NC STATE UNIVERSITY

Center for Human Health and the Environment

GenX Exposure Study

PFAS results for residential dust samples collected in February 2019

GenX Exposure Study

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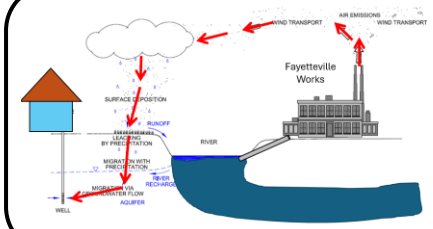
NIEHS Superfund Research Program
NC State/ECU

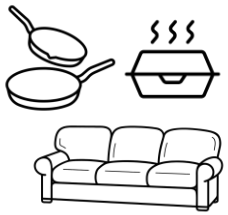
May 15, 2025

What did we find in dust?

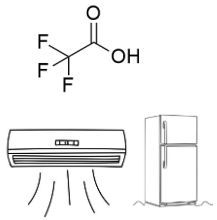
1) Many PFAS (19) found in >70% of dust samples from 65 homes:



PFEAs from Fayetteville Works facility



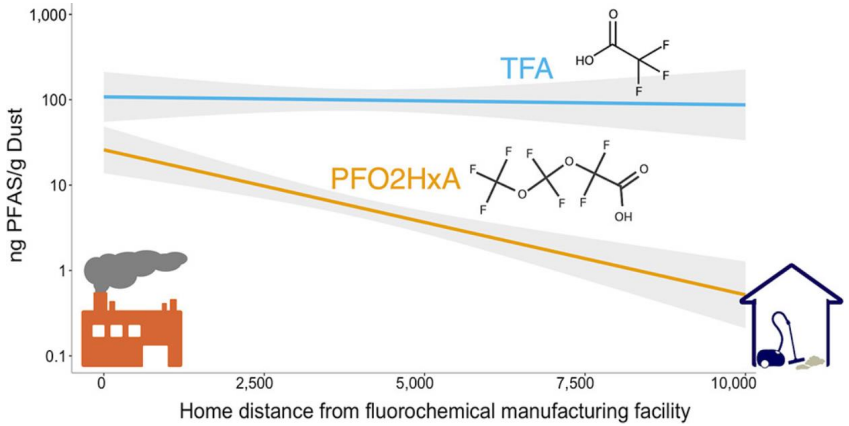
PFAS **commonly** found in dust



Ultrashort chain PFAS

2) Homes closer to the Fayetteville Works facility had, on average, higher levels of PFEAs in dust

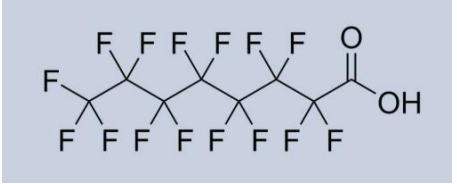
3) Concentrations of TFA and diPAPs were much higher than levels of PFEAs, and did not show distance relationships



What are PFAS?

PFAS= Per- and polyfluoroalkyl substances

- Chemicals
- Fluorinated (contain C-F bonds)
- Do not occur naturally; i.e., they are synthetic
- Useful because impart resistance to heat, water, grease
- Used in consumer products, industrial processes, fire-fighting foams
- Made as byproducts of fluoropolymer production

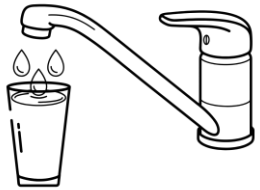


Perfluorooctanoic acid

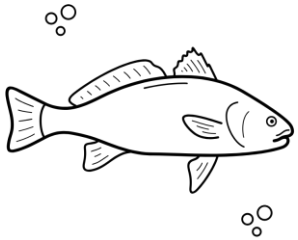
Early production focused on long-chain perfluoroalkyl acids

Today, hundreds of different PFAS have been identified in environmental samples

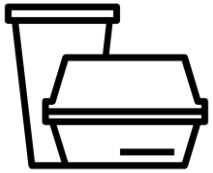
How are people exposed to PFAS?



Drinking Water

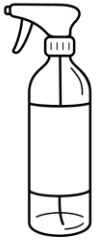


Fish



Food Packaging

Soil & Dust



Coatings & Cleaning

Pathways: Ingestion, inhalation, dermal contact

Health Effects of PFAS: Conclusions

Sufficient evidence of an association

Decreased antibody response (in adults and children)

Dyslipidemia (in adults and children)

Decreased infant and fetal growth

Increased risk of kidney cancer (in adults)

NASEM 2022

Health Effects of PFAS: Conclusions

Sufficient evidence of an association

Decreased antibody response (in adults and children)

Dyslipidemia (in adults and children)

Decreased infant and fetal growth

Increased risk of kidney cancer (in adults)

Limited suggestive evidence of an association

Increased risk of breast cancer (in adults)

Increased risk of testicular cancer (in adults)

Liver enzyme alterations (in adults and children)

Increased risk of pregnancy-induced hypertension (gestational hypertension and preeclampsia)

Increased thyroid disease and dysfunction (in adults)

Increased risk of ulcerative colitis (in adults)

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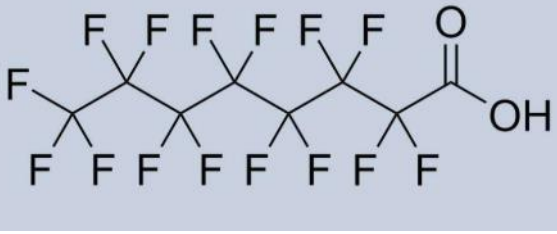
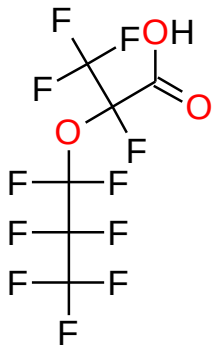
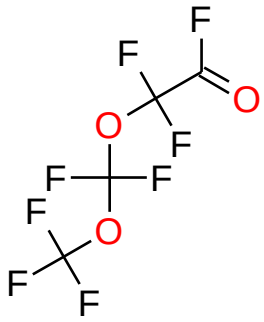
PFEAs are a subclass of PFAS



