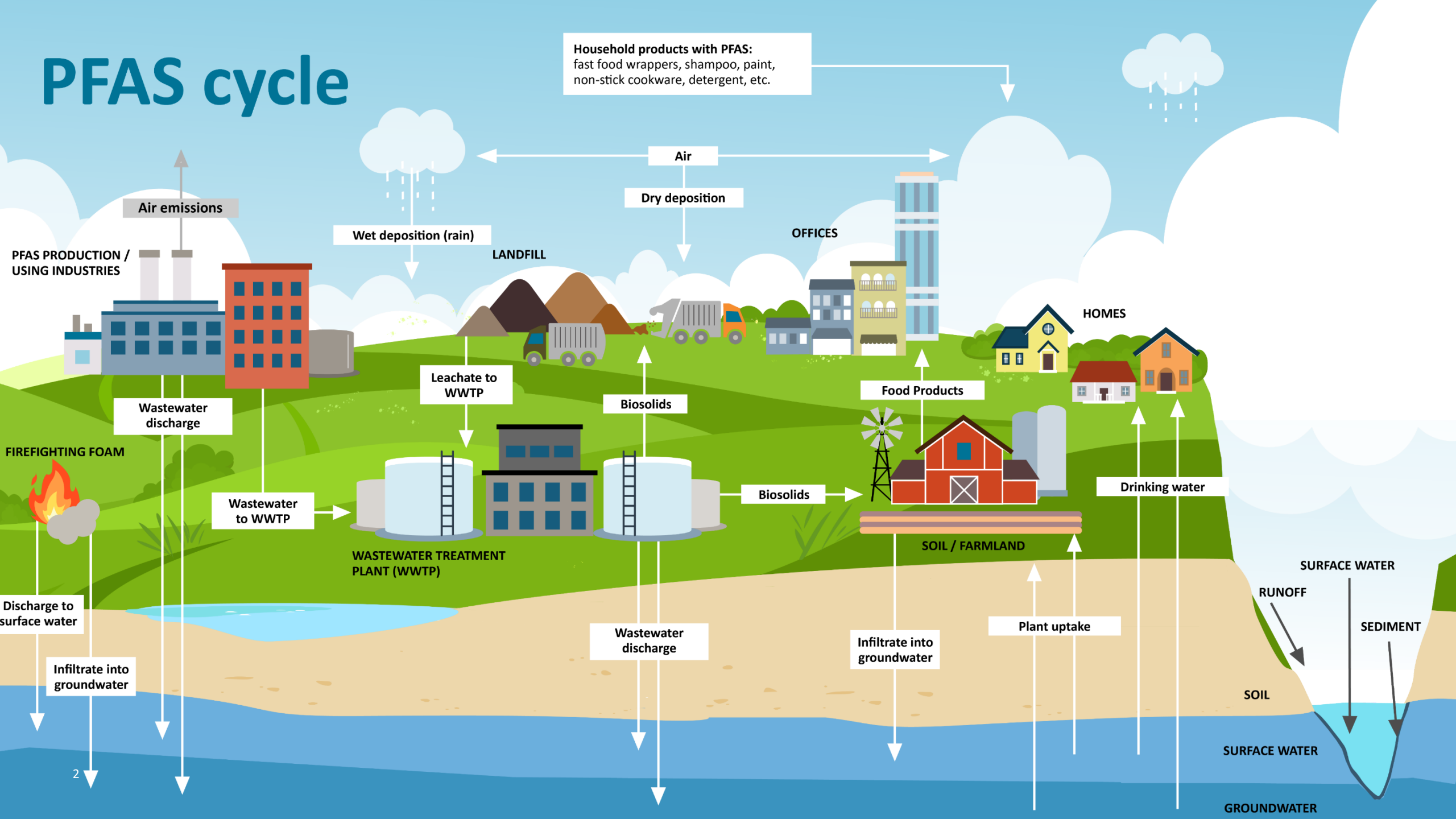


It's raining PFAS: A nationwide study of PFAS in rain

Sarah Mass, P.E.
Battelle Chlorinated Conference
June 6, 2024



PFAS cycle



Previous studies evaluated PFAS concentrations in rain or evaluated the extent of contamination due to air emissions

- Majority of prior studies were limited due to:
 - Short analyte lists
 - Limited geographic area
- A nationwide survey of PFAS in rain in the United States using expanded analyte lists was lacking... **until now...**

