Implications of the National Primary Drinking Water Regulation on PFAS in North Carolina

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August 2024

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Executive Summary

PFAS are dangerous chemicals that have been contaminating the nation's drinking water for many decades. Individual states have passed their own laws, but there hadn't been federal regulation until the passing of EPA's Final National Primary Drinking Water Regulation in April 2024. The purpose of this white paper is to describe this regulation, how we got here, the implications for North Carolina, reactions to the regulation, and the future of PFAS.

- There are thousands of PFAS used for industrial processes to create everyday products. These 'forever chemicals' don't naturally degrade and bioaccumulate in humans, animals, and the environment. Research suggests many negative health consequences associated with exposure to PFAS.

- North Carolina's waters have been polluted with PFAS for many decades. This pollution largely stems from Chemours dumping their wastewater into the Cape Fear River. This contamination is now widespread, with many counties, water systems, and wells affected.

- The NC DEQ established a PFAS state action plan in response to the contamination. Additionally, NCGA established the NC PFAS Testing Network, who works to test for PFAS across the state and provide relevant data to utilities, towns, and agencies.

- A number of states have established their own laws regarding PFAS based on the best available science and contamination issues most prevalent to that state. This resulted in a wide variety of regulations across the country, ranging from 2 ppt to 400,000 ppt.

- Federal actions that have been taken against PFAS include investing into research, creating action plans, establishing health advisory levels, designating certain compounds as toxic substances, and now regulating PFAS in drinking water.

- The National Primary Drinking Water Regulation creates maximum allowable levels of PFAS in drinking water and requires utilities to treat the water if they exceed these levels.

- Nearly 2,000 water systems in NC will be affected, with 17% of these estimated to have concentrations over the new regulation. 3.6 million North Carolinians have drinking water is over the federal limits. Many more's water is contaminated at lower levels or with other unregulated PFAS.

- Supporters of the Rule applaud the EPA for finally taking action against PFAS and to continue. Adversaries raise concerns over the costs and potential negative impacts.

What are PFAS?

Perfluoroalkyl and polyfluoroalkyl substances (PFAS) are a group of over 14,000 synthetic chemicals. In the late 1930s, scientists first created PFAS accidentally, and began incorporating them into manufacturing processes in the early 1940s. They are commonly used in commercial and consumer products to make items water, stain, and grease resistant. PFAS are also referred to as 'forever chemicals' because their chemical structure makes them resistant to natural degradation and extremely difficult to destroy with current technologies. As a result, PFAS have accumulated in humans, animals, and the environment. Research suggests that about 95% - 98% of the human population have encountered PFAS and have detectable concentrations in their blood.

These chemicals get into our environment through three main pathways. The first is from industrial and chemical manufacturing companies, who either directly make PFAS, or use PFAS in their manufacturing processes/products. Through these processes, PFAS are released into the environment through air emissions or are concentrated in wastewater. The second is through firefighting foam, which contains a PFAS called AFFF. This makes military bases, airports, fire stations, and firefighting training locations who use these foams hotspots for environmental contamination. The other pathway in which PFAS enter the environment is from landfills. Most consumer products containing PFAS eventually go to landfills and as the products degrade, the chemicals contaminate the area and end up in landfill leachate.

There are two broad types of PFAS: long-chain and short-chain, which refers to their chemical structure. Long-chain "legacy" PFAS were the first types to be produced and the majority have since been phased out of production. PFOS and PFOA are both examples of long-chain legacy pollutants. Short-chain PFAS are those that were developed as an alternative to the legacy PFAS. GenX and PFBA are both examples of short-chain PFAS. Though these were developed as 'safer' or better alternatives to legacy PFAS, short-chain PFAS are up to 70% more costly and harder to remove.

Exposure to PFAS has been linked to adverse health effects in animals and humans. In the 1960s and 1970s, PFAS manufacturing companies DuPont and 3M conducted their own scientific studies examining the health effects of PFAS, which found potential adverse health effects. Regardless, they continued to manufacture these chemicals while neglecting to notify the public of the possible dangers. Current research has indicated that PFAS exposure can lead to reproductive effects, developmental delays, increased risk of cancer, reduced immune function, kidney and liver damage, thyroid/hormonal disruptions, increased cholesterol, and risk of obesity. Future research is needed to determine the health effects of the PFAS studied less extensively as well as the effects associated with the lengths of exposure (short vs. long-term exposure).

PFAS in North Carolina

The chemical manufacturing company DuPont began production of PFAS in North Carolina starting in 1980 at a factory called Fayetteville Works, located right outside of Fayetteville, NC. In the early 2000s, officials became aware that DuPont was dumping wastewater containing PFAS into the Cape Fear River, which serves as a drinking water source for approximately 1.5 million North Carolinians. Concerns about the concentrations of PFAS detected in the waters motivated DuPont to switch from PFOA to GenX, which was thought to be a 'safer' PFAS, and continued to dispose their wastewater into the river. Shortly after, GenX was detected in the Cape Fear River. DuPont is the only company to manufacture GenX. In 2015, The Chemours Company was founded, which was a spin-off company of DuPont. The citizens of Wilmington, NC, who are downstream of the Fayetteville Works factory and source their drinking water from the Cape Fear River Basin, weren't alerted about the pollution in their water until 2017. During the same year, Chemours publicly admitted to releasing PFAS into the Cape Fear River since the 1980s. The image below shows the Cape Fear River Basin and relevant areas along the river.

From *Measurement of Novel, Drinking Water-Associated PFAS in Blood from Adults and Children in Wilmington, North Carolina* (Kotlarz et al., 2020). https://doi.org/10.1289/ehp6837

The North Carolina Department of Environmental Quality (DEQ) filed a Consent Order in 2019 against Chemours, which requires them to implement technologies to limit PFAS pollution, as well as conduct well water testing and provide alternative water sources to those affected. Chemours has been sued by multiple entities including the Cape Fear Public Utility Authority, North Carolina Attorney General Josh Stein, and other class action suits. Chemours has since stopped dumping into the Cape Fear and implemented various mechanisms to limit pollution. A timeline of Cape Fear's PFAS history is summarized below.

1940s: PFAS were first developed and began being used for a wide variety of products and processes.

1960s & 70s: DuPont and 3M conducted studies finding potential harms of PFAS.

1980s: DuPont began dumping wastewater containing PFAS into the Cape Fear River.

2000s: Officials became aware that DuPont has been polluting the Cape Fear River.

2009: DuPont switched from PFOA to the "safer" GenX.

2012: GenX first detected in Cape Fear.

2015: DuPont becomes Chemours.

2017: Wilmington residents first learn of the PFAS contamination in their water & Chemours publicly admits to releasing PFAS into the Cape Fear since the 1980s.

2019: Consent order to Chemours from DEQ.

Wilmington and the Cape Fear River Basin have been the focal point of PFAS issues in North Carolina because they have had the highest concentrations of multiple PFAS in the state. However, there are many other places and millions of people across the state whose drinking water is contaminated with these chemicals. Every river basin except for French Broad has detected at least one PFAS in the water. Listed below are just some of the cities and utilities in North Carolina who are facing these issues:

- Orange Water and Sewer Authority (OWASA), which serves more than 80,000 residents, found 11 PFAS in their water source when they first began monitoring PFAS in 2018. OWASA began the process of installing treatment technology to remove PFAS from the drinking water in 2023.

- Robeson County Water System, which serves 64,000 residents, detected concentrations of PFOS at 40 parts per trillion (ppt) and GenX at 33 ppt during UCMR5 testing.

- The Town of Maysville has a population of 1,000, but only 450 are on the town's water system. In 2019, they found PFAS concentrations of 103 ppt in their water supply. After a second test confirmed this, the town immediately shut their water off and switched to Jones County's water source, which tested normally. With the help of federal funds, the town is currently working to install PFAS treatment technology.

- In 2019, Burlington found their discharged raw wastewater had concentrations of up to 30,000 ppt. This wastewater is discharged into the Haw River, which other systems use as their source for drinking water. The origin of these contaminants was found to be from an industrial manufacturer whose wastewater contained PFAS. The city has been working to clean up PFAS upstream near the source.

- Pittsboro detected PFAS both in tap water and residents' blood. These concentrations were reported to be higher than the normal population. The town has a population of almost 5,000 people and sources their drinking water from the Haw River. Pittsboro has since implemented GAC to treat the town's water for PFAS.

- The Piedmont Triad Regional Water Authority serves 367,681 people throughout parts of Archdale, Greensboro, High Point, Jamestown, and Randolph County. The water authority has average concentrations of PFOA at 5 ppt and PFOS at 9 ppt. Currently, an expansion and new reverse osmosis treatment system has been proposed.

- The City of Durham has two water treatment plants that serve 321,414 people. From 2020-2024, the plants have reported average concentrations of PFOS at 5.91 ppt, PFOA at 3.73 ppt, and PFBS at 5.33 ppt based on the city's water quality reports. As of now, no treatment system has been proposed.

