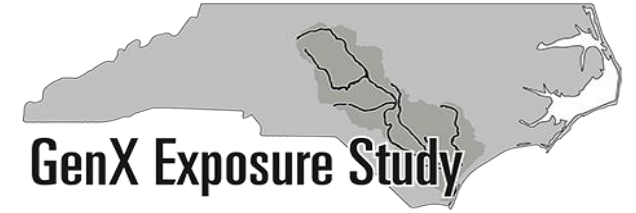
We will begin at 6 p.m.

This webinar will be recorded and uploaded to our website  
([genxstudy.ncsu.edu](http://genxstudy.ncsu.edu)).



Center for Environmental  
and Health Effects of PFAS

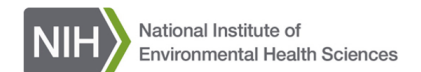
NC STATE | ECU

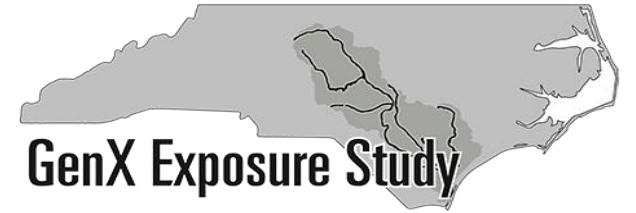


# GenX Exposure Study Update: PFAS results for blood samples collected 2023

Jane Hoppin  
Professor, NC State  
Principal Investigator

August 6, 2024





# Webinar: August 6, 2024

Welcome

Introduction to PFAS and GenX Exposure Study

Overview of community-level results

Future Plans

*If you have questions during the presentation, please use the Q&A function.*

*This webinar is being recorded and will be uploaded to our website ([genxstudy.ncsu.edu](http://genxstudy.ncsu.edu)).*

*In case loss of power/connection due to inclement weather, we will record and upload the presentation once able.*

# 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 from over 500 people throughout the Cape Fear River Basin collected in 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.

# Background

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

# Per- and Polyfluoroalkyl Substances (PFAS)

## Resistant to:

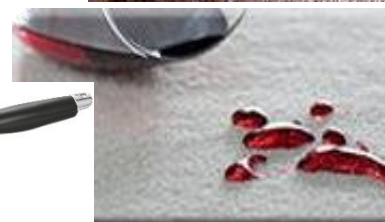
- Water
- Stains
- UV radiation

## Used in consumer products since the 1950s:

- Surfactants, lubricants, adhesives
- Carpet, upholstery, clothing
- Car interiors (e.g., Simoniz)
- Food packaging, nonstick cookware
- Cleaning products
- Personal care products
- Fire-fighting foam

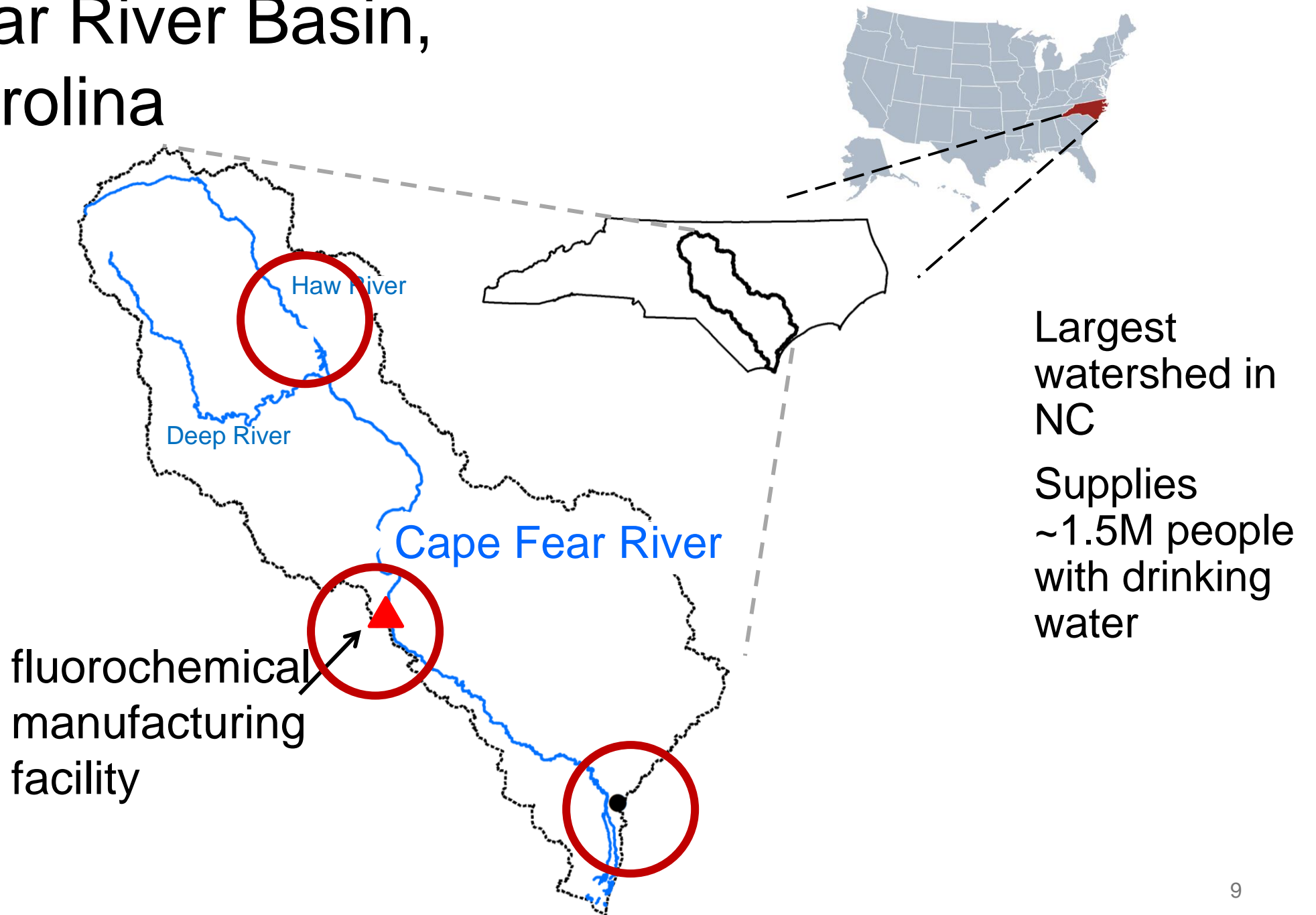
## Chemical Properties Lead to:

- 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



# 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.

**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 Health Study

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

Pittsboro

Fayetteville Private Well Community

Lower Cape Fear

Started in 2020-21

Enrolled >1000 people

Resampled in 2023

Plan to continue to collect data on study participants for up to 20 years



# 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

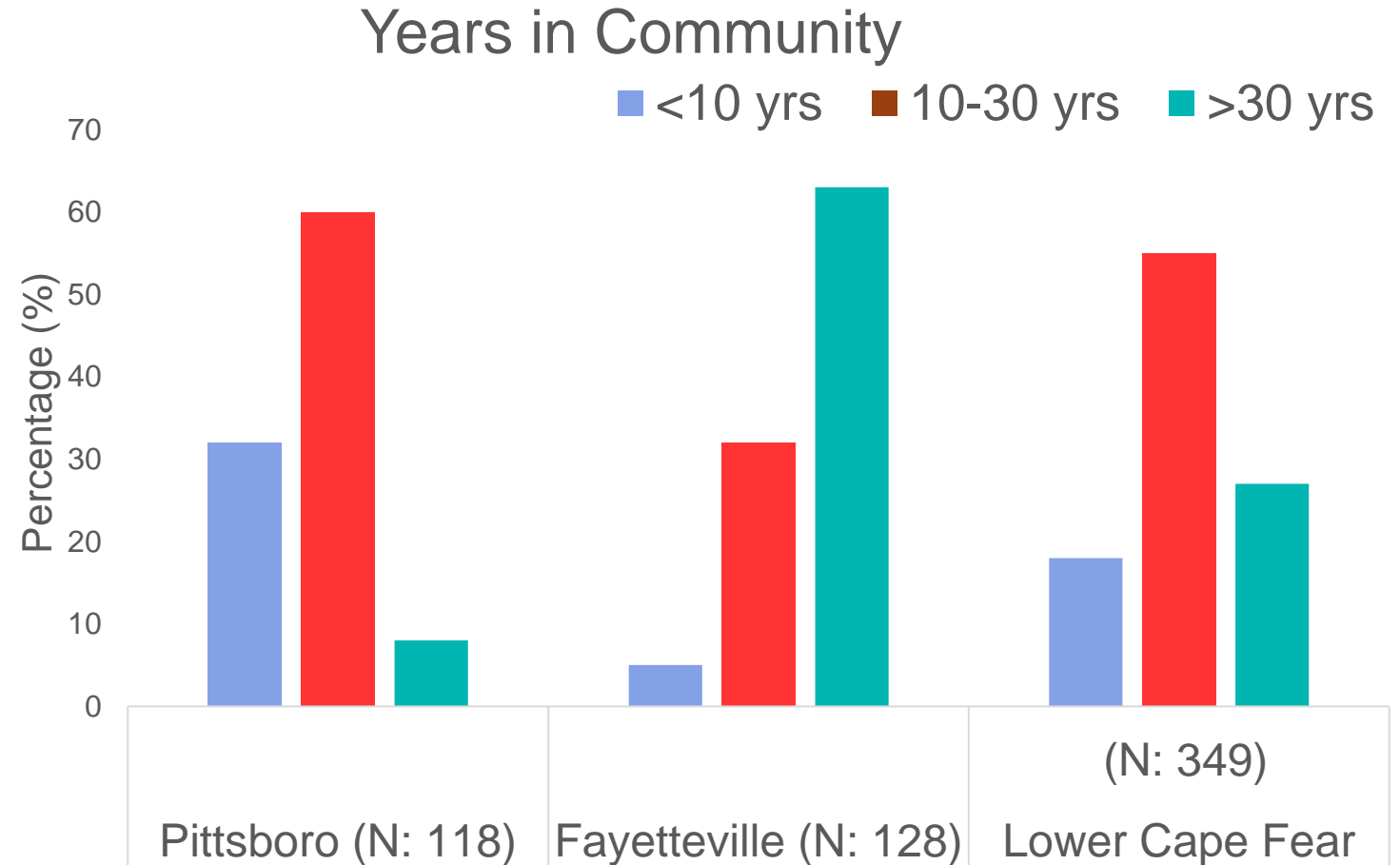
Mostly in Lower Cape Fear Region

# Who is in the study?

People range in age from 6 to 92 years old.

Most people are 60 and older

About 55% female



# Tested blood samples for 41 PFAS

## 7 PFAS found in most people in US

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  
FOSA  
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

## Zwitterions

N-TAmP-FHxSA  
N-CMAmP-6:2FOSA (6:2  
FTAB)  
N-AP-FHxSA

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  
FOSA  
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

## Zwitterions

N-TAmP-FHxSA  
N-CMAmP-6:2FOSA (6:2 FTAB)  
N-AP-FHxSA



Four PFAS were found in almost everyone:

PFOS

PFOA

PFHxS

PFNA

# Two Letters to Study Participants about 2023 results

## Individual PFAS Results

- Your individual PFAS values for 2023 and 2020/21

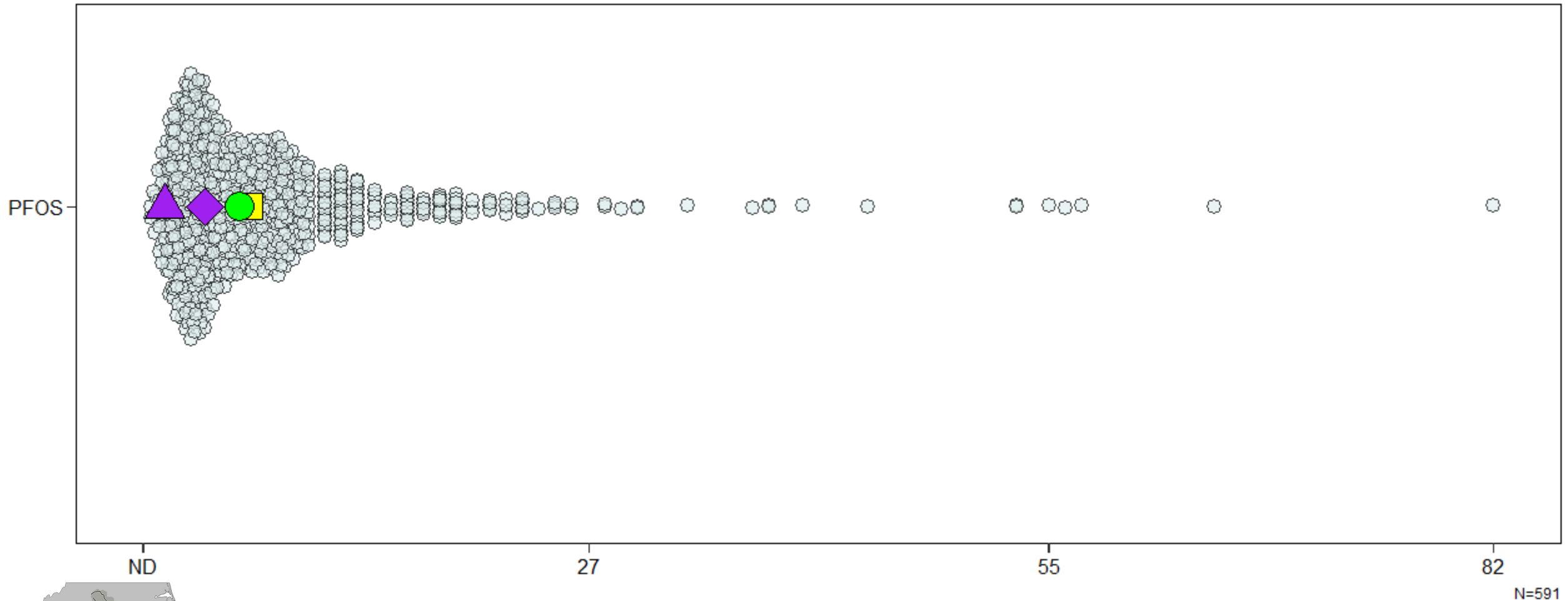
- Your individual NASEM recommendations

## Community PFAS results

- Shows where your PFAS results fit in your community

# Strip charts show spread of results

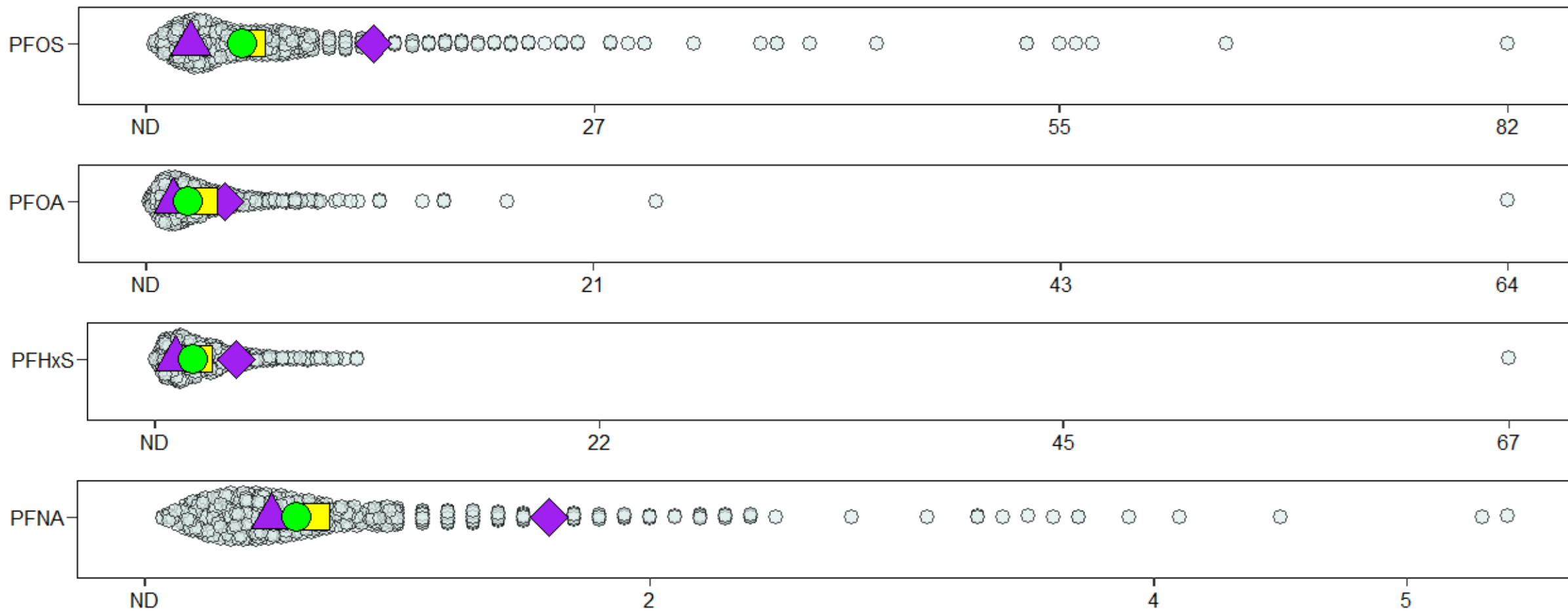
○ Individual Samples   ● Your Sample   ■ 2023 Sample Median   ▲ United States Median   ◆ United States 95th Percentile