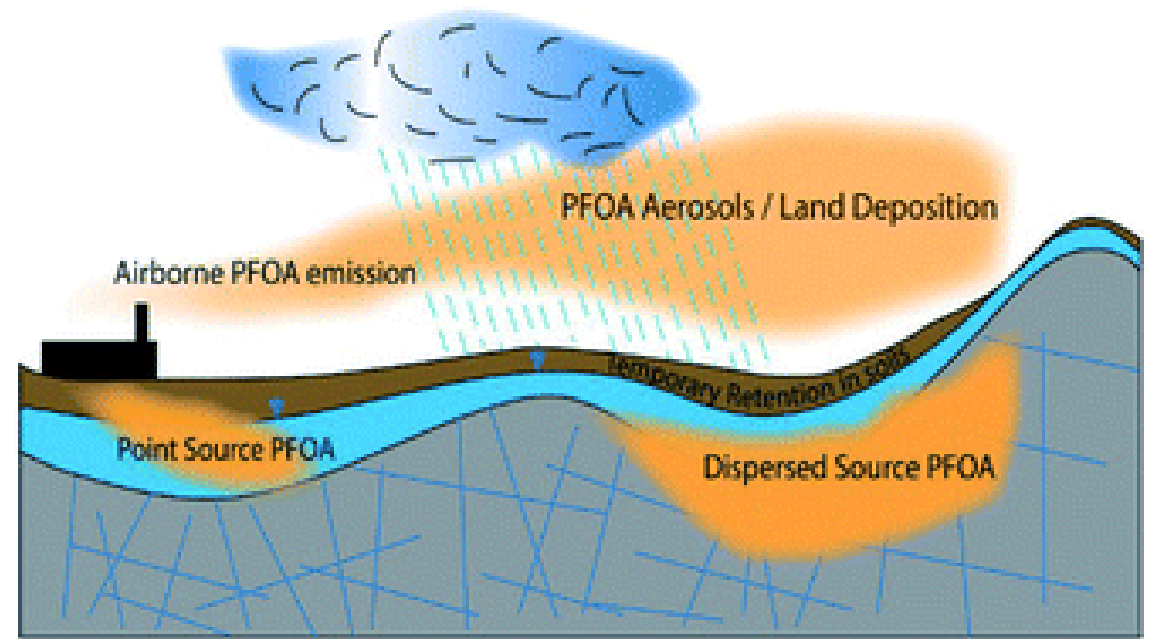


Image source: Shroeder et al. 2021

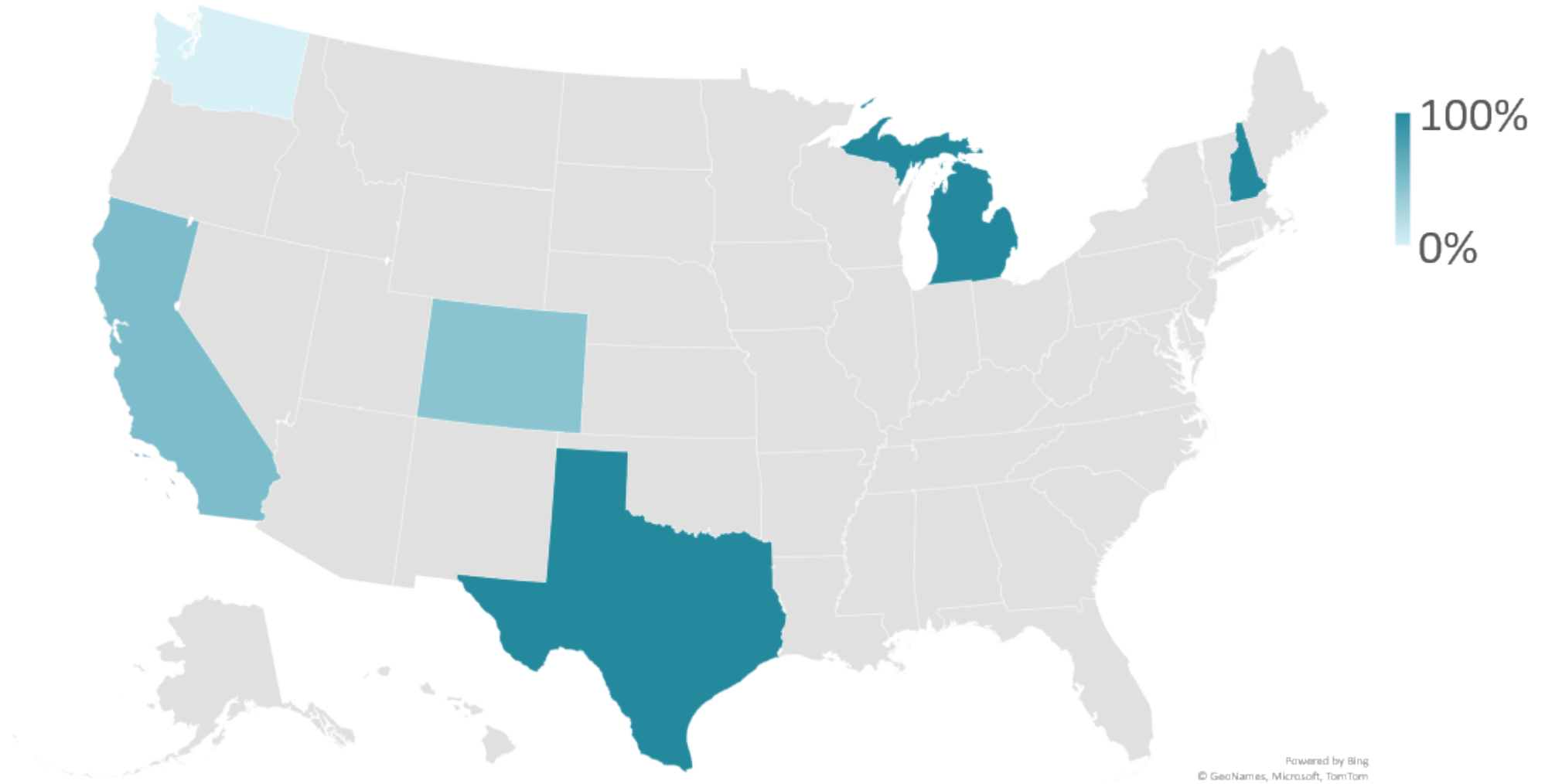
Due to a lack of standard protocol for measuring PFAS in rain, we created our own

- Samples were collected at residences of Haley & Aldrich employees
- **Analyzed using the Eurofins-specific expanded list of 72 analytes**

