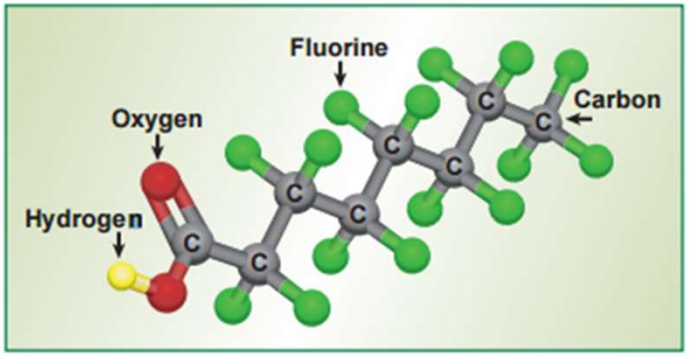
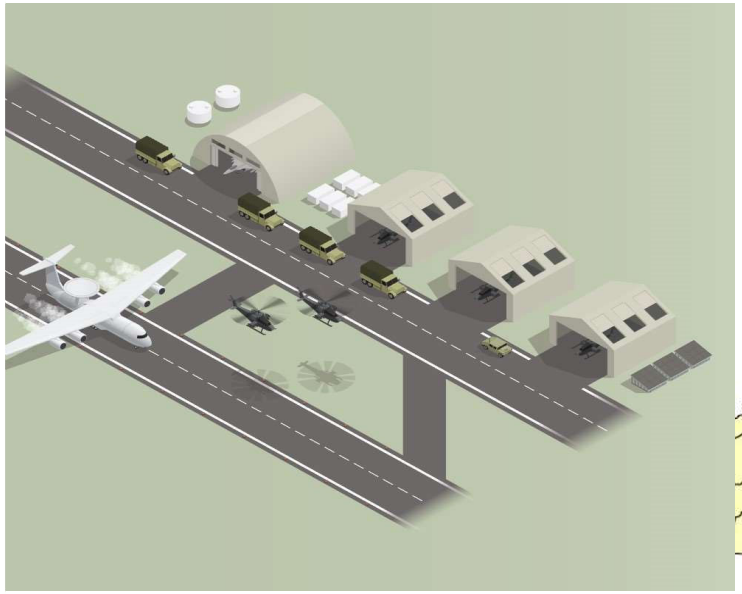
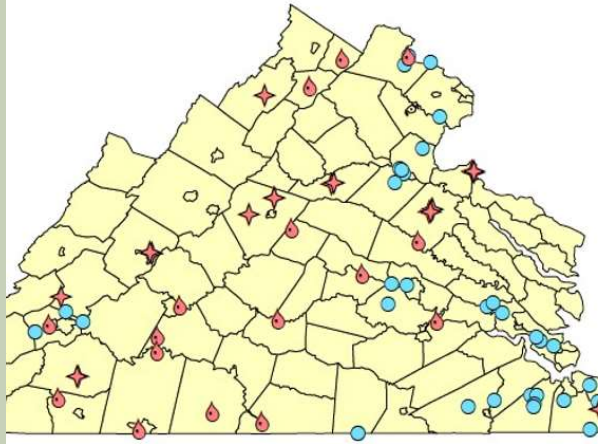
Hazen







PFAS in Virginia – Overview and Current Activities

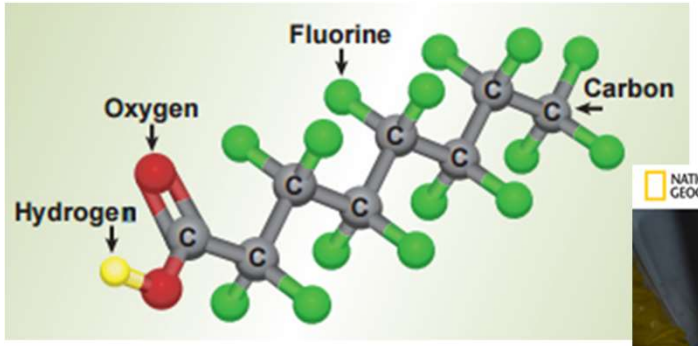
Erik Rosenfeldt, PE, PhD

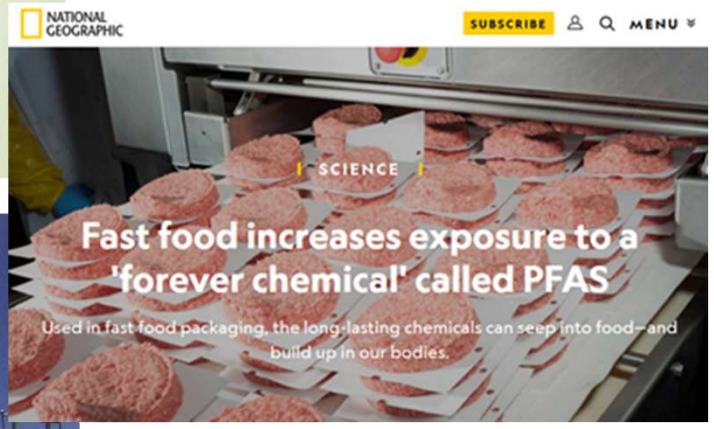
Per- and Polyfluoroalkyl Substances – PFAS

Manmade organic chemicals containing at least 1 fluorinated C atom

Commercial and Consumer Products Containing PFAS:

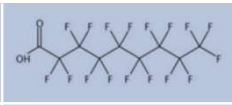
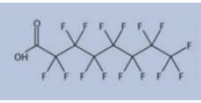
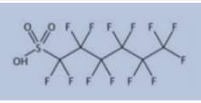
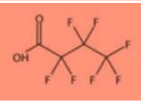
- paper and packaging
- clothing and carpets
- outdoor textiles and sporting equipment
- ski and snowboard waxes
- non-stick cookware
- cleaning agents and fabric softeners
- polishes and waxes, and latex paints
- pesticides and herbicides
- hydraulic fluids
- windshield wipers
- paints, varnishes, dyes, and inks
- adhesives
- medical products
- personal care products (for example, shampoo, hair conditioners, sunscreen, cosmetics, toothpaste, dental floss)