- The City of Greensboro has two water treatment plants which serve 318,057 people. Test results from 2024 between the two plants have shown averages of 20 ppt for PFOS, 3.28 ppt for PFOA, 14.5 ppt for PFHxS, and 4.2 for PFBS. GAC filters are currently being implemented at their Major Mitchell Water Treatment plant and other upgrades have been proposed.

- The Fayetteville Public Works Commission serves 214,137 people. Between October 2023 and January 2024, concentrations of PFHxS ranged from 4.5-18.2 ppt, PFOS 11.2-

21.8 ppt, PFOA 6.3-11 ppt, and PFBS 4.2-12.1 ppt. Both water plants under this utility are currently in the process of implementing GAC as well as other plant upgrades.

- Brunswick County Public Utilities, which serves 152,030 people, has detected average PFAS concentrations of 5 ppt for PFOA and 9 ppt for PFOS. A reverse osmosis treatment system is being constructed as well as other upgrades at their Northwest Water Treatment Plant.

Chemours is the only PFAS manufacturer in the southeast Atlantic US. But they aren't the only entity responsible for the environmental pollution. Other industrial facilities who use these chemicals in their production process, which can lead to PFAS concentrations being emitted into the air or wastewater. There are an estimated 736 industrial facilities and manufacturers in North Carolina that are suspected to be responsible for PFAS discharges. This includes 66 electroplating facilities and 50 chemical manufacturers as well as airports and landfills.

North Carolina Response

While the North Carolina legislature hasn't passed any regulation on PFAS in drinking water, the NC Department of Health and Human Services set a non-enforceable health goal of 140 ppt for GenX in 2017 based on the best available science. In 2022 this was changed to 10 ppt to match the Environmental Protection Agency's (EPA) national health advisory level.

State Action Strategy

The DEQ released an Action Strategy for PFAS in June of 2022. This strategy was developed to complement and strengthen the 2021 EPA Strategic Roadmap (discussed later) as well as establishing actionable plans to regulate and cleanup PFAS in North Carolina. The plan focuses on three main areas of action: protecting communities, protecting drinking water, and cleaning up existing contamination.

- **Protecting Communities**. The DEQ will work to identify and notify those at risk of exposure to PFAS while also expanding their knowledge of the chemicals and health risks through research, literature reviews, and further testing of drinking water sources in the state. Based on these findings, a PFAS Priority List will be developed according to the PFAS most prevalent in the state's waters. In taking action to address PFAS contamination, the DEQ will prioritize communities most affected and any environmental justice communities or concerns.

- **Protecting Drinking Water.** The DEQ will propose groundwater, surface water, and drinking water standards for PFAS. Groundwater standards will protect drinking water

for the 2.5 million people who rely on this water for drinking. The DEQ plans to propose standards for PFOA, PFOS, GenX, PFBS, and PFBA for groundwater based on EPA guidance. Surface water standards will be set to regulate PFAS levels in these waters, which can also serve as a source of drinking water. The DEQ plans to regulate PFOA and more PFAS in surface water once more research is completed. Finally, the DEQ plans to propose Maximum Contaminant Levels (MCLs) for priority PFAS. MCLs are legally enforceable maximum levels of a contaminant allowed in drinking water.

- **Clean Up Existing Contamination**. The DEQ will set remediation goals for sites contaminated with PFAS as well as continue efforts to remove chemicals from these sites. The DEQ will hold polluters and other responsible parties accountable for their actions when it comes to cleaning PFAS contamination and covering the cost.

The North Carolina Collaboratory

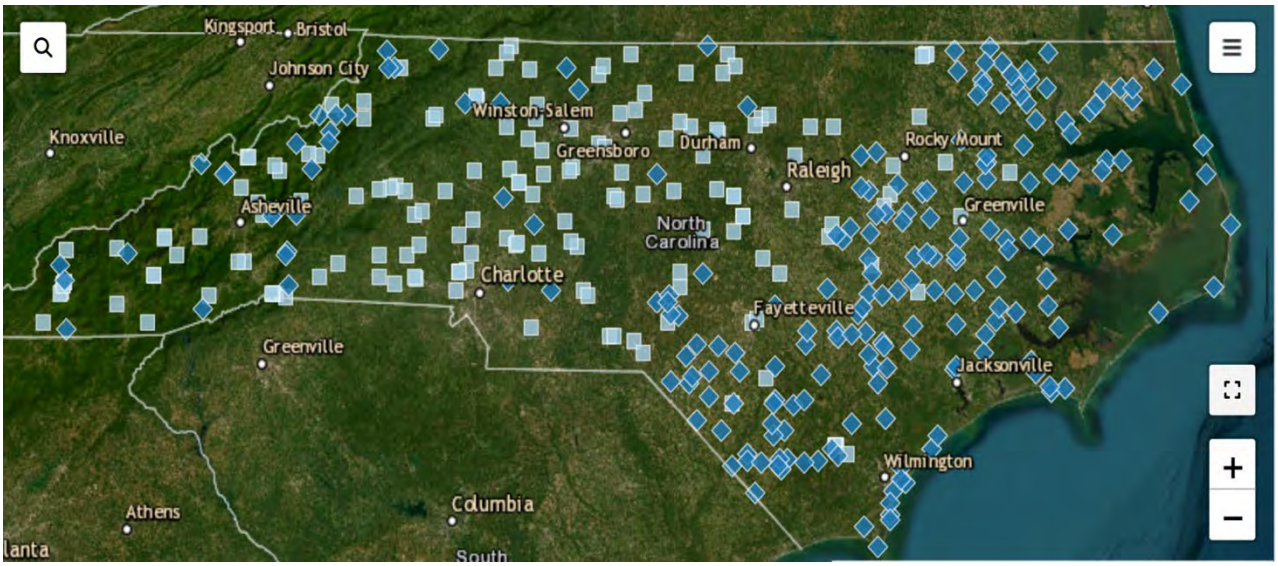
The North Carolina Collaboratory was established in 2016 by the North Carolina General Assembly (NCGA) with the purpose of conducting scientific research in a variety of sectors to provide lawmakers and agencies within North Carolina with relevant data and findings. The NC Collaboratory is based at UNC-Chapel Hill but conducts research across 17 North Carolina universities and higher learning institutions. To date, they have received $225 million from the NCGA to support over 500 projects.

NC PFAS Testing Network

The 2018 Water Safety Act provision allocated a little over $5 million to the NC Collaboratory, which was used to establish the North Carolina PFAS Testing Network (NC PFAST Network) following the discovery of high PFAS concentrations in North Carolina's drinking water. By June 30, 2025, funding for PFAS from the NCGA will total around $50 million, which is the biggest contribution to academic research surrounding PFAS provided by legislation in the whole country.

The goal of the NC PFAST Network is to address PFAS in North Carolina's water and air and better understand the overall toxicology of these chemicals. In 2019, researchers from the NC PFAST Network conducted water sampling of raw and treated water around the state. From this study, researchers developed a map (see below) which shows PFAS contamination sites around North Carolina, indicating what types of PFAS were found in what source. The light blue squares show surface water contamination while the dark blue diamonds show well water contamination. This data has since been used by state agencies and allowed the DEQ to conduct additional testing at sites where PFOA, PFOS, and/or GenX exceeded the 2022 EPA interim health. If interested in the PFAS concentrations for your area, visit the website linked below. From there, this interactive map can show you each PFAS detected at what concentration for

each site. Keep in mind, this data is based on 2019 sampling, so it may not be reflective of current concentrations.



https://ncpfastnetwork.com/data/

The NC Pure Project

The NC Collaboratory created The North Carolina PFAS University Research Alliance (NC Pure) through $10 million in funding received from the NCGA. This project is focused around developing technologies that remove PFAS from drinking water and comparing these to current existing commercial technologies. The NC Pure team developed novel sorbents (NS) called ionic fluorogels. Current pilot studies show that these are highly efficient, with the ability to remove several PFAS at a higher percentage than current PFAS removal technologies. The ionic fluorogels are specifically designed to target PFAS in water and remove them, which is what makes them so efficient and distinct from existing technologies. Once the PFAS are absorbed by ionic fluorogels, the sorbent is able to be cleaned and reused, unlike other PFAS technologies that simply remove them from the water. Currently, ionic fluorogels are being tested at the pilot scale in three water treatment plants in North Carolina.

PFAS in Other States

In the absence of federal regulation, all but 10 states in the US introduced a variety of legislative actions addressing PFAS. This ranged from funding for research and monitoring to banning the chemicals in consumer products. Not all legislation that was introduced in these states were enacted. A number of states were able to enact laws or legislations that addressed PFAS in drinking water by establishing their own enforceable drinking water standards, non-enforceable drinking water guidelines, or monitoring programs. States were motivated to make their own regulations based on their commitment to protecting public health as well as pressure from the

public to address these contaminants. Individual guidelines and regulations for states were based on current toxicological research and studies (both locally and from other states), regulations other states were making, and PFAS contamination issues most specific to that state. The result is a wide range of PFAS guidelines across the US, ranging from 2 ppt to 400,000 ppt. The table below outlines states that established enforceable MCLs to address PFAS in drinking water.

