NC STATE UNIVERSITY

Center for Human Health and the Environment

GenX Exposure Study

PFAS results from Fayetteville area blood samples, Feb 2019

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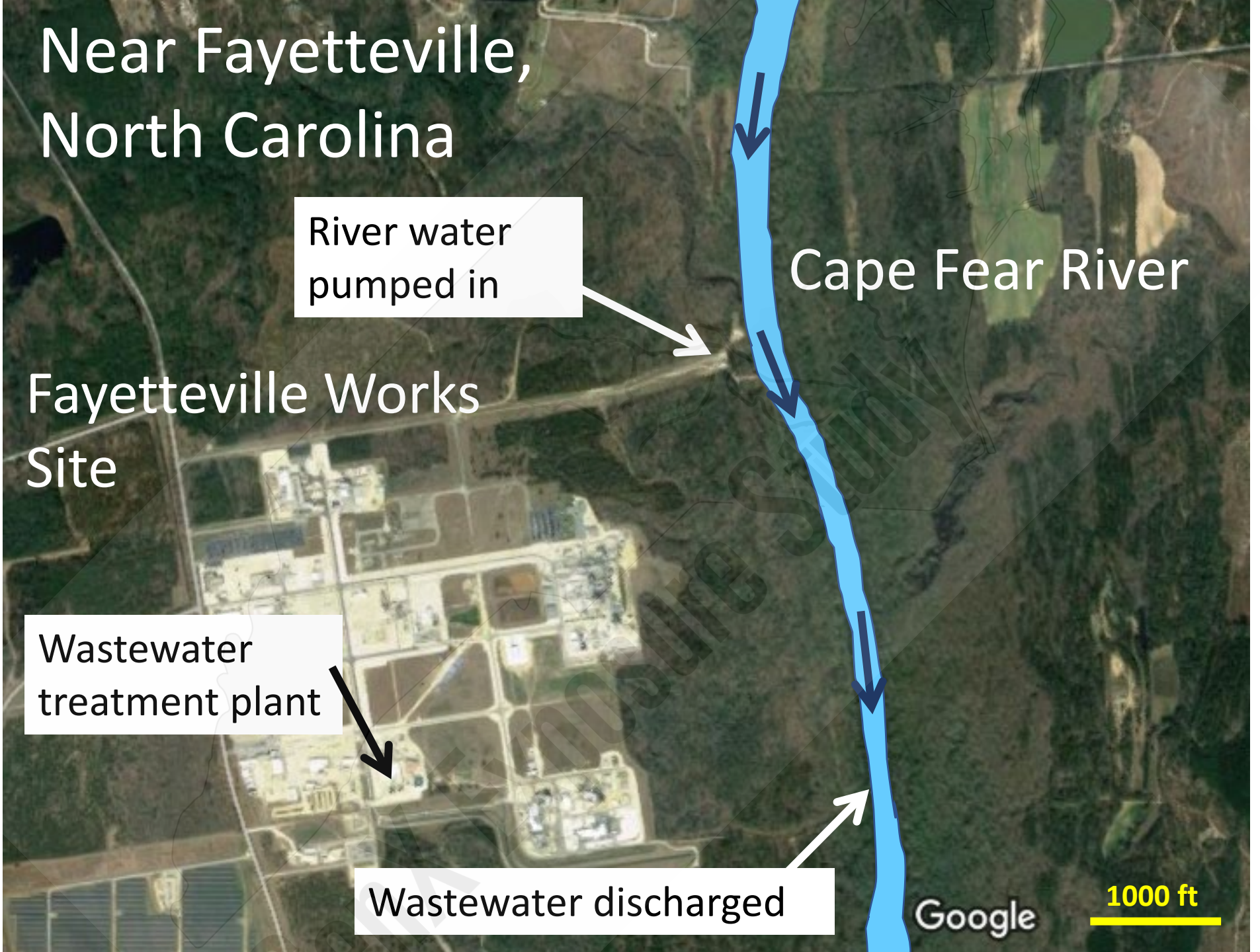
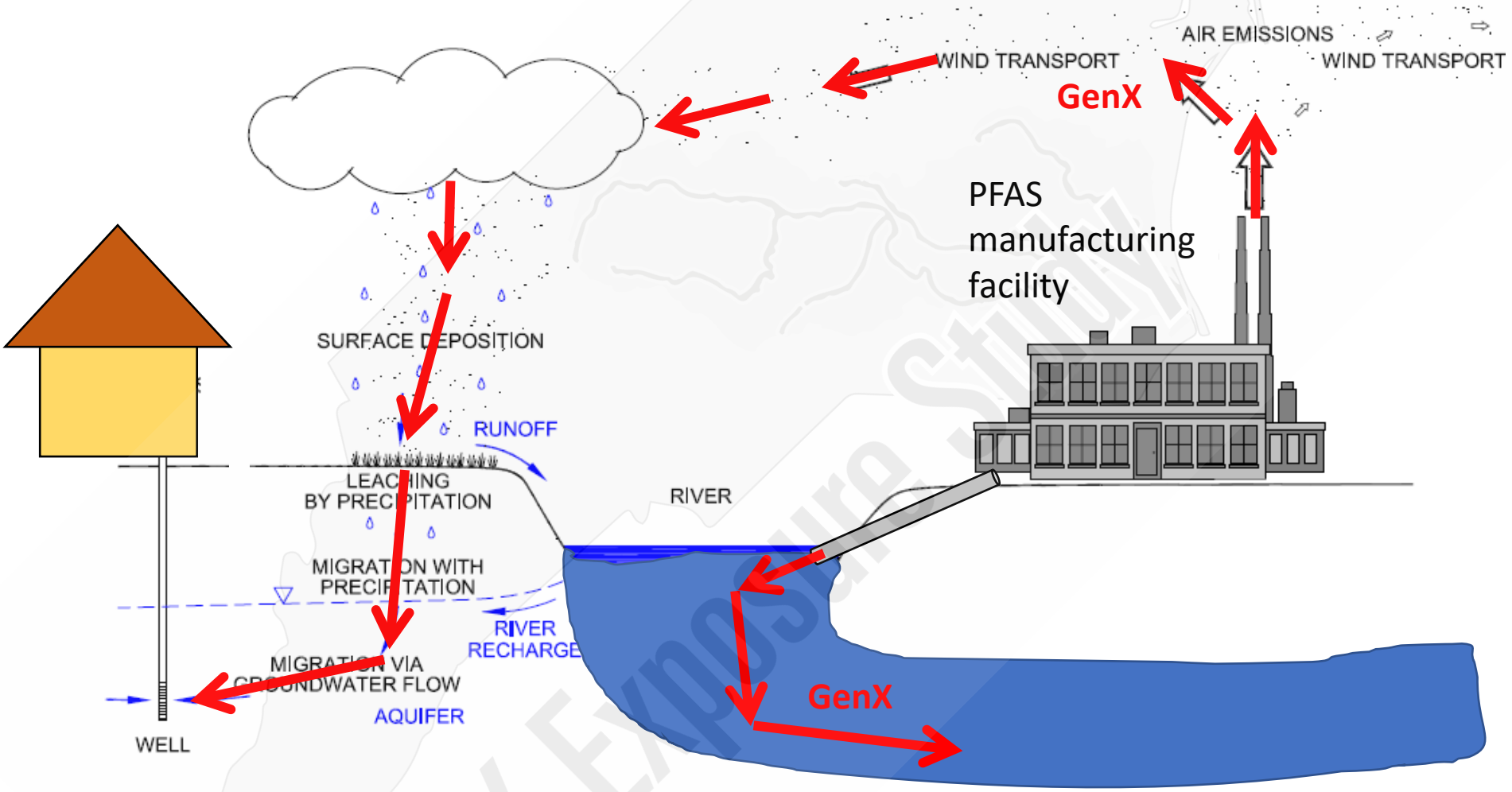
PFAS stands for per- and polyfluoroalkyl substances