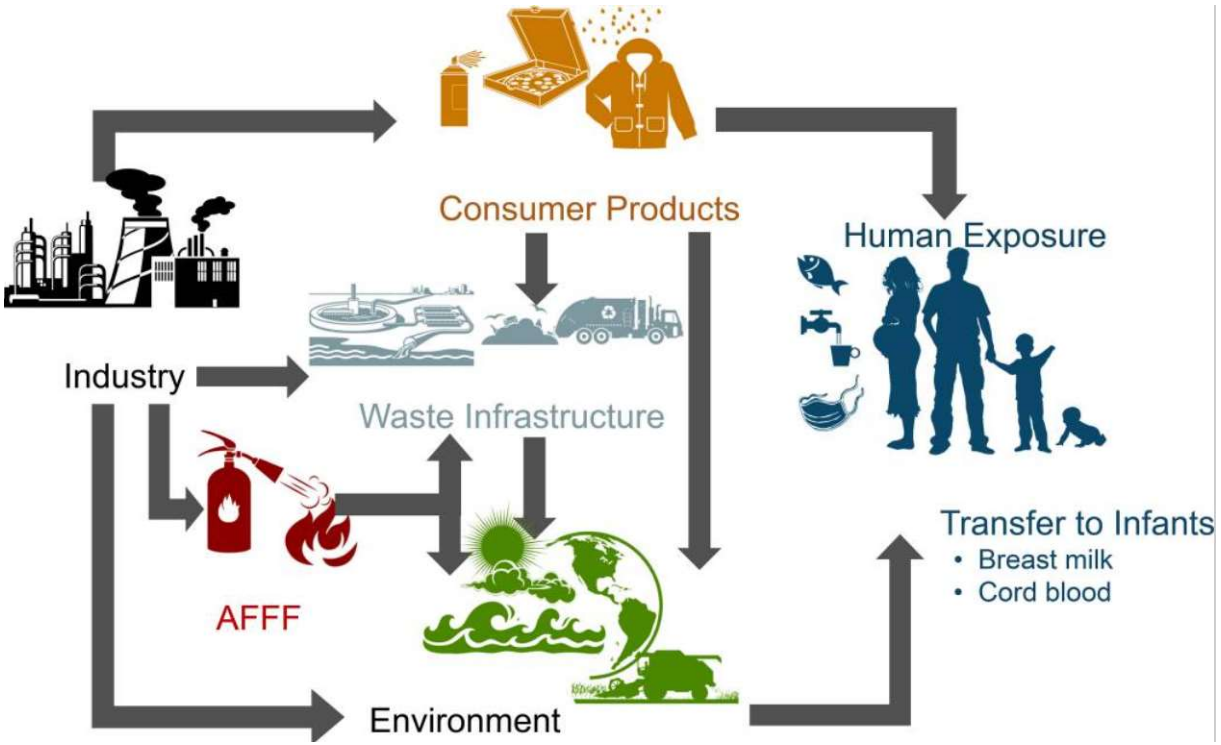


Environmental and Human Impacts

- PFAS are persistent in the environment
- Longer-chain chemicals bioaccumulate more than shorter chain molecules
  - EPA began phase-out of PFOS and PFOA
  - Manufacturers switched to shorter chain versions
  - Short-chain PFAS are more challenging to treat
- Humans are often exposed to PFAS through food, dust, consumer products, clothing, and water
  - Half life in humans is several years (slow elimination)
  - Exposure is cumulative

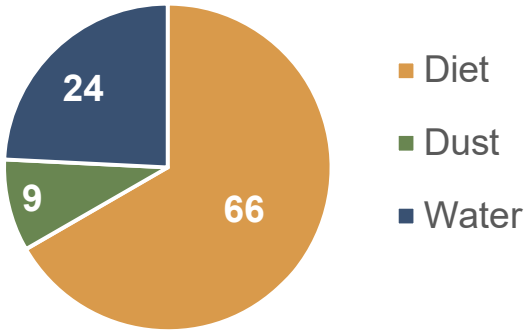
Long Chain	Perfluorononanoic acid (PFNA)	$C_9HF_{17}O_2$	
	Perfluorooctanoic acid (PFOA)	$C_8HF_{15}O_2$	
	Perfluorooctane sulfonic acid (PFOS)	$C_8F_{17}SO_3H$	
	Perfluorohexane sulfonic acid (PFHxS)	$C_6F_{13}SO_3H$	
Short Chain	Perfluorobutanonic acid (PFBA)	$C_4HF_7O_2$	
	Perfluorobutane sulfonic acid (PFBS)	$C_4HF_7O_3S$	
	2, 3, 3, 3-tetrafluoro-2-(haptafluropropoxy)-propanoate (GenX)	$C_6HF_{11}O_3$	

PFAS Exposure Points



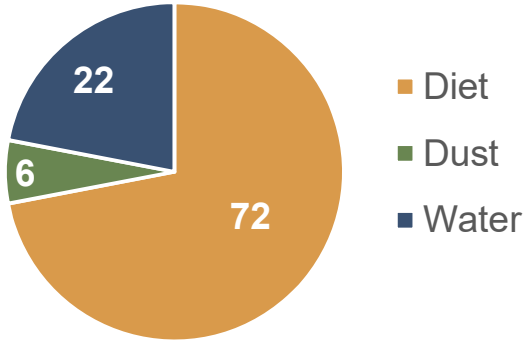
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6380916/

PFOA Exposure Routes



Data from: Environmental science & technology 2011; 45: 8006–8014.

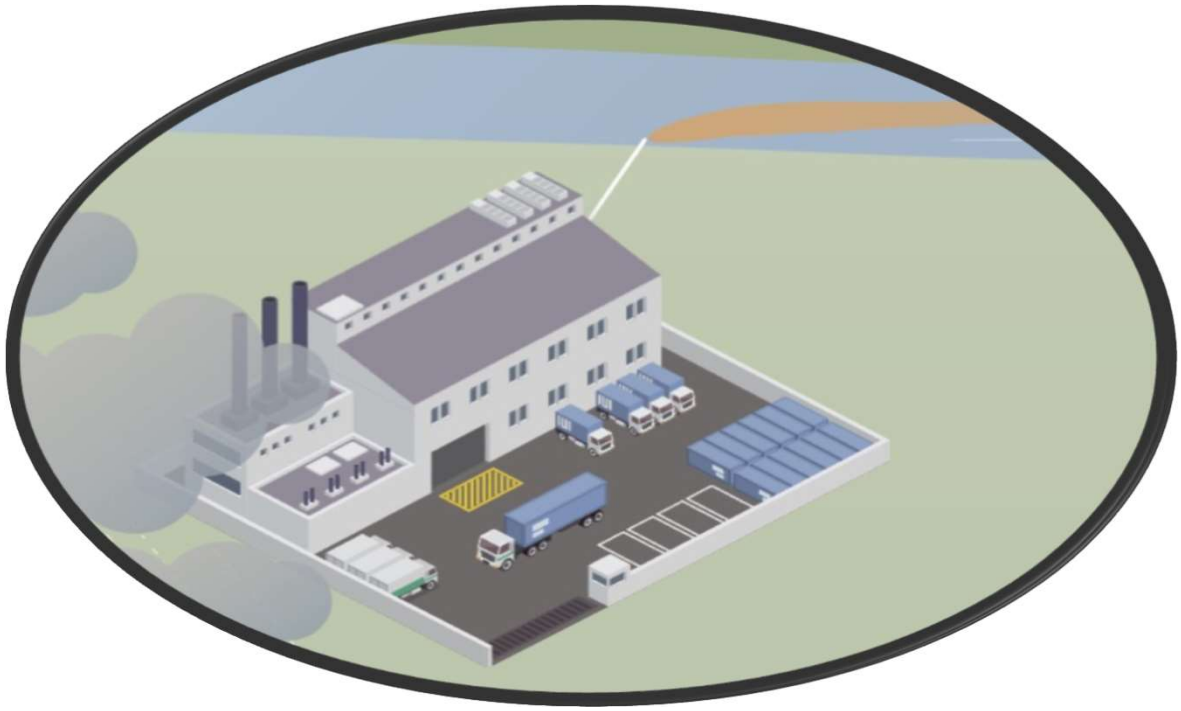
PFOS Exposure Routes



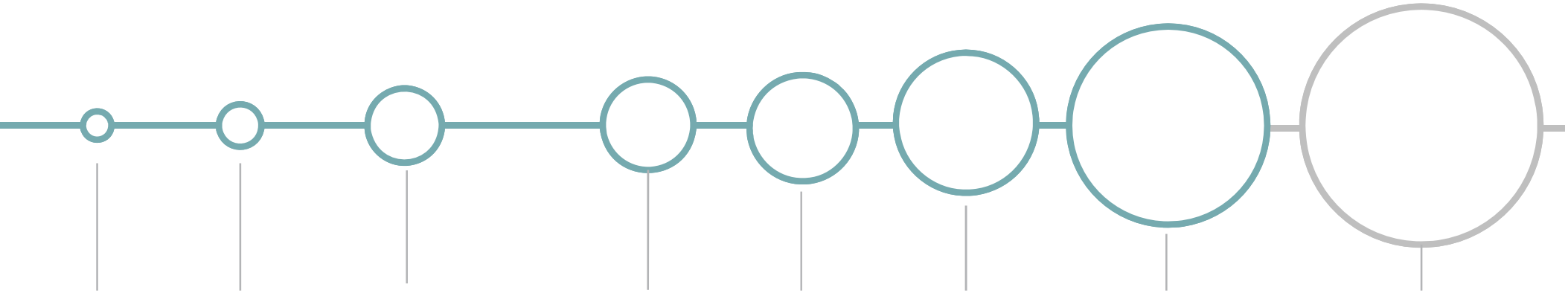
Data from: Journal of exposure science & environmental epidemiology 2011; 21: 150–168