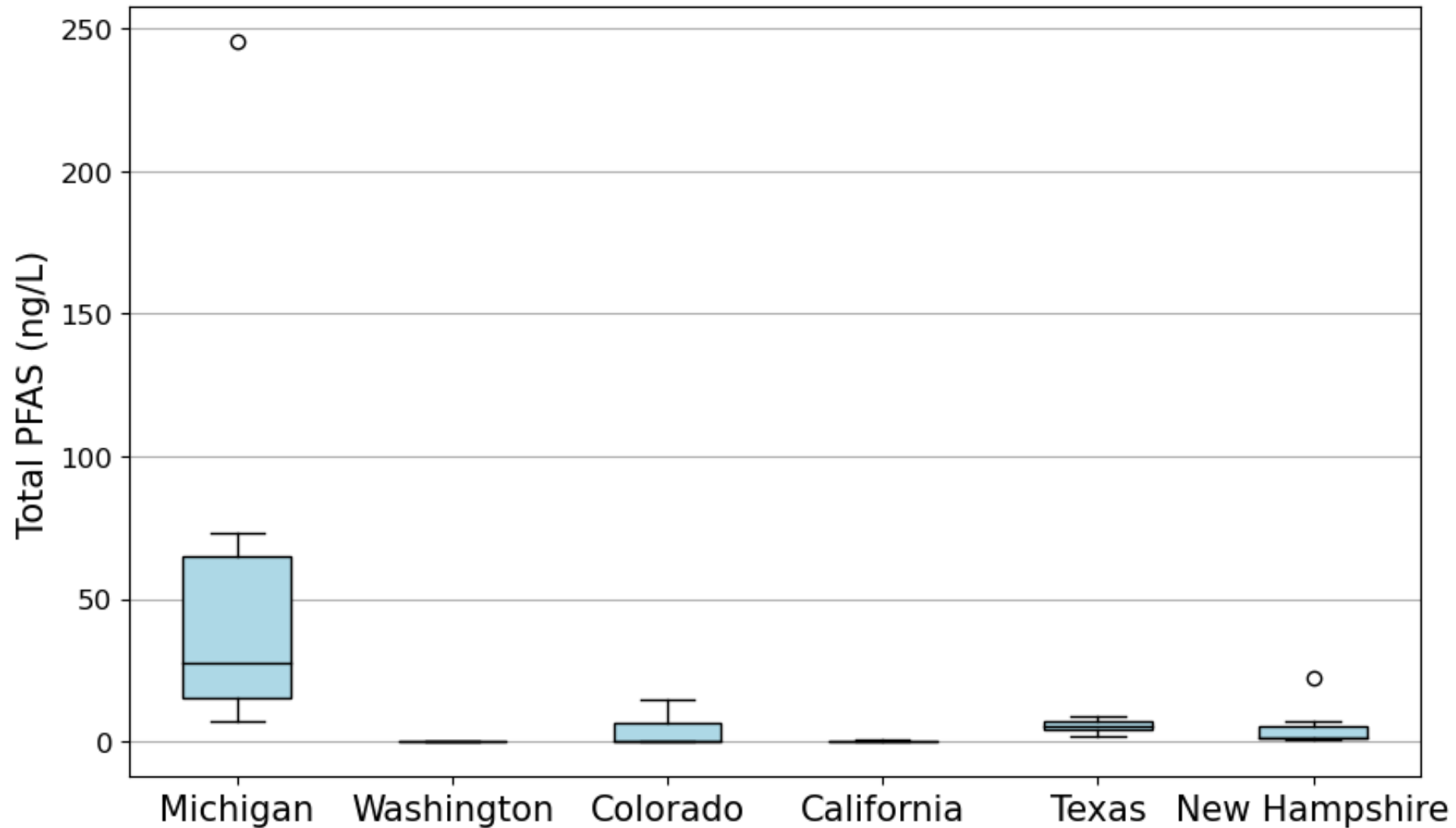


Sun 9/10	Mon 9/11	Tue 9/12	Wed 9/13	Thu 9/14
74° 54°F	70° 54°F	72° 53°F	74° 53°F	76° 53°F
				
PM	Scattered	PM	Isolated	PM Showers
Thunderstorms	Thunderstorms	Thunderstorms	Thunderstorms	
0.16 in	0.2 in	0.04 in	0.02 in	0.02 in

It's raining PFAS, but not everywhere, and not always...



