PFAS Source Assessment Prioritization Plan

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Introduction

Per- and Polyfluoroalkyl Substances (PFAS) are a class of synthetic compounds characterized by having multiple fluorine atoms bonded to a single carbon atom. PFAS are used widely in industrial and consumer products. PFAS are particularly stable, heat-resistant chemicals and used in nonstick, waterproof, or stain resistant coatings, in firefighting foams, and in insulation of electrical wire. Due to the stability of the chemical bond between carbon and fluorine, the molecules are persistent in the environment and have been called "forever chemicals" because they are slow to break down. The persistence of PFAS in the environment attracted research into the chemical's human health effects which showed that the chemicals are harmful to human health. As a result of this research, the U.S. Environmental Protection Agency (EPA) in April of 2024 set national drinking water standards for six (6) PFAS compounds. EPA issued a Maximum Contaminant Level (MCL) for five (5) PFAS chemicals individually, PFOA, PFOS, PFNA, PFHxS, and HFPO-DA (also known as GenX), and a hazard index level for mixtures of two or more of four (4) PFAS as a mixture, PFNA, PFHxS, HFPO-DA, and PFBS.

The 2024 Virginia General Assembly enacted legislation, effective July 1, 2024, codified as §§ 62.1-44.34:29 through 62.1-44.34:33 of the Code of Virginia, requiring the Virginia Department of Health (VDH) to transfer all validated data indicating a public drinking water systems' water exceeds the EPA's MCL to the Virginia Depart of Environmental Quality (DEQ). DEQ is then to perform source assessments for those drinking water systems to identify the significant sources of PFAS impacting Virginia's water supplies and to look for regulatory and nonregulatory options to address the significant sources of PFAS. The General Assembly also required DEQ to develop a plan to prioritize the drinking water systems for receiving these PFAS Source Assessments. The plan is to be developed within sixth months of the first data exchange with VDH and annually thereafter. The first transmittal of data occurred on July 1, 2024, and therefore the initial prioritization plan is to be prepared prior to January 1, 2025.

The legislation directs DEQ to consider the following in developing its prioritization plan for conducting PFAS source assessments:

i. data and other information available from VDH regarding public water supplies, including but not limited to applicable PFAS data;
ii. any data or other information submitted directly to the Department by public water systems on a voluntary basis;
iii. information from consultation with VDH and public water systems with finished water monitoring results above any PFAS MCL; and
iv. other data or information the Department considers useful for setting priorities, including studies published in the scientific literature.

Plan Development

In establishing the initial PFAS Source Assessment Prioritization Plan, DEQ considered the elements above as required by the legislation. In formulating the plan, DEQ conducted research on how other similar problems have been approached within DEQ, in other Virginia state agencies, and other states in the nation. The results of the research generated ideas as a starting point for identifying factors to consider in prioritization planning. These factors were then translated into metrics for consideration. The process for reviewing, discussing, critiquing and finalizing this initial PFAS Source Assessment Prioritization Plan is reflected in the work of the PFAS Expert Advisory Committee.

The 2024 legislation directs DEQ to establish a PFAS Expert Advisory Committee (PEAC) to assist DEQ and VDH in identifying (i) PFAS sources through PFAS assessments and associated monitoring and reporting, (ii) public and private lab testing capacity issues, and (iii) options for reducing PFAS in source waters causing exceedances of PFAS MCLs.
The PEAC met two times in 2024; first on November 8, 2024, and second on December 16, 2024. At each of these meetings there was discussion and input on factors to consider in developing this PFAS Source Assessment Prioritization Plan.

At the first PEAC meeting, DEQ presented on its analysis of PFAS monitoring data reported to DEQ from VDH and research staff had conducted pertaining to PFAS prioritization rankings in other states. DEQ facilitated a discussion among the PEAC on the results of its research, and analyses and factors which may be considered in establishing a framework for prioritization planning. The minutes and presentation materials from the November 8, 2024, PEAC meeting are available at: https://townhall.virginia.gov/l/Viewmeeting.cfm?meetingid=40753.

In advance of the second PEAC meeting, staff evaluated the feedback and recommendations from committee members, inventoried available data and information that may be used for evaluating and ranking public water systems for PFAS source assessments and prepared a draft planning framework and ranking system for review and discussion.