Sources of PFAS in Drinking Water

- Groundwater and Surface Water
- Industrial Manufacturing Sources
  - Waste Discharges
  - Air Pollution
- Military Installations and Airports
  - Firefighting
  - Training Exercises
- Consumer Products
  - Wastewater Effluent, Solids
  - Landfill Leachate
- Persistent and Mobile



Regulatory PFAS Timeline



1998

EPA First alerted to risks

2000

ES&T[1] article on global PFAS distribution, Dupont WV crisis

2006

Manufacturers phase out chemicals via participation in EPA's Stewardship Program

2015

Third Unregulated Contaminant Monitoring Rule (UCMR3) nationwide occurrence study

2016

EPA revised Health Advisories for PFOA and PFOS

2019

EPA PFAS Action Plan

State level regulatory action and monitoring

2020

Preliminary regulatory determination for PFOA/PFOS;

State regulatory action and monitoring

2021+

"PFAS 2021 – 2025"

National Occurrence Testing (2023 – 2025)

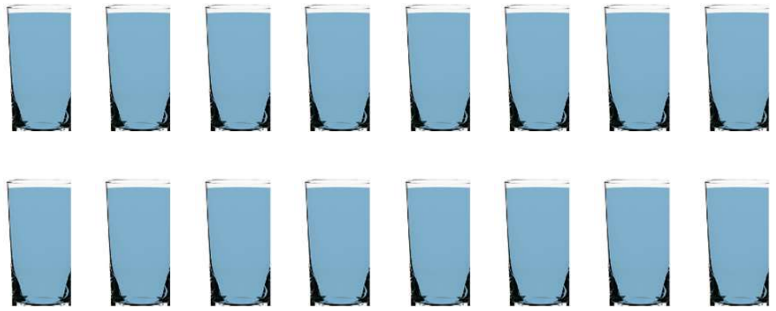
Virginia Department of Health Statewide Monitoring (2021)

[1] Environmental Science & Technology

EPA HAL (November 2016)

"Best guidance we have right now"

"To provide Americans, including the most sensitive populations, with a margin of protection from a lifetime of exposure to PFOA and PFOS from drinking water, EPA has established the health advisory levels at 70 parts per trillion."

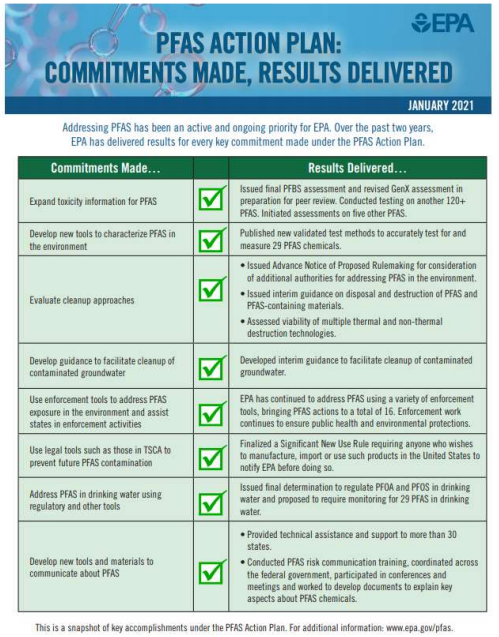


Daily consumption *at or below which adverse health effects are not anticipated to occur over a lifetime of exposure (4L or 16 8oz glasses).*

National Perspective – EPA PFAS Action Plan Update

EPA Progress as of January 2021

- Final Regulatory Determinations for PFOA and PFOS
  - EPA to initiate development of Primary Drinking Water Regulations
  - Nationwide monitoring of 29 PFAS chemicals in UCMR5 (2023 - 2025)
- Proposed Rulemaking for PFOA/PFOS in environment
- Toxicity assessment for PFBS and GenX
- Proposed Rulemaking for PFOA/PFOS from manufacturing facilities
  - Possible development of national Effluent Limitation Guidelines
- Final regulation adding 172 PFAS chemicals to Toxics Release Inventory reporting
- PFAS Action plan is soon to be replaced with PFAS 2021-2025



EPA

PFAS ACTION PLAN:
COMMITMENTS MADE, RESULTS DELIVERED

JANUARY 2021

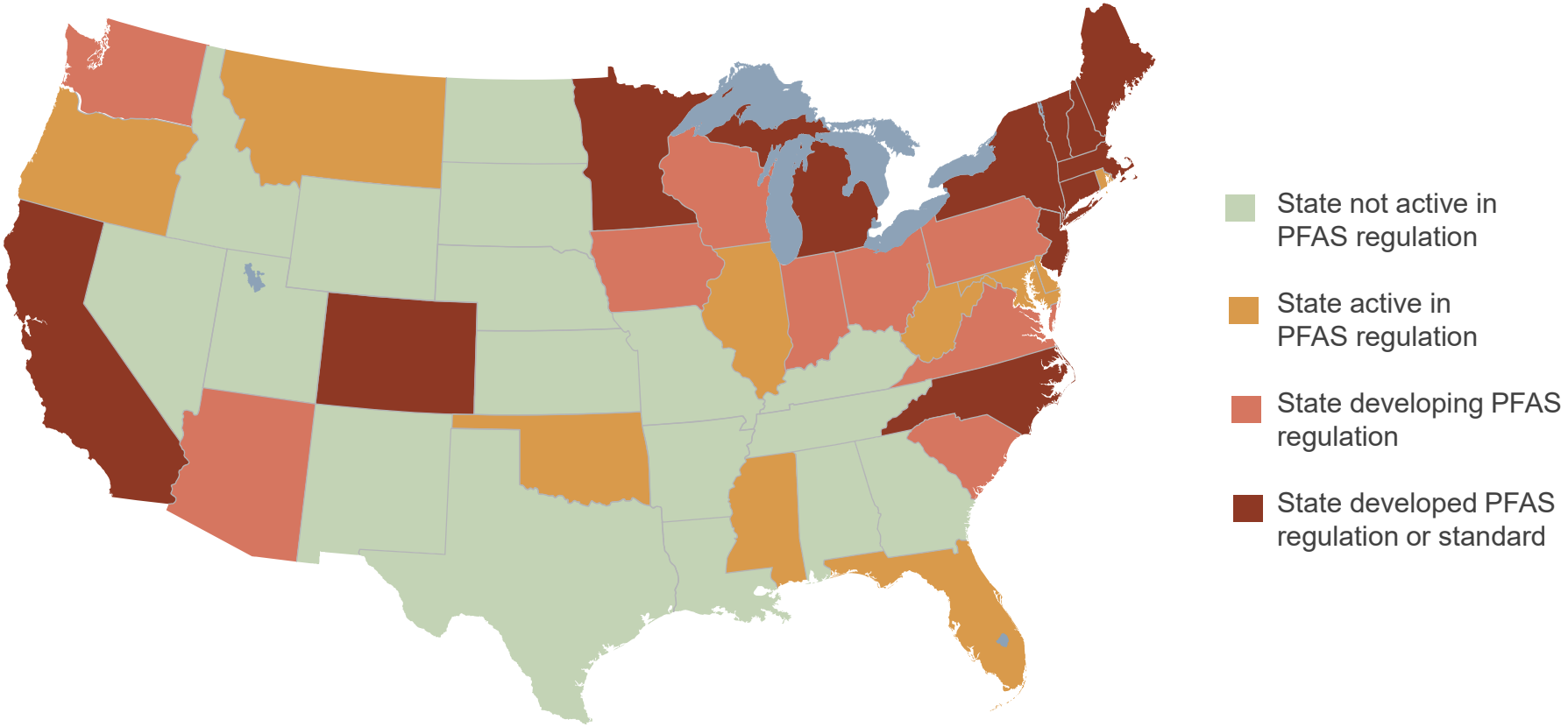
Addressing PFAS has been an active and ongoing priority for EPA. Over the past two years, EPA has delivered results for every key commitment made under the PFAS Action Plan.