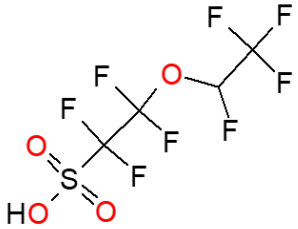
PFOA



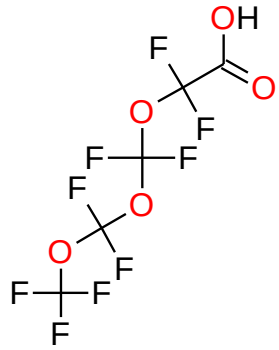
GenX



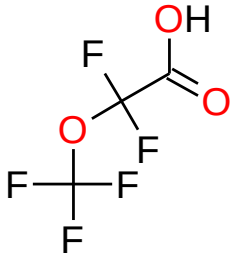
PFO2HxA



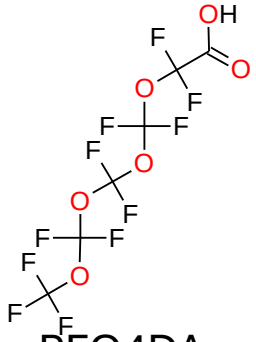
NVHOS



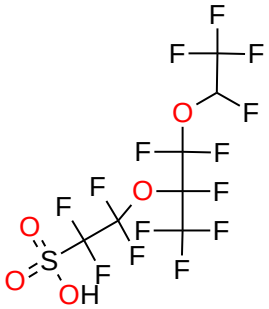
PFO3OA



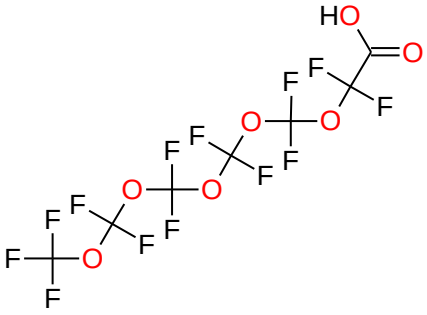
PFMOAA



PFO4DA

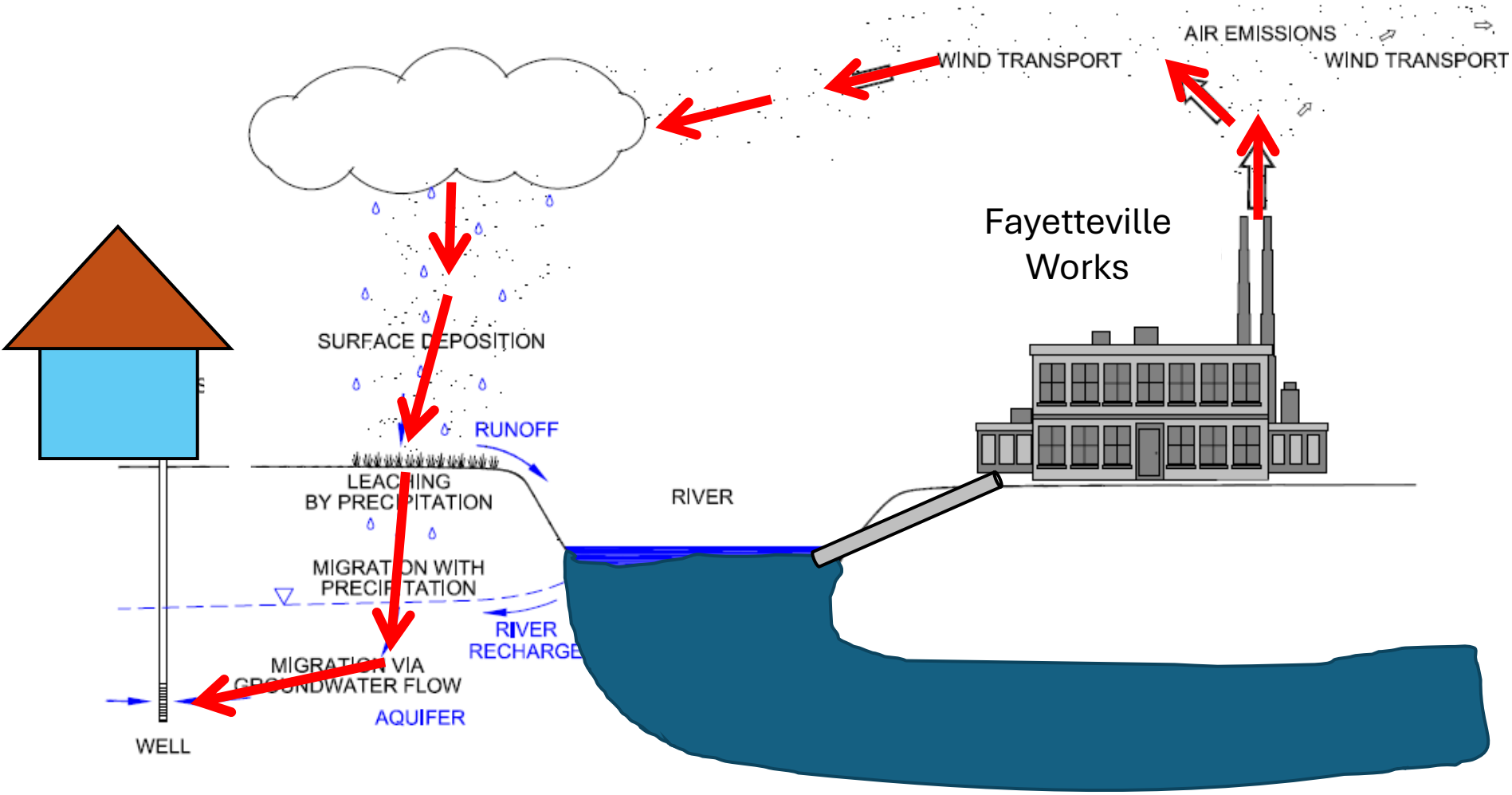


Nafion byproduct 2



PFO5DoA

Air discharges contaminated >10,000 private wells with PFEAs



What is the GenX Exposure Study?