	MCL (ppt)								
State	**PFOS**	**PFOA**	**PFNA**	**PFHxS**	**PFHpA**	**HFPO-DA (GenX)**	**PFBS**	**PFDA**	**PFHxA**
Maine	20	20	20	20	20			20	
Massachusetts*	20	20	20	20	20			20	
Michigan	16	8	6	51		370	420		400,000
New Hampshire	15	12	11	18					
New Jersey	13	14	13						
New York	10	10							
Pennsylvania	18	14							
Rhode Island	20	20		20				20	
Vermont*	20	20	20	20	20				
Wisconsin*	70	70							

*The regulations for these states are for detections of PFAS levels either individually or in combination with others.

The following table shows states who adopted non-enforceable “action levels” or drinking water guidelines prior to federal regulations. California, Illinois, Maryland, Minnesota, and North Carolina released Health Advisory Levels (HALs). HALs are levels of contaminants at which adverse health effects are not anticipated to occur. These are not a regulation, nor an enforceable measure, but rather guidelines to aid agencies and water systems. Alaska, Connecticut, Hawaii, and Ohio issued action levels for individual PFAS at varying concentrations. Action levels are not the same as MCLs. Both MCLs and action levels are set at levels to protect human health and are based on the best available science. The difference between the two is what happens after these levels are detected. Reaching or exceeding MCLs triggers a whole range of actions, but most importantly requires water systems to lower PFAS concentrations. On the other hand, reaching or exceeding an action level requires public notification and increased monitoring.

Installing treatment technology to lower concentrations or switching water sources is recommended, however, it is not legally required.

Non-Enforceable Guidelines (ppt)								
State	**PFOS**	**PFOA**	**PFNA**	**PFHxS**	**HFPO-DA (GenX)**	**PFHxA**	**PFBS**	**PFBA**
Alaska*	70	70						
California	6.5	5.1		3			500	
Connecticut	10	16	12	49	19	240	760	1,800
Hawaii	7.7	12	12	77	12	1,900	1,700	15,000
Illinois	14	2	21	140		3,500	2,100	
Maryland				140				
Minnesota	2.3	0.0079		47		200	100	7,000
North Carolina					10			
Ohio	70*	70*	21	140	700		140,000	
Washington	15	10	9	65			345	

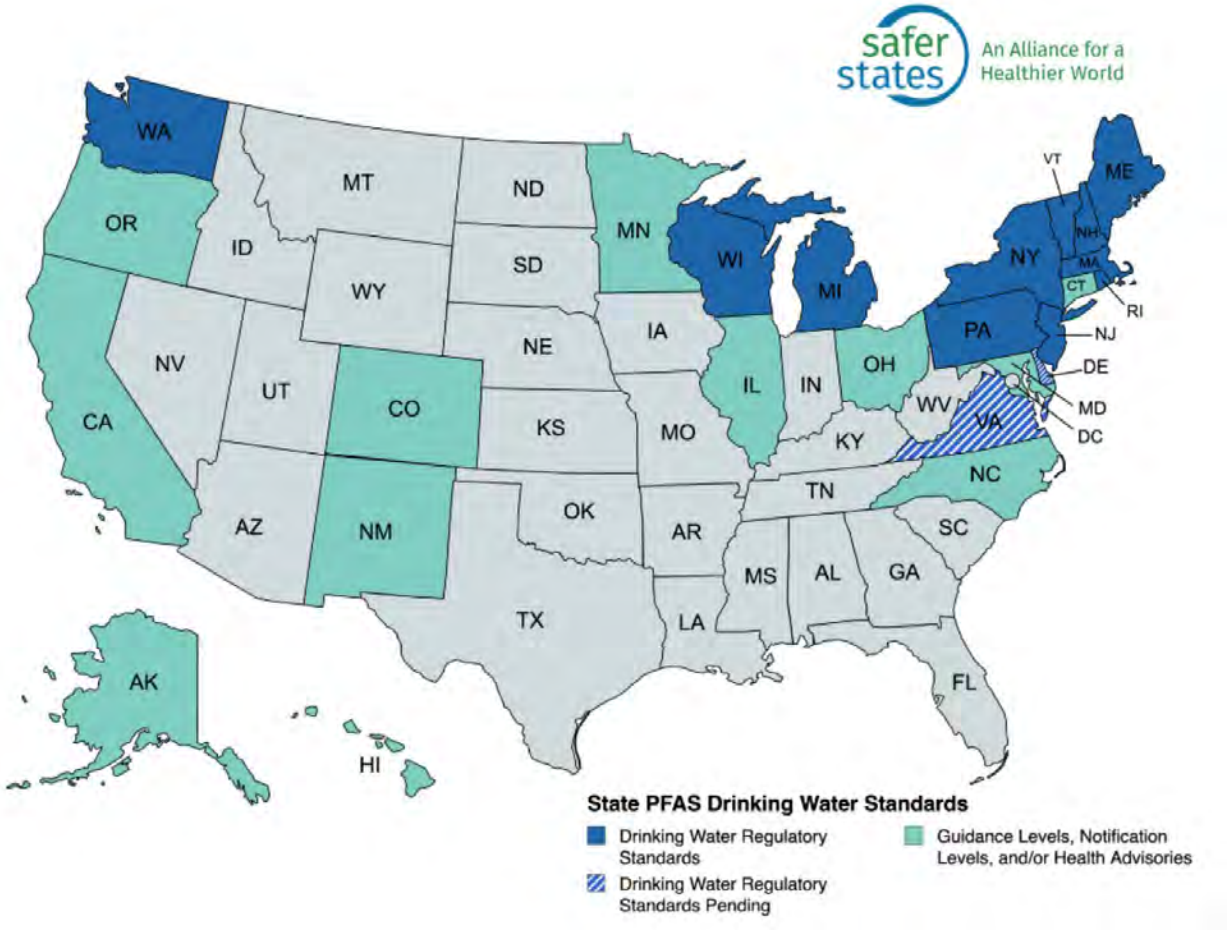
*The regulations for these states are for detections of PFAS levels either individually or in combination with others.

In addition to those listed in the table, Connecticut and Hawaii also released action levels for a few less commonly known PFAS:

- **Connecticut**: 6:2 Cl-PFESA at 2 ppt & 8:2 Cl-PFESA at 5 ppt

- **Hawaii**: PFUnDA at 19 ppt, PFDoDA at 26 ppt, PFTrDA at 26 ppt, PFHpS at 38 ppt, PFDS at 38 ppt, PFOSA at 46 ppt, PFHpA at 77 ppt, PFTeDA at 260 ppt, ADONA at 1,200 ppt, PFPeA at 1,500 ppt, and 6:2 FTS at 1,500 ppt

Colorado, New Mexico, and Oregon have also adopted guidance or notification levels for certain PFAS. Delaware and Virginia have been in the process of establishing their own regulations for PFAS. The map below generated by Safer States shows each state that has taken action against PFAS in drinking water.



https://www.saferstates.org/priorities/pfas/

Federal Actions

For the past few decades, the EPA has taken many steps to address these forever chemicals. These actions look like many different things, such as requiring manufactures to alter their usage of PFAS, to the EPA establishing various types of action plans. The major actions associated with addressing PFAS contamination in waters are outlined below.

EPA's Strategic Roadmap

The EPA released their PFAS Strategic Roadmap in October of 2021, which gives a timeline of actions to be taken from 2021 through 2024 to address PFAS in the United States. This Strategic Roadmap follows and strengthens the 2019 EPA PFAS Action Plan, with similar goals and priority actions. Their approach to tackling PFAS relies on the following principles:

- **Consider the Lifecycle of PFAS**. This includes manufacturing, processing, distribution in commerce, use of product, and disposal. PFAS can be released and contaminate the environment in any stage of its lifecycle, which makes this consideration crucial.

- **Get Upstream of the Problem**. It is important to eliminate PFAS from the environment by preventing them from initially entering it. This means targeting industries who pollute with regulations on usage of new PFAS as well as limits for emissions and discharges.

- **Hold Polluters Accountable.** Those who put the PFAS into the environment should be responsible for remediation efforts and associated costs. It is expected that shifting the responsibility to polluters will deter them from polluting in the future.

- **Ensure Science-Based Decision-Making**. Future decisions and regulations will be made based on the best available science. Current gaps in PFAS knowledge will be researched by federal and state governments as well as nonprofits, academia, and industries. The research aims to better understand exposure pathways, toxicities, and health impacts of lesser known PFAS.