Commitments Made…		Results Delivered…
Expand toxicity information for PFAS	☑	Issued final PFBS assessment and revised GenX assessment in preparation for peer review. Conducted testing on another 120+ PFAS. Initiated assessments on five other PFAS.
Develop new tools to characterize PFAS in the environment	☑	Published new validated test methods to accurately test for and measure 29 PFAS chemicals.
Evaluate cleanup approaches	☑	• Issued Advance Notice of Proposed Rulemaking for consideration of additional authorities for addressing PFAS in the environment. • Issued interim guidance on disposal and destruction of PFAS and PFAS-containing materials. • Assessed viability of multiple thermal and non-thermal destruction technologies.
Develop guidance to facilitate cleanup of contaminated groundwater	☑	Developed interim guidance to facilitate cleanup of contaminated groundwater.
Use enforcement tools to address PFAS exposure in the environment and assist states in enforcement activities	☑	EPA has continued to address PFAS using a variety of enforcement tools, bringing PFAS actions to a total of 16. Enforcement work continues to ensure public health and environmental protections.
Use legal tools such as those in TSCA to prevent future PFAS contamination	☑	Finalized a Significant New Use Rule requiring anyone who wishes to manufacture, import or use such products in the United States to notify EPA before doing so.
Address PFAS in drinking water using regulatory and other tools	☑	Issued final determination to regulate PFOA and PFOS in drinking water and proposed to require monitoring for 29 PFAS in drinking water.
Develop new tools and materials to communicate about PFAS	☑	• Provided technical assistance and support to more than 30 states. • Conducted PFAS risk communication training, coordinated across the federal government, participated in conferences and meetings and worked to develop documents to explain key aspects about PFAS chemicals.

This is a snapshot of key accomplishments under the PFAS Action Plan. For additional information: www.epa.gov/pfas.

https://www.epa.gov/newsreleases/epa-delivers-results-pfas-action-plan

PFAS Regulatory Approaches Vary Nationwide



PFAS Regulation in Virginia

Two Bills passed in 2020 (HB 586 and HB1257) addressed PFAS

HB 586

- Creation of Virginia PFAS task force
- Study occurrence of PFOA, PFOS, PFBA, PFHpA, PFHxS, PFNA, *"and other PFAS in the Commonwealth's public drinking water."*
  - **Occurrence Study –**
    - *"Sample no more than 50 representative waterworks and major sources of water"*
    - *"Identify possible sources of such contamination"*
    - *"Evaluate existing approaches to regulating…"*
  - **Develop recommendations for specific MCLs**
- Report on findings by December 1, 2021

HB 1257

- Directs VDH to adopt MCLs for several compounds
  - **PFOA, PFOS, "*and other PFAS as the Board deems necessary*"**
  - **But also…**
    - *Chromium-6*
    - *1,4-dioxane*
  - **"Protective of public health… and no higher than any MCL or health advisory adopted by the USEPA for the same contaminant"**
- Publish MCLs in January 2022

Upcoming VDH PFAS Monitoring:

Collecting the best possible data

PFAS Samples are Tricky to Collect

Lab-specific Protocols designed to eliminate contamination of samples

Microbac Sampling Precautions

NO:

- Gore-Tex or Tyvek clothing/materials
- Clothes washed with fabric softener
- Cosmetics, moisturizers, sunscreen, or insect repellant
- Permanent markers or sharpies
- Plastic clipboards, binders, or hard covers

Eurofins Sampling Precautions

- Sample for PFAS at beginning of workday
- No new clothing; must have been washed 5x or more
- Shower only with PFAS-free soap/shampoo
- Brush teeth with fluoride-free toothpaste and avoid flossing before sampling
- Do not handle any packaged food or drinks, aluminum foil, etc. around sampling site
- Ball-point pen only
- Untreated paper and aluminum clipboards only

Summary of Tips for Sample Collection

1. Pre-label all bottles and use ONLY a standard ballpoint pen to mark
2. Do not use waterproof log-books or plastic clipboards on-site
3. Grab PFAS samples first and early in the day
4. Do not wear anything waterproof or “stain” resistant
   - Old, worn clothes are best
   - Do NOT use clothes washed with fabric softener
5. Do not shower, apply makeup or deodorant, or brush teeth the morning of sampling
   - No sunscreen or insect repellent either
6. Collect samples with nitrile gloves (no latex)
7. Fill to neck (do not over fill or spill preservative)
8. Put samples in their own plastic bag (separate from other samples), and ship on bag ice to lab

Once Samples are Collected, What Does the Lab Do?

PFAS in Drinking Water Analytical Methods
(Provided by Eurofins)

Method #	537.1	533	L402
Techniques	SPE and LC/MS/MS Internal Standards	SPE and LC/MS/MS isotope dilution	SPE and LC/MS/MS isotope dilution
Extraction	Single polymer Styrenedivinylbenzene (SDVB) sorbents	Dual phase weak anion exchange (WAX) sorbents	Single phase weak anion exchange (WAX) sorbents
Analytes	18 analytes	25 analytes	25 EPA 533 analytes + 14 additional analytes
Preservatives	Trizma	Ammonium Acetate	Nitric Acid
QC Criteria	Standard EPA QC acceptance criteria	Standard EPA QC acceptance criteria	In-house QC acceptance criteria
Standards Utilized	All 18	All 25	All 39

Methods Comparison

537.1

- Characterizes “long-chain” PFAS
- Approved for identifying 18 PFAS
- Concentrates with single polymer SDVB sorbents
- Uses “Internal Standards” for QC

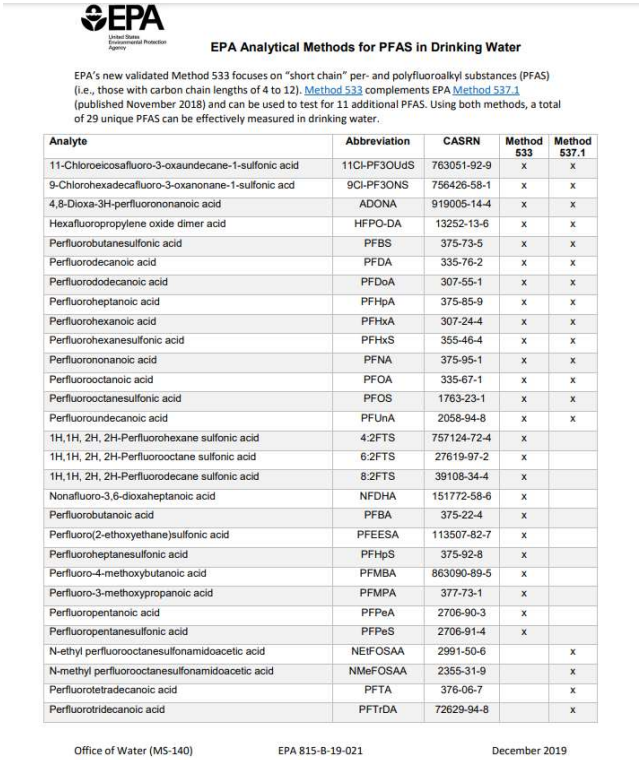
533

- Characterizes “shorter-chain” PFAS
- Approved for identifying 25 PFAS
- Concentrates with dual phase WAX sorbents
- Uses “Isotope Dilution” for QC

VDH method (for finished DW)

Table B-15 of DoD ELAP QSM?

- Used for all non-drinking water PFAS methods
- Not an analytical method – more like a set of QC guidelines
- Requires LC/MS/MS and Isotope Dilution



EPA

EPA Analytical Methods for PFAS in Drinking Water

EPA’s new validated Method 533 focuses on “short chain” per- and polyfluoroalkyl substances (PFAS) (i.e., those with carbon chain lengths of 4 to 12). Method 533 complements EPA Method 537.1 (published November 2018) and can be used to test for 11 additional PFAS. Using both methods, a total of 29 unique PFAS can be effectively measured in drinking water.

