Virginia PFAS Occurrence & Monitoring Subgroup
Virginia Department of Health Office of Drinking Water
DRAFT Meeting Minutes
Monday, December 14, 2020
1:00 – 3:00 pm

1. Member Introductions
   The following members and their organizations attended the meeting:
   Anna Killius – James River Assoc.
   Henry Bryndza – DuPont
   Jamie Hedges – Fairfax Water
   Jessica Edwards-Brandt – Loudoun Water
   Mike McEvoy – Western Virginia Water Authority
   Tony Singh – ODW
   Dwight Flammia – ODW
   Bob Edelman - ODW

   The following persons from the public observed the meeting:
   Carroll Courtney – Southern Environmental Law Center
   Emily Francis – Southern Environmental Law Center
   Joel Thompson – Fairfax Water
   Katie Kruger – Hampton Roads
   Scott Powers – Fairfax Water

2. Subgroup – Objectives, Milestones, Logistics and Ground rules

   Logistics
   Bob Edelman explained that he will act as facilitator, with assistance from Tony Singh and others from ODW. This subgroup will report to the PFAS Workgroup on findings and recommendations. Members will have assignments. The subgroup will make decisions by consensus, or if not by consensus, vote by members. ODW will post meeting minutes, agendas, handouts, etc. on Town Hall. Each meeting will have time for public comments. This is a public meeting.

   The subgroup will use Google Drive for sharing data files rather than emailing. The subgroup will meet through WebEx. ODW will email meeting information and a link for Google Drive. Please do not "respond all" to any email. We estimate 5 to 10 hours per month of work will be required for this group.

   Objectives
   The objective for this subgroup is, "**Determining occurrence of PFAS in drinking water throughout the Commonwealth."**

   Bob reviewed the legislation passed by the General Assembly in the 2020 session that established the objectives. See slide 8. The General Assembly (GA) provided no funding for the activities under HB586 and HB1257.

   Bob pointed out that the funding and the limitation of no more than 50 waterworks and source waters are fundamental limitations to the PFAS occurrence study. Tony pointed out that HB586 identified six specific PFAS chemicals (listed on slide 7), based on historical detections of specific compounds.

A member asked if there any additional funding planned in the future. ODW issued a fiscal impact statement and mentioned a comprehensive study plan with the understanding that in the future the GA would give ODW more money. Anna reached out to Delegate Guzman and there might be some room for funding in the future.

3. Subgroup Schedule, Expectations, and Deliverables:
   Bob presented deliverables for this subgroup (see PowerPoint beginning at slide 9 for more details):
   1. Research PFAS Occurrence/Sampling Studies in other states to see what they have done. Discuss at our next meeting, week of Jan 11, 2021.
   2. Virginia PFAS Sampling Study Plan by next Workgroup meeting, January 19, 2021.
   3. Organize, tabulate, and summarize Virginia PFAS Occurrence data – date TBD

4. Presentation and Discussion:
   a. Research PFAS Occurrence/Sampling Studies in other states
      Tony pointed out that the 11 states that have taken action on PFAS have a lot of literature on their PFAS Occurrence/Sampling Studies. Tony proposed VDH to collect information on other states activities and share with workgroup. Tony already has some information on what some other states have done, and suggests the workgroup focus on looking at summaries rather than researching the states and developing summaries.

      Action item: ODW/Tony to collect items summarizing work by other states. Bob will review to see what is missing and what is involved to supply missing pieces. Then Bob will share the information with the workgroup members.

   b. Considerations for sampling in Virginia
      Study limitations:
      - HB586 – Limits sampling to no more than 50 representative waterworks and major sources of water.
      - VDH received a grant from EPA for emerging contaminants. VDH has set aside roughly $40,000 to cover samples and shipping to and from samplers.
      - Assumes 150 samples + limited field reagent blank (FRB) samples
      - Assumes waterworks personnel will collect samples
      - Assumes VDH will provide shipping of sample kits to waterworks/to laboratory

      Jamie and Mike indicated that conducting the sampling would not be a problem with their systems. Mike offered to reach out to other utilities to make sure there is no opposition.

   c. Proposed PFAS Sampling/Monitoring Study Concepts:

      Sample at 17 largest water systems (slide 18) at entry points to the distribution system, a total of 33 locations, and a total population of 4.5 million. Propose that utility staff will collect samples. There will be no cost to the waterworks; return shipping to laboratory will be prepaid. This suggestion looks at the most people served. (Slide 19 has list of sample locations) Entry point (EP) is the entry point to the distribution system. A second option is to sample only the water plant entry points owned by the 17 largest waterworks, reducing to 21 locations and 12 waterworks (slide 23). This reduces the number of samples and waterworks sampled, but also excludes Arlington County and a portion of Prince William County.

High potential PFAS sampling points (slide 24) – Use potential of PFAS contamination to prioritize and address some smaller groundwater sources. This will address smaller systems and rural sites. There is not enough funding to sample all of the waterworks. To date, we have not identified the number of sample sites and locations. Will use a "heat map" to help visualize potential. Focus is on community water systems based on proximity to certain facilities – landfills, airport, industrial sites, and military installations. Did not look at direction of groundwater flows, presence of PFAS in landfills – only looked at distance. Only considered unconfined aquifers, west of I-95. Heat maps will look at activity; it does not mean that PFAS is present and are only preliminary. The PFAS potential gives us a way to prioritize where to sample.

The group discussed that EPA is recommending states mandate PFAS monitoring and that the group is not aware that DEQ is requiring PFAS monitoring of wastewater plants.

Bob reviewed the methodology of identifying sources with high PFAS potential – see slide 27. VDH used this method to develop the list on slide 29.

The group discussed why exclude the confined aquifers in the groundwater management areas. Bob explained that the confined aquifers have an impermeable layer of clay and have a lower risk of contamination due to activities on the surface. Since many of our military installations are located in the GWMAs, do we have a way to capture these communities if they are high risk? Any risk to communities that we are not capturing, wells that are shallow, potential contamination through drinking water?

Tony – The GWMA contains some installations that may be using PFAS chemicals. The sampling study is limited to the budget and scope, but we need to get useful information. The workgroup needs to decide if to include/exclude the GWMA while selecting sample locations. Envision that we will get additional resources to study PFAS occurrence in a future phase.

Sampling Major Water Sources (see slide 31) – 12 systems of the 17 large systems have water treatment plants with intakes. Propose to have water system personnel take samples from raw water sample taps. These represent raw water used by water systems. This is not representative of recreational use and would not represent water body in its entirety since the drinking water intake is usually below the water surface. To save cost and make this feasible, we propose to sample from plant taps rather than deploying samplers in boats, etc.