1. Group of human-made chemicals
2. Used to make consumer products
3. Can be released to environment by facilities that make or use PFAS


Near Fayetteville, North Carolina
River water pumped in
Cape Fear River
Fayetteville Works Site
Wastewater treatment plant
Wastewater discharged
Google
1000 ft

PFAS releases from Fayetteville Works Facility, North Carolina



Modified from Davis et al. *Chemosphere* 2007, 67, 2011–2019

GenX Exposure Study

A research study funded by the National Institutes of Health (NIH)

Started Nov 2017 in Wilmington, NC

Feb 2019 in Fayetteville, NC

Designed to answer community questions

1) Is GenX detectable in my body?
2) What predicts GenX in my body?
3) Are there health effects associated with GenX?

More than just GenX

Other PFAS from Fayetteville Works
- Nafion byproduct 2, PFO5DoA, and others

Also measuring "legacy PFAS"
- Used historically throughout the Cape Fear Basin and the United States
- Several possible sources
- Chemicals like PFOA, PFOS

Study goal: to get a picture of overall PFAS exposure

GenX Exposure Study, Fayetteville, Feb 2019

Recruited people who…

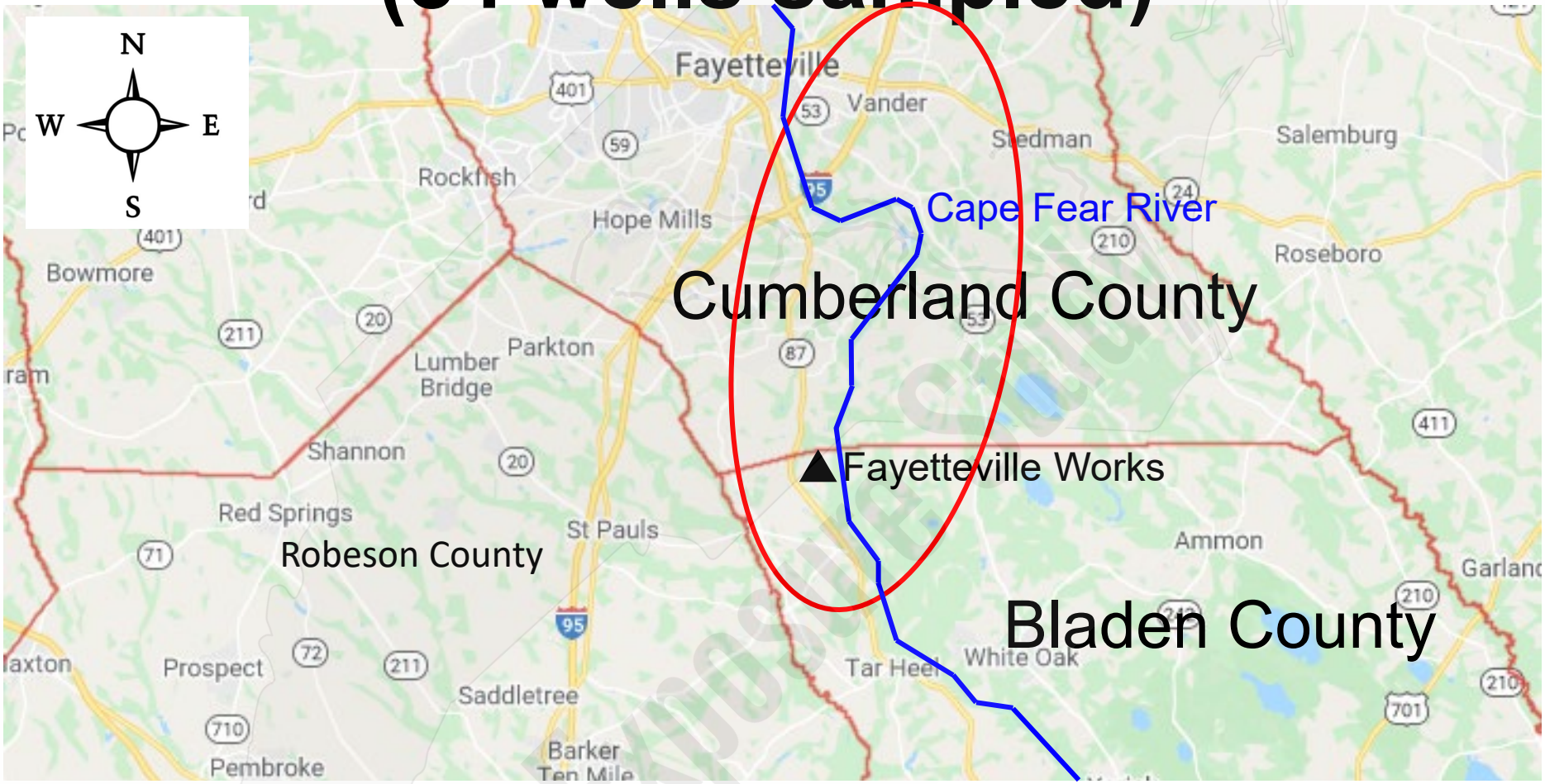
- had homes served by private wells
- had wells tested for GenX by Dec 2018

Aimed to have

- half participants with wells more than 140 ng/L GenX
- half with wells less than 140 ng/L GenX

Enrolled 153 participants, ages 9-85 years

Fayetteville participants' homes (84 wells sampled)



GenX Exposure Study

Fayetteville well water: Key findings from 84 wells

1) Wide range of GenX concentrations (non-detect to ~900 ng/L or parts-per-trillion)
2) Found 10 other PFAS frequently in wells

   8 of the 10 PFAS are from Fayetteville Works

   PMPA was highest (median: 350 ng/L)
3) Legacy PFAS (PFOA and PFOS) detected in some wells

What did we find in Fayetteville blood from Feb 2019?

Fayetteville blood: Key findings

1) Found three PFAS from Fayetteville Works in more than 10% of samples: **Nafion byproduct 2, PFO5DoA, PEPA**

2) Did not find GenX, PMPA, or Hydro-EVE in blood

3) Found five legacy PFAS in almost all participants' blood samples: **PFHxS, PFHpS, PFOA, PFOS, PFNA**

4) Legacy PFAS in Fayetteville area blood are higher than average for people living in the United States

Looked for 26 PFAS in blood

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Each participant provided one blood sample (153 participants=153 blood samples)

Tested blood at US EPA facility in Research Triangle Park, NC

- PFAS associated with Fayetteville Works releases
- PFAS commonly detected in blood of people living in US