Analyte	Abbreviation	CASRN	Method 533	Method 537.1
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9	x	x
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acd	9Cl-PF3ONS	756426-58-1	x	x
4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4	x	x
Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6	x	x
Perfluorobutanesulfonic acid	PFBS	375-73-5	x	x
Perfluorodecanoic acid	PFDA	335-76-2	x	x
Perfluorododecanoic acid	PFDoA	307-55-1	x	x
Perfluoroheptanoic acid	PFHpA	375-85-9	x	x
Perfluorohexanoic acid	PFHxA	307-24-4	x	x
Perfluorohexanesulfonic acid	PFHxS	355-46-4	x	x
Perfluorononanoic acid	PFNA	375-95-1	x	x
Perfluorooctanoic acid	PFOA	335-67-1	x	x
Perfluorooctanesulfonic acid	PFOS	1763-23-1	x	x
Perfluoroundecanoic acid	PFUnA	2058-94-8	x	x
1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	4:2FTS	757124-72-4	x	
1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	6:2FTS	27619-97-2	x	
1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	8:2FTS	39108-34-4	x	
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	x	
Perfluorobutanoic acid	PFBA	375-22-4	x	
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	x	
Perfluoroheptanesulfonic acid	PFHpS	375-92-8	x	
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	x	
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	x	
Perfluoropentanoic acid	PFPeA	2706-90-3	x	
Perfluoropentanesulfonic acid	PFPeS	2706-91-4	x	
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6		x
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9		x
Perfluorotetradecanoic acid	PFTA	376-06-7		x
Perfluorotridecanoic acid	PFTrDA	72629-94-8		x

Office of Water (MS-140) EPA 815-B-19-021 December 2019

Differences Between UCMR3 and UCMR5

Much lower detection, many more compounds (highlighted NOT measured with 533)

Compound	MRL (UCMR3) ppt	MRL (UCMR5)* ppt
PFBS	90	4 (533/537.1)
PFHpA	10	4 (533/537.1)
PFHxS	30	4 (533/537.1)
PFNA	20	4 (533/537.1)
PFOS	40	4 (533/537.1)
PFOA	20	4 (533/537.1)
PFBA	--	4 (533)
PFDA	--	4 (533/537.1)
PFDoA	--	4 (533/537.1)
PFHpS	--	4 (533)
PFHxA	--	4 (533/537.1)
PFPeS	--	4 (533)
PFPeA	--	4 (533)
PFUnA	--	4 (533/537.1)
NEtFOSAA	--	4 (537.1)

Compound	MRL (UCMR3) ppt	MRL (UCMR5)* ppt
NMeFOSAA	--	4 (537.1)
PFTA	--	4 (537.1)
PFTrDA	--	4 (537.1)
11Cl-PF3OUdS	--	4 (533/537.1)
8:2FTS	--	4 (533)
4:2FTS	--	4 (533)
6:2 FTS	--	4 (533)
ADONA	--	4 (533/537.1)
9ClPF3ONS	--	4 (533/537.1)
HFPO-DA (GenX)	--	4 (533/537.1)
NFDHA	--	4/5 (533)
PFEESA	--	4 (533)
PFMPA	--	4 (533)
PFMBA	--	4 (533)

*MRLs based on AEL reported information (via VDH)

Fairfax Water's Proactive Approach to Sampling and Communication

Waterworks Staff will Collect PFAS Samples for VDH Testing

- Monitoring Locations include:
  - Entry points to the distribution system
  - Consecutive connections
  - Intakes (raw water sample taps)

- Fairfax Water Sample Staff Training
  - Trained Drinking Water Staff collecting samples
  - ODW developing instructions with assistance from AEL
  - AEL instructional video for samplers
  - Webinar for sampler training and Q&A

Corbalis Water Treatment Plant Sample Taps

Sampling in April Found Low Levels of PFAS

Analyte ID #	Analyte	Sample Date	Method	Reg Limit	MRL†	P02A ng/L	R06 ng/L	
757124-72-4	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	4/6/2021	533	---	2	< 2.0	< 2.0	
27619-97-2	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	4/6/2021	533	---	2	< 2.0	2.8	
39108-34-4	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	4/6/2021	533	---	2	< 2.0	< 2.0	
919005-14-4	ADONA	4/6/2021	533	---	2	< 2.0	< 2.0	
756426-58-1	9Cl-PF3ONS/F-53B Major	4/6/2021	533	---	2	< 2.0	< 2.0	
763051-92-9	11Cl-PF3OUdS/F-53B Minor	4/6/2021	533	---	2	< 2.0	< 2.0	
13252-13-6	HFPO-DA/GenX	4/6/2021	533	---	2	< 2.0	< 2.0	
113507-82-7	Perfluoro(2-ethoxyethane) sulfonic acid (PFEESA)	4/6/2021	533	---	2	< 2.0	< 2.0	
375-73-5	Perfluorobutanesulfonic acid (PFBS)	4/6/2021	533	---	2	< 2.0	3.9	
375-22-4	Perfluorobutanoic acid (PFBA)	4/6/2021	533	---	2	2.1	6.9	
335-76-2	Perfluorodecanoic acid (PFDA)	4/6/2021	533	---	2	< 2.0	< 2.0	
375-85-9	Perfluoroheptanoic acid (PFHpA)	4/6/2021	533	---	2	< 2.0	3.3	
355-46-4	Perfluorohexanesulfonic acid (PFHxS)	4/6/2021	533	---	2	< 2.0	< 2.0	
307-24-4	Perfluorohexanoic acid (PFHxA)	4/6/2021	533	---	2	< 2.0	7.8	
307-55-1	Perfluorododecanoic acid (PFDoA)	4/6/2021	533	---	2	< 2.0	< 2.0	
375-95-1	Perfluorononanoic acid (PFNA)	4/6/2021	533	---	2	< 2.0	< 2.0	
1763-23-1	Perfluorooctanesulfonic acid (PFOS)	4/6/2021	533	---	2	< 2.0	3.7	
335-67-1	Perfluorooctanoic acid (PFOA)	4/6/2021	533	---	2	< 2.0	4.3	
2058-94-8	Perfluoroundecanoic acid (PFUnA)	4/6/2021	533	---	2	< 2.0	< 2.0	
375-92-8	Perfluoroheptanesulfonic acid (PFHpS)	4/6/2021	533	---	2	< 2.0	< 2.0	
863090-89-5	Perfluoro-4-methoxybutanoic acid (PFMBA)	4/6/2021	533	---	2	< 2.0	< 2.0	
377-73-1	Perfluoro-3-methoxypropanoic acid (PFMPA)	4/6/2021	533	---	2	< 2.0	< 2.0	
2706-90-3	Perfluoropentanoic acid (PFPeA)	4/6/2021	533	---	2	< 2.0	9	
2706-91-4	Perfluoropentanesulfonic acid (PFPeS)	4/6/2021	533	---	2	< 2.0	< 2.0	
151772-58-6	Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	4/6/2021	533	---	2	< 2.0	< 2.0	

PFOA	< MRL	4.3	
PFOS	< MRL	3.7	
PFOA + PFOS	< MRL	8	70 (Fed HAL)