Group discussed that this approach is a balance of all of the key elements. It would be a simple to do. In some cases, one sample could represent raw water for more than one waterworks.

One group member pointed out that raw water sampling alone is not sufficient to represent water in distribution systems because water systems have treatment, etc. Bob explained that this addresses the requirement for sampling major water sources.

One member suggested to sample near places where people are recreating in bodies of water.

Hybrid approach – Sampling at the 17 large systems plus select high PFAS risk waterworks plus selected source waters. Using large and small systems. This will cover more of the state and generate information we need regarding PFAS occurrence. This is limited to 50 waterworks plus major water sources and the approaches shown exceed 50, so the group will need to make some decisions.

A member asked about timing of past PFAS samples. Bob stated that any sample 3 years old or less would be considered current.

Team – think about the number of rounds of samples – is one round good enough? Think about the criteria for selecting sample locations. Does the hybrid approach provide enough diversity?

One group member liked the idea of capturing as large a population as possible with the large systems recognizing that is not the whole story. Suggest to use the UCMR5 sample results of large systems, to perhaps enable sampling of other systems.

Tony asked about timeline for UCMR5. Will this work for our required timeline? Should keep an eye on UCMR5 timeline. Possibly UCMR5 could free up Virginia's resources to sample smaller or different water systems. [Post-meeting note: UCMR5 sampling is 2023 through 2025. Therefore, the UCMR5 does not work with our required timeline.]

Workgroup: Is the balance right, or should we do something different?

One person commented that it is hard to visualize what is proposed.

Action item: ODW to develop a map of the 20 high-risk sample points, and a separate map of the surface water intakes to help visualize what is proposed.

Tony stated that the heat maps are very preliminary and suggested that we get more data from DEQ and DOD then overlap the maps we have with their information. Until we have data from DEQ, we should not select sample points at waterworks. ODW updated the criteria to less than 1 mile from potential sources of PFAS. Bob is concerned to make sure he gets information from DEQ and others immediately due to time constraints.

Action Item – ODW to obtain PFAS environmental data from DEQ and update heat maps.

Action Item - Members to go back and look at seven discussion questions on site selection criteria on slide 35. Look at diversity, balance between urban and rural, surface sources and groundwater sources, etc. Be ready to have a conversation about sample site selection at the next meeting.

Action Items – Members to consider the three action items on slide 36:

- Does this subgroup wish to request any existing PFAS sample results? ODW is interested in sample results less than 3 years old and analyzed by EPA methods 533 or 537.1.
- Review the waterworks sample site selection concepts and make a recommendation.
- Review the source water site selection and make a recommendation.

Analytical Method Considerations (slide 40)
EPA methods for testing PFAS – HB 586 calls for analysis of PFBA and is only available using Method 533, not 537.1. More states have decided to test for PFBS and regulate PFBS than PFBA. This subgroup can decide to test for PFBS by selecting method 537.1. Method 533 costs about $40-$50 more than 537.1 and will give us the analytes we need. Method 533 can test for 24 analytes, but if we limit the reporting to only the six analytes listed in HB 586, it might be less

expensive. This subgroup could make the decision to limit the reporting to only the six analytes listed in HB 586.

Action Item – ODW to ask Laboratory if it is cheaper to only test for the six analytes in HB 586. Look to see if other states eliminated some analytes in their occurrence studies.

Field Reagent Blanks – See slide 42. Michigan and New Hampshire did not see a value in FRBs, so reduced FRBs to 20-10% of total samples. A national lab analyzes the FRB only when PFAS is detected in the FRB. Client gets charged for extraction of FRBs, each time, which is less expensive than testing each sample. Virginia needs to decide the strategy for handling FRBs. This group is to discuss and make a recommendation on this strategy.

The sampling protocol itself is very detailed. We would like to get some feedback on the sampling instructions.

Action Item – Scott Powers to give feedback on instructions, including will the instructions require specialists to complete successfully.

Action Item – Members answer questions on slide 44 as homework

We agreed that homework and action items would be due on January 6, 2020. Please email homeworks and results from action items to Bob Edelman (Robert.Edelman@vdh.virginia.gov). He will compile the input for sharing with the group in the meeting on the week of January 11, 2021.

5. Public Comments

No one made public comments.

The next meeting will be, tentatively, week of January 11, 2021. Bob will send out a doodle poll to finalize date and time. Slides will be available on Town Hall along with minutes of meeting. Bob will email the PowerPont presentation to members.

Establishing Regulatory Limits for PFAS in Virginia Drinking Water

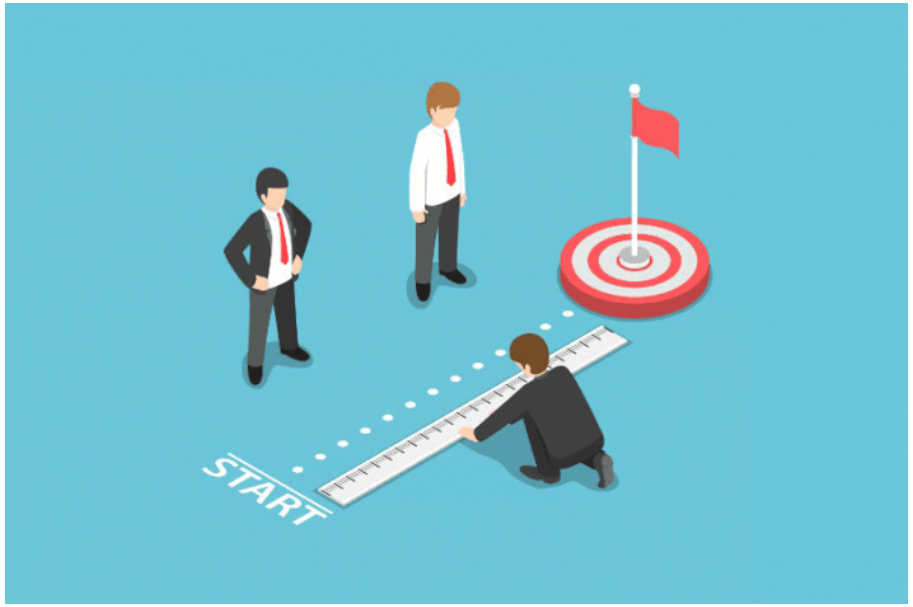
Monitoring and Occurrence Subgroup

Bob Edelman
Virginia Department of Health
December 14, 2020

PFAS Workgroup Meeting Overview

Meeting Overview

- Member Introductions
- Subgroup – Objectives, Milestones, Logistics and Ground Rules
- Schedule, Expectations and Deliverables
- Presentations
- Public Comment
- Next Meeting