We aim to

- Characterize exposure to PFAS in the Cape Fear River Basin region
- Investigate potential health effects of exposure

Not just about GenX

Study started in 2017 in Wilmington, NC

- Exposed to PFAS through contaminated public water

Expanded the study to include Fayetteville area, NC, in 2019

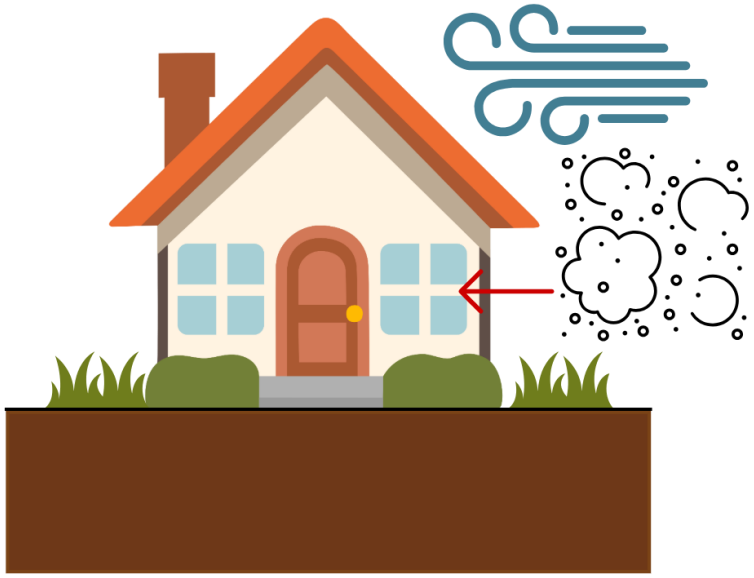
- Exposed to PFAS through contaminated well water

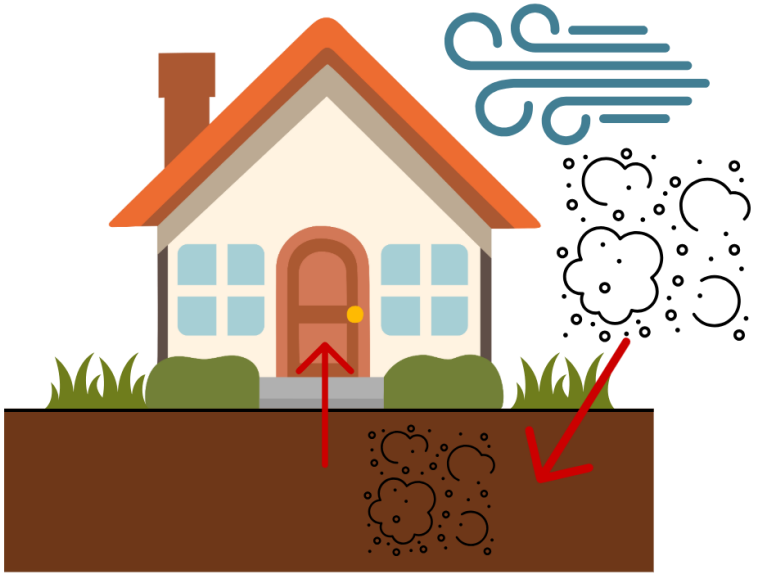
Is home dust another source of PFAS exposure?

PFAS may be present in dust through

A) Deposition from air to dust directly

B) Deposition from air to soil, then contaminated soil tracked into the house

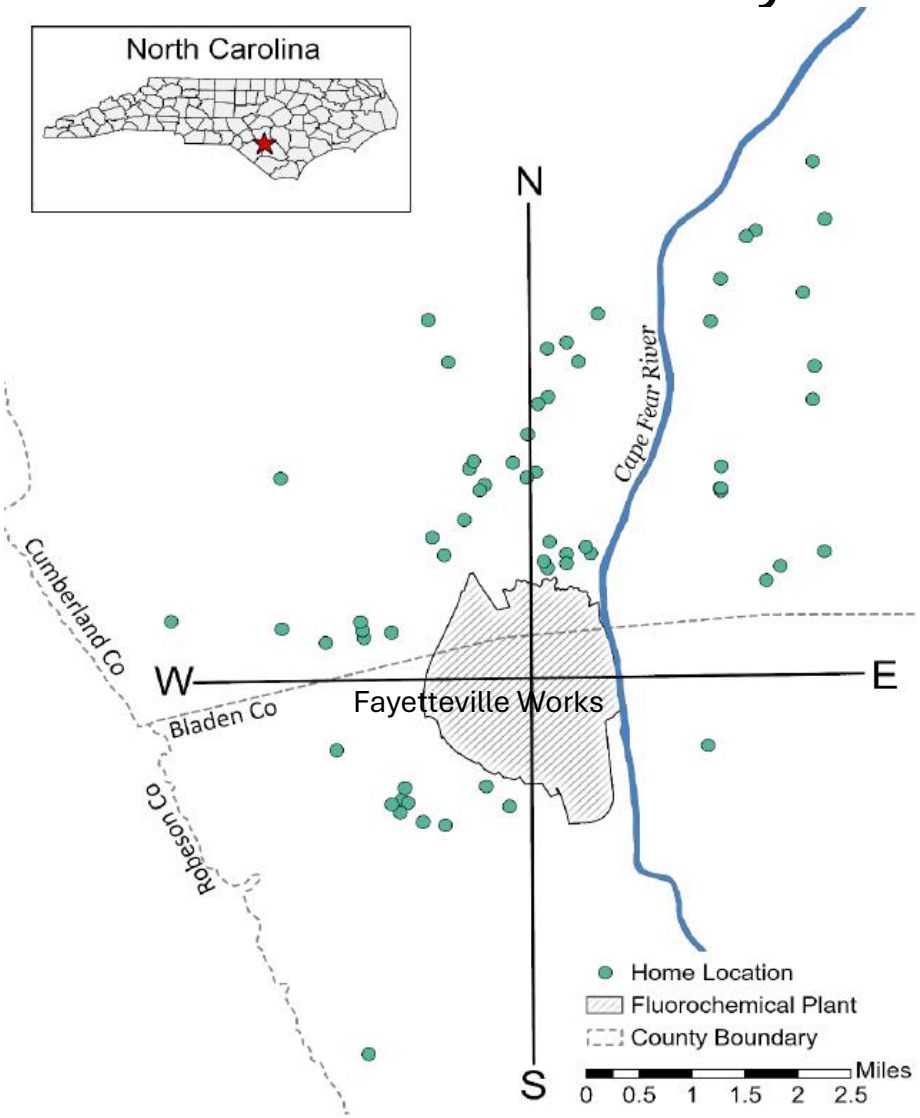




What did we do?