Drs. Mark Strynar, James McCord, Theresa Guillette

Looked for 26 PFAS in blood

From Fayetteville Works

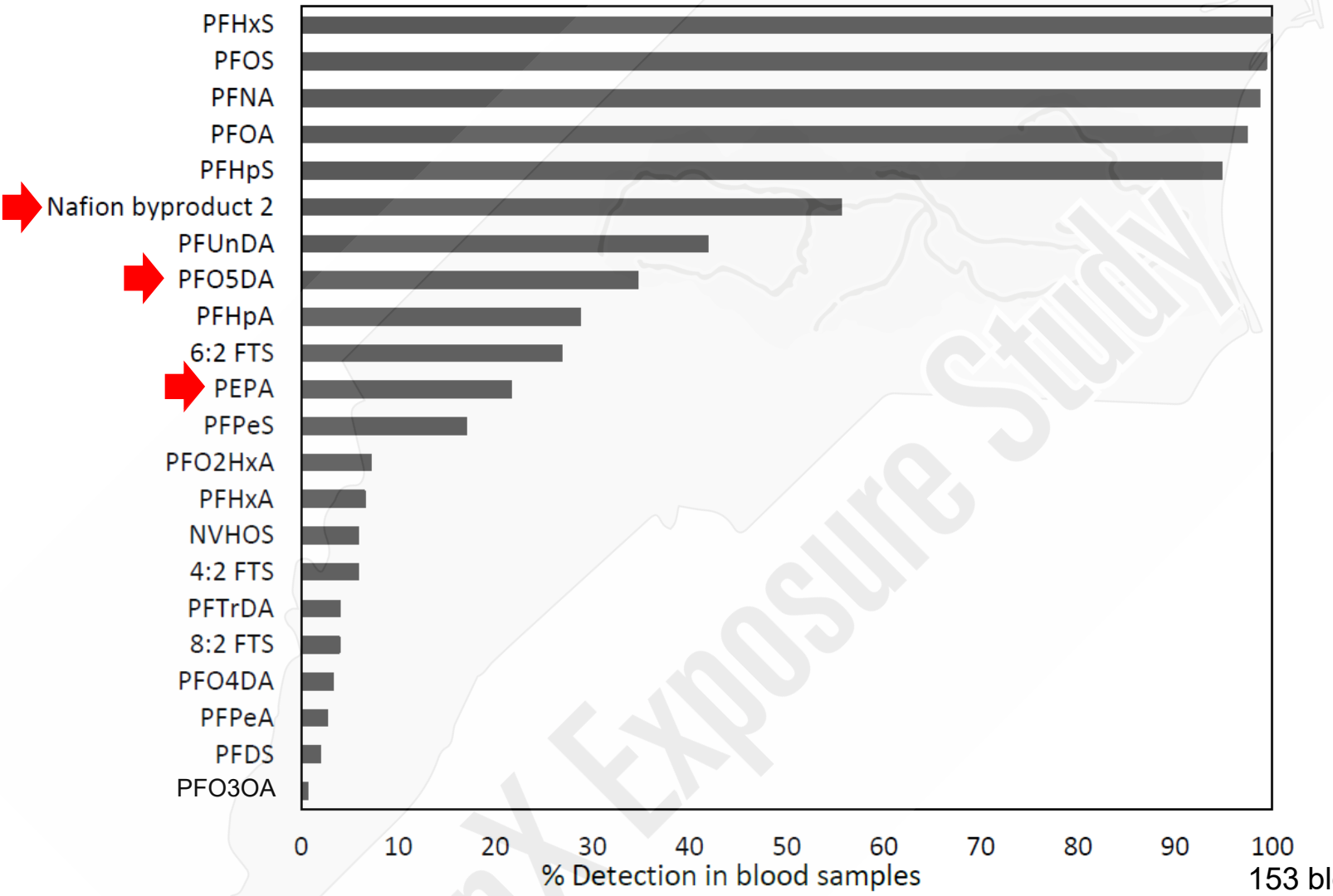
1. GenX
2. PEPA
3. PMPA
4. PFO2HxA
5. PFO3OA
6. NVHOS
7. PFO4DA
8. Hydro-EVE
9. PFO5DoA
10. Nafion byproduct 2

“Legacy” PFAS

1. PFPeA
2. PFPeS
3. PFHxA
4. PFHxS
5. PFHpA
6. PFHpS
7. PFOA
8. PFOS
9. PFNA
10. PFNS
11. PFDS
12. PFTrDA
13. PFUnDA
14. 4:2 FTS
15. 6:2 FTS
16. 8:2 FTS

GenX Exposure Study

22 of the 26 PFAS detected in at least one blood sample



153 blood samples

Ohio River Valley PFAS Exposure Study

Three PFAS from Fayetteville Works detected in more than 10% of samples

1) **Nafion byproduct 2** (about 60% of 153 participants' samples)

2) **PFO5DoA** (about 40%)

3) **PEPA** (about 20%)

GenX Exposure Study

Did not find GenX in blood samples

We did not detect GenX in blood

Department of Health and Human Services also did not detect GenX in blood from 30 people living near Fayetteville Works in 2018