Workgroup Member Introductions

David Jurgen (City of Chesapeake)
Jamie Hedges (Fairfax Water)
Mark Estes (Halifax County Service Authority)
Jessica Edwards (Loudoun Water)
Mike McEvoy (Western Virginia Water Authority)
Henry Bryndza (DuPont)
Jeff Steers (VDEQ)
Dwight Flammia (State Toxicologist)
Anna Killius (James River Assoc)
Tony Singh (VDH ODW)
Bob Edelman (VDH ODW) - VDH Lead*

Subgroup Structure

Bob Edelman will act as facilitator

Tony Singh will assist, other ODW representatives may attend

We will report back to the Workgroup on findings and recommendations

Members will have assignments

Make decisions by consensus or if not by consensus, vote by members

ODW will post meeting minutes, agendas, handouts, etc. on Town Hall

We will provide time for public comments

Subworkgroup Logistics

D**ata sharing** – An electronic file sharing platform (Google Drive)

Facilitation – Bob Edelman will facilitate quarterly meetings

Meeting information on Town Hall (www.townhall.virginia.gov).

Admin support – Office of Drinking Water (ODW) staff

Meeting Schedule – Monthly (as needed)

Meetings – Virtual via Webex

Email – Communications to Members – do not reply-all

PFAS Workgroup Member Expectation

- Participate and contribute to this sub-workgroup
- Commitment of 5-10 hours per month to study, review, interpret and develop new documents / guidelines / recommendations

Virginia PFAS Workgroup – Objectives

- **Determine the occurrence of PFAS in drinking water throughout the Commonwealth,**
- Identify possible sources of PFAS contamination,
- May develop recommendations for specific maximum contaminant levels (MCLs)

Six specific PFAS, including:

- Perfluorooctanoic acid (PFOA)
- Perfluorooctane sulfonate (PFOS)
- Perfluorobutyrate (PFBA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorohexane sulfonate (PFHxS)
- Perfluorononanoic acid (PFNA)

Other PFAS “as deemed necessary”

HB586

Patron: Delegate Guzman (GA 2020)

- The State Health Commissioner to convene a PFAS workgroup,
- Conduct a detailed investigation on current literature and what other states are doing,
- Conduct PFAS occurrence study at no more than 50 waterworks and source waters,
- May develop MCL guidelines
- **Timeline**: December 01, 2021

Potential Issues: No state funding

HB1257

Patron: Delegate Rasoul (GA 2020)

- Establish MCLs for PFOA, PFOS, and other PFAS compounds, 1,4-Dioxane, and Chromium (VI)
- Provide status report by 11/1/20
- Provide detailed report by 10/1/21
- Effective Date: 1/1/22

Potential Issues:

- No comprehensive PFAS,1,4-dioxane, or Cr(VI) occurrence data in VA
- No funding

Subgroup Deliverables

1. Research PFAS Occurrence/Sampling Studies in other states – internal deliverable – Week of January 11, 2021
2. Virginia PFAS Sampling Study Plan – January 19, 2021
3. Organize, tabulate, and summarize Virginia PFAS Occurrence data - TBD

Subgroup Deliverables

PFAS Occurrence/Sampling Study Methodology in other states – internal deliverable

a. Scope of sampling
b. Sample location selection criteria
c. Analytical Methods, target analytes, detection levels
d. Sampling Frequency, what's necessary
e. Sample collection protocol
f. Summary of occurrence data, PFAS detections, species, levels
g. Funding/Cost for sampling
h. Lessons learned
i. Recommend if same methods apply to Virginia

Subgroup Deliverables

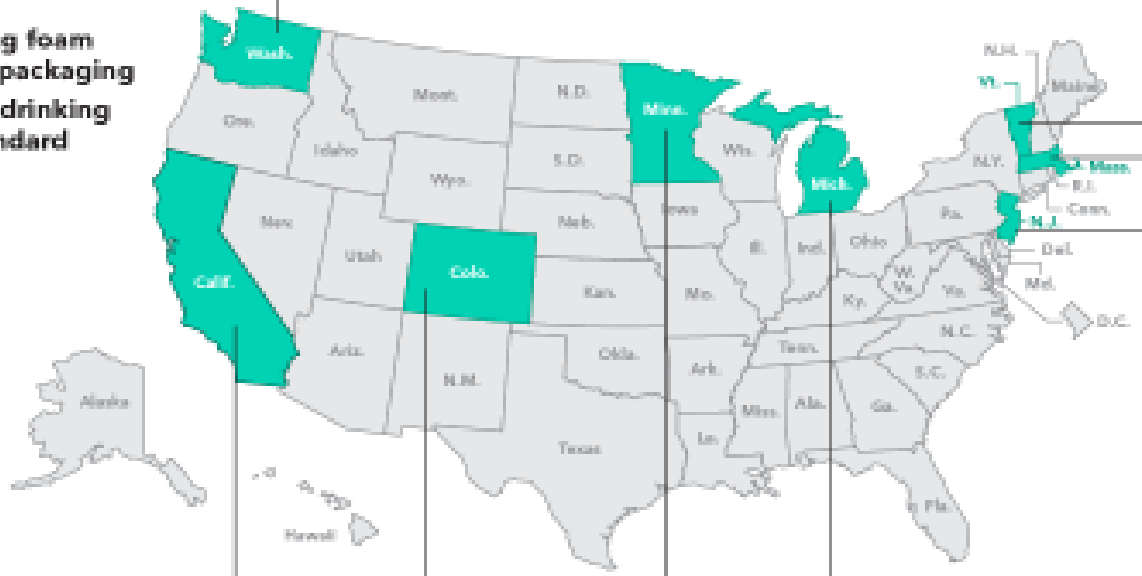
Virginia PFAS Sampling Study Plan – January 19, 2021

a. Scope of sampling, number of samples, frequency
b. Sample location selection criteria, including source water sampling
c. Analytical Methods, target analytes, QA/QC

Organize, tabulate, and summarize Virginia PFAS Occurrence data – TBD

a. Collect PFAS Occurrence sample study data, other data
b. Tabulate in a database
c. Generate reports
d. Map data
e. Analyze and summarize data

States With Numerical PFAS Limits



Washington
- Banned in firefighting foam and food packaging
- Proposed drinking water standard