At the second PEAC meeting held on December 16, 2024, DEQ staff shared a draft PFAS source assessment prioritization planning framework reflecting staff research and analysis, the available information for use in prioritization planning and input provided by the PEAC at the first meeting. Staff reviewed and facilitated discussion among the committee on the specific factors and inputs which may be used for this initial PFAS source assessment prioritization plan. Consensus was reached by the PEAC on a PFAS source assessment prioritization plan based on the factors discussed at that meeting and summarized in the following sections. The minutes and presentation materials from the second PEAC meeting are available at: https://townhall.virginia.gov/l/Viewmeeting.cfm?meetingid=40905.

The Plan

For this initial PFAS Source Assessment Prioritization Plan, the factors used to develop a prioritization framework consider the potential health risk posed by level or magnitude of exceedance(s) above the MCL health-based threshold and the number of people that may be exposed to elevated levels of PFAS in drinking water. Source water for public water supplies include both surface waters, such as reservoirs and rivers, as well as groundwater from wells as the source water.

Public Drinking Water Systems will be ranked into High, Medium, and Low categories based on the severity of their MCL exceedance as measured by a Cumulative Risk Index (CRI), which is defined in the next paragraph, and the size of the population affected by the MCL exceedance. Systems will be ranked High priority if they meet one of the following criteria:

1) CRI is greater than the 90th percentile of systems with an MCL exceedance or
2) Serve > 100,000 customers.

Systems will be ranked Medium priority if they meet one of the following criteria:

1) CRI is greater than the 50th percentile of systems with an MCL exceedance or
2) Serve > 10,000 customers.

If none of the criteria are met the system will be ranked Low priority.

Cumulative Risk Index

The CRI is a measure of the exceedance of the MCL and provides an indication of overall, or aggregated, public health risk. It considers the magnitude of an exceedance for each of the PFAS compounds for which there is an established health-based water concentration in a combined unitless factor. It is calculated by taking the concentration of each regulated PFAS measured by a public drinking water system divided by its MCL. The formula for the CRI is:

$$CRI = \frac{[PFOA_{ppt}]}{4\ ppt} + \frac{[PFOS_{ppt}]}{4\ ppt} + \frac{[HFPO-DA_{ppt}]}{10\ ppt} + \frac{[PFBS_{ppt}]}{2000\ ppt} + \frac{[PFNA_{ppt}]}{10\ ppt} + \frac{[PFHxS_{ppt}]}{10\ ppt}$$

When performing these calculations, the CRI will be rounded to the nearest tenth of a decimal point, e.g. 3.15 is rounded to 3.2. Not detected and not measured will be treated as 0 for the purposes of these calculations. Estimated values, those that are between the minimum detection level and minimum reporting level, will also be treated as 0. An alternative approach would be to assume the minimum detection level because it is likely the detected PFAS is present in the water. However, this approach is not feasible because it cannot be consistently applied.

For 2025, the CRI will be calculated using the 5-year maximum values of each regulated PFAS for the drinking water system[1]. When calculating the 5-year maximum, the values will be drawn from the

[1] Looking forward to 2026, the annual average is likely to be incorporated into the CRI calculation while also including the 5-year maximum with less weight. The running annual average is not being used in 2024 based on the lack of available data to calculate the annual average in 2024 as the EPA initial monitoring requirements were not released until April of 2024.

maximum value of each regulated PFAS in the 5-year window. The highest measured value in any validated measurement will be selected and used to calculate the CRI as shown in Table 1.

Table 1. Demonstration of how the maximum value is selected for a system with two measurements. The maximum value from either measurement is taken from the last five years and used for the calculation.

	PFBS	HFPO-DA	PFHxS	PFOA	PFOS	PFNA
Measurement 1	8	0	23	11	8.8	0
Measurement 2	7.6	0	25	8.4	9.4	0
Values for Calculation	**8**	**0**	**25**	**11**	**9.4**	**0**

The measured values for each of the regulated PFAS for the 2025 prioritization plan are drawn from values submitted to DEQ by VDH in their quarterly data transmittals on July 1 and October 1 of 2024, which includes data collected by VDH in their 2021-2023 sampling efforts, the Unregulated Contaminant Monitoring Rule (UCMR) 5 Data released by the EPA prior to October 1, 2024, and data voluntarily submitted to VDH by Aqua Virginia, Fairfax County Water Authority, Fauquier County Water and Sanitation Authority, Loudon Water, Rivanna Water and Sewer Authority, Orange County Water & Sewer Department, Virginia American Water, and the Washington County Service Authority.