GenX leaves body quickly

- Biological half life: 81 hr, on average
- Reported in June 2021

Did not find three PFAS in blood samples

GenX

PMPA

Hydro-EVE

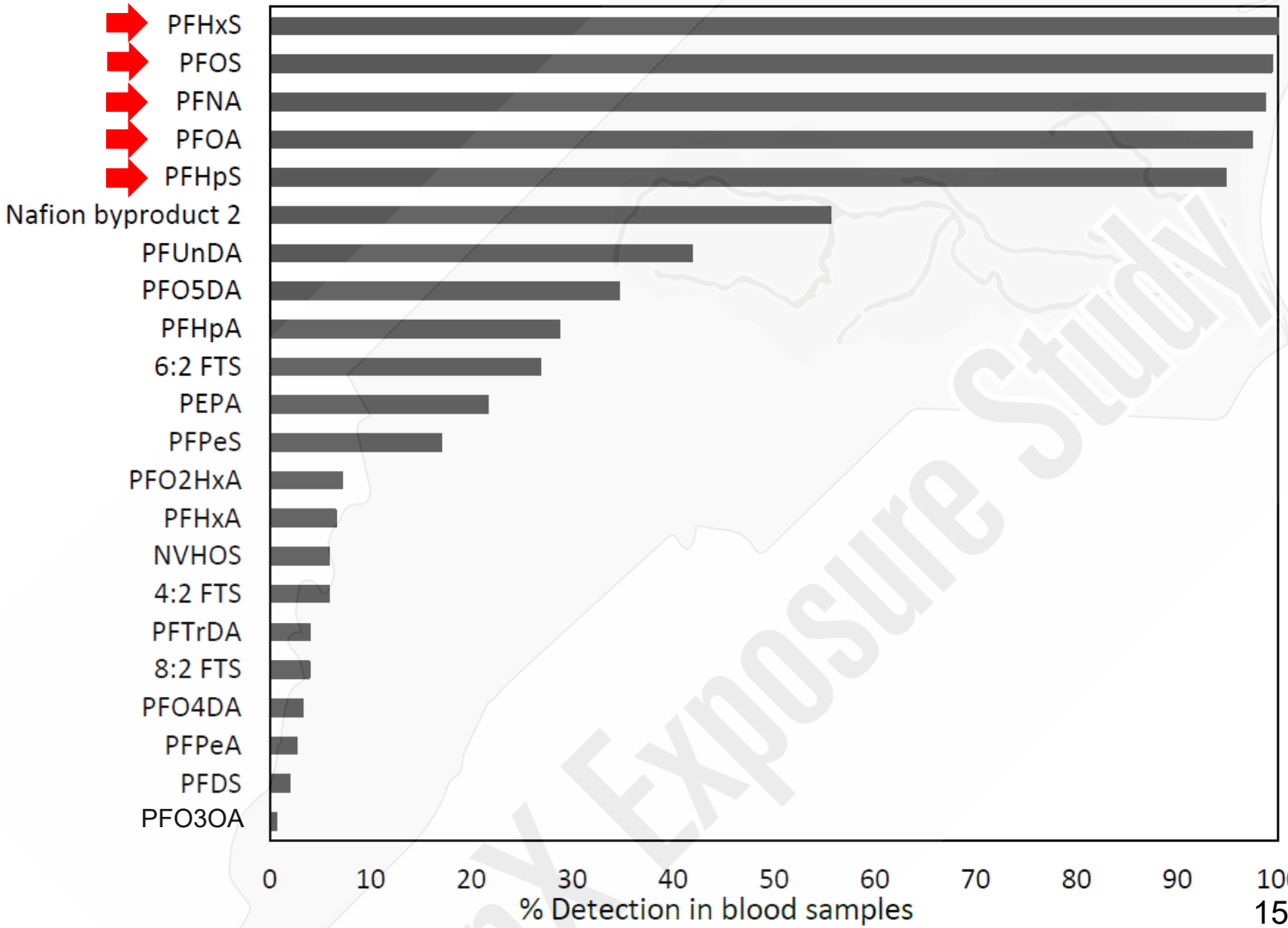
Did not find three PFAS in blood samples

GenX	Found in more than half of wells
PMPA	Found in more than half of wells
Hydro-EVE	Found in about 20% of wells