Vermont
- 20 PPT (PFAS)
- Drinking water health advisory for 5 PFAS

Massachusetts
- 70 PPT (PFAS)
- State guidance for concentrations of 5 PFAS in drinking water

New Jersey
- Set PFNA standard at 13 ppt
- Weighing proposed standards for:
  PFOA at 14 ppt
  PFOS at 13 ppt

California
- 14 PPT (PFOA)
- 13 PPT (PFOS)
- Drinking water notification guidance

Colorado
- PFOA/PFAS listed as hazardous waste
- 70 PPT (Combined PFOA/PFOS)
- Groundwater quality standard for El Paso County only

Minnesota
- 35 PPT (PFOA)
- 27 PPT (PFOS)
- Health-based guidance values

Michigan
- 70 PPT (Combined PFOA/PFOS)
- State standard for concentrations in drinking water

- New Jersey
- Connecticut
- Maine
- Michigan
- Pennsylvania
- Colorado
- California
- Massachusetts

Bloomberg Environment

VIRGINIA DEPARTMENT OF HEALTH
...ng You and Your Environment

States that have taken action to regulate PFAS

State	Drinking Water Action	Compound	Level (ppt)
California	Response Levels	PFOA	10
		PFOS	40
	Notification Levels	PFOA	5.1
		PFOS	6.5
Colorado			
Connecticut	Action Level	Σ (PFOA, PFOS, PFNA, PFHxS, PFHpA)	70
Massachusetts	Adopted Regulation 9/16/20	Σ (PFOA, PFOS, PFNA, PFHxS, PFHpA, PFDA)	20
Michigan	Adopted Regulation 8/3/20	PFOA	8
		PFOS	16
		PFNA	6
		PFHxS	51
		PFBS	420
		PFHxA	400,000
		GenX	370
Minnesota	Health Based Guidance-Water	PFOA	35
		PFOS	15
		PFHxS	47

States that have taken action to regulate PFAS

State	Drinking Water Action	Compound	Level (ppt)
New Hampshire	Adopted Regulation 10/1/19	PFOA	12
		PFOS	########
		PFHxS	18
		PFNA	11
New Jersey	Adopted Regulation	PFNA	13
		PFOA	14
	Adopted Regulations 6/1/20	PFOS	13
New York	Adopted Regulation 7/30/20	PFOA	10
		PFOS	10
North Carolina	Health Advisory	GenX	140
	Proposed legislation (HB1175)		
Vermont	Adopted Regulation 3/17/20	Σ (PFOA, PFOS, PFNA, PFHxS, PFHpA)	20
Virginia	HB1257/HB586		

PFAS Occurrence/Sampling Study Methodology in other states – internal deliverable

For each state summarize (PowerPoint Slide):

a. Scope of sampling
b. Sample location selection criteria
c. Analytical Methods, target analytes, detection levels
d. Sampling Frequency, what's necessary
e. Sample collection protocol
f. Summary of occurrence data, PFAS detections, species, levels
g. Funding/Cost for sampling
h. Lessons learned
i. Recommend if same methods apply to Virginia

State
California
Colorado
Connecticut
Massachusetts
Michigan
Minnesota
New Hampshire
New Jersey
New York
North Carolina
Vermont
Other States?

Virginia PFAS Sampling Study Plan

Scope of sampling, number of samples, frequency

- HB 586: "…the Department of Health shall sample no more than 50 representative waterworks and major sources of water…"
- Budget: $38,000 PFAS
- Assumes 150 samples + limited FRB samples + shipping

Proposed PFAS Sampling/Monitoring Study

Approaches based on:

- Available funding → number of sampling sites, frequency of sampling
- Maximum public health risk reduction
- Proximity to potential PFAS contamination
- Limited to 50 waterworks and sources of water

Proposed strategy (depends on budget):

1. Largest waterworks (17) in Virginia serve appx. 4.5 million consumers
2. Sampling – based on potential for PFAS contamination – VDH - DEQ data/risk maps
3. Major water supplies – James River, Potomac River, etc.
4. Hybrid approach
5. Statewide comprehensive PFAS occurrence study (Not considered in this study)

1. Sampling Select Large Waterworks

- Sampling at the entry points to the distribution from 17 VA large waterworks
- Utilities licensed professional to collect samples, FRB and ship it back to the Lab for analysis (No cost to the utility; shipping included)
- Sampling instructions and guidance will be provided

Pros:

- Maximum Public Health risk reduction (Serve >4.5 Million people)
- Can leverage sampling effort with existing resources

Cons:

- May duplicate efforts by the 17 VA large waterworks
- Involves some duplication of treated water for consecutive connections