- In February 2019, collected dust samples from 82 homes which had previously undergone well water testing as part of the GenX Exposure Study.
- Analyzed dust samples from 65 homes located within ~9 km of Fayetteville Works
- Analyzed 48 PFAS using liquid chromatography tandem mass spectrometry
  - 12 PFEAs (GenX and others)
  - 2 Ultrashort chain PFAS
  - 34 other PFAS

65 homes in Cumberland and Bladen Counties, NC, within ~6 miles of the facility midpoint



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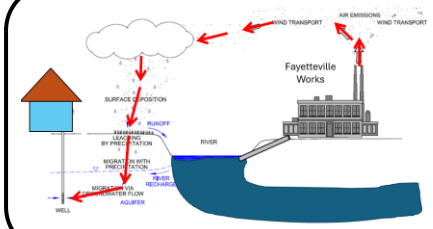

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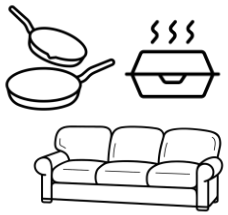

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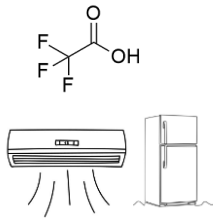

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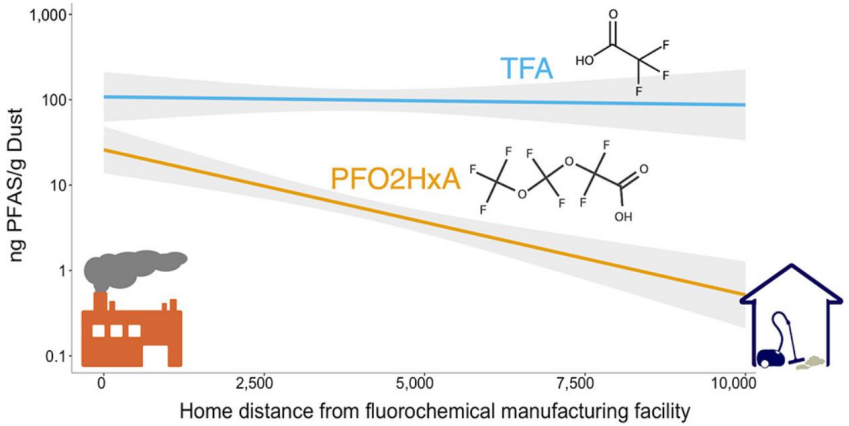
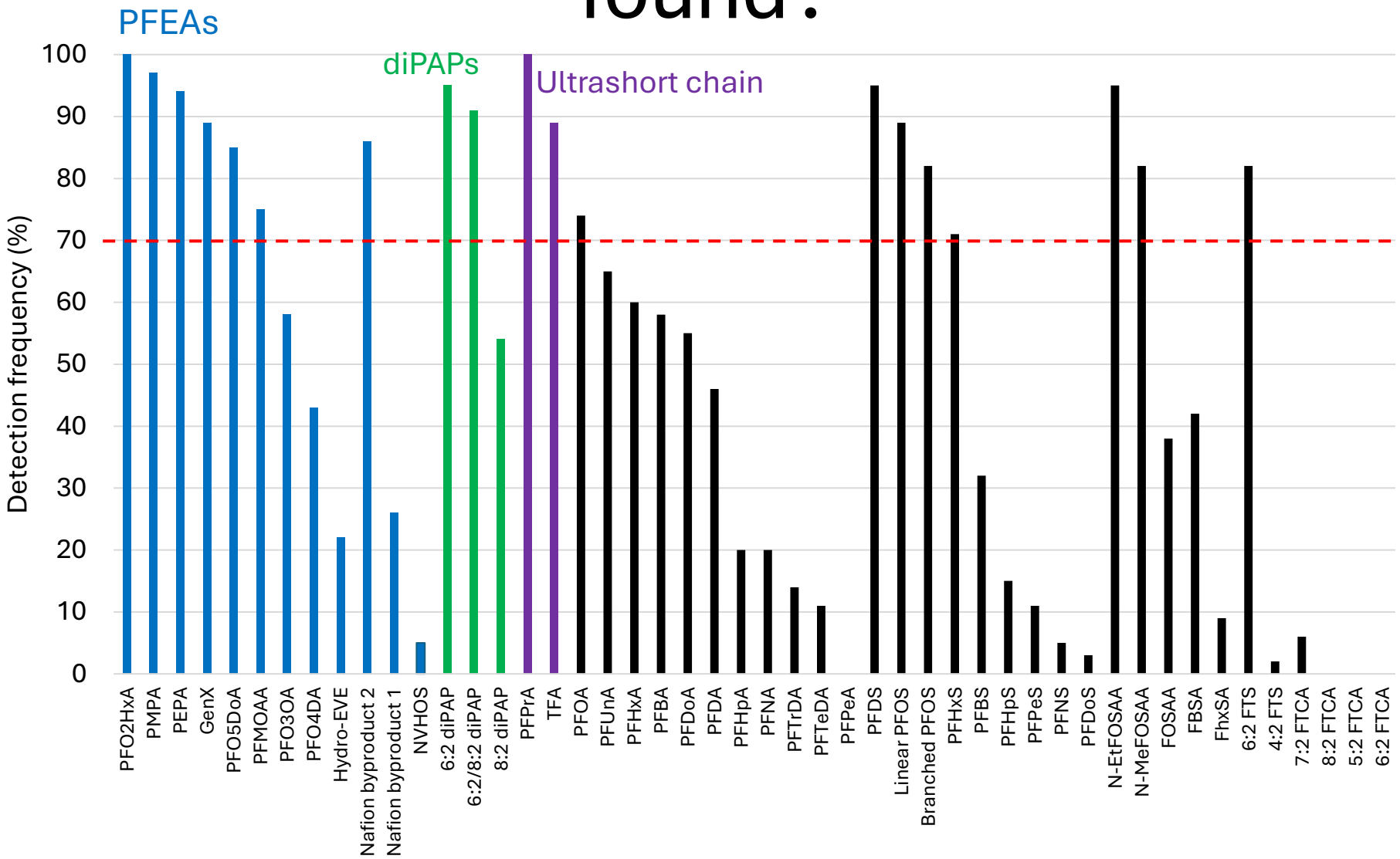
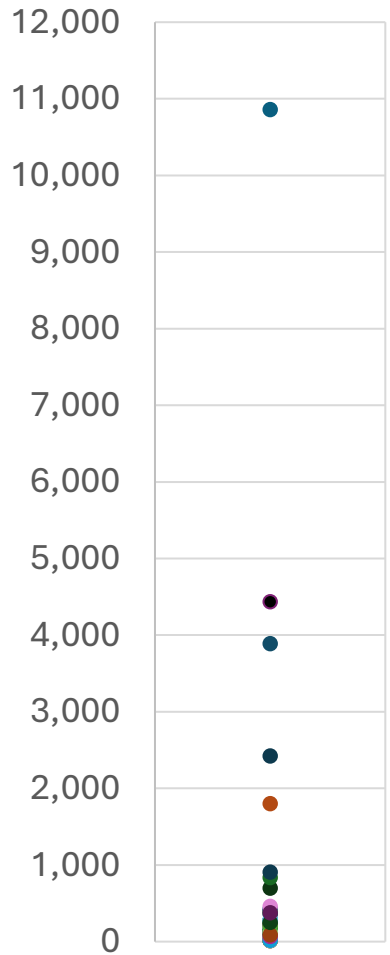