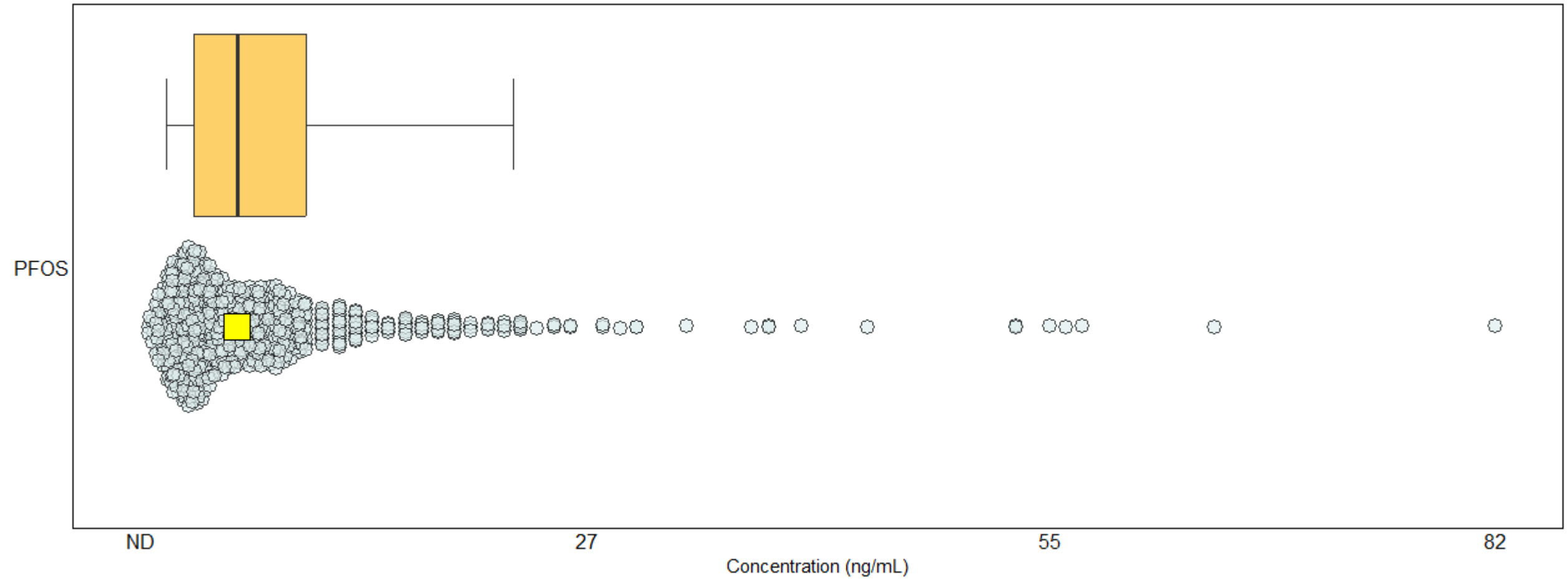
N=591

# Strip Charts of Individual PFAS Across Cohort 2023 (example)

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



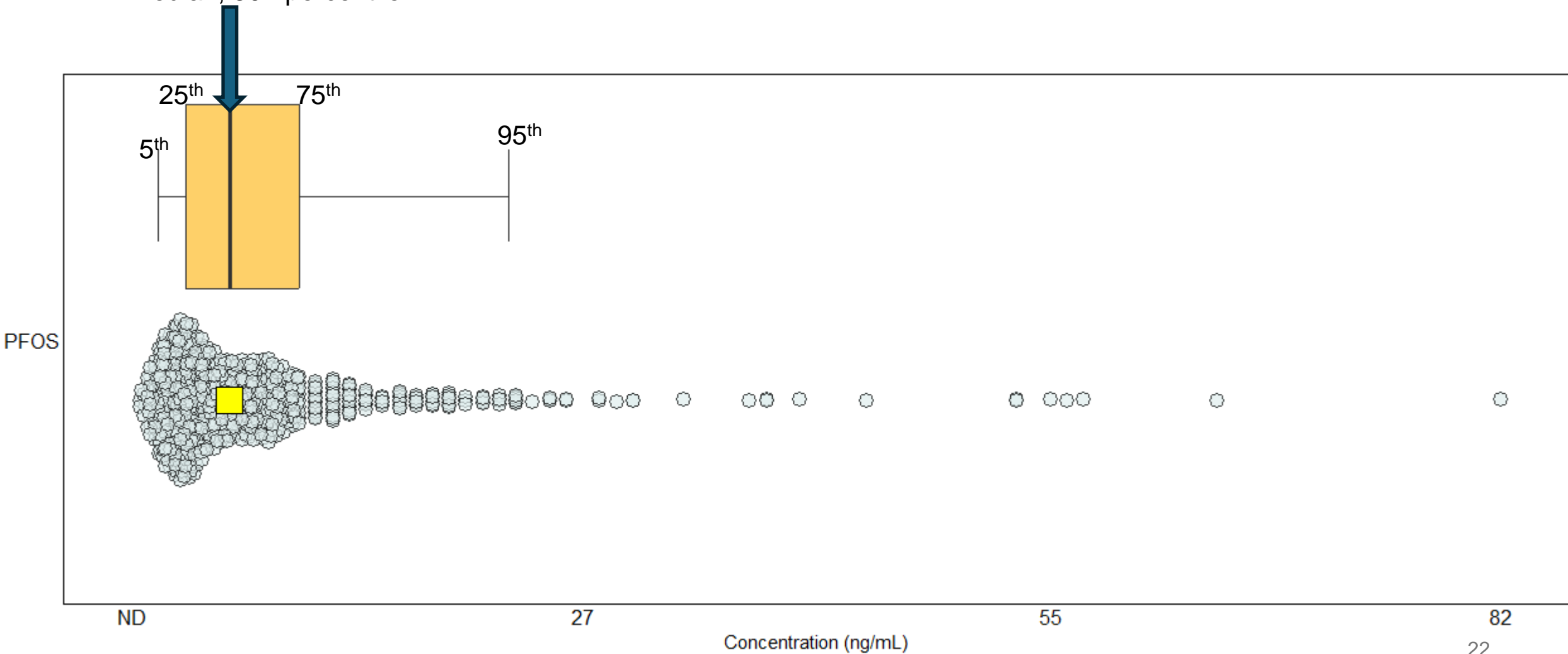
# Strip chart to box plot



N=591

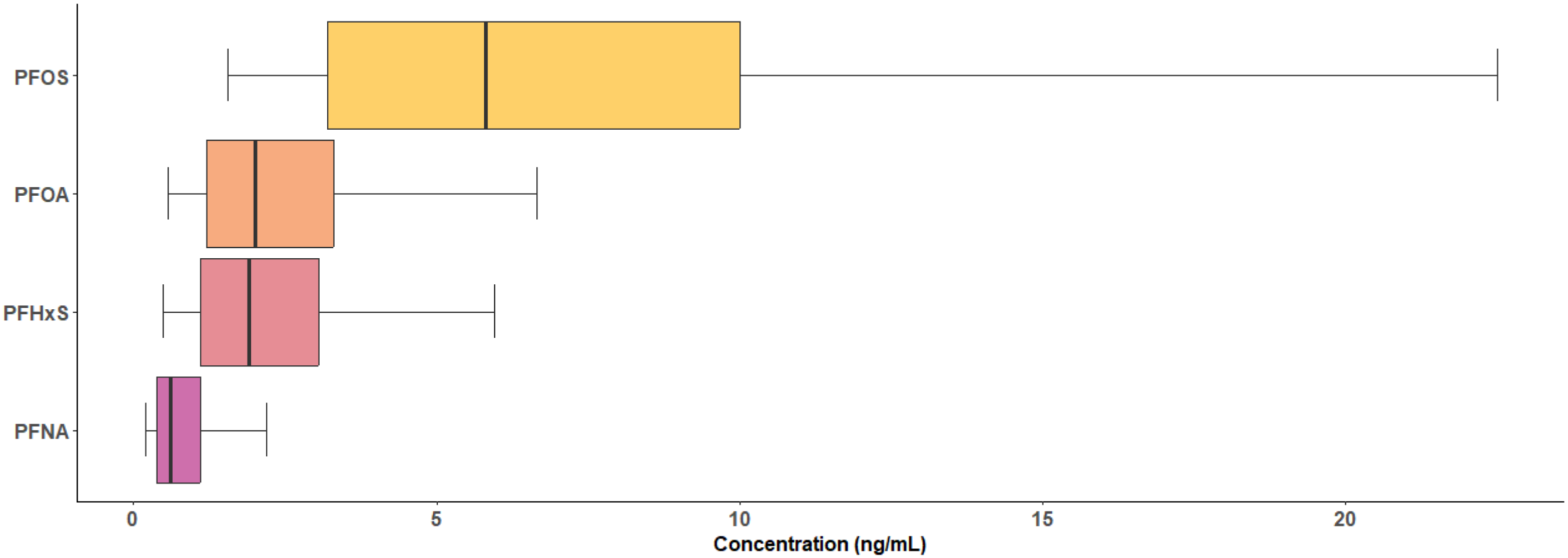