17 Large Waterworks

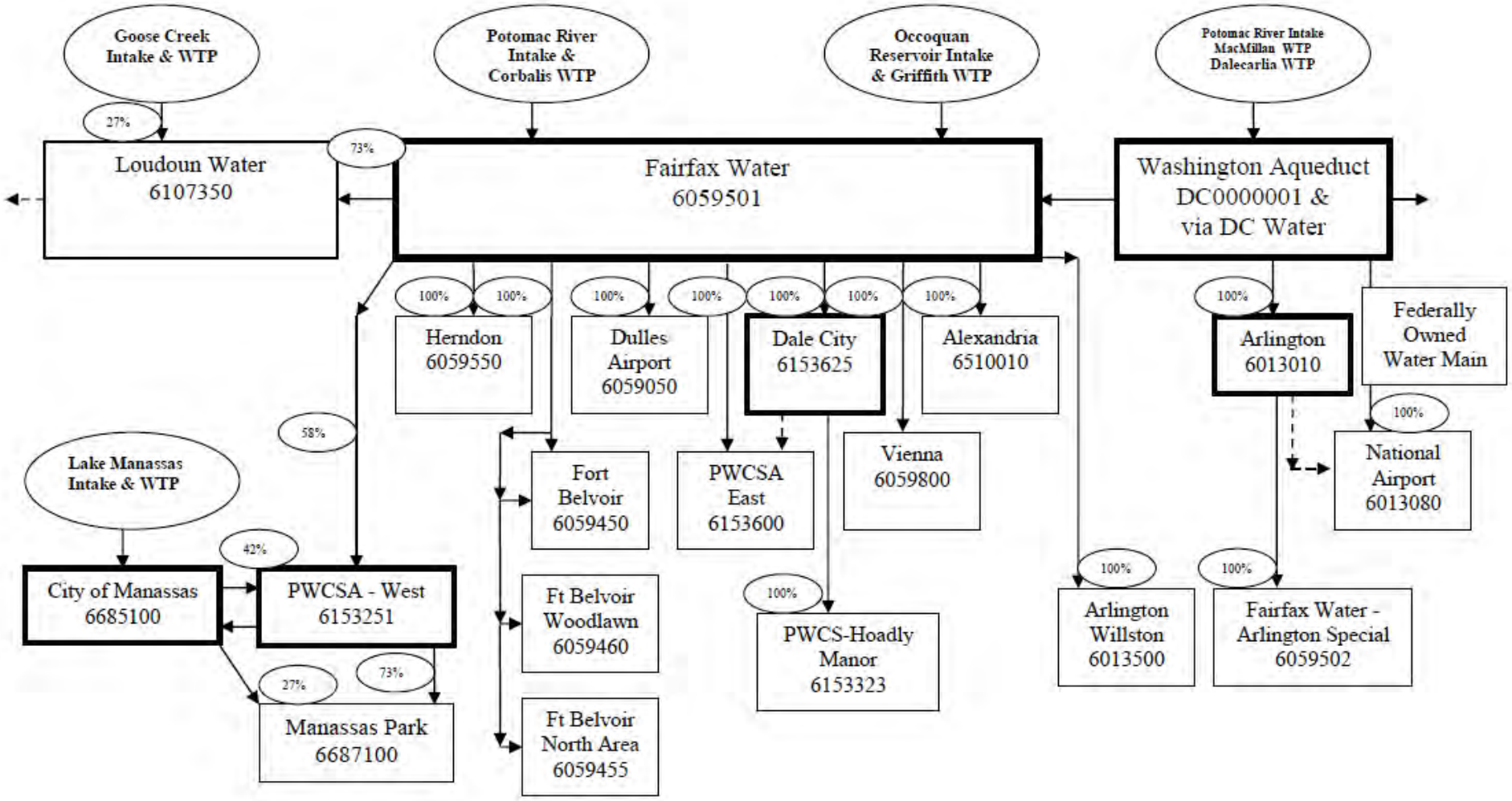
PWSID	PWS name	City / County	Population	# SWTPs	# Raw	# EPs	#CCs
6059501	FAIRFAX COUNTY WATER AUTHORITY	FAIRFAX COUNTY	1074422	2	2	2	1
3810900	VIRGINIA BEACH, CITY OF	VIRGINIA BEACH	446067	0	0	0	1
3700500	NEWPORT NEWS, CITY OF	NEWPORT NEWS	407300	2	2	2	0
4041845	CHESTERFIELD CO CENTRAL WATER SYSTEM	CHESTERFIELD	320658	1	1	1	2
4087125	HENRICO COUNTY WATER SYSTEM	HENRICO	292000	1	1	1	1
6107350	LOUDOUN WATER - CENTRAL SYSTEM	LOUDOUN	286202	1	1	1	1
3710100	NORFOLK, CITY OF	NORFOLK	234220	2	2	2	0
6013010	ARLINGTON COUNTY	ARLINGTON	215000	0	0	0	1
4760100	RICHMOND, CITY OF	RICHMOND CITY	197000	1	1	1	0
3550051	CITY OF CHESAPEAKE - NORTHWEST RIVER SYS	CHESAPEAKE	166704	2	2	2	0
2770900	WESTERN VIRGINIA WATER AUTHORITY	ROANOKE CITY	155000	4	4	4	0
6153600	PWCSA - EAST	PRINCE WILLIAM	153000	0	0	0	1
6510010	ALEXANDRIA, CITY OF	ALEXANDRIA	146970	0	0	0	2
6153251	PWCSA - WEST	PRINCE WILLIAM	130001	0	0	0	2
3740600	PORTSMOUTH, CITY OF	PORTSMOUTH	120400	1	3	1	0
6179100	STAFFORD COUNTY UTILITIES	STAFFORD	112285	2	2	2	0
6177300	SPOTSYLVANIA COUNTY UTILITIES	SPOTSYLVANIA	84390	2	2	2	0
Totals				21	23	21	12
Total EP + CC				33			

17 Large Waterworks

Surface water systems:

- 23 Raw sources
- 21 Water Treatment Plants
- 21 Entry Points
- 12 Consecutive Connections

- Entry Points + Consecutive Connections = 33 locations – All 17
- Entry Points only – 21 locations – covers 16 of 17, samples in 12 WW
- Raw Sources – 23 locations



17 Large Waterworks

Entry Points + Consecutive Connections = 33

3 rounds → 99 samples

2 rounds → 66 samples

1 round → 33 samples

Number of WW = 17

Entry points = 21

3 rounds → 63 samples

2 rounds → 42 samples

1 round → 21 samples

Number of WW = 12

1a. Sampling Select Large Waterworks

- Sampling at the water plants at to the distribution from 12 VA large waterworks
- Utilities licensed professional to collect samples, FRB and ship it back to the Lab for analysis (No cost to the utility; shipping included)
- Sampling instructions and guidance will be provided

Pros:

- Maximum Public Health risk reduction
- Covers VA sources and WTPs
- 21 Entry points, a reduction from 33
- Can leverage sampling effort with existing resources

Cons:

- Omits several consecutive connections not otherwise sampled (Washington Aqueduct, City of Manassas)

2. Sampling Potential High PFAS Risk Waterworks

- Sampling at the entry points to the distribution
- Utilities licensed professional to collect samples, FRB and ship it back to the Lab for analysis (No cost to the utility; shipping included)
- Sampling instructions and guidance will be provided

Pros:

- Addresses groundwater sources
- Addresses smaller population areas, more rural waterworks
- Can generate valuable data on potential statewide PFAS sampling study

Cons:

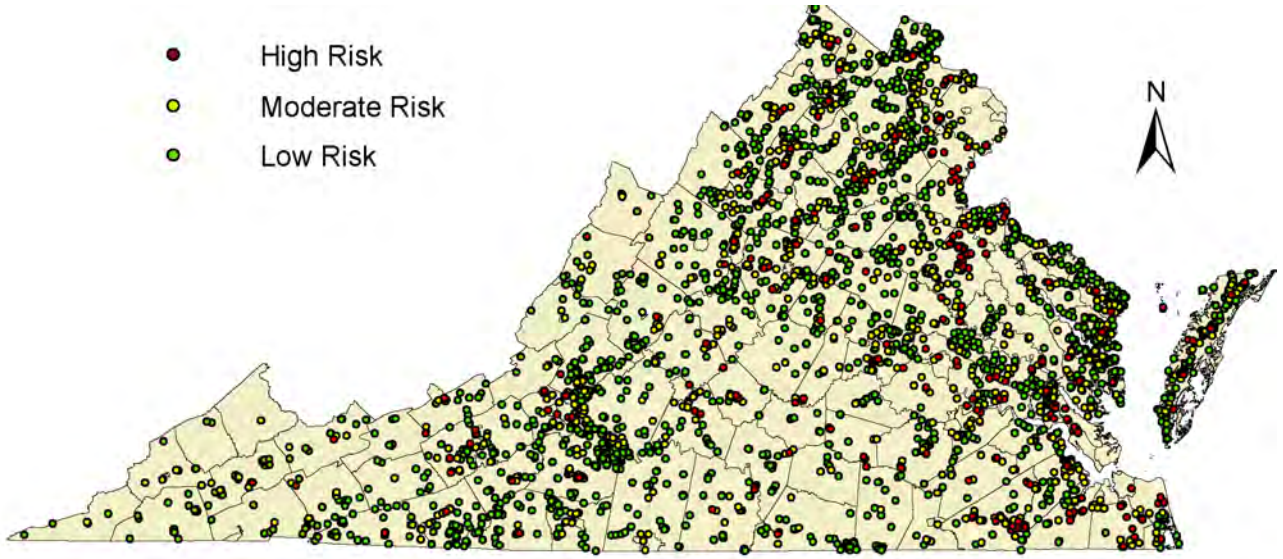
- Funding not sufficient to sample all high risk sources

Potential PFAS Contamination Risk Maps

- Focus on “community” waterworks
- Prioritize based on risk due to proximity to certain activities:
  - Landfills
  - Airports
  - Industrial sites
  - Military usage and discharge of fire fighting foams
- Known or suspected contamination
- Unconfined aquifers (higher risk of contamination)
- Any previous available data

Preliminary PFAS Contamination Risk Maps

- Collaborative effort with Virginia DEQ

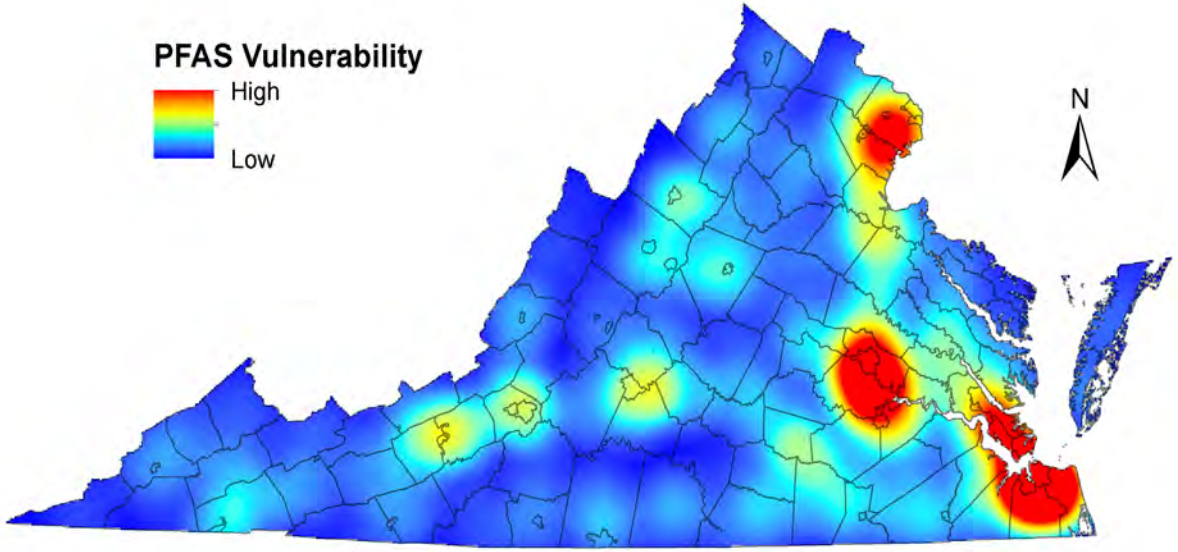


Office of Drinking Water
Safe Drinking Water for a Healthy Virginia

0 25 50 100 150 200 Miles

Virginia Department of Health - Office of Drinking Water
This map shows the risk posed by PFAS sources to water sources in Virginia based on the water source's proximity to surrounding PFAS sources.

VDH VIRGINIA DEPARTMENT OF HEALTH
Protecting You and Your Environment



Office of Drinking Water
Safe Drinking Water for a Healthy Virginia

0 20 40 80 120 160 Miles

Virginia Department of Health - Office of Drinking Water
PFAS Density Map showing the areas at highest risk of PFAS contamination based on clusters of PFAS contaminant sources