Which PFAS were most frequently found?

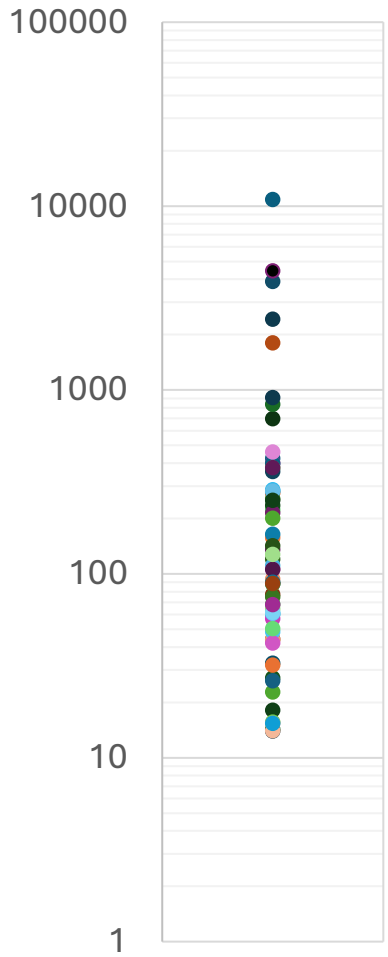


Proctor et al., *ES&T*, 2025

Wide range in concentrations for some PFAS (e.g., TFA)