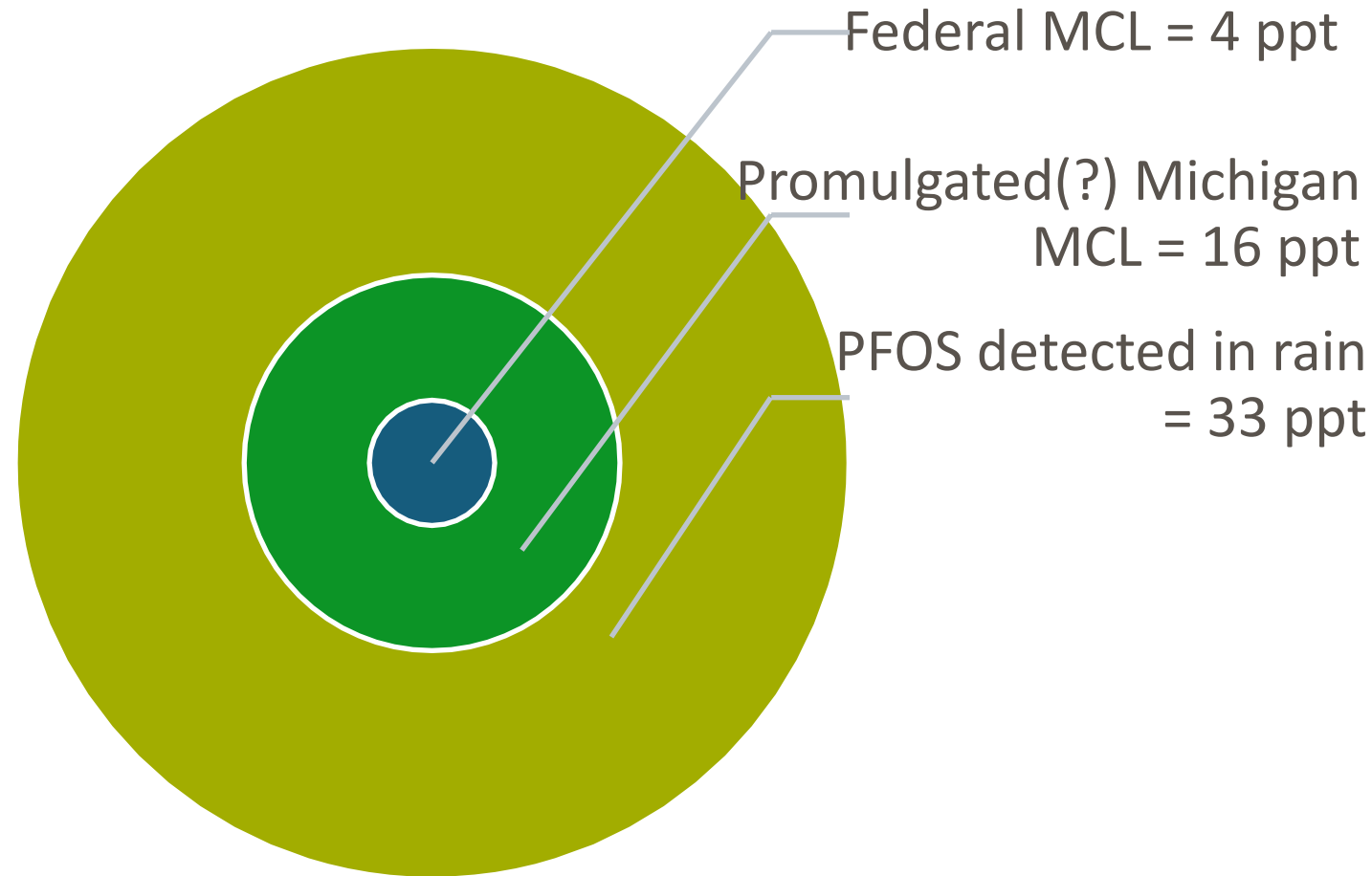
“Total PFAS” concentrations varied in space and in time



One sample collected in Michigan exceeded the PFOS drinking water MCL by eight times!