- **Prioritizing Protection of Disadvantaged Communities**. PFAS regulations and remediation efforts will be accessible to all communities. Low-income communities and/or communities of color are disproportionately located near highly contaminated PFAS sites. The EPA will ensure these communities will receive equitable access to contamination solutions, which involves considering exposure pathways, characteristics of these communities (such as current infrastructure), and facilitating community engagement.

The EPA's overarching objectives and goals of this strategic roadmap is to invest in ***research*** to further understand PFAS and their toxicities, ***restrict*** PFAS from entering the air, land, and water, and provide support for accelerated ***remediation*** of contaminated sites. The EPA has outlined key actions that will achieve these goals and assigned various offices within the Agency to these tasks.

Interim Health Advisories

The EPA has released several interim health advisories for certain PFAS. As previously mentioned, health advisories are not regulations and not enforceable, rather, they are levels of contaminants that are thought to not cause human health effects based on the best currently available science. The first health advisory was released in 2009 and has been updated several times as scientists gain a better understanding of these chemicals.

Year	Health Advisory	PFAS	ppt
2009	Provisional Health Advisory	PFOA	400 ppt
		PFOS	200 ppt
2016	Lifetime Health Advisory	PFOA	70 ppt (individually or mixed with PFOS)
		PFOS	70 ppt (individually or mixed with PFOA)
2022	Interim Lifetime Health Advisories	PFOA	0.004 ppt
		PFOS	0.02 ppt
		PFBS	2000 ppt
		GenX (HFPO-DA)	10 ppt

CERCLA Designation

The EPA officially designated PFOA and PFOS as hazardous substances under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) on April 19, 2024. This step in EPA's Strategic Roadmap will ensure official reporting and transparency of PFOA and PFOS contamination, allowing for quicker response and cleanup times, with the expectations of lower adverse health effects associated with PFAS contamination. This will also hold the polluters liable by shifting the responsibility of cleanup to the polluter, rather than utilities and taxpayers. This designation doesn't automatically ensure that a contaminated site will be immediately investigated and cleaned, but it does take away certain barriers that will allow this process to occur in a more timely manner.

National Primary Drinking Water Regulation

On April 10, 2024, the EPA announced the first ever national drinking water regulation for PFAS under the Safe Drinking Water Act (SDWA). The final National Primary Drinking Water Regulation (NPDWR) (Final Rule) sets MCLs for six PFAS in drinking water. They also released Maximum Contaminant Level Goals (MCLGs), which are non-enforceable levels at which the best scientific findings indicate no harm is associated with that level of exposure. MCLs are set as close as feasible, technically, and fiscally possible to MCLGs. The table below

shows the MCLs and MCLGs for the six PFAS specified under this new Rule. These levels are set as parts per trillion (ppt), which is also commonly seen as nanograms per liter (ng/L).

Compound	Final MCL	Final MCLG
PFOA	4.0 ppt	0
PFOS	4.0 ppt	0
PFHxS	10 ppt	10 ppt
PFNA	10 ppt	10 ppt
GenX (HFPO-DA)	10 ppt	10 ppt
Mixtures containing two or more of: PFHxS, PFNA, GenX, and PFBS	Hazard Index of 1 (unitless)	Hazard Index of 1 (unitless)

The Hazard Index (HI) is used to regulate mixtures of two or more of PFHxS, PFNA, GenX, and PFBS. Since PFAS are commonly found in mixtures with other PFAS, this HI ensures protection when individual PFAS are at low levels but are combined with others. As you can see, PFOA and PFOS are not included in the HI. This is because the EPA determined there is no level of exposure to these two PFAS that do not pose a risk of adverse health effects. This is why the MCLGs for PFOA and PFOS are set at zero. However, the MCLs are 4.0 ppt because this is the most feasible level at which current technologies can remove them from the water. The HI is calculated by adding the ratio of concentration to health-based water concentrations for each PFAS present and cannot exceed 1. The formula is shown below. The benefit of using a formula and index like this is that the EPA can always add more PFAS to the HI in the future if they choose to do so.

$$HI\ MCL = \left(\frac{[HFPO\text{-}DA_{water}]}{[10\ ppt]}\right) + \left(\frac{[PFBS_{water}]}{[2000\ ppt]}\right) + \left(\frac{[PFNA_{water}]}{[10\ ppt]}\right) + \left(\frac{[PFHxS_{water}]}{[10\ ppt]}\right) = 1$$

Under the Final Rule, public water systems (PWS) now have three years (until 2027) to complete initial monitoring for these regulated PFAS and inform the public about the levels in their water. This involves sampling quarterly (4 times) or bi-annually (2 times) within a 12-month period. The frequency of sampling is dependent on the size and type of system. Water systems also have the option to instead present water samples previously collected during the fifth Unregulated Contaminant Monitoring Rule (UCMR 5) or other drinking water collection programs/data. The Unregulated Contaminant Monitoring Rule (UCMR) is a federal rule mandating monitoring for up to 30 unregulated contaminants every 5 years in select public water systems. The list of

contaminants to monitor can be updated each cycle. In 2013 during the third Unregulated Contaminant Monitoring Rule (UCMR 3), EPA added six PFAS (PFOA, PFOS, PFNA, PFHxS, PFHpA, and PFBS) to the list of contaminants and every state has had to monitor these PFAS since.

If PFAS are detected at levels higher than the MCLs, the public water systems will have five years (until 2029) to implement removal technologies or other solutions. Five years following the implementation of the Final Rule (2029), water systems are required to start notifying the public if there are any violations of the MCLs. Following the period of initial monitoring (2027), systems will need to continue monitoring their water for PFAS to ensure compliance. The frequency of monitoring is dependent on if initial monitoring results exceed trigger levels. These trigger levels are values set at ½ of the MCLs. This means the trigger level for PFOA and PFOS is 2.0 ppt, 5.0 ppt for PFHxS, PFNA, and GenX, and 0.5 for the Hazard Index. The PFAS concentration relative to the trigger levels will determine if that water system has to monitor more or less frequently moving forward. A summarized timeline of the rule implementation is outlined below.

Timeline of Final Rule Implementation	
By 2027:	Public water systems must complete their initial monitoring or provide records of their previous monitoring data.
Starting 2027:	Public water systems must start compliance monitoring and provide the public notification of monitoring and testing violations within 1 year of violation. Public water systems must start providing Consumer Confidence Reports every year, which are water quality reports measuring regulated PFAS levels in that system.
By 2029:	Public water systems must have their PFAS treatment technologies installed if needed and all systems must be in compliance with the Final Rule.
Starting 2029:	Public water systems are required to notify the public in the instance that PFAS levels exceed MCLs within 30 days of learning about the violation.

What Changed?

The EPA first published a proposed NPDWR in March 2023. Between then and the release of the Final Rule, the EPA received and considered over 120,000 comments pertaining to the rule. This led to a couple key changes that distinguishes the proposed from the Final Rule:

- The addition of individual MCLs and MCLGs for PFHxS, PFNA, GenX. In the proposed rules, these 4 PFAS ***did not*** have MCLs and MCLGs for individual concentrations. In the Final Rule, these 4 PFAS now have individual MCLs and MCLGs set at ***10 ppt each***.

- The MCLs and MCLGs for the Hazard Index were altered. In the proposed rule, the Hazard Index was 1 for mixtures of ***1 or more*** of 4 PFAS: PFHxS, PFNA, GenX, and PFBS. Under the Final Rule, the Hazard Index is used in mixtures of ***2 or more*** of these 4 PFAS.

- The Final Rule extends the time water systems have to comply with the MCL standards. In the proposed rule, systems were required to complete their initial monitoring and comply with standards within the first ***3 years***. The Final Rule gives a 2-year extension for compliance, giving water systems ***5 years*** after the Final Rule goes into effect to comply with the MCL standards.

- The Final Rule extends the amount of time water systems have to inform the public of the levels of PFAS in their drinking water. In the proposed rule, systems were required to do this after the first ***3 years*** of the rule going into effect. Now, after ***5 years*** of the Final Rule being implemented, water systems are required to provide public notification if there are any violations of the MCLs in their drinking water.

- The trigger levels which determine compliance monitoring were altered. In the proposed rule, trigger levels were set at ***⅓*** of the proposed MCLs. In the Final Rule, the trigger levels were set to be ***½*** of the final regulated MCLs.

- The Final Rule reduced ongoing compliance monitoring frequency from ***quarterly*** to either ***annually*** or ***triennial*** for water systems to show they are consistently keeping their water below the regulated PFAS MCLs.

The primary purpose of these changes was to help ease the burden on water systems and give them more time to comply with the standards, especially water systems in small and rural communities. This additional time allotted to achieve compliance will allow these systems to obtain funding, install treatments or identify other sources of water, and overall, properly prepare for complying with the Final Rule in the best and most cost-effective way for that community.