# Strip chart to box plot

Median, 50<sup>th</sup> percentile



# PFAS Levels for 4 most common PFAS in full cohort 2023

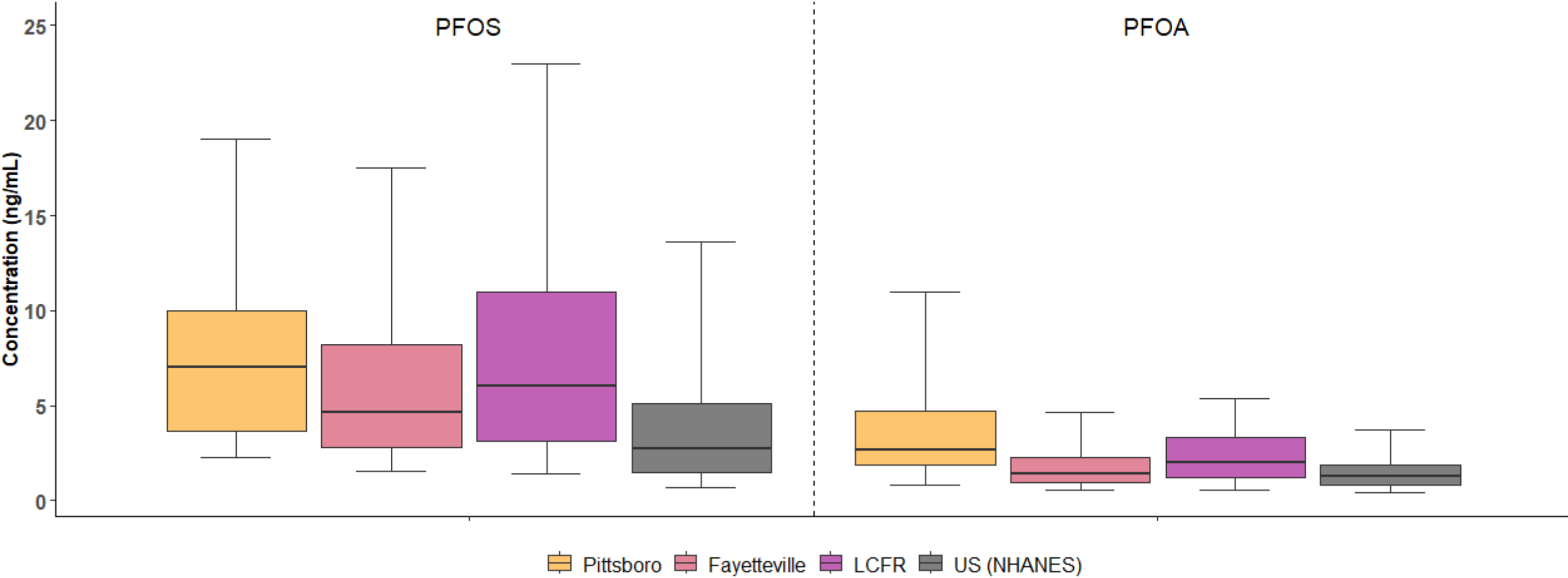
2023 PFAS levels: GenX Study



N=591



# PFAS Levels by Community compared to US population

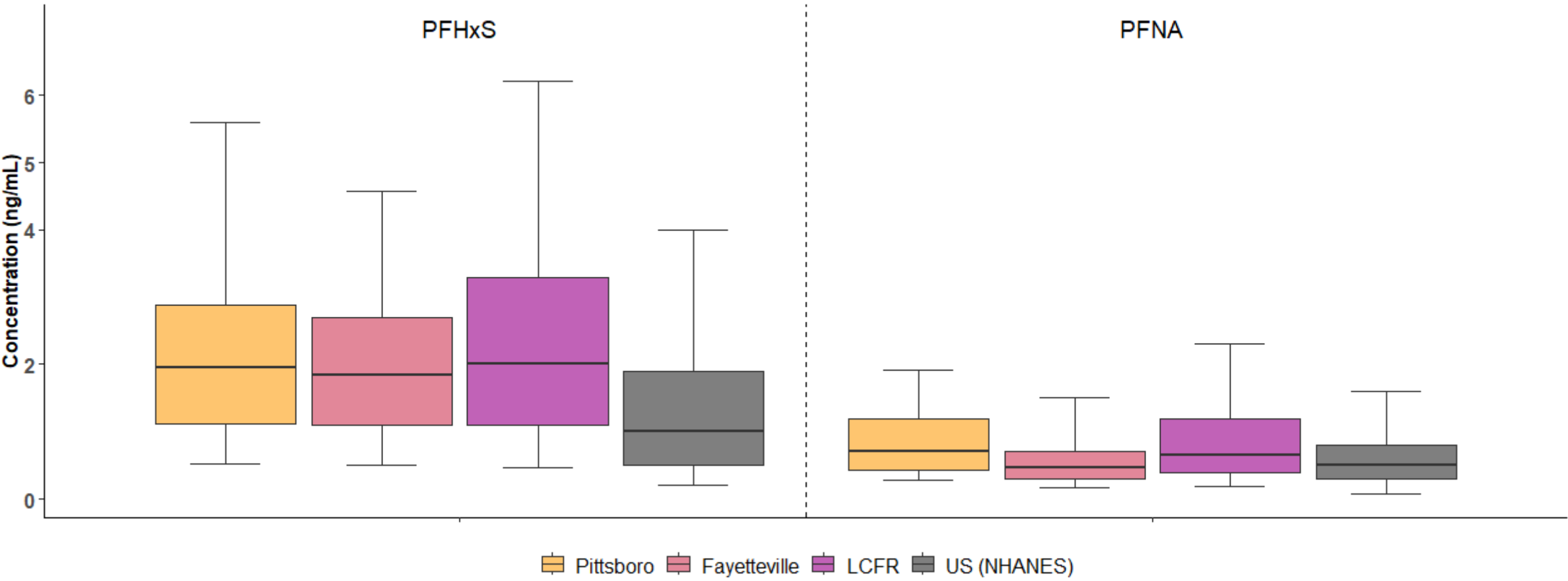