Sampling in April Found Low Levels of PFAS

Analyte ID #	Analyte	Sample Date	Method	Reg Limit	MRL†	P02A ppt	R06 ppt
757124-72-4	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	4/6/2021	533	---	2	< 2.0	< 2.0
27619-97-2	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	4/6/2021	533	---	2	< 2.0	2.8
39108-34-4	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	4/6/2021	533	---	2	< 2.0	< 2.0
919005-14-4	ADONA	4/6/2021	533	---	2	< 2.0	< 2.0
756426-58-1	9Cl-PF3ONS/F-53B Major	4/6/2021	533	---	2	< 2.0	< 2.0
763051-92-9	11Cl-PF3OUdS/F-53B Minor	4/6/2021	533	---	2	< 2.0	< 2.0
13252-13-6	HFPO-DA/GenX	4/6/2021	533	---	2	< 2.0	< 2.0
113507-82-7	Perfluoro(2-ethoxyethane) sulfonic acid (PFEESA)	4/6/2021	533	---	2	< 2.0	< 2.0
375-73-5	Perfluorobutanesulfonic acid (PFBS)	4/6/2021	533	---	2	< 2.0	3.9
375-22-4	Perfluorobutanoic acid (PFBA)	4/6/2021	533	---	2	2.1	6.9
335-76-2	Perfluorodecanoic acid (PFDA)	4/6/2021	533	---	2	< 2.0	< 2.0
375-85-9	Perfluoroheptanoic acid (PFHpA)	4/6/2021	533	---	2	< 2.0	3.3
355-46-4	Perfluorohexanesulfonic acid (PFHxS)	4/6/2021	533	---	2	< 2.0	< 2.0
307-24-4	Perfluorohexanoic acid (PFHxA)	4/6/2021	533	---	2	< 2.0	7.8
307-55-1	Perfluorododecanoic acid (PFDoA)	4/6/2021	533	---	2	< 2.0	< 2.0
375-95-1	Perfluorononanoic acid (PFNA)	4/6/2021	533	---	2	< 2.0	< 2.0
1763-23-1	Perfluorooctanesulfonic acid (PFOS)	4/6/2021	533	---	2	< 2.0	3.7
335-67-1	Perfluorooctanoic acid (PFOA)	4/6/2021	533	---	2	< 2.0	4.3
2058-94-8	Perfluoroundecanoic acid (PFUnA)	4/6/2021	533	---	2	< 2.0	< 2.0
375-92-8	Perfluoroheptanesulfonic acid (PFHpS)	4/6/2021	533	---	2	< 2.0	< 2.0
863090-89-5	Perfluoro-4-methoxybutanoic acid (PFMBA)	4/6/2021	533	---	2	< 2.0	< 2.0
377-73-1	Perfluoro-3-methoxypropanoic acid (PFMPA)	4/6/2021	533	---	2	< 2.0	< 2.0
2706-90-3	Perfluoropentanoic acid (PFPeA)	4/6/2021	533	---	2	< 2.0	9
2706-91-4	Perfluoropentanesulfonic acid (PFPeS)						
151772-58-6	Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)						

PFOA	< MRL	4.3	
PFOS	< MRL	3.7	
PFOA + PFOS	< MRL	8	70 (Fed HAL)

Upcoming VDH Testing

VDH PFAS Occurrence Study

General Assembly approved $60,000 for PFAS sampling

- Available July 2021 (if budget approved)

ODW has selected laboratory for the proposed PFAS sampling

Kickoff Timeline

		Revised Timeline
• Review Quotes and finalize an analytical Laboratory	- March 10, 2021	- Late March, 2021
• Revise QAPP and resubmit to US EPA	- March 15, 2021	- April, 2021
• Inform LHD, ODW Field offices about PFAS sampling	- March 15, 2021	- April, 2021
• Communicate with waterworks	- March 17, 2021	- April/May 2021
• VA PFAS Sampling – First Phase	- March 25, 2021	- Occurring now

VDH PFAS Occurrence Study

Developed / "Approved" a Monitoring "Plan"

Waterworks participation in the study is voluntary but encouraged

Site Selection: Hybrid approach balancing "risk" with "impact"

- Sample finished water from the 17 largest waterworks
- Additional water sources and waterworks that have the "greatest potential for PFAS contaminants in raw water"
  - *DEQ assistance for potential source identification*

ODW to contact waterworks ID'd in the Sampling Plan

- Tell them of the PFAS workgroup
- Explain the required study
- Describe the planned sample collection / analysis
- Gain concurrence to collect samples

VDH PFAS Occurrence Study

Developed / “Approved” a Monitoring “Plan”

Waterworks staff must perform sampling

- ODW (or contract lab) will provide training on sample collection for the waterworks operators
- Waterworks will receive sampling kit from ODW’s contract lab

All testing, sample collection equipment, analysis will be paid for by ODW using funds from EPA

VA PFAS Sampling Training Webinar - April 14, 2021

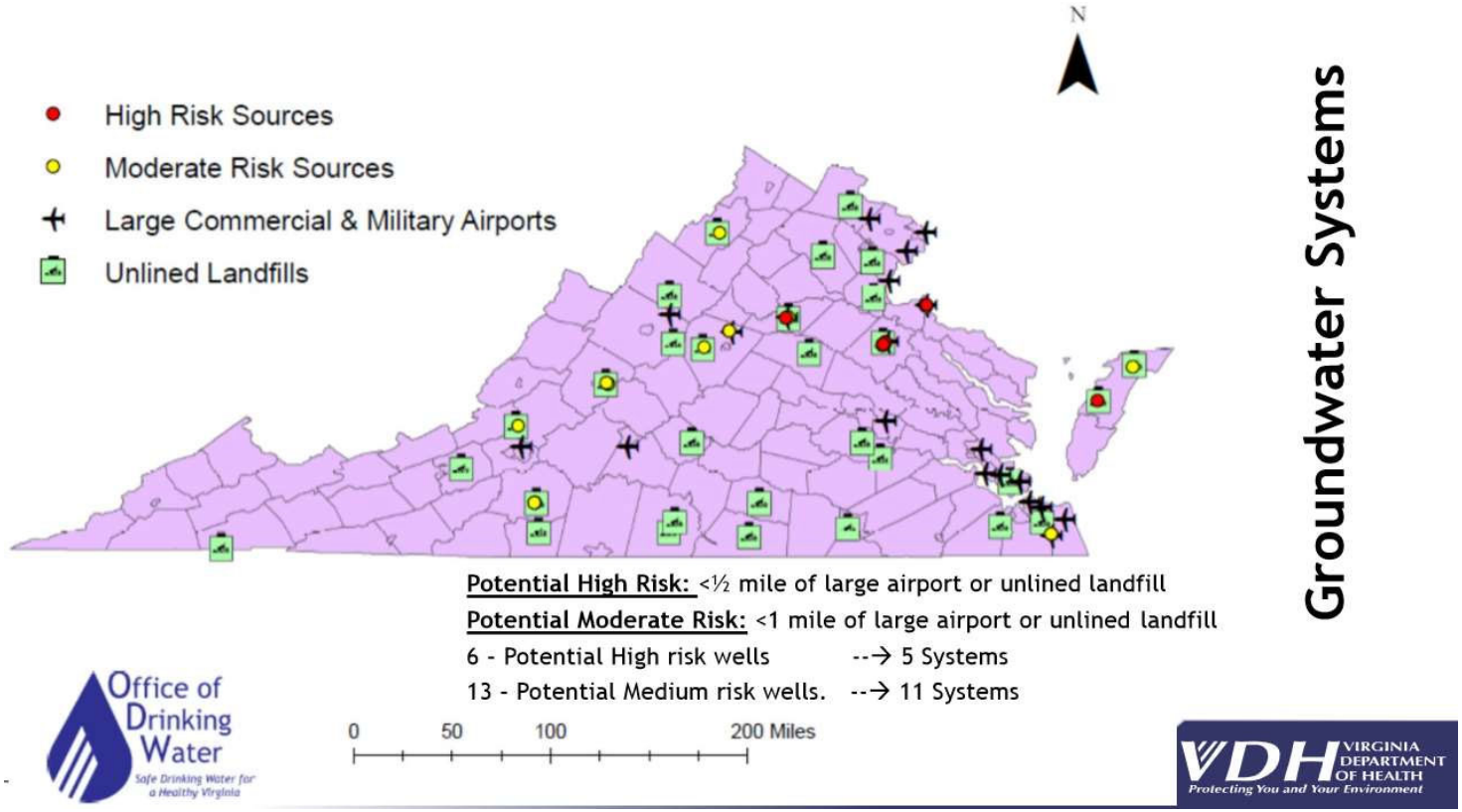
Site Selection

17 largest water providers + Additional “At Risk” locations + Select Source Waters