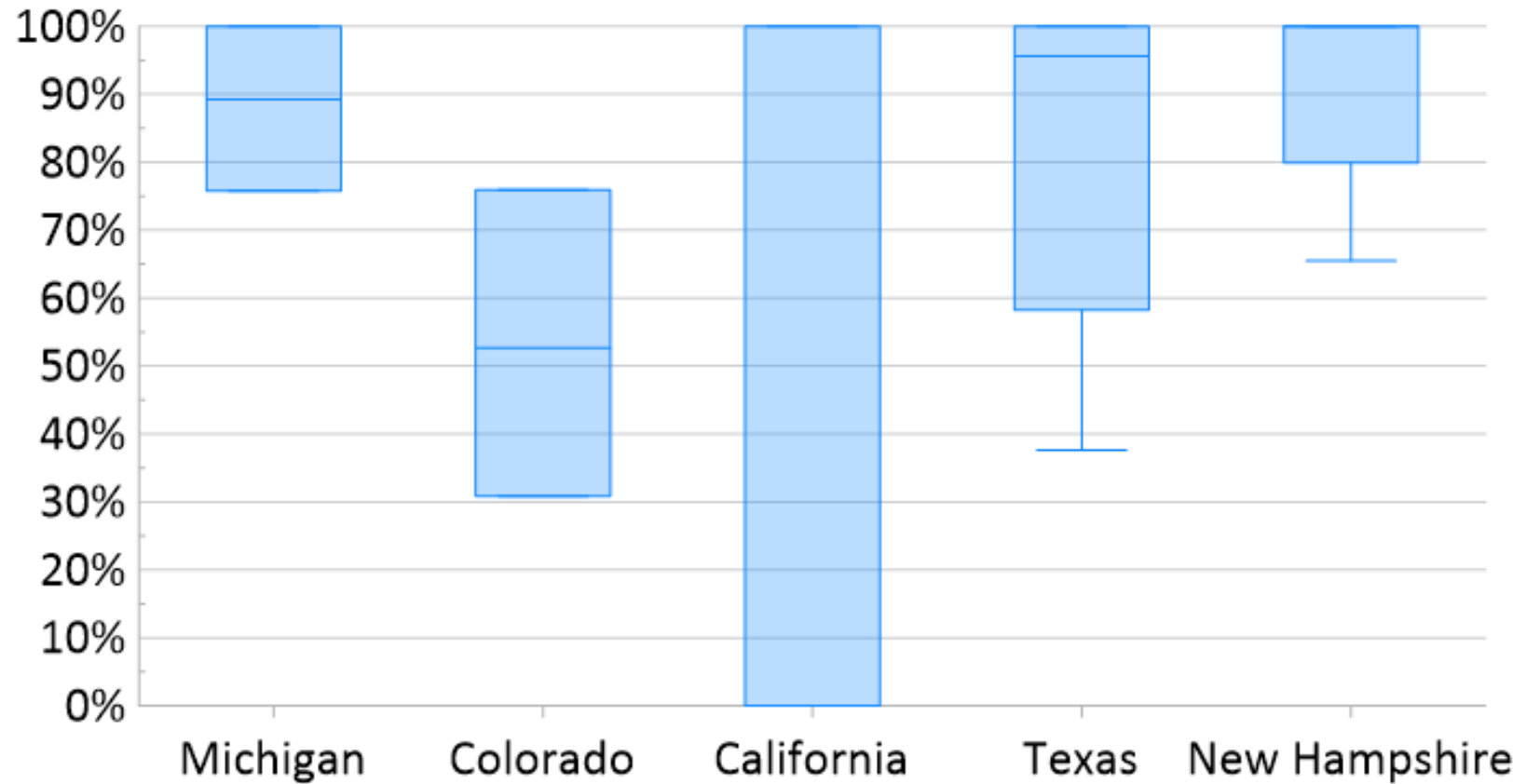
In samples where PFAS were detected, 32% of samples had detections of compounds with federal MCLs, including:

- PFNA
- PFOA
- GenX
- PFOS



Analytes that are not included in USEPA Method 1633 dominated at many locations

Percent of "total PFAS" detected that are not on 1633 analyte list



Translation: Using the USEPA standard method would significantly underreport PFAS concentrations!

PFPrA, an ultrashort chain compound, was the most frequently detected PFAS

- PFPrA is:
 - More mobile and more difficult to treat than long chain PFAS
 - Persistent
 - Unregulated
- No significant difference in concentrations across CA, CO, TX, MI, NH
- PFPrA was also the most frequently detected PFAS in bottled water (Chow et al. 2021) and water supplies (Pelch et al. 2023)

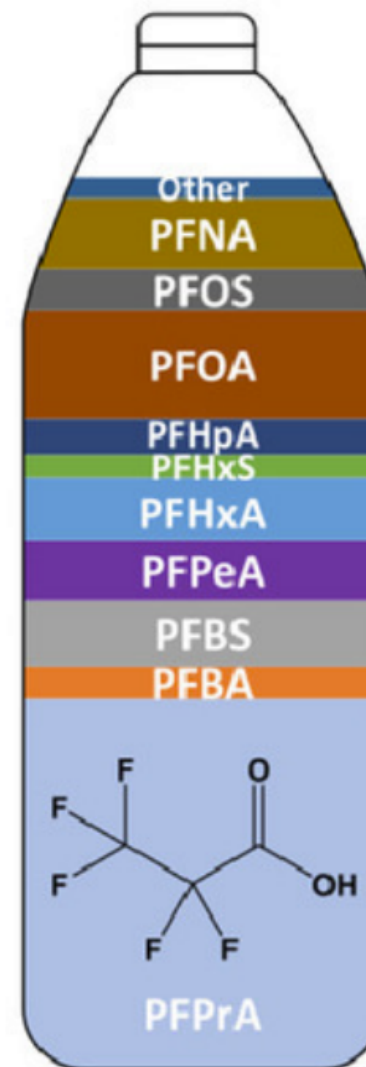
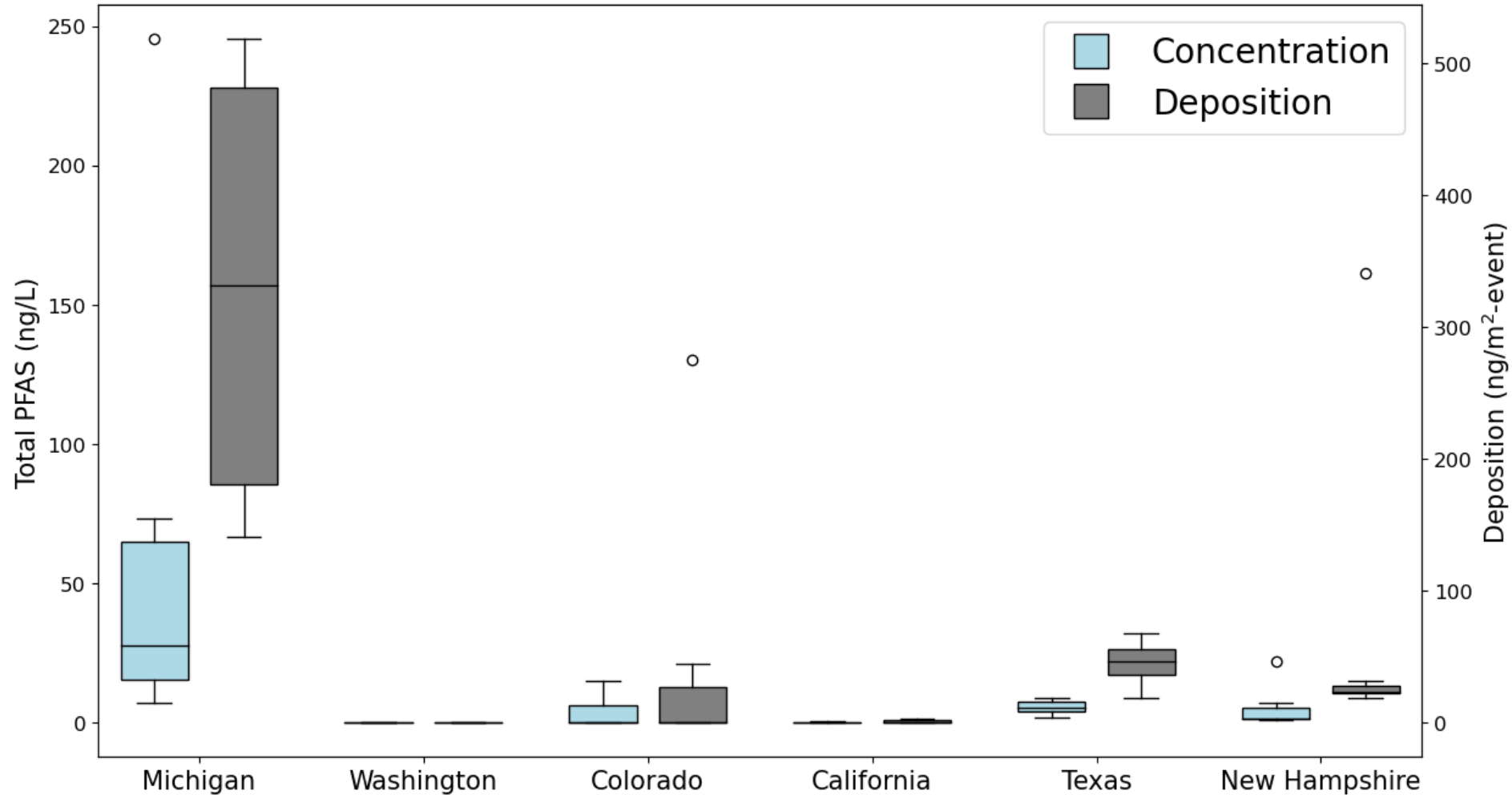


Image source: Chow et al. 2021

Event-based mass flux highlights the significance of non-point sources



Preliminary Conclusions

- PFAS are not in every sample, and in Washington, it didn't rain PFAS at all!
- Spatial and temporal differences suggest site-specific rain monitoring is needed
- Standard analyte lists may significantly underreport PFAS occurrence
- Ultrashort chain compound PFPrA was the most common PFAS detected
- Mass flux estimates highlight the importance of non-point sources of PFAS



Acknowledgements

Taryn McKnight (Taryn.McKnight@et.eurofinsus.com)



Thank you!