Population Served by Public Water Systems

The population provides information on the number of people potentially exposed to elevated levels of PFAS in drinking water. Source water for public water supplies include both surface waters, such as reservoirs and rivers, as well as groundwater from wells as the source water. Population numbers for customers served by the identified public water systems are drawn from VDH's Water Works Owner Listings, as published on June 20, 2024. The population numbers in VDH's Water Works Owner Listings only account for the direct customers that a drinking water system sells to; however, several of the systems also sell their water to other drinking water systems. To account for this additional exposed population, DEQ added the population of each unique, permanent, and available, secondary drinking water system water is sold from the "Sells To" table in VDH's Drinking Water Viewer. A limitation of the Water Works Owner Listings is that population is aggregated at a system level not for individual water treatment plants. As a result, the system wide population data is applied to each water treatment plant, unless it can be separated by other data in the Drinking Water Viewer, such as by type of water source.

Transmittal of data from VDH is expected on January 1, April 1, July 1, and October 1 of 2025, and that data will be incorporated into the next annual prioritization plan.

The Prioritization

Using the scheme outlined in the previous sections, the systems are ranked as presented in Table 2.

Table 2. 2025 Prioritization Ranking for PFAS Source Assessments. Systems that meet the CRI threshold are in bold; systems that meet the customer threshold are in italics.

Systems Ranked High Priority CRI >= 9.9 (90th percentile) OR >100,000 customers served			
Marshall Waterworks	**Bealeton Regional**	*FCWA*: Occoquan Reservoir*	*Stafford County Utilities*
Waterloo Estates	**Vint Hill**	*Newport News: Lee Hall*	*Norfolk: Moores Bridges WTP*
WVWA: Spring Hollow TF*	*Newport News: Harwoods Mill*		
Systems Ranked Moderate Priority CRI >= 2.8 (50th percentile) OR >10,000 customers served			
North Rivanna WTP	**Beacon Hill**	**Town Of Round Hill**	**Mountain View Elementary**
Hazel River	**Botha Subdivision**	**New Baltimore Regional**	**Drysdale Subdivision**
Aldie Water Co	**Bethel Academy**	**Norman Acres**	**One Stop**
Bellavista Estates	*Washington County Service Authority*		
Systems Ranked Low Priority			
Town Of Hamilton	Palmyra	Town Of Clarksville	WVWA: Bush #1 Well
Heritage Estates	Mountainview MHP	Creighton Farms	WVWA: Muse Spring TP
Twin Oaks	Hiway MHC	WVWA: Craig Avenue Well	Spring Meadows
Pine Hill	WVWA: North Lakes 6 Well	Mill Quarter Plantation	WVWA: Melissa Well

Notes:
WVWA is short for Western Virginia Water Authority; FCWA is short for Fairfax County Water Authority.

Within the categories of High, Medium and Low, DEQ will use discretion to prioritize or deprioritize systems further based on the availability of data to aid in source assessment, further information from the public drinking water supply managers about the status of the supply, additional evidence of a clear source that can be quickly addressed, and any new systems DEQ receives notification of that have an exceptional exceedance of a PFAS MCL.

The prioritization system ranks the systems highest who have the greatest magnitude of exceedances and who serve the largest populations. In starting the process of source assessment for the system ranked high by these metrics, greater than 95% of the Virginian's who are known to have experienced exceedances of the MCL in their community drinking water will be prioritized for identifying potentially significant sources of PFAS in the public water systems.

Appendix 1: Maximum Concentrations and Population for Public Drinking Water Supplies with an MCL Exceedance

The table below presents the maximum concentration value of each regulated PFAS used in the Cumulative Risk Index (CRI) calculation for a given drinking water system with an MCL exceedance. The table is organized by rank order of the CRI, within each qualitative category of High, Medium, and Low Priority. The 90th and 50th percentile values of the CRI used to categorize systems in High and Medium priority are 9.9 and 2.8, respectively.