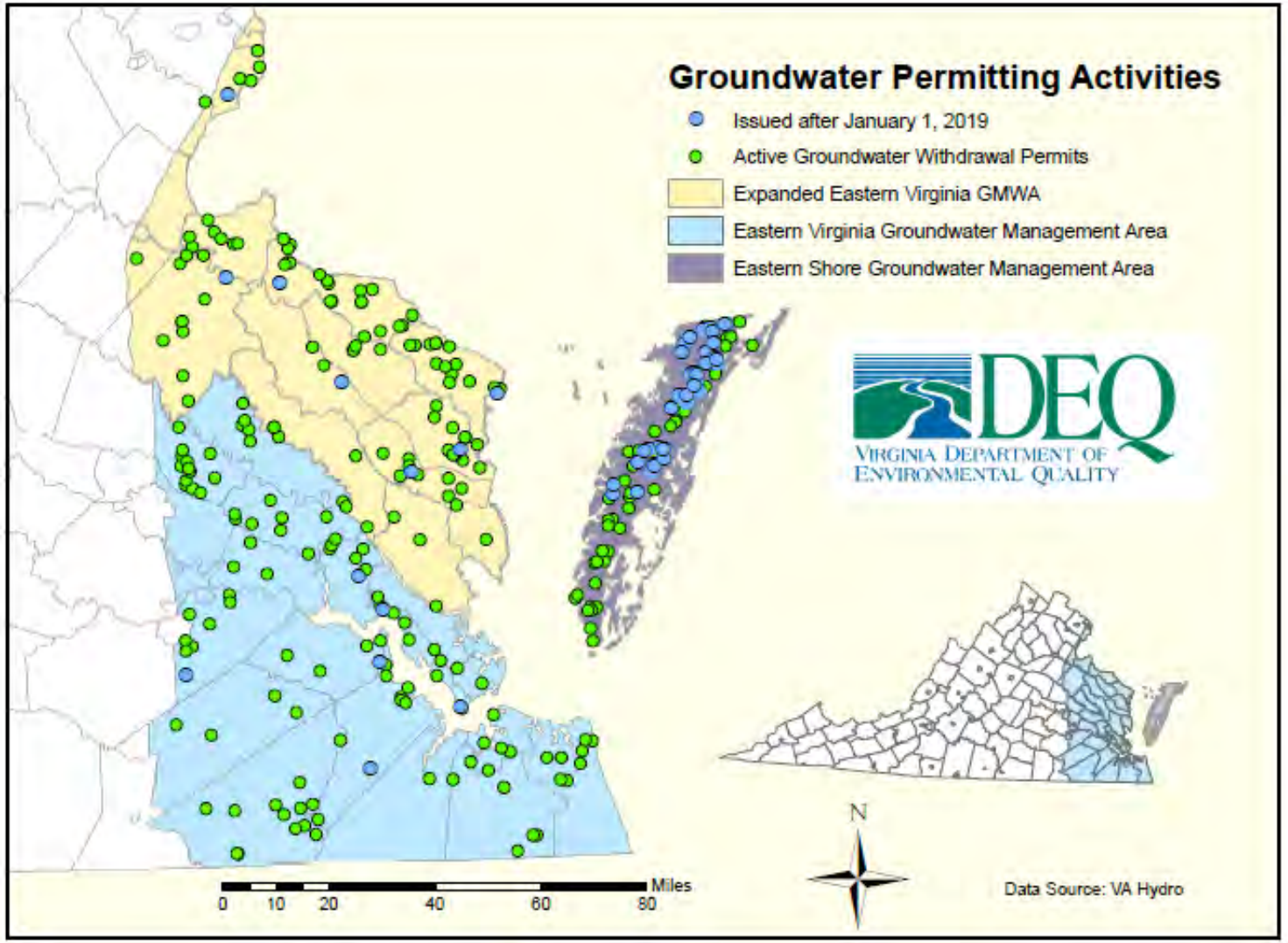
VDH VIRGINIA DEPARTMENT OF HEALTH
Protecting You and Your Environment

VDH VIRGINIA DEPARTMENT OF HEALTH
Protecting You and Your Environment

Methodology

1. Start with list of sources that are ranked as high risk from GIS
2. Select community waterworks
3. Sort from highest population to lowest
4. Sort to identify waterworks NOT in the Groundwater Management Areas.
5. Select one groundwater source from each waterworks

Groundwater Management Areas



Example Results from Risk Maps

System Name	PWSID	Population	Facility Name	ID
WESTERN VIRGINIA WATER AUTHORITY	2770900	155000	CRYSTAL SPRING	SP001
CITY OF SALEM WTP	2775300	25862	WELL 3	WL003
WAYNESBORO_ CITY OF	2820775	21006	JEFFERSON WELL 1	WL003
WARRENTON_ TOWN OF	6061600	11574	WELL 3	WL003
NEW BALTIMORE REGIONAL	6061318	10060	TERRANOVA WELL	WL009
FRANKLIN_ CITY OF	3620350	9000	WELL NO. 7 (HUNTERDALE)	WL007
LURAY_ TOWN OF	2139330	4865	HUDSON SPRING	SP002
LOUISA COUNTY WATER AUTHORITY	2109510	4254	INDUSTRIAL PARK WELL	WL001
STANLEY_ TOWN OF	2139935	4185	WELL NO. 2	WL002
POWHATAN COURTHOUSE	4145675	2605	WELL NO. 4	WL004
ELKTON_ TOWN OF	2165270	2595	ELKTON WELL	WL001
FLOYD-FLOYD CO PSA	1063220	2300	WELL NO.3	WL003
SALTVILLE_ TOWN OF	1173723	2204	WELL NO. 10	WL003
FORK UNION SANITARY DISTRICT	2065300	2150	OWENS WELL	WL003
MOUNTAIN LAKES WATER COMPANY	2079590	2141	DURHAM WELL 5	WLDR5
APPOMATTOX WATER SYSTEM	5011050	1761	WELL NO. 41	WL041
INDEPENDENCE_ TOWN OF	1077335	971	CASSELL WELL	WL007
MCKENNEY_ TOWN OF	3053700	482	NEW WELL IN TOWN	WL004
BURKEVILLE_ TOWN OF	5135110	432	WELL NO. 5	WL005
RSA ROUTE 20	6137120	387	WELL #1 (PORTER RD)	WL001

High Risk Sources

Entry Points = 20

Waterworks = Entry Points

3 rounds → 60 samples

2 rounds → 40 samples

1 round → 20 samples

3. Sampling Major Water Sources

- Sampling at the water intakes to the Waterworks, prior to treatment
- Utilities licensed professional to collect samples, FRB and ship it back to the Lab for analysis (No cost to the utility; shipping included)
- Sampling instructions and guidance will be provided

Pros:

- Sampling at raw water is relatively easy at water plant intakes
- Represents raw water for utilities
- One source water (river or aquifer) can serve multiple waterworks
- Information can be used for other purposes such as recreation, aquatic life, groundwater contamination etc.
- Can potentially lead to the identification of the PFAS source

Cons:

- Not necessarily representative of recreational use or the entire body of water
- Limited budget; this may require more resources

17 Large Waterworks

Raw sources = 23

3 rounds → 69 samples

2 rounds → 46 samples

1 round → 23 samples

4. Hybrid Approach

- Sampling at the 17 large + select high PFAS risk waterworks + select source waters (as dictated by the available budget)
- Waterworks can volunteer to participate at the reduced rate ($ per sample)
- More ideas from the Virginia PFAS Workgroup

Pros:

- More waterworks and source waters can be covered
- Can generate more valuable information on the PFAS occurrence in VA drinking water
- Better understanding will lead to better recommendations

Cons:

- Difficult to design and manage such hybrid study

Hybrid Approach

	17 Large	High Risk	Major Sources	Total
3 rounds	99	60	69	228
2 rounds	66	40	46	152
1 round	33	20	23	76
Number	17	20	23	60
	12 Large	**High Risk**	**Major Sources**	**Total**
3 rounds	63	60	69	192
2 rounds	42	40	46	128
1 round	21	20	23	64
Number	12	20	23	45

Sample site selection

Discussion:

1. Does the hybrid approach provide enough diversity (geographic, small, medium, large, etc.)?
2. Balance between covering large populations (urban systems) vs. small rural systems
3. Surface sources vs. groundwater sources
4. Community vs. noncommunity
5. Source water sampling at waterworks intakes vs other locations?
6. Would any waterworks be willing to pay for their own PFAS sampling concurrently with this occurrence study?
7. What's missing?