2023 GenX Samples





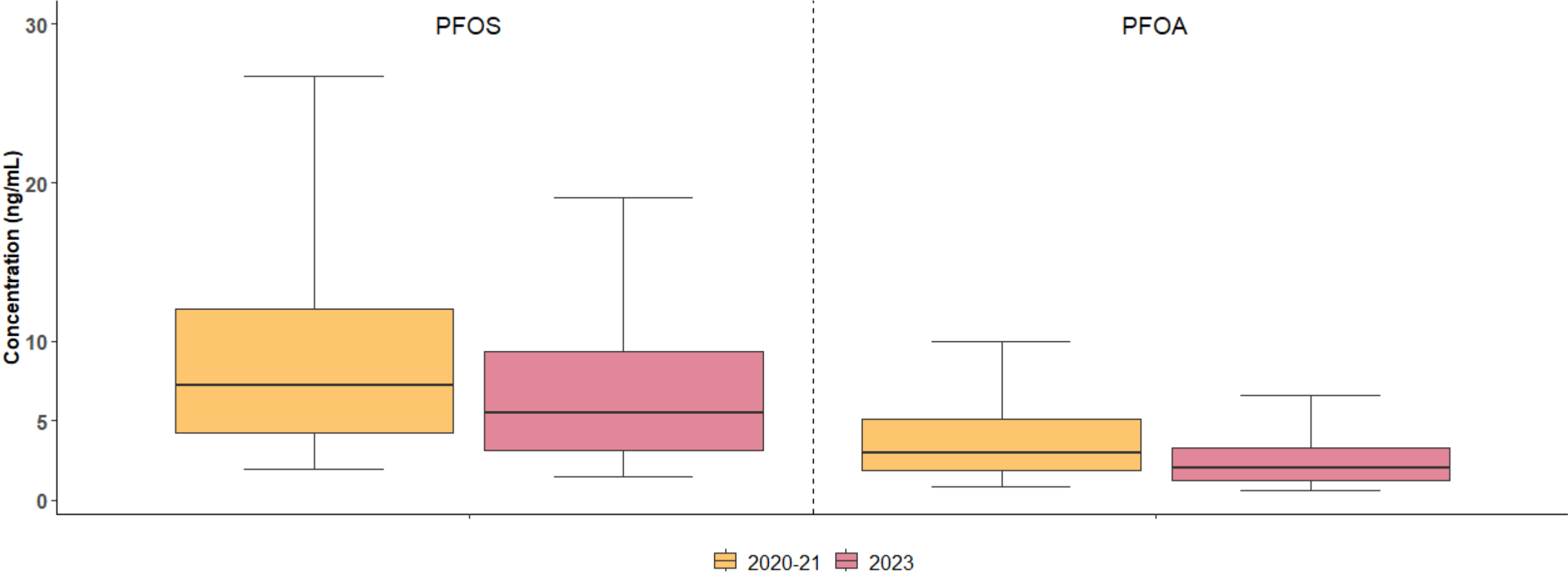
# PFAS Levels by Community



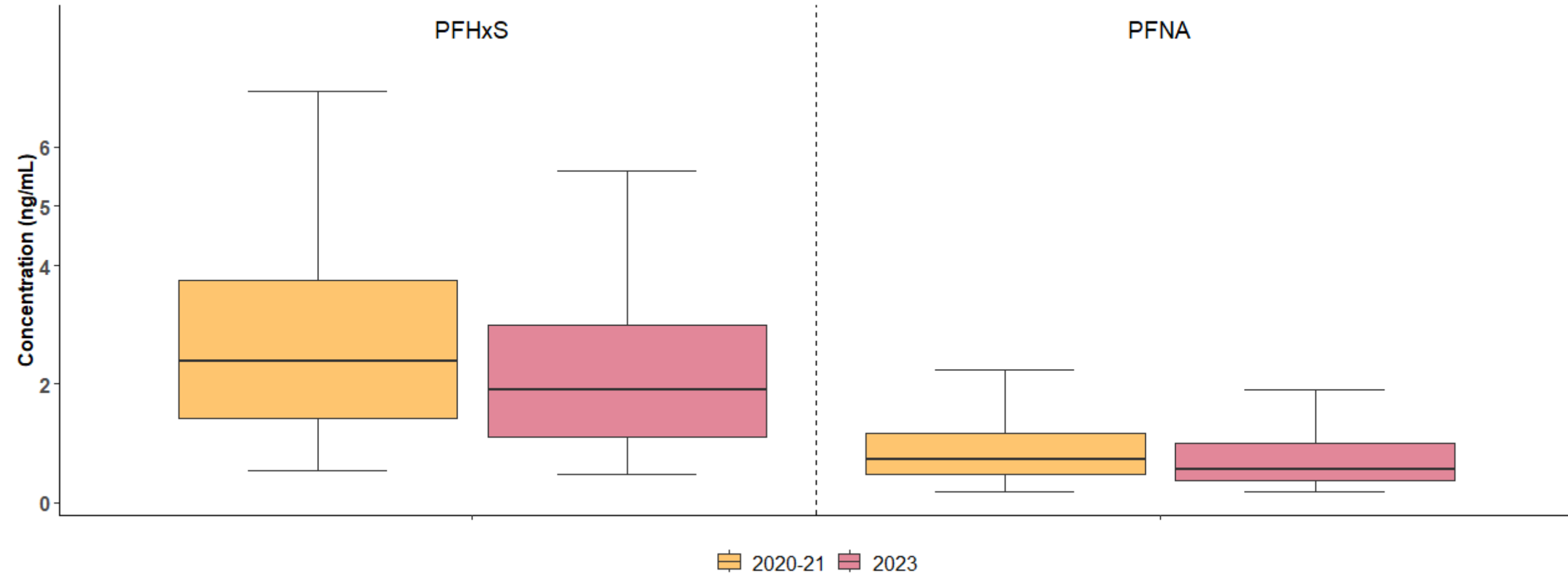
2023 GenX Samples



# Changes in PFOS and PFOA across cohort from 2020/21 to 2023, N=519



# Changes in PFHxS and PFNA