GenX Exposure Study

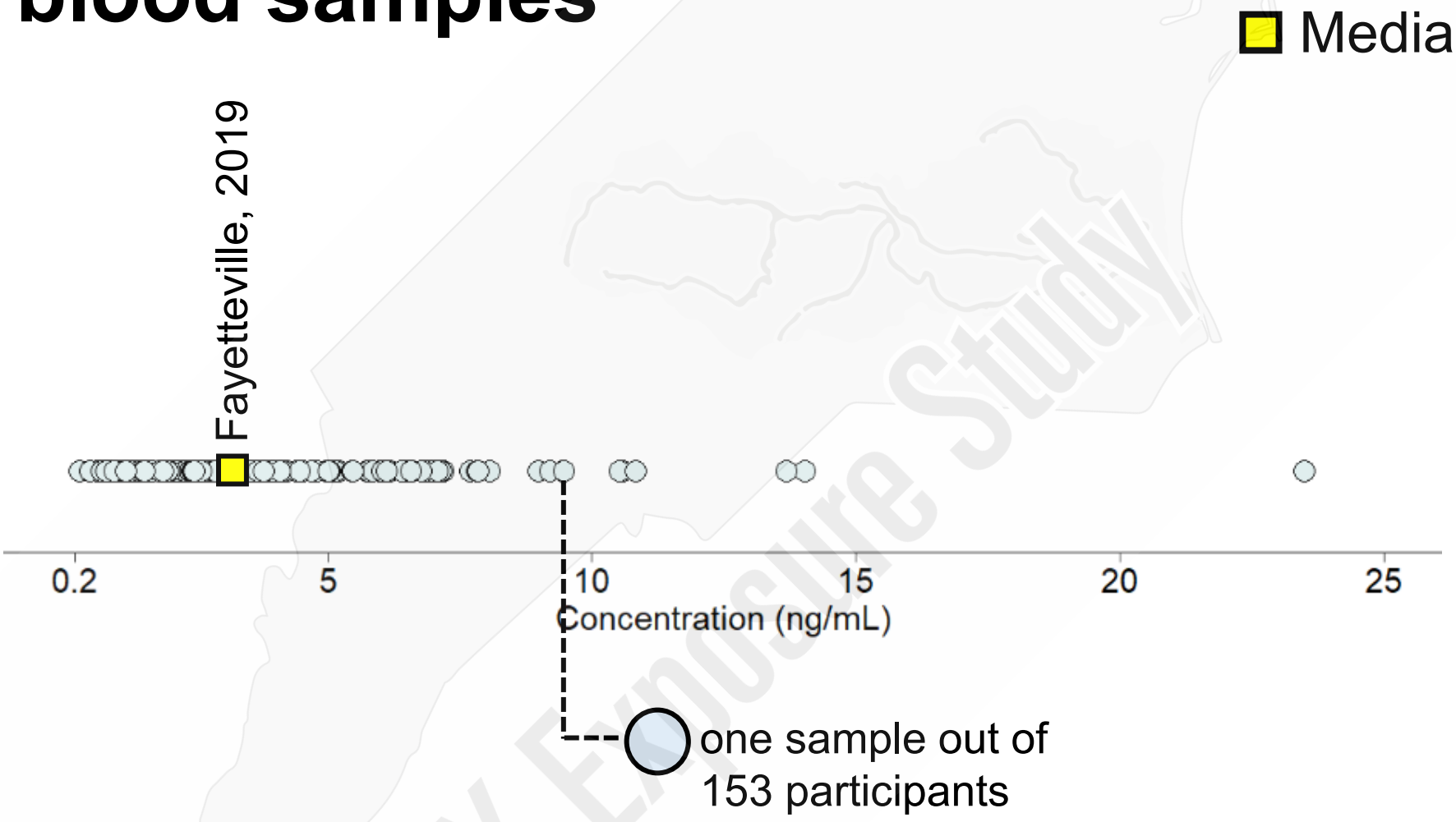
What about the legacy PFAS?

5 legacy PFAS detected in almost all participants' blood



153 blood samples

PFHxS detected in all participants' blood samples



GenX Exposure Study

How do legacy PFAS levels in Fayetteville compare with people living in the US?

Centers for Disease Control and Prevention's National Health and Nutrition Examination Survey (NHANES)

PFHxS, PFHpS, PFOA, PFOS, PFNA results are publicly available

Results from 1,929 people in 2017-2018

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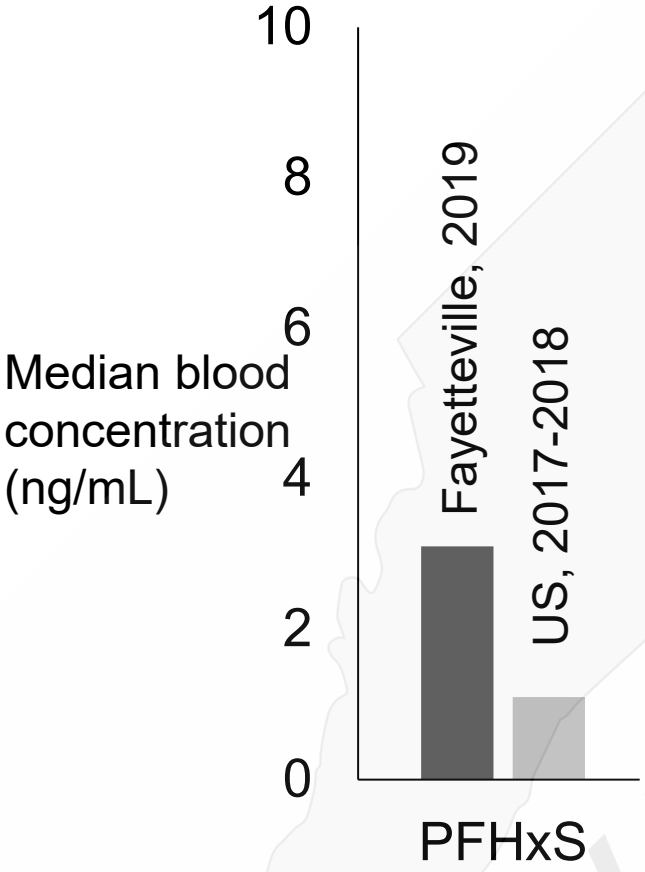