PWS Name	# Entry Points	# Consecutive Connections
Fairfax County Water Authority	2	1
Virginia Beach, City Of	0	1
Newport News, City Of	2	0
Chesterfield Co Central Water System	1	2
Henrico County Water System	1	1
Loudoun Water - Central Sytem	1	1
Norfolk, City Of	2	0
Arlington County	0	1
Richmond, City Of	1	0
City Of Chesapeake - Northwest River Sys	2	0
Western Virginia Water Authority	2	0
Pwcsa - East	0	1
Alexandria, City Of	0	2
Pwcsa - West	0	2
Portsmouth, City Of	1	0
Stafford County Utilities	2	0
Spotsylvania County Utilities	2	0
Totals	19	12
Total EP + CC = 31		

Determining “At Risk” Locations

Groundwater Systems



Site Selection

17 largest water providers + Additional “At Risk” locations + Select Source Waters

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Fairfax County Water Authority	2	1
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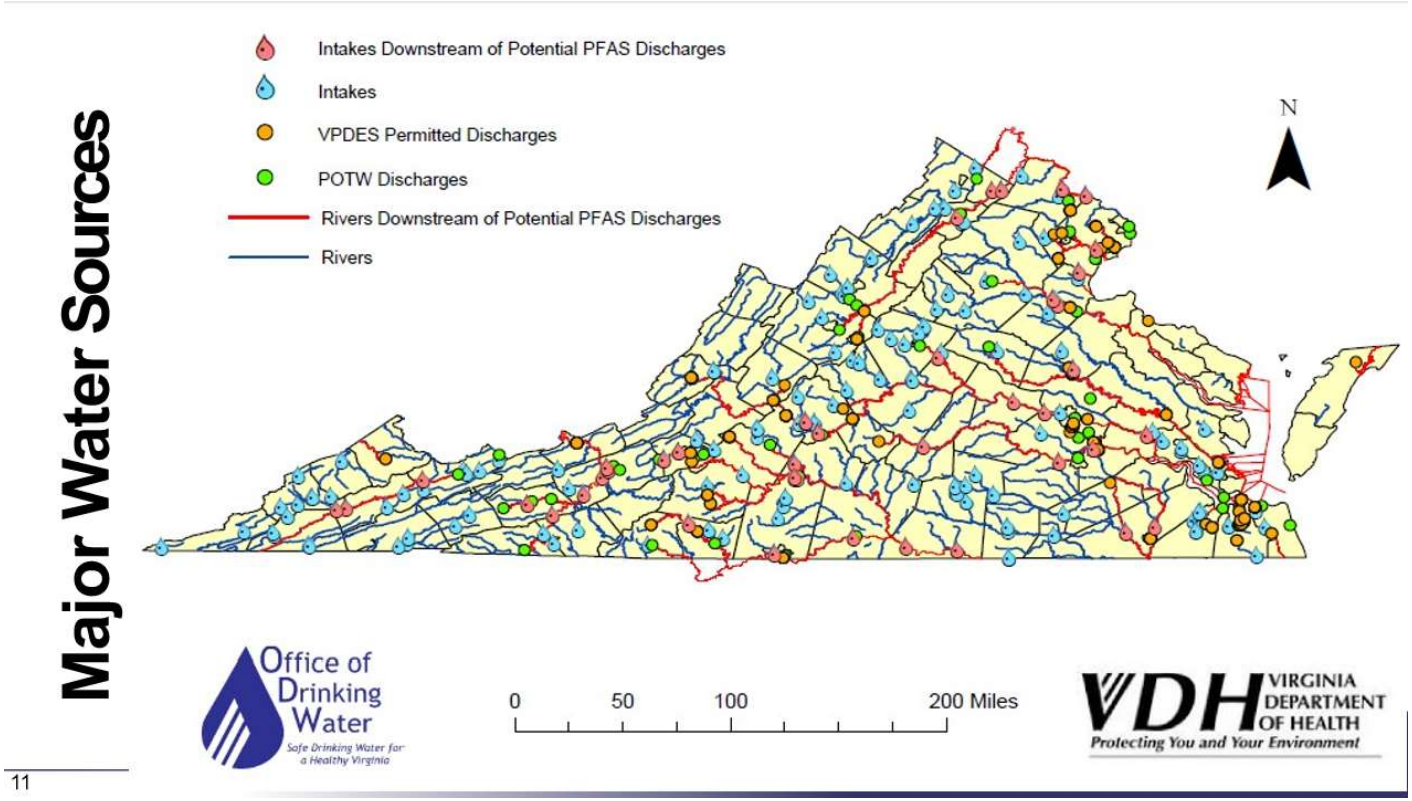
Chesterfield Co Central Water System	1	2
Henrico County Water System	1	1
Loudoun Water - Central Sytem	1	1
Norfolk, City Of	2	0
Arlington County	0	1
Richmond, City Of	1	0
City Of Chesapeake - Northwest River Sys	2	0
Western Virginia Water Authority	2	0
Pwcsa - East	0	1
Alexandria, City Of	0	2
Pwcsa - West	0	2
Portsmouth, City Of	1	0
Stafford County Utilities	2	0
Spotsylvania County Utilities	2	0
Totals	19	12
Total EP + CC = 31		

System Name
Naval Support Facility_dahlgren
Naval Support Facility_dahlgren
Bowling Green_town Of
Pungoteague Elementary School
Rsaroute 20
Ftaphill - Headquarters
Naval Support Facility_dahlgren
Bowling Green_town Of
Bowling Green_town Of
Longhollow
Longhollow
Earlysville Forest
Earlysville Forest
Peacock Hill Subdivision
Rsaroute 20
Mountain View Elem School
Roanoke Cement Company
Ftaphill - Headquarters
Franklin County Commerce Center

Determining “At Risk” Locations

Surface Water Systems



Site Selection

17 largest water providers + Additional “At Risk” locations + Select Source Waters

31 samples + 19 wells + 22 “additional” locations

PWS name	# Entry Points	# Consecutive Connections
Fairfax County Water Authority	2	1
Virginia Beach, City Of	0	1
Newport News, City Of	2	0
Chesterfield Co Central Water System	1	2
Henrico County Water System	1	1
Loudoun Water - Central Sytem	1	1
Norfolk, City Of	2	0
Arlington County	0	1
Richmond, City Of	1	0
City Of Chesapeake - Northwest River Sys	2	0
Western Virginia Water Authority	2	0
Pwcsa - East	0	1
Alexandria, City Of	0	2
Pwcsa - West	0	2
Portsmouth, City Of	1	0
Stafford County Utilities	2	0
Spotsylvania County Utilities	2	0
Totals	19	12
Total EP + CC = 31		