Implications of the Final Rule

Treatment Technologies

It is estimated that 4,100 - 6,700 of the nation's public water systems will have PFAS concentrations exceeding the MCLs. These systems will be required to either find a new source of water or implement the "Best Available Technologies" (BAT) of their choosing. There are four available BAT options: granular activated carbon (GAC), ion exchange (IX), reverse osmosis (RO), and nanofiltration (NF). GAC is a filter filled with activated carbon and as the water passes through, the PFAS "stick" to the activated carbon. Eventually the filter will need to be changed, which poses the problem of extra costs and where to dispose of the PFAS laden material. IX works in a similar way as GAC; the water passes through a container of ion exchange media and the ions switch places with the PFAS. Like GAC, this media will eventually become too full of PFAS and will have to be exchanged. RO and NF are high pressure membrane processes that divide the clean water from the contaminated water. These technologies tend to be more efficient than GAC and IX, however, they are more costly. Due to this, GAC and IX are typically the most common technology used to treat PFAS in water systems.

The commercially available BATs are highly effective at removing PFAS from water systems, however, these technologies have limitations such as inability to remove certain PFAS and high costs. Additionally, these technologies only remove PFAS from the water rather than destroy them. This leaves the problem of what to do with the PFAS once they are removed. Currently, there is not a large-scale commercial technology that can destroy PFAS. Therefore, many studies have been completed and are currently underway to advance our knowledge around the most effective way to treat PFAS. For a detailed list of the commercially available and emerging technologies see Appendix A.

Costs and Benefits

The EPA estimated the costs of implementing the Final Rule nationally to approximately $1.548 billion annually. The costs include those associated with water system monitoring, communication with customers, installation of treatment technologies or finding alternative water sources, maintenance of these technologies, and administrative fees. It is estimated that around 66,000 public water systems will be affected by the Final Rule, with around 4,000-7,000 systems having to implement solutions to lower PFAS concentrations.

The calculated benefits of implementing the Final Rule nationally is expected to be approximately $1.549 billion annually. It is expected to result in 83-105 million people gaining access to clean drinking water, prevent over 9,600 deaths, and reduce about 30,000 serious illnesses due to decreased exposure to PFAS. The calculated benefits are derived from the

prevented costs of illnesses, such as lost wages and medical bills, and the value of a statistical life lost from PFAS related illnesses.

There are also unquantifiable costs and benefits, which means that the EPA wasn't able to distinguish an exact price. For the costs, this includes the costs for systems to comply with the Hazard Index and GenX and PFNA MCLs. For the benefits, this includes the increased immune system functions, decreases in thyroid and liver disease, reduced negative reproductive effects, and reductions in co-occurring contaminants.

Funding

With the finalization of the Rule, the EPA dedicated $1 billion to aid states and territories with the implementation. This funding supports PFAS testing and treatment technologies for public water systems and private well owners. This funding is made available through the Bipartisan Infrastructure Law (BIL). Under this bill, a total of $21 billion is dedicated to supporting improvements to drinking water systems nationwide. $12 billion of this is to support general drinking water investments through the Drinking Water State Revolving Funds (DWSRF), which can be used for PFAS. The other $9 billion is dedicated to addressing emerging contaminants, such as PFAS. This $9 billion is where the $1 billion associated with the Final Rule originates from.

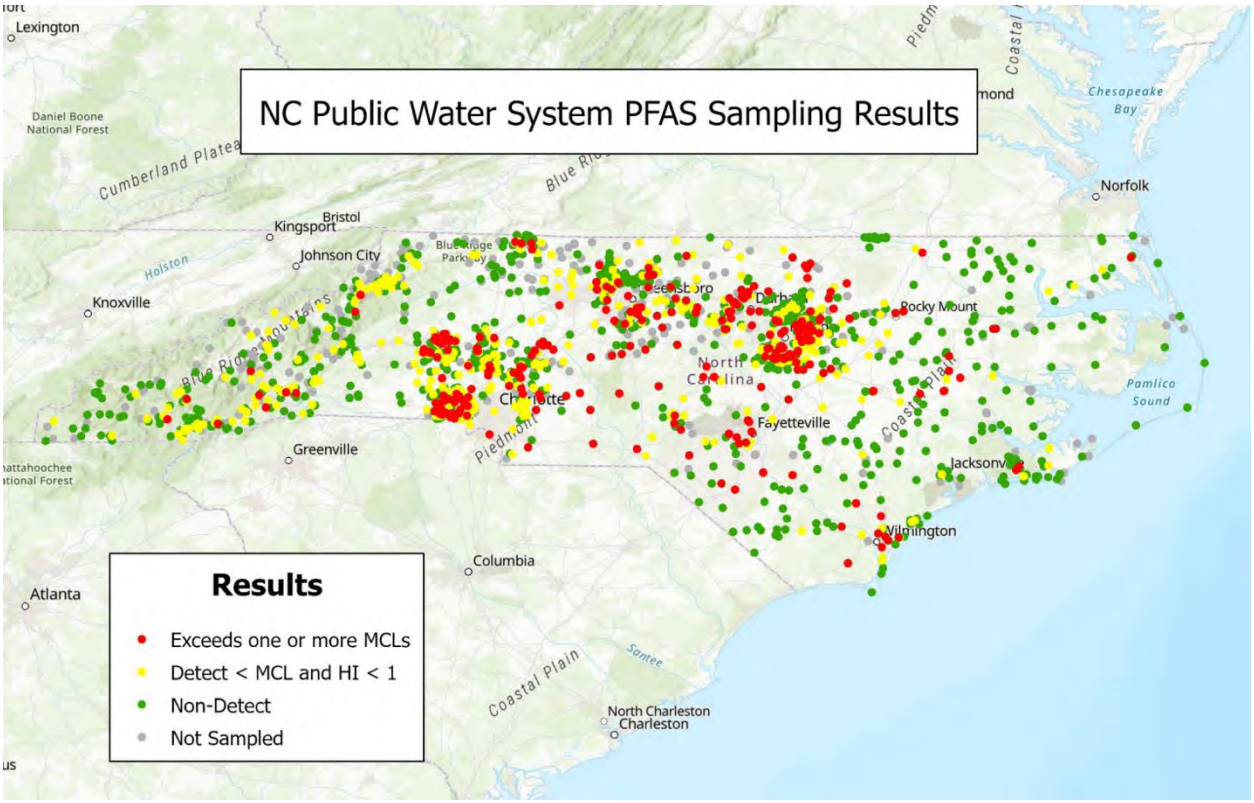
More than $5 billion of the $9 billion is dedicated to the Emerging Contaminants in Small or Disadvantaged Communities Grant (EC-SDC). This program assists small or disadvantaged communities with addressing emerging contaminants in their drinking water, including PFAS. The EPA also offers free Water Technical Assistance (WaterTA), which is meant to support states' and territories' plans to address issues in drinking water and help them access funding necessary for these changes. The Water Infrastructure Finance and Innovation Act (WIFIA) is a federal loan program that is another option to help states and territories access funding necessary to comply with the Final Rule. The loan program provides funding to water infrastructure projects, including those that are meant to address PFAS contamination.

The costs of the Final Rule fall directly onto water utilities, who will most likely cover these costs by increasing their customer's rates. This has already started to occur in states that established their own PFAS regulations prior to the Final Rule. States were able to use state dollars as well as federal grants and loans to cover the costs associated with testing and implementing PFAS treatment technologies. However, water utilities and treatment plants still faced high costs and passed them onto customers in the form of increased water rates. Across different states, water rate increases varied from 5% - 65%. These rates are expected to increase even more under the Final Rule because a greater number of utilities will be affected.

Implications for North Carolina

The implementation of the Final Rule will require all states including North Carolina to adhere to the federal MCLs if they are stricter than the state MCLs, and/or adopt their own drinking water standards if they want to have more stringent regulations than the Final Rule. This can look like either smaller MCLs or establishing MCLs for PFAS that were not regulated under the Final Rule. North Carolina also has the option to set compliance schedules after the first 3 years of initial monitoring, require more frequent monitoring during the initial monitoring phase, require a confirmation sample for any results, or increase compliance monitoring frequency.