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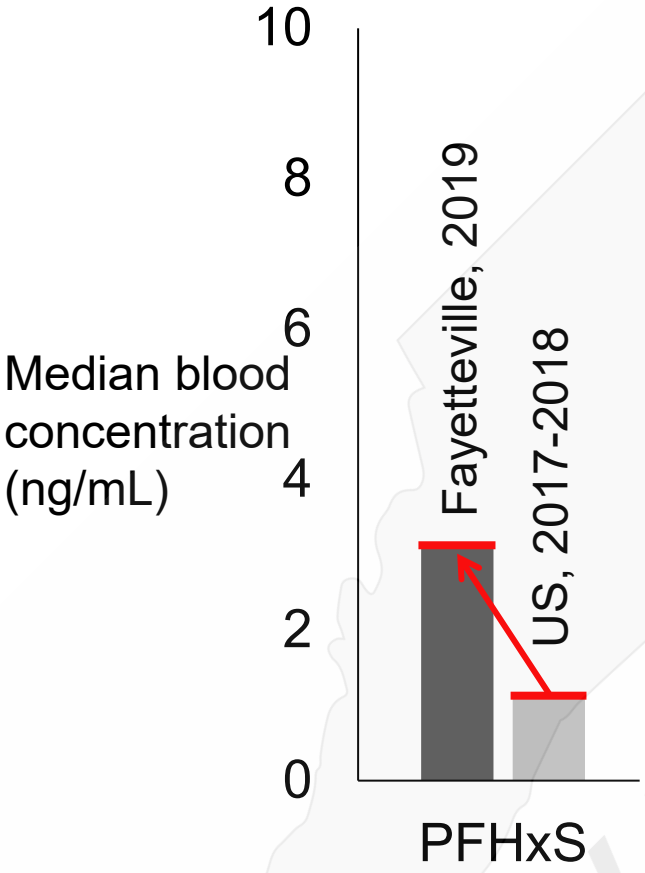
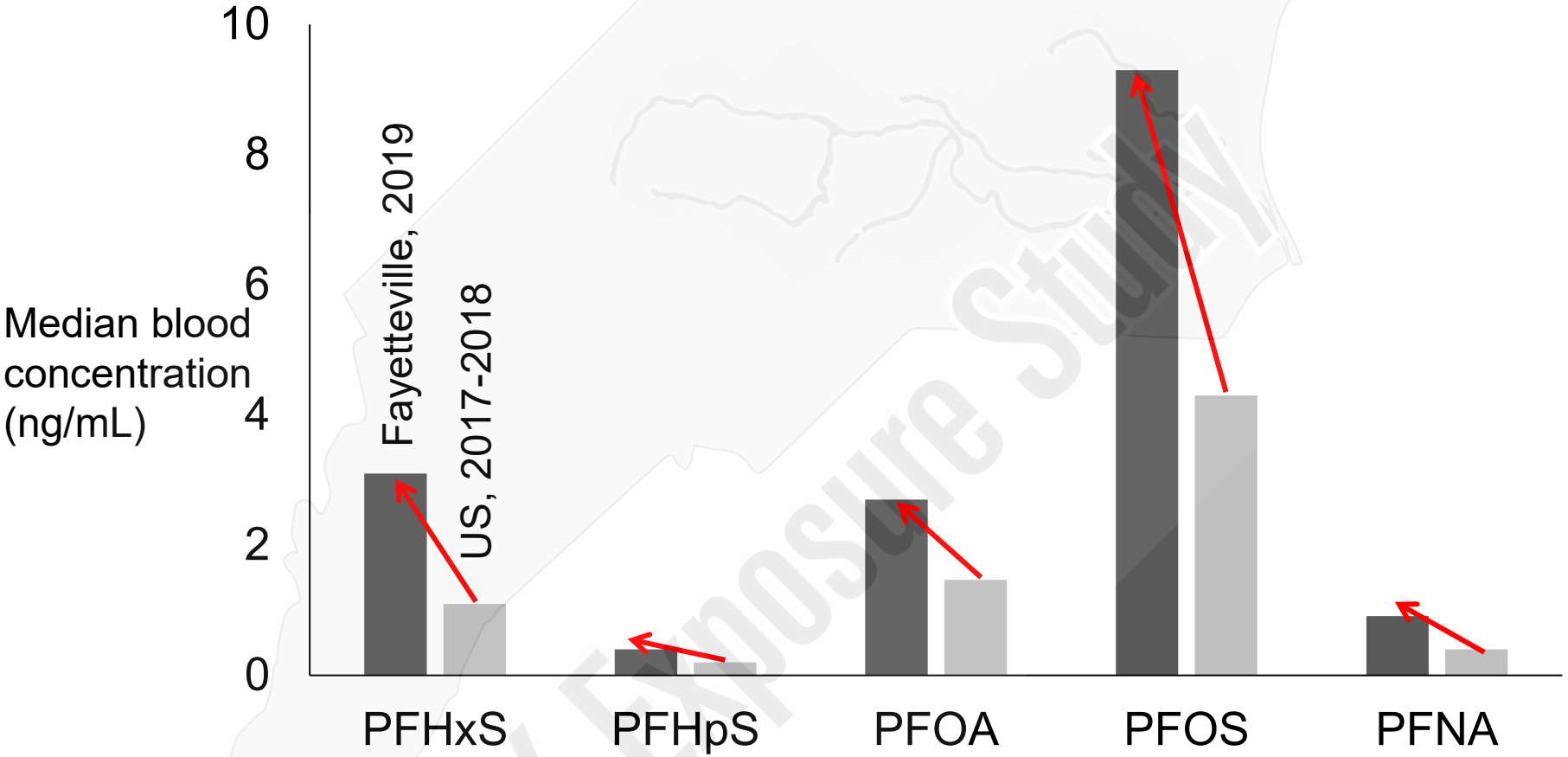