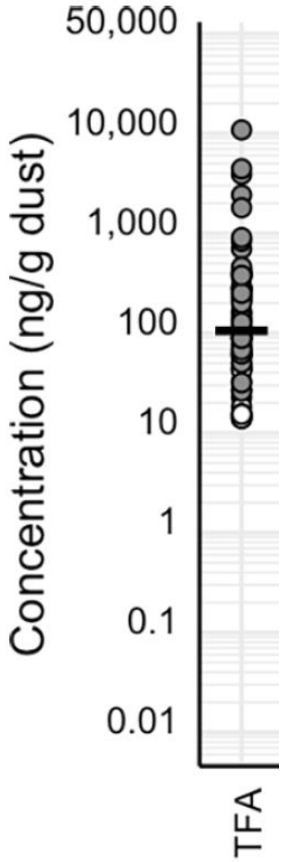


Linear scale



Log scale

Concentrations of 19 PFAS detected in >70% of samples



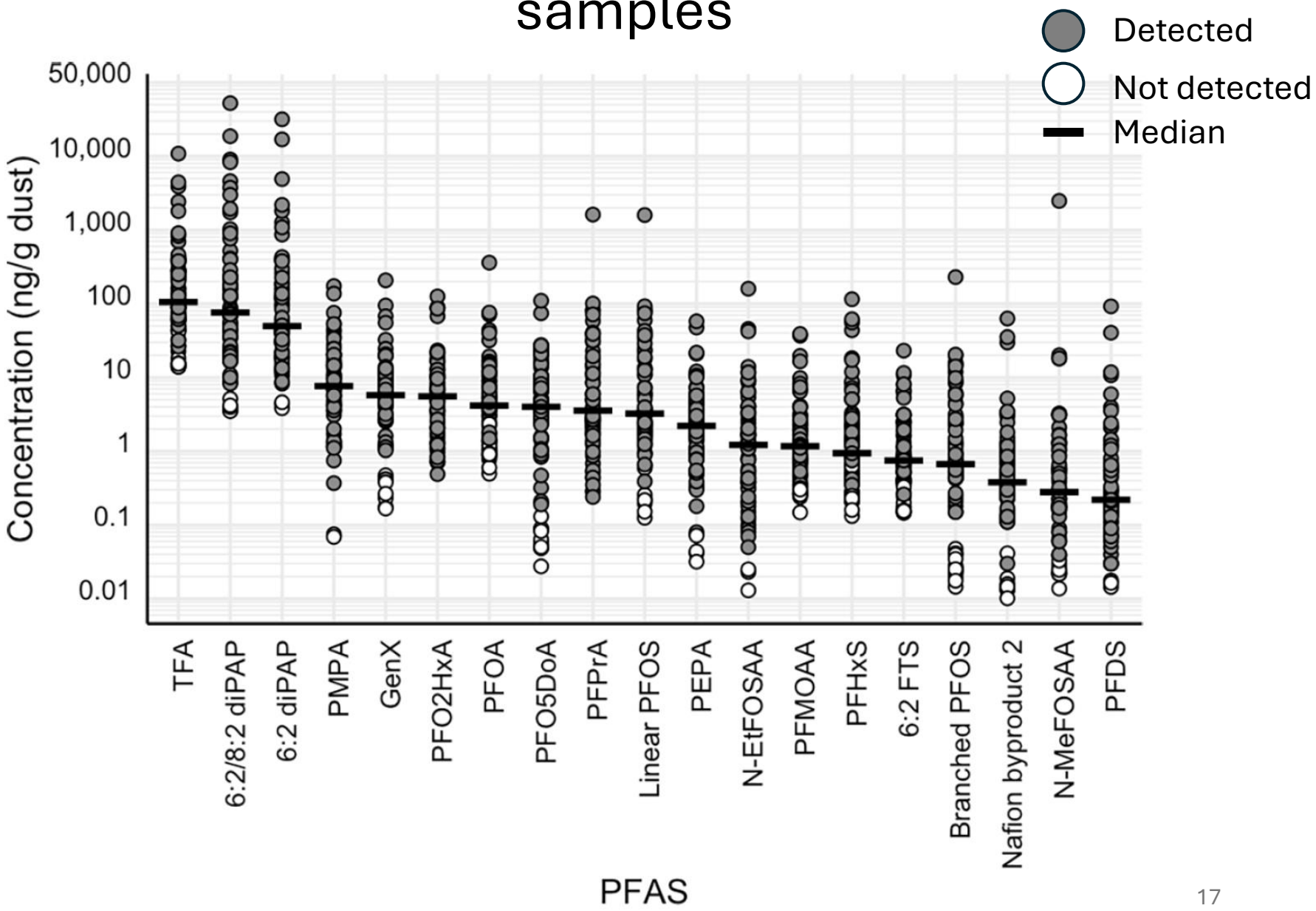
Detected

Not detected

Median

PFAS

Concentrations of 19 PFAS detected in >70% of samples



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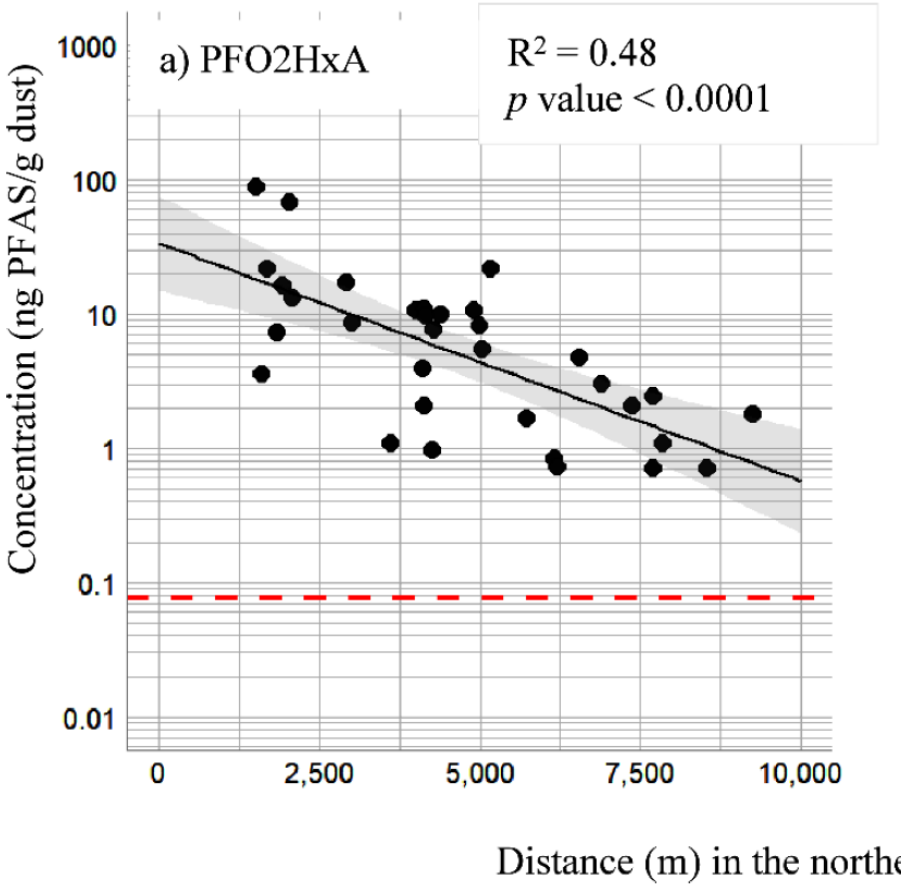

Other PFEAs with distance relationships:
PEPA, PMPA, PFMOAA, PFO2HxA, GenX, Nafion byproduct 2