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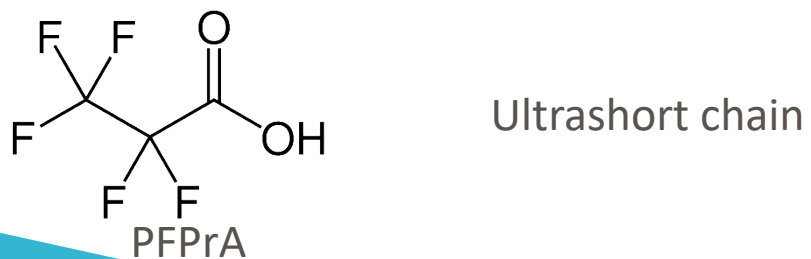
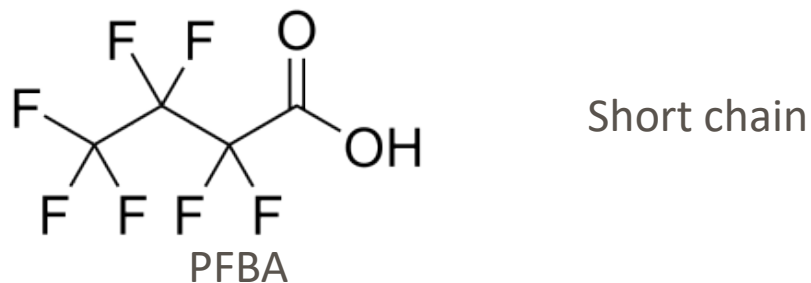
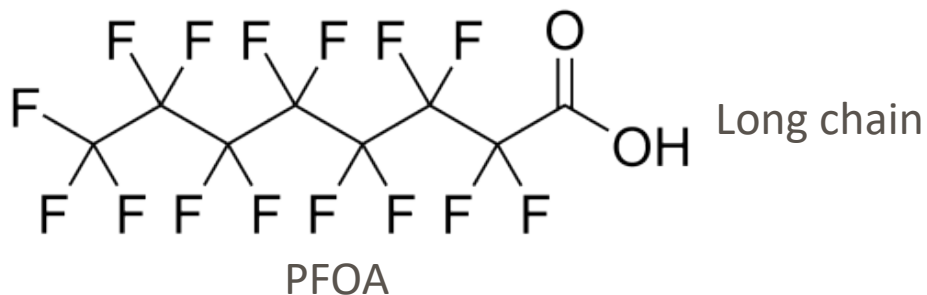
<https://www.haleyaldrich.com/services/contaminated-site-management/pfas/>

Backup Slides

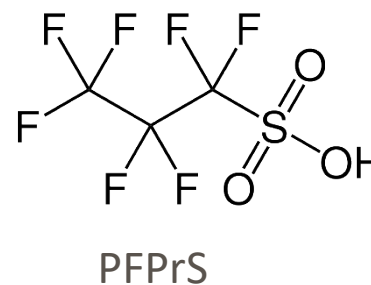
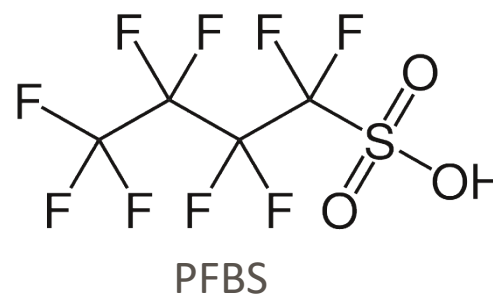
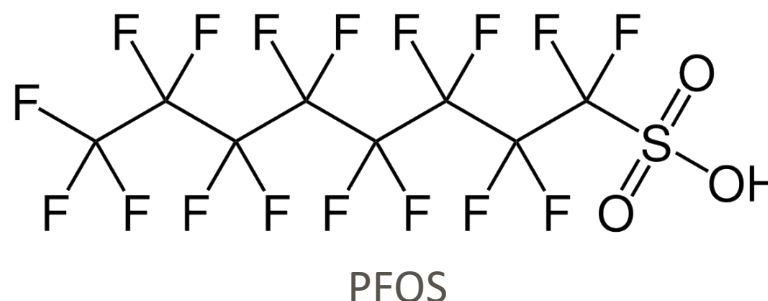
Poly- and perfluoroalkyl substances (PFAS) are a group of thousands of compounds

Perfluoroalkyl acids (PFAAs)

Perfluoroalkyl carboxylic acids (PFCAs)



Perfluoroalkyl sulfonic acids (PFSAs)



Ether-substituted PFAS