GenX Exposure Study

Were legacy PFAS higher in Fayetteville than in people living in US? Yes.



GenX Exposure Study

Fayetteville blood: Key findings

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What your PFAS results **can** and **cannot** tell you

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Can: How much PFAS was present in blood when sample was collected

Cannot: How blood levels change over time

GenX Exposure Study

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PFAS Exposure Study

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Can: How much PFAS was present in blood when sample was collected
Cannot: How blood levels change over time

Cannot: What exposure (e.g., drinking water, air, food) led to the presence of PFAS in blood

Can: The range of blood levels in our 153 study participants
Cannot: The range of blood levels in people exposed to PFAS from Fayetteville works

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Can: How much PFAS was present in blood when sample was collected
Cannot: How blood levels change over time

Cannot: What exposure (e.g., drinking water, air, food) led to the presence of PFAS in blood

Can: The range of blood levels in our 153 study participants
Cannot: The range of blood levels in people exposed to PFAS from Fayetteville works

Cannot: If a current health problem is related to the PFAS level in blood
Cannot: If the PFAS levels in blood will have negative health effects later

There are no health advisory levels for PFAS in blood

Other things to remember about blood measurements

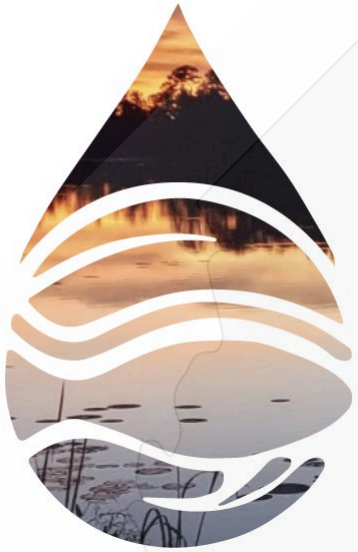
1. Why did we collect blood?
   - Blood is “gold standard” for evaluating exposure
   - Higher blood levels → higher exposure
   - Much blood data for legacy PFAS for comparison

2. What are the units?
   - Blood levels in **ng/mL or parts-per-billion**
   - Water levels in **ng/L or parts-per-trillion** (1000x lower)
   - Exposure to ppt in water → ppb levels in blood

3. What if we didn’t find a PFAS in blood?
   - Some PFAS may **not** be found in blood even though an exposure **did** happen
   - Doesn’t mean there aren’t health effects
   - Find another way to estimate exposure to that PFAS

What are we doing next?

Center for Environmental and Health Effects of PFAS (NC State Superfund Center)



The NC State Superfund Center is focusing on several key areas to advance understanding about PFAS -

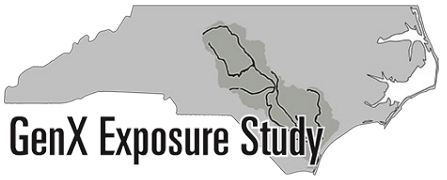
- **Exposure** in NC communities and environment
- Toxicity and underlying mechanisms of **thyroid** and **immune** function
- **Bioaccumulation** potential
- **Remediation**

GenX Exposure Study has grown

Transition from an Exposure Study to a Health Study

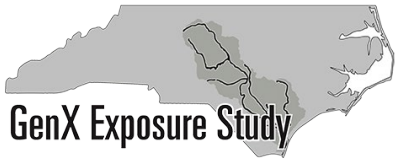
Grow from 500 participants to 1000 participants
- Fayetteville (collected in June and July 2021)
- New Hanover and Brunswick Counties
- Pittsboro

Five year study
- 2 blood collection events
- Measure PFAS
- Measure thyroid hormones
- Measure response to COVID/vaccine



Next Steps for GenX Study: 2021-2022

- Analyze data collected to date
  - What predicts PFAS in your body?
  - Are PFAS related to thyroid disease? Cholesterol?
  - How long do these chemicals remain in the body?
  - How do environmental sources contribute to PFAS levels in blood?
    - Water, dust, wristband analysis
- Analyze samples collected for PFAS
- Share results
  - Newsletters
  - Community meetings
- Get your suggestions about things to look at next.



GenX Exposure Study Team

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- Mark Strynar

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Cape Fear River Watch

Sustainable Sandhills

Cumberland County Health Department

New Hanover County Health Department

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Thank you! Questions?

For more information: https://genxstudy.ncsu.edu/