Sample site selection

Action items:

1. Request any existing PFAS sample results – to share with workgroup.
2. Review waterworks sample site selection concepts and make a recommendation.
3. Review source water site selection and make a recommendation.

Analytical Method Considerations

Selecting an analytical method

- **EPA Method 537** - Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)(2009).
- **EPA Method 537.1** - Determination of Selected Per- and Polyflourinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS) (2020)
- **EPA Method 533** - Determination of PFAS in Drinking Water by Isotope Dilution Anion Exchange Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (November 2019).
- **Proprietary methods** - Determination of PFAS using isotope dilution via proprietary methods

Comparing EPA Method 537, EPA Method 537.1 and EPA Method 533 Analytes

	Analyte	Abbreviation	CASRN	Method 533	Method 537	Method 537.1
1	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9	X		X
2	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	756426-58-1	X		X
3	4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4	X		X
4	Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6	X		X
5	Perfluorobutanesulfonic acid	PFBS	375-73-5	X	X	X
6	Perfluorodecanoic acid	PFDA	335-76-2	X	X	X
7	Perfluorododecanoic acid	PFDoA	307-55-1	X	X	X
8	Perfluoroheptanoic acid	PFHpA	375-85-9	X	X	X
9	Perfluorohexanoic acid	PFHxA	307-24-4	X	X	X
10	Perfluorohexanesulfonic acid	PFHxS	355-46-4	X	X	X
11	Perfluorononanoic acid	PFNA	375-95-1	X	X	X
12	Perfluorooctanoic acid	PFOA	335-67-1	X	X	X
13	Perfluorooctanesulfonic acid	PFOS	1763-23-1	X	X	X
14	Perfluoroundecanoic acid	PFUnA	2058-94-8	X	X	X
15	1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	4:2FTS	757124-72-4	X		
16	1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	6:2FTS	27619-97-2	X		
17	1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	8:2FTS	39108-34-4	X		
18	Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	X		
19	Perfluorobutanoic acid	PFBA	375-22-4	X		

Alpha Analytical: Available PFAS Methodologies and Target Compound Lists	CAS	US EPA	US EPA	Alpha ID	Alpha TOP	RI/ ME	NJ	PA/ IN	CT/ VT	MA	NH	OH	NY	DoD	MI	WI
(all applicable compound subset lists are also available)	#	537.1	533	ID	TOP											
PERFLUOROBUTANOIC ACID - PFBA	375-22-4		x	x	x						x		x	x	x	x
PERFLUOROPENTANOIC ACID - PFPeA	2706-90-3		x	x	x						x		x	x	x	x
PERFLUOROHEXANOIC ACID - PFHxA	307-24-4	x	x	x	x						x		x	x	x	x
PERFLUOROHEPTANOIC ACID - PFHpA	375-85-9	x	x	x	x				x	x	x		x	x	x	x
PERFLUOROOCTANOIC ACID - PFOA	335-67-1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
PERFLUORONONANOIC ACID - PFNA	375-95-1	x	x	x	x		x		x	x	x	x	x	x	x	x
PERFLUORODECANOIC ACID - PFDA	335-76-2	x	x	x	x					x			x	x	x	x
PERFLUOROUNDECANOIC ACID - PFUnA	2058-94-8	x	x	x	x								x	x	x	x
PERFLUORODODECANOIC ACID - PFDoA	307-55-1	x	x	x	x								x	x	x	x
PERFLUOROTRIDECANOIC ACID - PFTrDA	72629-94-8	x		x	x								x	x	x	x
PERFLUOROTETRADECANOIC ACID - PFTA	376-06-7	x		x	x								x	x	x	x
PERFLUOROHEXADECANOIC ACID - PFHxDA	67905-19-5			x												x
PERFLUOROOCTADECANOIC ACID - PFODA	16517-11-6			x												x
PERFLUOROBUTANE SULFONIC ACID - PFBS	375-73-5	x	x	x	x			x			x	x	x	x	x	x

Analytical Method Considerations

Selecting an analytical method:

- **Problem with EPA 537 and 537.1: PFBA is not included.**
  - **PFBA – listed in 5 states; 0 states with standards**
  - **PFBS – listed in 7 states; 3 states with standards**
  - **PFBS – More toxic/persistent/more common?**
- **Methods 537.1 and 533 are limited to clean water.**
- **Non-potable water: Use other methods**

Analytical Method Considerations

Selecting an analytical method

ASDWA Recommends:

- Analyze for PFAS in in UCMR3: PFOS, PFOA, PFNA, PFHxS, PFHpA and PFBS
  - All 6 – both EPA Method 533 and EPA Method 537.1
- Additional: PFBA, PFPeA and PFHxA – Found in drinking water
  - PFBA and PFPeA – EPA Method 533
  - PFHxA - both EPA Method 533 and EPA Method 537.1
- This seems to favor EPA Method 533 (more expensive)

Field Reagent Blanks

EPA Methods 537.1 and 533 require field reagent blanks (FRBs)

- At each sampling location
- Addresses sample contamination collection
- Tyvek, waterproofing is potential source of contamination
- Some states have not found PFAS routinely in FRBs – good sampling protocol
- Other states have detected PFAS in FRBs
- Waterworks staff will collect samples
- Some labs will hold FRBs and analyze only if PFAS is detected
- FRBs are not free – labs charge for each one tested or extracted
- Significant cost impact to sampling budget – could double number of analyses

Sample Protocol Considerations

- Waterworks personnel to collect samples
- Detailed sampling protocol/instructions
- Proposing a sampling instructional video
- Samples results are sensitive to PPE and clothes worn by sampler

- Action item: Request review proposed sampling instructions with waterworks/laboratory staff for feedback

Sample Protocol Discussion

1. Method 533 vs 537.1?
2. A basis for excluding PFBA from analytes?
3. Method will be inconsistent with other states, existing VA data – is this a problem?
4. Method Detection Limits? 2 ppt?
5. Experience with methods, labs on PFAS monitoring?

Sample Protocol

Action Items:

1. ODW: Get more detailed cost quotations on Method 533 and 537.1 including FRBs and MDLs.
2. ODW: Work toward recommending methods for drinking water and raw water.
3. DEQ: What analytes (and methods) are required for groundwater/wastewater monitoring?
4. What PFAS analytes are detected in Virginia waters, drinking water?
5. Any additional input for method selection?

Public Comments

Next Meeting

Suggest week of January 11, 2021

Have any Question, Comment or Suggestion, contact Us

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