DRINKING WATER SYSTEMS	MAX HFPO-DA (PPT)	MAX PFBS (PPT)	MAX PFOA (PPT)	MAX PFOS (PPT)	MAX PFNA (PPT)	MAX PFHXS (PPT)	POPULATION	CRI	PRIORITY
MARSHALL WATERWORKS	0	42	9.9	130	0.57	200	1728	55.1	High
WATERLOO ESTATES	0	20	7.4	120	0.48	120	213	43.9	High
VINT HILL	0	13	31	41	67	50	2449	29.7	High
BEALETON REGIONAL	0	26	56	33	5	9.5	4250	23.7	High
WVWA*: SPRING HOLLOW TF	57	0	8.9	0	0	0	200593	7.9	High
FCWA*: OCCOQUAN RESERVOIR	0	10	6.2	8.7	2.6	2.6	2150792	4.3	High
NEWPORT NEWS: LEE HALL	0	1.9	4.2	7.1	0	6.8	447717	3.5	High
NEWPORT NEWS: HARWOODS MILL	0	0	0	6.1	0	3.9	447717	1.9	High
STAFFORD COUNTY UTILITIES	0	0	0	6.4	0	0	132373	1.6	High
NORFOLK: MOORES BRIDGES WTP	0	0	0	5.8	0	0	766641	1.5	High
NORTH RIVANNA WTP	0	4.6	25	6.5	0	5.2	71078	8.4	Medium
BOTHA SUBDIVISION	0	8	12	11	0.2	25	46	8.3	Medium
BEACON HILL	0	4	26	1.9	6.6	0	333	7.6	Medium
BETHEL ACADEMY	0	9	11	14	0.67	2.9	346	6.6	Medium
TOWN OF ROUND HILL	0	8.3	6.9	11	0	5.4	5019	5	Medium
NEW BALTIMORE REGIONAL	0	5.6	4.9	12	0	6.2	8818	4.8	Medium
NORMAN ACRES	0	0	0	12	0	14	50	4.4	Medium
MOUNTAIN VIEW ELEMENTARY	0	0	3	10	0	2.1	250	3.5	Medium
ALDIE WATER CO	0	5	0	10	0	8.4	70	3.3	Medium
DRYSDALE SUBDIVISION	0	2.1	5.3	7.3	0.4	0.8	63	3.3	Medium

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DRINKING WATER SYSTEMS	MAX HFPO-DA (PPT)	MAX PFBS (PPT)	MAX PFOA (PPT)	MAX PFOS (PPT)	MAX PFNA (PPT)	MAX PFHXS (PPT)	POPULATION	CRI	PRIORITY
ONE STOP	0	3.4	5	7.4	0	1.9	60	3.3	Medium
HAZEL RIVER	0	1.3	5.2	6.3	0.4	1.5	28	3.1	Medium
BELLAVISTA ESTATES	0	2	4.4	6.1	0	3.2	45	2.9	Medium
WASHINGTON COUNTY SERVICE AUTHORITY	0	0	0	5.2	0	0	26229	1.3	Medium
TOWN OF HAMILTON	0	6	6.1	4.6	0	0	2240	2.7	Low
HERITAGE ESTATES	0	3.3	4.9	3.4	0	5	80	2.6	Low
TWIN OAKS	0	0	3.5	5.7	0	0	50	2.3	Low
MOUNTAINVIEW MHP	0	3.8	6.3	0	0	5.7	80	2.1	Low
PINE HILL	0	0	2	6.3	0	0	71	2.1	Low
PALMYRA	0	2	2.1	4.8	1.7	1.2	90	2	Low
HIWAY MHC	0	4	3.2	4.2	0	0	80	1.9	Low
WVWA*: NORTH LAKES 6 WELL	0	0	0	6.3	0	0	9135†	1.6	Low
TOWN OF CLARKSVILLE	0	0	2	4.1	0	0	1400	1.5	Low
WVWA*: CRAIG AVENUE WELL	0	0	0	5.5	0	0	9135†	1.4	Low
CREIGHTON FARMS	0	2.6	5.5	0	0	0	95	1.4	Low
MILL QUARTER PLANTATION	0	0	5	0	0	0	273	1.3	Low
WVWA*: BUSH #1 WELL	0	0	0	4.9	0	0	9135†	1.2	Low
WVWA*: MUSE SPRING TP	0	0	0	4.7	0	0	9135†	1.2	Low
SPRING MEADOWS	0	0	0	4.2	0	0	2362	1.1	Low
WVWA*: MELISSA WELL	0	0	0	4.1	0	0	9135†	1	Low

Notes:

* WVWA is short for Western Virginia Water Authority; FCWA is short for Fairfax County Water Authority.

† Western Virginia Water Authority's Wells have an assumed population number as populations numbers for each well are not provided by VDH. The values were estimated from the WVWA reporting it gets 5% of its water from GW sources in VDH's Drinking Water Viewer. The population value for each well was assigned 5% of the overall population of the drinking water system. This is a conservative approach, which overestimates each well's population served. Consecutive connections were not considered as including them would further overestimate the population served.