across cohort from 2020/21 to 2023, N=519



# 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

# 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.

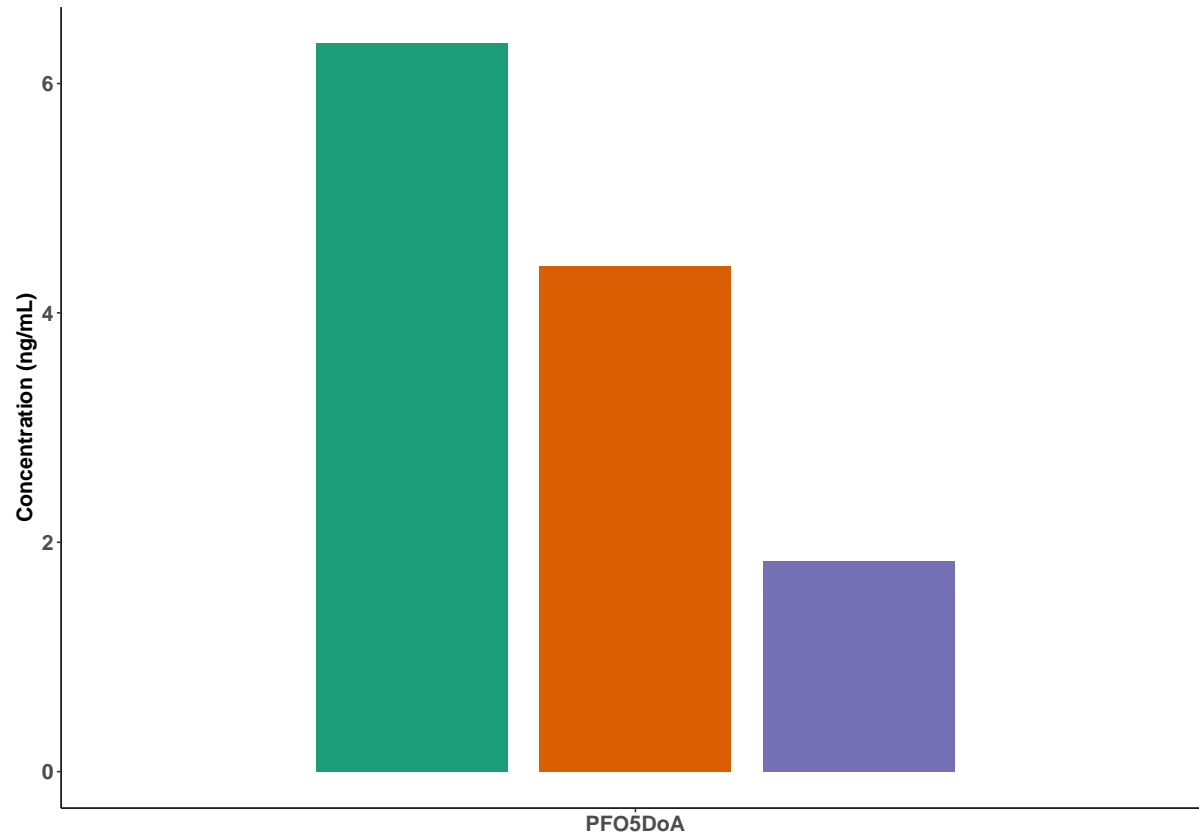
	Lower Cape Fear Region	Fayetteville
PFO5DoA	90%	18%
Nafion byproduct 2	57%	21%