Under the Final Rule, a total of 1,961 water systems in North Carolina will be affected. Of these, it is estimated that about 17%, or 320 water systems (42 of which are municipal) have PFAS concentrations over the federal MCLs and will have to implement a treatment technology or find an alternative water source. This equates to over 3.6 million people whose drinking water source is contaminated with PFAS at levels exceeding the MCLs and/or HI. Additionally, about 25% of private wells used for drinking water may contain PFAS at levels higher than the MCLs. The map below shows public water systems in North Carolina that have been sampled for PFAS. These results are of raw and treated samples taken by the NC Collaboratory (PFAST Network), Public Water Supply Section 2022, Public Water Supply Section 2023, Public Water Supply Section 2024, UCMR5, Aqua North Carolina, Inc., and Carolina Water Service, Inc. of North Carolina. For a more detailed list of North Carolina water systems affected see Appendices B-D.



https://edocs.deq.nc.gov/WaterResources/DocView.aspx?id=3283140&dbid=0&repo=WaterResources

Many more public water systems and private wells are contaminated with PFAS but are under the federal MCLs. PFOS and PFOA were the most common PFAS found to exceed the MCLs. Water systems are also finding other PFAS concentrations that are not regulated in the Final Rule. Some of the most common ones in North Carolina that are not federally regulated are PFMOAA, PMPA, PEPA, PFO2HxA, PFO3OA. The DEQ has named these five chemicals Priority PFAS. Additional unregulated PFAS that are either most frequently detected or detected in high concentrations are PFPeA, PFHxA, PFHpA, PFO4DA. Future regulations of these are unclear due to limited toxicity data and the distribution of types and concentrations of PFAS in varying water bodies.

North Carolina will receive $29 million out of the $1 billion dedicated to states with the passing of the Final Rule. To put this amount into perspective, the Cape Fear Public Utility Authority paid over $43 million to install GAC in their Sweeney Water Treatment Plant and are expected to have $5 million of annual costs associated with operating costs. The costs of treating PFAS at one treatment plant exceeded the total amount dedicated to North Carolina. With the federal funding falling short of what is needed to help water systems comply, most of these costs are expected to fall on utilities and the customers of these systems via increases in water rates.

State Regulation

The North Carolina Commission for Public Health is responsible for establishing drinking water standards. Currently there are no regulations for PFAS in drinking water beyond federal MCLs. However, other agencies have had discussions regarding regulating PFAS in North Carolina.

The DEQ is responsible for regulating surface and groundwater in the state. The DEQ's Division of Water Resources has released 2 proposed PFAS regulations for the state to adopt in addition to the Final Rule. The first is Surface Water Quality PFAS Standards for eight PFAS seen in the table below. These eight PFAS were chosen on the basis that there is the most research about them and they are most prevalent in North Carolina. It is important to regulate PFAS in surface water because 171 public water systems source their drinking water from surface waters. Of these, 71 systems are contaminated with PFAS levels exceeding the MCLs. This affects nearly 2.3 million North Carolinians. The proposed standards are to be made to Title 15A North Carolina Administrative Code (NCAC) Subchapter 02B: Surface Water and Wetland Standards.

PFAS Compound	Proposed 02B Standards (ppt)
PFOS	0.06
PFOA	0.001
GenX (HFPO-DA)	10

PFBS	2,000
PFBA	6,000
PFHxA	3,000
PFNA	9
PFHxS	10

The second proposed regulation is Groundwater Quality PFAS Standards under Title 15A NCAC Subchapter 02L: Groundwater Classifications and Standards. Groundwater is used as a water source for 1,790 water systems, 248 of which are known to be contaminated with PFAS levels exceeding the federal MCLs. This affects over 177,000 North Carolinians. There are still a remaining 350 systems that have yet to be tested, so the number of effected residents could be higher. This standard regulates the same eight PFAS as the surface water standard for similar reasonings. However, the limits are set at slightly different concentrations. For this rule, the compliance level PFOS and PFOA is higher than the proposed standards. The compliance level is set at the practical quantitation limit (PQL), which is the lowest concentration that a substance can get with the current technologies. If the standards are passed, the proposed date that they will be effective is estimated to be May 1, 2025.

PFAS Compound	Proposed 02L Standards (ppt)	Compliance Level Under Proposed Rule (ppt)
PFOS	0.7	PQL (4.0)
PFOA	0.001	PQL (4.0)
HFPO-DA (GenX)	10	10
PFBS	2,000	2,000
PFBA	7,000	7,000
PFHxA	4,000	4,000
PFNA	10	10
PFHxS	10	10

Establishing surface water and groundwater standards are both actions that will start holding polluters accountable for PFAS contamination in the state’s waters. These standards establish

permits for effluent limits, or how much waste an industrial or manufacturing firm can release into the environment.

In July of 2024, the DEQ presented these proposed standards to subcommittees of the Environmental Management Commission (EMC). The EMC is a 15-member non-partisan appointed commission embedded in the DEQ. They are responsible for overseeing and adopting rules for several divisions in the DEQ. The EMC's Water Quality Committee decided that the water quality standards should not yet move to be voted on at the full EMC meeting. Their reasoning was that they wanted more time to review the Regulatory Impact Analysis associated with the regulation. The standard will be presented again at their next meeting in September.

The Groundwater and Waste Management Committee decided to proceed with rulemaking on the standards for only three of the eight PFAS presented: PFOA, PFOS, and GenX. This decision was based on the fact that PFOA and PFOS are the most well researched PFAS and GenX is highly concentrated in North Carolina. The commissioners recommended that the standards for these three PFAS move the public comment phase of the decision-making process while the rest of the groundwater rule be reevaluated and presented in their September meeting.

Reactions to the Final Rule

Following the passage of the Final Rule, many elected officials and organizations were quick to release their opinions. Positive and negative reactions were seen both across the country and in North Carolina. The diverse array of perspectives uncover the realities of the benefits and challenges associated with the passing a regulation such as this one. This section provides summaries and quotes of some of these reactions.

Positive Reactions

Many environmental nonprofits, advocates, elected officials, and other entities released statements applauding the EPA and Biden Administration for this first, monumental step to regulating PFAS. Many express their relief at the long-awaited regulation that will grant people across the nation access to clean, safe drinking water. However, they also emphasize that this should merely be the first step and urge the EPA to keep establishing regulations to protect people from PFAS. The next step many want to see is for the PFAS manufacturers to be held accountable for their actions and have pollution stopped at the source. Below are just some of the positive reactions the EPA and Biden Administration received following the passing of the Final Rule.

National Environmental Groups and Nonprofits

Sarah Doll, National Director of Safer States:

> *"This is a huge victory. These new rules will give communities across America access to safer drinking water. For years, states have led the way in addressing PFAS contamination. We applaud the administration for stepping up to ensure all states and communities have these protections."*

Ken Cook, President of the Environmental Working Group:

> *"Today's announcement of robust, health protective legal limits on PFAS in tap water will finally give tens of millions of Americans the protection they should have had decades ago. It is the most consequential decision to regulate drinking water in 30 years."*

Liz Hitchcock, Federal Policy Program Director for Toxic-Free Future:

> *"Communities across the country are suffering the financial and health consequences of ongoing exposures to these highly toxic 'forever chemicals'. We have to prevent further pollution from PFAS by ending their use …. Congress and the Administration must keep moving forward to protect us from these toxic chemicals."*

Elizabeth Biser, President of Environmental Council of the States:

> *"Having federal standards for these forever chemicals in our drinking water provides certainty for the states, our public water systems, and our residents. Addressing PFAS requires a comprehensive approach, and the partnership between the EPA and the states is critical to our success on this issue."*

Katherine O'Brien, Senior Attorney of Earthjustice:

> *"At last, EPA has taken powerful action to protect tens of millions of people across the country whose drinking water is contaminated with dangerous levels of PFAS. The law and science strongly support EPA's standards, and we will advocate and ensure they are fully implemented and enforced."*

Jean Zhuang, Senior Attorney at the Southern Environmental Law Center:

> *"EPA's new drinking water standards for several PFAS are a welcome backstop, now agencies and municipalities can and should stop all PFAS pollution at the source under existing law so no more communities suffer from contaminated water in their taps. The Clean Water Act already provides the tools necessary for agencies to stop PFAS pollution through the permitting process before it gets into drinking water sources. If existing*

laws are enforced, as they should be, they will keep PFAS pollution out of our waterways and downstream drinking water."

Elected Officials

US Congresswoman **Debbie Dingell** (D - MI 6th District):

> *"I thank the Biden Administration and the EPA for their continued commitment to ensuring clean and safe drinking water for all Americans and for prioritizing the fight against PFAS. I will continue to work every day in Congress, with the Administration, and with our states and local leaders to implement this rule, and to eliminate PFAS …. We must continue to take aggressive action and a whole-of-government approach to clean up PFAS…."*

Negative Reactions

Those who have spoken out against the Final Rule are concerned that the EPA did not use the best available science when developing MCLs. They also claim that the EPA has exceeded their authority under the Safe Drinking Water Act by passing this regulation. Additional critics of the Final Rule stems from claims that the EPA's cost-benefit analysis is faulty and underestimates the cost drastically compared to a cost-benefit analysis completed by another association.

This leads to another concern, which is that the federal funding made available to states to support rule compliance is not enough to cover actual costs and worry about how this will affect utilities. Under the Final Rule, the cost of cleaning PFAS out of water falls on utilities, and this price is eventually passed onto water ratepayers. There are many concerns about the fate of compliance when it comes to small and rural communities. These communities are more likely to have PFAS in their drinking water and are less likely to have the funds or capabilities to install treatment technologies. In these cases, the costs that are passed to ratepayers would be higher than larger utilities because they serve a smaller population and can't disburse the costs as widely. Below is some of the backlash that the EPA has faced associated with the Final Rule.