System Name
Naval Support Facility_dahlgren
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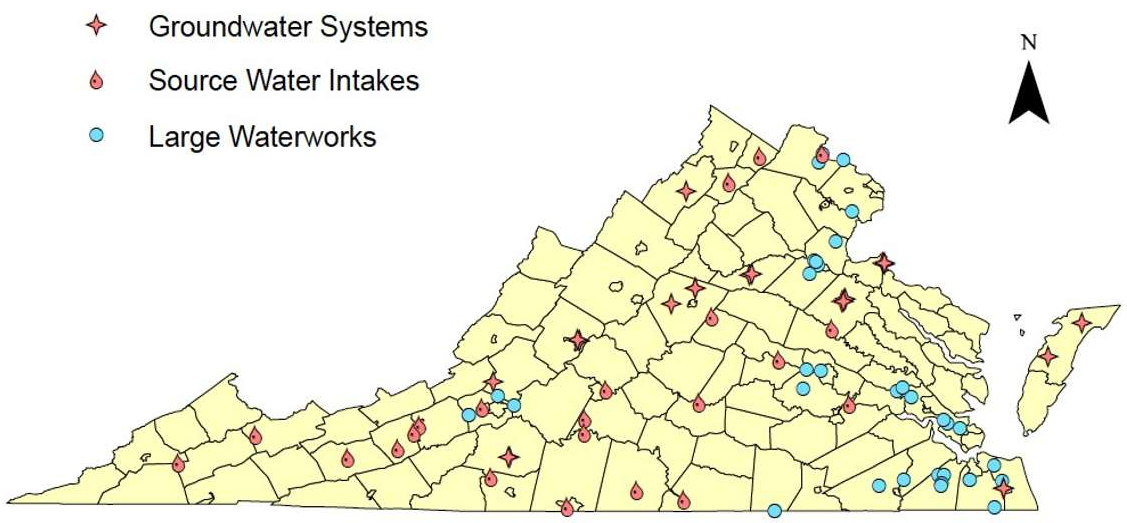
Longhollow
Earlysville Forest
Earlysville Forest
Peacock Hill Subdivision
Rsaroute 20
Mountain View Elem School
Roanoke Cement Company
Ftaphill - Headquarters
Franklin County Commerce Center

System	Facility
Lynchburg, City Of	James River - Albert
Hanover Suburban Water System	North Anna Rwi
Leesburg_town Of	Potomac Intake
Dannville, City Of	Dan River Intake
Upper Smith River Water Supply	Smith River Intake
Virginia-american Water Co.	Appomattox River
City Of Salem Wtp	Roanoke River
Campbell County Central System	Big Otter River
Quantico Marine Base-mainside	Breckinridge Reservoir
Radford_city Of	Intake On New River
Front Royal_town Of	South Fork Shenandoah River
Lake Monticello	Rivanna River
Wise County Regional Water System	Clinch River Intake
Pulaski County Psa	Claytor Lake
Hcsa- Leigh Street Plant	Raw Water Intake
Farmville_town Of	Appomattox River
Witheville_town Of	Reed Creek
James River Correctional Ctr	James River Intake
Richlands_town Of	In001- Clinch River Intake
Berryville_town Of	Shenandoah River
Altavista, Town Of	Staunton River
Radford Army Ammunition Plant	New River
Clarksville_town Of	Kerr Reservoir Intake
St Paul_town Of	Clinch River
Roanoke River Service Authority	Lake Gaston Intake
Mount Weather Emergency Operations Cente	Shenandoah River
Nrv Regional Water Authority	New River (Raw Water) Pump Station
New River Regional Water Authority	Intake - New River
Appomattox River Water Authority	Lake Chesdin Raw Water Intake

Site Location – Geographical Considerations

Proposed Sampling Locations



	17 Large Waterworks	GW – Potential High Risk	GW – Potential Medium Risk	Major Water Sources	Total
# Samples	31	6	13	22	**72**
# Systems	17		11	22	**50**
Population	4.5M	13k	2k	?	**4.5M+**

Summary and Parting Thoughts

Coming in 2021

- VDH is proceeding with the state-wide occurrence study (May/June 2021)
  - Locations identified and utilities contacts
  - Analytical methods determined
  - Lab under contract
  - Extensive sampling training resources being provided

- The program is **voluntary**
  - PFOA + PFOS in finished > 70ppt requires “corrective actions”
  - PFOA + PFOS in source > 70ppt likely to require finished water sampling
  - Only one contacted utility has decided not to participate

- PFAS is everywhere, making correct sampling technique critical

Media Coverage Will be Nationwide

Elevated Levels Of 'Forever Chemicals' Found In Some Colorado Drinking Water Districts (March 3, 2021)

"Poisonous "forever chemicals" have been found at levels higher than what some states say are safe in more than a dozen Colorado water districts."

EPA "recommends the level not be any higher than 70 parts per trillion for PFOA and PFOS."

- "But eight states say that's not good enough, setting more stringent legal limits."
- "Massachusetts, which has a PFAS maximum of only 20 parts per trillion for six PFAS chemicals"
- "Michigan recently set at 8 parts per trillion for PFOA."

https://denver.cbslocal.com/2021/03/03/chemicals-water-denver-colorado-pfas/

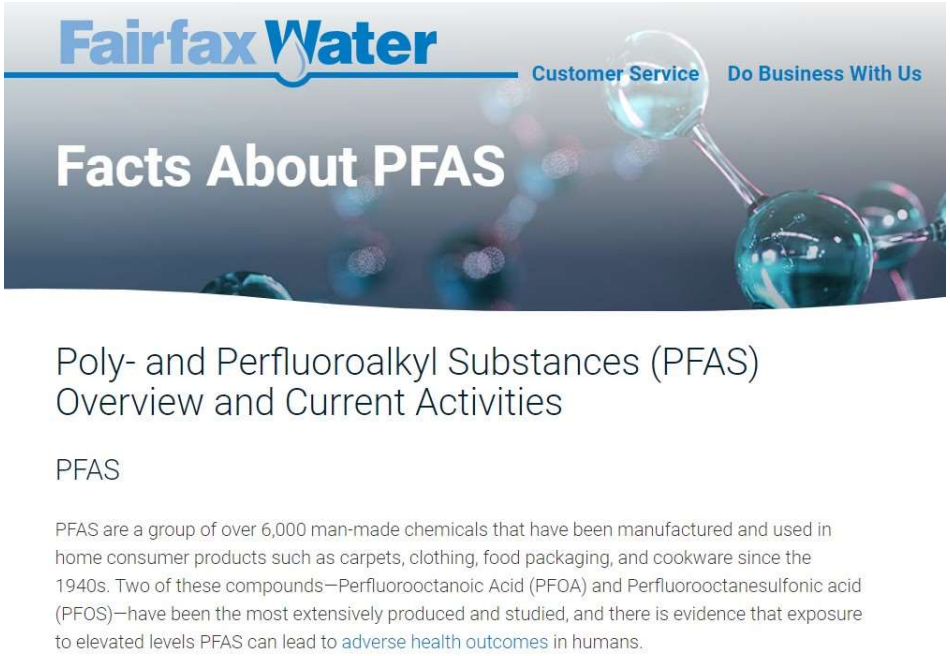
Compounds Detected Lower Than the Strictest Regulations Nationwide

State	Type	PFOA (ppt)	PFOS (ppt)	GenX (ppt)	PFBA (ppt)	PFBS (ppt)	PFHxA (ppt)	PFHxS (ppt)	PFHpA (ppt)	PFNA (ppt)	PFDA (ppt)	Sum of PFAS MA, VT (ppt)
CA	Notification Limit	5.1*	6.5*									
MI	MCL	8	16	370		420	140,000	51		6		
NY	MCL	10	10									
NH	MCL	12	15					18				
NJ	MCL	14	13							13		
MN	Health Advisory	35	15		7,000	2,000		47				
MA	MCL (sum)	20	20					20	20	20	20	20
VT	MC (sum)	20	20					20	20	20		20
OH	Guidance	70	70	700		140,000		140		21		
CT	HAL (sum)	70	70					70	70	70		
NC	HAL			140								
4/21 Sampling	**Corbalis**	**<2.0**	**<2.0**	**<2.0**	**2.1**	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**	**<2.0**
	Griffith	**4.3**	**3.7**	**<2.0**	**6.9**	**3.9**	**7.8**	**<2.0**	**3.3**	**<2.0**	**<2.0**	**11.3**

*These levels required public notification only. Corrective action required at PFOA = 10 ppt, PFOS = 40 ppt

Comprehensive PFAS Information on Fairfax Water Website

- **Data**
  - Results of independent 2021 sampling
  - Results of the VDH sampling effort
- **Regulations**
  - EPA
  - VDH
- **Education**
  - CDC
  - ASTDR



https://www.fairfaxwater.org/water-quality/facts-about-pfas

Please Contact Us

- We believe our methods and outcomes should be as transparent and healthy as the water we deliver

- We are happy to answer any questions you have or refer you to the proper authority

Questions?