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

## PFO5DoA

Change in Median PFO5DoA concentrations in LCFR

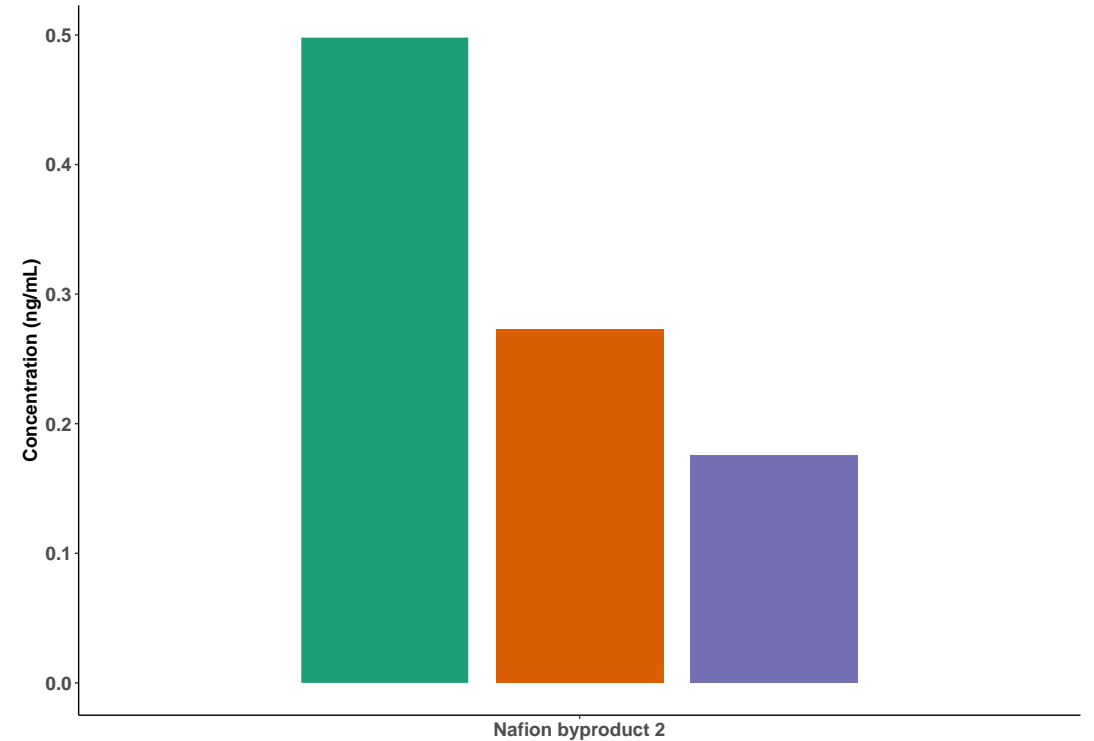
2020 2021 2023



## Nafion byproduct 2

Change in Median Nafion byproduct 2 concentrations in LCFR

2020 2021 2023



# 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

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



# 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 21% exceed 20 ng/mL

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

## **≥ 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.

# 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 you about do 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 2024 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

# 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

Attend our in-person meetings

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

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

# In Person Meetings

Pittsboro

Fayetteville

Wilmington

New Hanover and Brunswick Counties

Meetings will be held September 2024

Information will be announced on study website and Instagram

# Acknowledgements

- 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

Thank you for joining! Now please welcome our panelists.

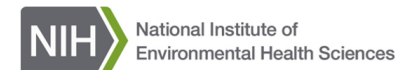
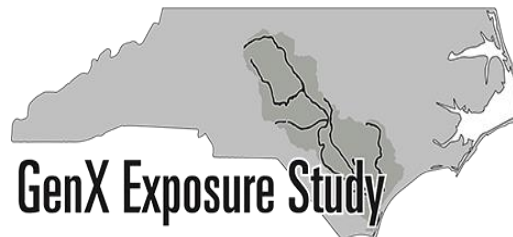
- Questions?
- Please put in the Q&A box.

Please contact us with additional questions and concerns by emailing [genx-exposure-study@ncsu.edu](mailto:genx-exposure-study@ncsu.edu) or call us at **(855) 854-2641**



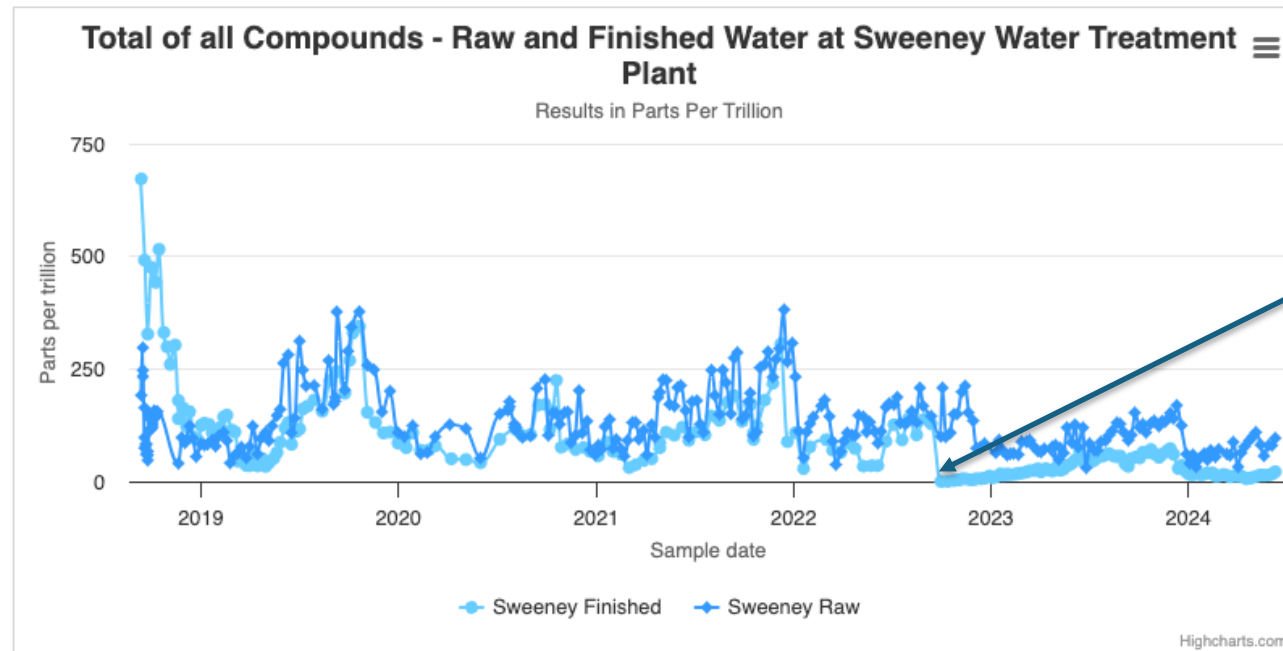
**Center for Environmental  
and Health Effects of PFAS**

**NC STATE | ECU**



# Water treatment plant upgrades

- Pittsboro: Added granular activated carbon (GAC)
- Wilmington (CFPUA, Sweeney): Added GAC



October 2023:  
New GAC filters  
went online

- Brunswick County (Northwest Plant): Building reverse osmosis (RO) plant
- Brunswick County (H2GO): Changed water source from Cape Fear River to groundwater that is being treated by RO