Detecting PFAS in Virginian Private Wells

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EPA cites West Virginia plant linked to Roanoke Valley reservoir contamination for release of 'forever chemical'

Laurence Hammack Apr 27, 2023 🔍 11

Virginia localities are working to limit PFAS chemical exposures

VPM | By Patrick Larsen Published August 23, 2023 at 7:22 PM EDT f 🔽 in 🖂

Community calls on Department of Defence to expand PFAS testing zone in Richmond

By Housnia Shams

Posted Mon 11 Sep 2023 at 3:13pm

'Forever chemicals' found in more than a dozen waterways in Chesapeake region

Timothy B. Wheeler Nov 8, 2022 🔍 0

Private Drinking Water

• 10-20% of Americans are reliant on private drinking water supplies



- Private wells are NOT subject to the US Safe Drinking Water Act
- Treatment prior to consumption is limited
- Few datasets describing PFAS in household wells under baseline conditions
 - Smalling et al. 2023. PFAS in US Tap Water.... Environment International 178: 108033. <u>https://doi.org/10.1016/j.envint.2023.108033</u>
 - 269 well samples across the nation (~5 in Virginia)
 - At least one PFAS compound in 20% of well samples

Virginia Household Water Quality Program

Virginia Household Water Quality Program

2022 Annual Report

The Virginia Household Water Quality Program provides affordable, confidential water testing and education to the

1.7 million, or 22% of Virginians

who rely on wells, springs and cisterns for household water. Municipal water supplies are regulated in the U.S., but maintenance, testing and addressing problems with

private water supplies are the responsibility of the owner.

3,011
samples
analyzed
serving7,599
Virginiansin 90/96
counties

Virginia Cooperative

Virginia Tech Virginia State University

Extension



Erin Ling, VCE (Main Campus)

Clinic targets:

- Coliform
- E. coli
- Nitrate
- Fluoride
- Sodium
- Manganese
- Iron
- Copper
- pH
- TDS
- Sulfate
- Hardness
- Arsenic
- Lead

https://www.wellwater.bse.vt.edu/files/2022VAHWQPWellWaterAnnualReportFINAL.pdf



Characterizing prevalence and risk factors of PFAS in rural private water supplies (#G22AP00015-00)

MOTIVATION:

- Drinking water is hypothesized to be the primary exposure route for PFAS
- Private drinking water supplies may be uniquely vulnerable



Y SEHOLD Science for a changing world







Two major questions when it came to private drinking water systems:

- 1. Are PFAS compounds detected in private wells at the point of use (POU) or in well groundwater?
- 2. Does participant collection of samples for PFAS analysis introduce bias when compared to expert collected samples?



Sampling Methods for PFAS





At least one PFAS was detected in 88% (n=60) point of use samples





 Average number of PFAS compounds in a POU sample (n=60) was 3.3, outside (n=20) was 3.4

 66% of total samples (n=80) contained ≥ 3 PFAS compounds

 Maximum number of PFAS compounds detected in a single sample was 8



Are detections of PFAS compounds related to one another?

1.0

0

-1.0

_	PFBA	PFPeA	PFBS	PFHxA	РЕНрА	ADONA	PFHxS	PFOA	6-2 FTS	PFOS	
PFBA	1.00	-0.02	0.26	-0.04	-0.18	0.06	-0.23	-0.21	0.21	-0.27	0.34
PFPeA	-0.02	1.00	0.38	0.31	-0.07	0.11	-0.10	0.16	-0.23	0.06	0.46
PFBS	0.26	0.38	1.00	0.19	0.30	0.06	0.35	0.24	0.22	0.28	0.63
PFHxA	-0.04	0.31	0.19	1.00	0.47	0.30	-0.06	0.13	0.46	0.01	0.65
PFHpA	-0.18	-0.07	0.30	0.47	1.00	0.05	0.52	0.42	0.24	0.37	0.47
ADONA	0.06	0.11	0.06	0.30	0.05	1.00	-0.20	-0.15	0.17	-0.16	0.16
PFHxS	-0.23	-0.10	0.35	-0.06	0.52	-0.20	1.00	0.52	-0.17	0.66	0.22
PFOA	-0.21	0.16	0.24	0.13	0.42	-0.15	0.52	1.00	-0.17	0.63	0.31
6-2 FTS	0.21	-0.23	0.22	0.46	0.24	0.17	-0.17	9 17	1.00	-0.11	0.33
PFOS	-0.27	0.06	0.29	0.01	0.37	-0.16	0.66	0.63	-0.11	1.00	0.21
Σ PFAS	0.34	0.46	0.63	0.65	0.47	0.16	0.22	0.31	0.33	0.21	1.00

Spearman's correlation matrix for non-parametric data

 A variety of legacy PFAS were frequently detected with their short chain replacements

 High concentrations of PFHxA and PFBS were indicative of higher overall Σ PFAS values

Higher concentrations of legacy PFOS was likely to correlate to higher concentrations of PFOA and PFHxS (0.66) and (0.63)





- PFAS detection in VA private wells is common but variable
- Detection of ≥ 3 PFAS compounds in mixture is also common
- A variety of PFAS compounds (i.e. legacy and replacement) were detected (15/31)
- Homeowner/expert collected samples showed inconsistent bias (Wilcoxon, p= 0.05)
 - Are system factors contributing?

Characterizing prevalence and risk factors of PFAS in rural private water supplies (#G22AP00015-00)

Phase II sampling in six counties representative of three geologic regions

Development of public education and communication materials → Evolving Regulations are DIFFICULT





A Collaborative Multi-State Research and Technical Assistance Consortium: State of Science and Future Opportunities to Address PFAS (NR223A750008C011/G-70444-05)

Planning a small pilot Montgomery County testing clinic to examine sources of methodological bias

Future sampling of private drinking water samples in multiple states



1 ppt = 1 drop of water in 20 Olympic swimming pools!!





Dr. Kang Xia, kxia@vt.edu

What's Next?: PFAS "Profiling"

- Inconsistent bias between expert & homeowner samples
- Related to sampling "time", i.e. sample "location" in premise plumbing
- Analogous to lead?



What's Next?: PFAS "Profiling"



Questions?



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