American Water Works Association

The American Water Works Association (AWWA) is a science and educational based nonprofit of around 4,300 utilities and 51,000 members. They advocated for clean and safe water internationally. AWWA supports the EPA's motives to clean PFAS from drinking water, but they have concerns over the EPA's cost analysis. In 2023, AWWA completed their own analysis of what a proposed PFAS national drinking water rule would cost the US. The analysis found that it would cost $3.8 billion annually, which is over three times higher than the cost estimate provided by the EPA's analysis. The AWWA is concerned that this miscalculation will lead to

water affordability issues nationwide. AWWA urges the EPA to protect citizens from PFAS by regulating them at the source and holding polluters responsible.

American Chemistry Council

The American Chemistry Council (ACC) is an industry trade association which represents over 190 businesses and corporations engaged in chemistry. They advocate on behalf of chemical companies in order to excel America in innovation and manufacturing. The ACC released a statement expressing their concerns with the EPA's Final Rule on the foundation that it was rushed, ignored science, and is based on an inaccurate cost-benefit analysis.

> *"We strongly support the establishment of a science-based drinking water standard, but this rushed, unscientific approach is unacceptable when it comes to an issue as important as access to safe drinking water. We strongly oppose this rule and will be working with a broad range of concerned stakeholders to determine next steps."*

The ACC questions the science used to develop the MCLs and claims that the EPA's own Science Advisory Board shares these concerns. They also cited the American Water Works Association's finding that the costs will be over three times more than what the EPA estimated them to be and that the benefits were not accurately assessed. The ACC claims that the stringent standard will force small water systems to divert their attention away from other higher priority water issues.

National Association of Manufacturers

The National Association of Manufacturers (NAM) is an advocacy group of over 14,000 industries and 13 million people. The purpose of NAM is to strengthen manufacturers and allow American industries to thrive. NAM expressed their views of the Final Rule, claiming the regulation would backfire and hurt manufacturers.

> **Linda Kelly,** NAM Chief Legal Officer:
>
> *"[The final regulation] is wholly infeasible and threatens these vital substances' continued application in the manufacturing processes."*

NAM officials also claim that this will lead to higher prices along the supply chain. Not only will the Final Rule have many effects for manufacturers, but NAM states that these chemicals are also crucial for the everyday lives' of emergency workers:

> **Chris Netram,** NAM Managing Vice President of Policy:

"In many instances, there is no viable alternative for these chemicals, and companies may be forced to change plans dramatically. In everyday life, including emergency situations like a fire or operating room circumstance, there's a real reliance on these products - it's not just about job losses and costs but fundamental decisions that have widespread ramifications."

Elected Officials

US Senator **Shelley Moore Capito** (R - WV):

"The EPA's unprecedented decision today puts local communities and ratepayers on the hook for PFAS contamination they had nothing to do with in the first place. Along with many other members in Congress, I have repeatedly warned the EPA about the unintended consequences stemming from this rule, which will have disproportionate impacts on providers of essential public services, such as water and waste utilities, airports, farmers and ranchers, and fire departments. Today's ill-advised decision underscores the urgent need for Congress to act. We must pass legislation to safeguard American ratepayers from the financial burden imposed by this misguided rule."

Lawsuit Against EPA

The EPA has been sued by multiple entities over various aspects of the Final Rule, all claiming that the Final Rule is arbitrary and capricious. The AWWA and Association of Metropolitan Water Agencies (AMWA) filed a petition in the D.C. Circuit Court of Appeals on June 7th, 2024. The petition claimed the EPA "… did not rely on the best available science and the most recent occurrence data and used novel approaches as the basis for certain portions of the rule." Further, they argued that the EPA did not estimate the costs associated with the Final Rule accurately and that the affordability of water will be significantly impacted. Shortly after, the ACC and NAM filed a petition in the D.C. Circuit Court of Appeals on June 10, 2024. The basis of their petition is that the EPA does not have the regulatory authority to implement the Final Rule based on the SDWA.

Chemours has also sued the EPA over the Final Rule. Filed June 10 in the D.C. Circuit Court of Appeals, Chemours claims that the EPA's passing of the Final Rule is unlawful due to:

- A flawed cost benefit analysis,
- The EPA has exceeded their authority under the Safe Drinking Water Act,

- The adoption of a hazard index and MCL for GenX is arbitrary, capricious, not in accordance with law, and is not based on the best available scientific data.

They also cite their pending court case *The Chemours Company FC, LLC v. EPA* No. 22-2287 as another reason why they are petitioning for review of the NPDWR. This lawsuit is challenging the human health toxicity data of GenX, in which they claim the underlying research is flawed.

North Carolina Reactions

The following are positive and negative reactions that were seen across North Carolina.

Elected Officials

North Carolina **Governor Roy Cooper:**

> *"We are thankful that Administrator Regan and the Biden Administration are taking this action to protect drinking water in North Carolina and across the county. We asked for this because we know science-based standards for PFAS and other components are desperately needed."*

US Congresswoman **Deborah Ross** (D - NC 2nd District):

> *"To safeguard public health and protect our environment, we need a robust, comprehensive approach to rid our water of these harmful chemicals and ensure everyone has access to clean drinking water. I'm incredibly grateful for the leadership of President Biden on this issue. Thanks to this new standard, we are now one step closer to ensuring every American has access to safe drinking water, free of these dangerous pollutants."*

The Chemours Company

Chemours is a global PFAS manufacturing company who has a facility located outside of Fayetteville, NC. Following the release of the Final Rule, Chemours claims that the EPA used "unsound data" and "misuses its authority." During a discussion at a NC House Environment Committee meeting on a Pollution Liability Bill, a representative from Chemours spoke out against the bill and asked it not to proceed because Chemours has already taken steps to limit pollution and thus should not be targeted and held liable under this bill.

NC Chamber of Commerce

The North Carolina Chamber of Commerce (NC Chamber) is a business advocacy organization and have advocated for the critical role that PFAS play for businesses. They believe that the regulations made at the federal level were "aggressively low". Further, they assert that the action taken by the DEQ is even more aggressive, stating that the proposed surface and groundwater

standards are problematic. The NC Chamber also questions the DEQ's science and rulemaking associated with these standards. In April of 2024, the NC Chamber wrote a letter to the DEQ asking for them to delay decision making on these proposed standards and requested "that further research is done to understand how requirements established by the EPA intersect with state statutes and an estimate of the cost to local government and the business community to comply with these proposed regulations."

> **Gary Salamindo,** President of NC Chamber:
>
> *"On behalf of the business community, we urge NC DEQ and the NC Environmental Management Commission (EMC) to delay any action until we receive appropriate studies and have greater clarity on the benefits and cost of regulation."*

Environmental Management Commission

The EMC hasn't made public comments on the Final Rule, but they have taken action against state regulation. Voting on DEQ's proposed surface water and groundwater regulations have been delayed several times. EMC members who opposed these standards claim that the DEQ didn't provide them with enough information to start the decision-making process.

Other Reactions

Emily Donovan, Co-Founder of Clean Cape Fear:

> *"No one should ever worry if their tap water will make them sick or give them cancer. I'm grateful the Biden EPA heard our pleas and kept its promise to the American people. We will keep fighting until all exposures to PFAS end and the chemical companies responsible for business-related human rights abuses are held fully accountable."*
>
> *"It's monumental. For our community, it's validation. It recognizes we knew what we were talking about. When a lot of elected leaders were saying drinking water met all federal and state standards, they were speaking out of liability, not public health. The science was clear. The science was right."*

Alexis Luckey, Executive Director of Toxic Free North Carolina:

> *"This is a turning point in the fight for environmental justice in North Carolina communities who have been drinking polluted water for decades. With these new standards for PFAS, EPA has taken a critical step in beginning to address forever chemical contamination. There are thousands of forever chemicals yet to be regulated - we urge EPA to keep up the momentum. We all deserve safe, clean drinking water."*

La'Meshia Whittington, member of NC's Environmental Justice and Equity Advisory Board:

> *"The fight against PFAS is a story of communities' commitment to perseverance in the face of insurmountable odds and consequences that span several decades. The establishment of national standards for PFAS in drinking water means justice for my own ancestors, for my family, and the countless communities I serve who have had to bury loved ones due to an invisible enemy lurking in our drinking water."*

Kenneth Waldroup, Executive Director of Cape Fear Public Utility Authority:

> The $1 billion provided in the BIL is *"... woefully inadequate in offsetting the burden. While such regulations are necessary, we note that the most cost-effective, equitable approach to reducing American's exposure to PFAS in their drinking water is keeping PFAS out of the source water in the first place. Those who manufacture PFAS or use it in their manufacturing should be the primary focus of EPA's regulatory efforts, and they should be the ones to bear the burden of compliance with regulations regarding the PFAS they discharge into the sources of drinking water."*

The Future of PFAS

All states are required to adhere to this Final Rule if the regulations are stricter than their own drinking water regulations. However, states are still able to adopt their own PFAS legislations if they want to be more stringent than the federal level. A few examples of what actions states can take would be to regulate PFAS other than the six in the Final Rule, set lower MCLs for the six regulated PFAS, implement a more frequent monitoring program, and/or invest in research surrounding PFAS to further our understanding of these 'forever chemicals'.