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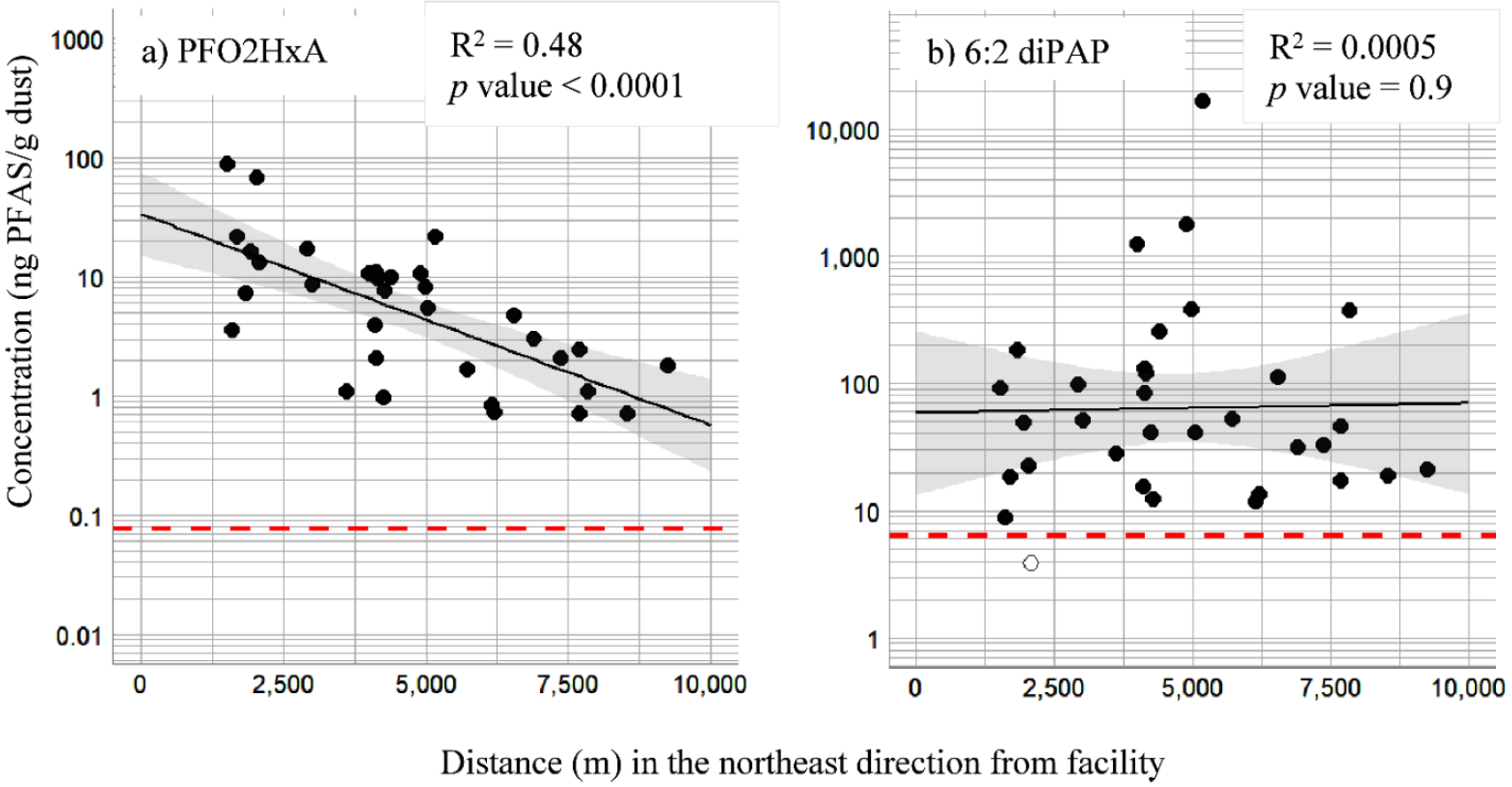
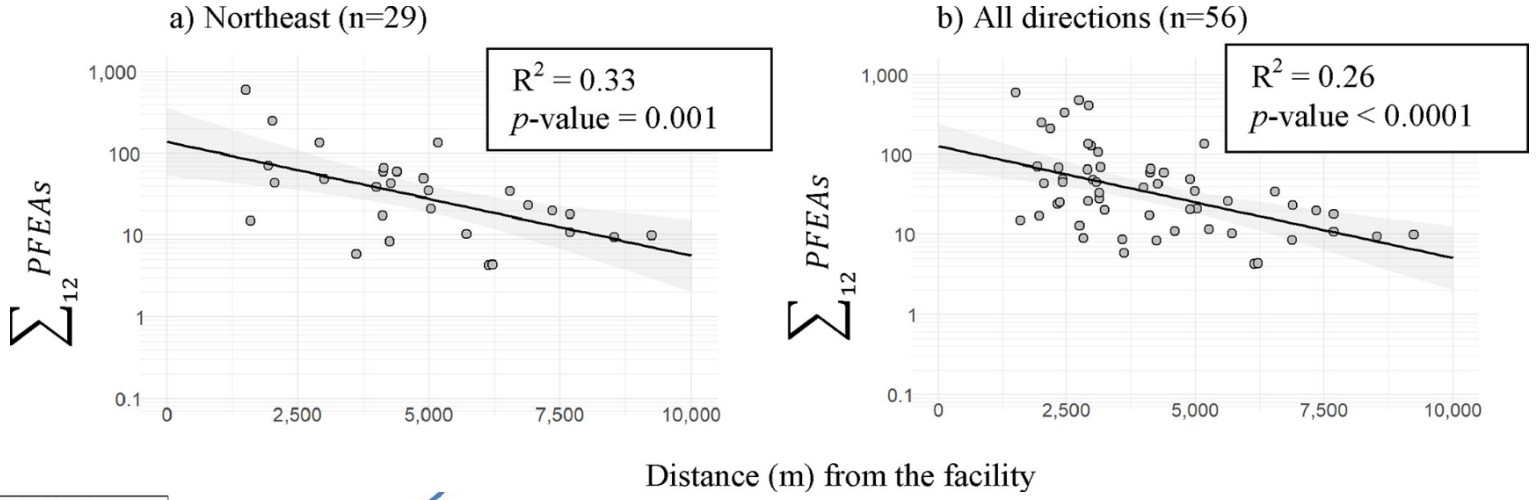
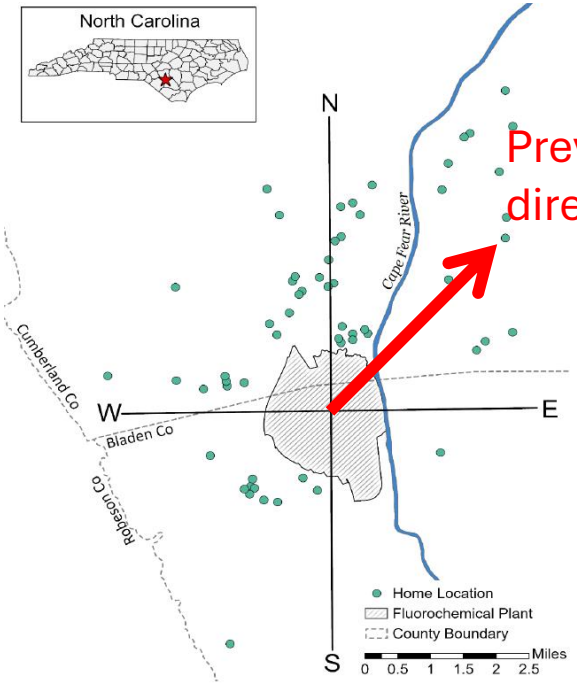


Other PFEAs with distance relationships:
PEPA, PMPA, PFMOAA, PFO2HxA, GenX, Nafion byproduct 2

The distance relationship was **stronger** for homes to the northeast of the facility

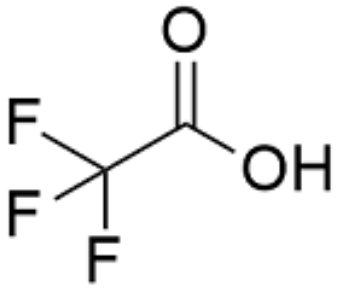




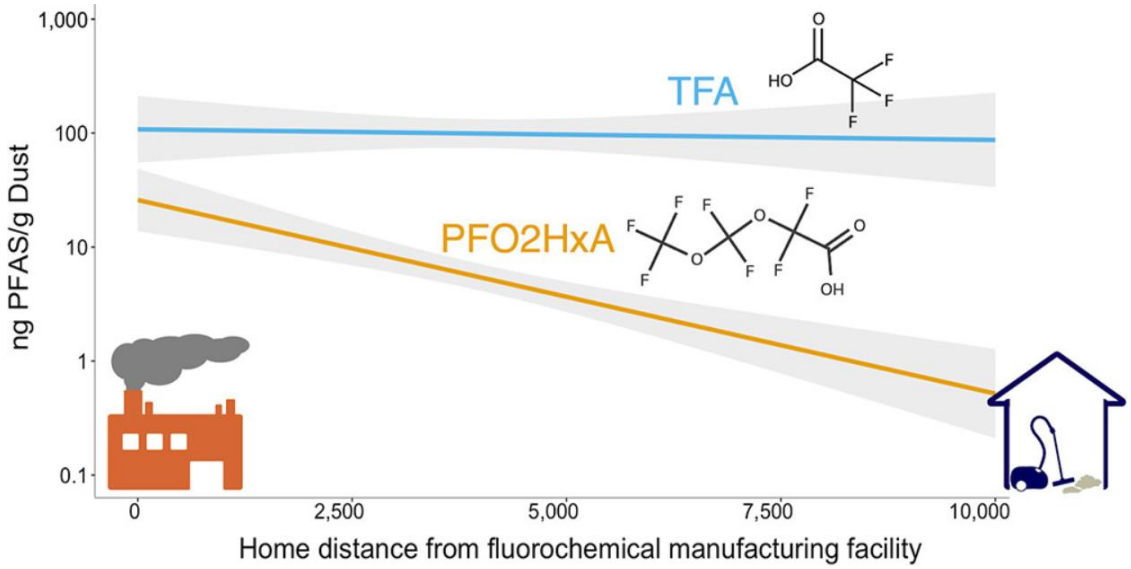
Prevailing wind direction

Trifluoroacetic acid (TFA), an ultrashort chain PFAS

- Ultrashort chain (only 2 carbons)
- Formed by breakdown of some fluorinated refrigerants
- Only recently been incorporated into analytical methods



TFA makes up ~16% of the total targeted PFAS mass in dust, and TFA levels did not vary with distance



	Median (ng/g dust)	% of Summed 48 PFAS
Summed 48 PFAS	657.6	
TFA	105.7	16
Summed 12 PFEAs	28.1	4

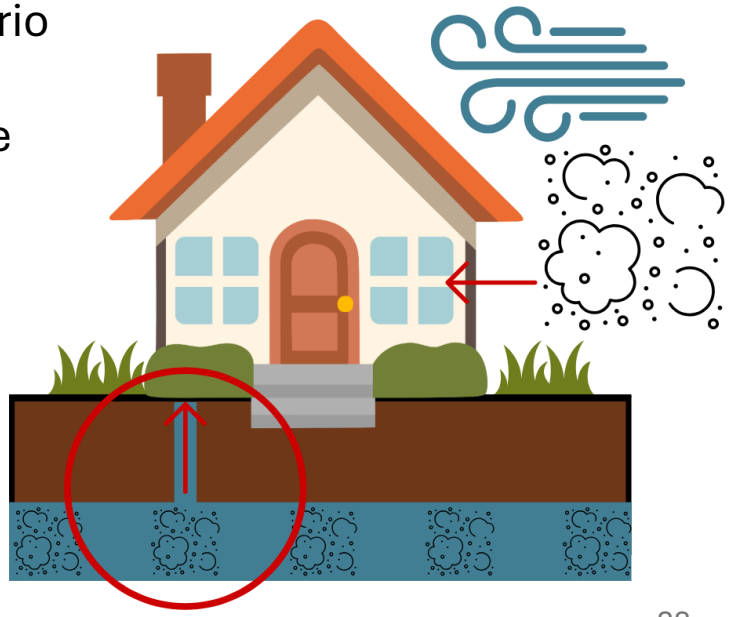
What do these results mean?

1) Home dust is a source of PFAS exposure for people in homes nearby Fayetteville Works
   Many of these people already have contaminated private wells

2) A comparison of estimated daily intake of GenX by ingestion in a

a) worst-case dust contamination scenario
b) medium-case well water contamination scenario

=> Well water intake much higher than dust intake

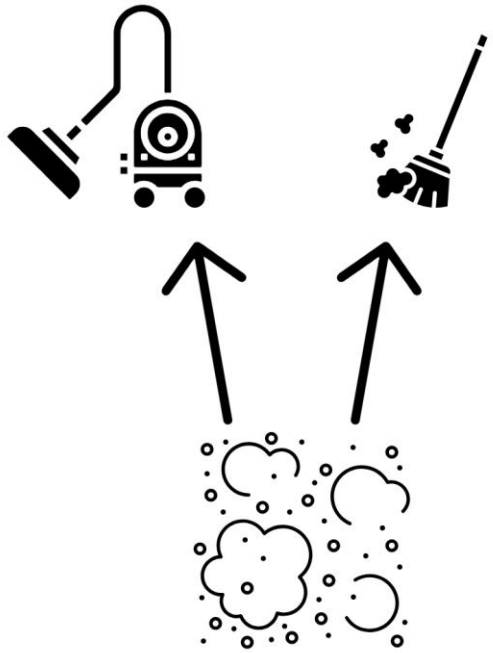


What are the next questions?

What are the PFAS levels in home dust now?

Thermal oxidizer at Fayetteville Works operational in Dec 2019

What effect does homeowner-led remedial activities (e.g., cleaning, etc.) have?



Thank you!

CONTACT US

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