The future of PFAS is still unknown, but many believe that the EPA's implementation of the Final Rule is simply the first step of many in the right direction. As further research is completed on PFAS, there is expected to be more guidelines and regulations. EPA experts have suggested establishing official groups of PFAS based on their chemical structure, health effects, treatment techniques, or other similar characteristics. This will ensure each PFAS is regulated in a way that is best to protect environmental and public health from that specific PFAS. The next steps in EPA's Strategic Roadmap involve addressing PFAS in air emissions, advancing research to other PFAS, and holding polluters accountable. The CERCLA designation of PFOA and PFOS was the first step to make polluters liable, but more actions are needed to strengthen polluter accountability and stop the pollution at the source rather than relying on utilities to clean the water.

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Appendix A

Commercially Available and Emerging PFAS Treatment Technologies

The following table is an overview of commercially available and emerging technologies to both remove and destroy PFAS. Each technology has their own advantages and disadvantages, but studies have indicated that there are many promising technologies out there.

Category		Technology	Type	Status
Adsorption	Activated Carbon	Granular Activated Carbon (GAC)**	Removal	Commercially available
		Powdered Activated Carbon (PAC)	Removal	Commercially available
		Colloidal Activated Carbon	Removal	Emerging*
	Resins and Polymers	Ion Exchange Resin (IX)**	Removal	Commercially available
		Cationic Polymer (Hydrogel)	Removal	Emerging
		Polymer Coated Sand	Removal	Emerging
		Metal-Organic Frameworks (MOF)	Removal	Emerging
		Covalent Organic Frameworks (COF)	Removal	Emerging
		Chitin (CT)/Chitosan (CS)	Removal	Emerging
		Cellulose	Removal	Emerging
	Clay and Minerals	Hydrotalcite (HD or HT)	Removal	Emerging*
		Zeolites / Clay minerals	Removal	Emerging*
		Iron and Iron-Based Minerals	Removal	Emerging*
	Novel Sorbents	Ionic Fluorogels	Removal	Emerging
	Bio-Adsorbents	Biochar-Based	Removal	Emerging*
		Rice Husks (RHs)	Removal	Emerging
		Quaternized Cotton	Removal	Emerging
		Cyclodextrins (CD)	Removal	Emerging

			Moringa Seeds	Removal	Emerging
			Others	Removal	Emerging*
Membranes		High Pressure	Nanofiltration (NF)**	Removal	Commercially available
			Reverse Osmosis (RO)**	Removal	Commercially available
		Porous Membranes	Microfiltration (MF)	Removal	Emerging
			Ultrafiltration (UF)	Removal	Emerging
		Other	Nanofiber Membrane	Removal	Emerging
			Membrane Distillation (MD)	Removal	Emerging
			Low Energy Membrane	Removal	Emerging
			Forward Osmosis (FO)	Removal	Emerging
		Novel Mixed Matrix Membranes (MMMs)		Removal	Emerging
Aggressive Redox Process	Advanced Reduction Processes (ARPs)	Ionizing Irradiation	High-Energy Electron Beam (eBeam) *(also an AOPs)*	Degradation	Emerging*
			Gamma Irradiation	Degradation	Emerging
		Solvated Electrons	Hydrated Electrons	Degradation	Emerging
		Other	Plasma *(also an AOPs)*	Degradation	Emerging
			Zero-valent Iron (ZVI) / Doped ZVI	Degradation	Emerging*
			UV Irradiation *(also an AOP)*	Degradation	Emerging
	Advanced Oxidation Processes (AOPs)		Heat Activated Persulfate	Degradation	Emerging
			Ozone-Based Systems	Degradation	Emerging*
			Photochemical Oxidation	Destruction	Emerging
			Sonochemical Oxidation / Ultrasound	Degradation	Emerging
			Electrochemical Oxidation (EO)	Destruction	Emerging*
	Other		Supercritical Water Oxidation (SCWO)	Destruction	Commercially availability

		Alkaline Metal Reduction	Degradation	Emerging
		Catalyzed Hydrogen Peroxide (CHP)	Degradation	Emerging
Adsorptive Bubble Separation		Foam Fractionation	Removal	Commercially available
		Aeration	Removal	Emerging
		Ozofractionation	Removal	Emerging
Thermal		Incineration	Destruction	Commercially available
		Hydrothermal Alkaline Treatment (HALT)	Destruction	Commercially available
Natural Sources		Microbial/Fungus	Degradation	Emerging
Coagulation		Electrocoagulation (EC)	Removal	Emerging*
		Coagulant aids	Removal	Emerging
		Coagulation-Flocculation	Removal	Emerging*

* Indicates that this technology is currently in the research phase for PFAS usage, but it is commercially available for other applications.

** Indicates BATs, which are the only technologies that can be used to comply with the NPDWR.

Appendix B

PFAS in North Carolina

The table below shows the concentrations of PFAS throughout water systems in North Carolina. The information is mainly derived from UCMR testing as well as testing completed by the Environmental Working Group (EWG). Sampling dates vary between sites and type of PFAS but overall range from 2014-2024. The sites included here are only those who are in violation of the MCLs indicated in the National Primary Drinking Water Regulation. To see the complete list of places who have detected any type of PFAS at any level, you can visit this interactive map on the EWG's website.

County	Site	Pop. Served	Years Tested	PFOS (ppt)	PFOA (ppt)	GenX (ppt)	PFBS (ppt)	PFNA (ppt)	PFHxS (ppt)
Alamance	City of Burlington	54,000	2019-2022	34	25			5.1	3.6
Alamance	City of Graham	14,308	2019-2023	10	7.6		11		
Alamance	City of Mebane	15,284	2023-2024	7.4	7.8		11		
Anson	Anson Co Water System	13,380	2019-2022	7.6	3.8		3.2		
Anson	Town of Wadesboro	5,506	2023	5.1					
Beaufort	Aurora Water System	502	2019		51				
Bladen	Bladen Bluffs Water System	4,589	2019-2022	25	8.8	18	7.1		7.7
Brunswick	Brunswick Co Water System	100,694	2019-2023	17	7.7	28	7.1		7.5
Brunswick	The Village of Bald Head Island	3,291	2019-2022	3.6	23	9.2			
Brunswick	Town of Oak Island	23,635	2023	12	7.0		6.0		5.1
Cabarrus	City of Concord	107,188	2019-2022	20	4.3				
Cabarrus & Rowan	City of Kannapolis	48,336	2019-2022	6.6	3.4				2.4
Catawba & Lincoln	Town of Maiden	5,100	2024		12				
Chatham	Siler City	8,501	2019-2022	12	6.0		4.7		7.0
Chatham	Town of Pittsboro	4,401	2019-2022	22	24	0.3	13	5.4	6.9
Columbus	International Paper Co.	750	2019-2022	18	8.4	15			
Cumberland	Bragg Comm.	3,733	2023	14	9.5		15		4.1
Cumberland	Brookwood Comm. Water System	15,665	2014		21				
Cumberland	Cliffdale West	15,463	2014	41					
Cumberland	Fayetteville Public Works Comm.	217,948	2019-2024	121	64	16	12		22

Dare	Cape Hatteras Water	5,486	2019		4.9				
Davidson	Town of Denton	3,080	2019-2022	6.3	3.3		1.9		
Davidson & Montgomery	Handy Sanitary District	7,899	2023	4.1			3.8		
Durham	City of Durham	282,343	2019-2023	8.2	4.3		6.5		
Edgecombe	Edgecombe Water & Sewer District	12,700	2023	4.7	4.5				
Edgecombe	Town of Tarboro	11,310	2019	7.2	3.6		2.2	2.5	
Franklin	Lake Royale	4,623	2023	4.8					
Gaston	Bessemer City	5,500	2019-2023	2.8	7.7		1.4		
Gaston	Town of Dallas	7,422	2019-2023	1.7	4.1		3.9		
Granville	S. Granville Water & Sewer Auth	19,216	2019-2023	28	12			4.4	2.9
Granville	Town of Oxford	8,819	2023	5.3					
Guilford	City of Greensboro	290,201	2014-2024	90	6.1		5.3	3.5	34
Guilford	City of High Point	114,183	2019-2022	12	4.4		3.9		10
Guilford	Town of Jamestown	6,457	2023	10	5.9		7.6		6.3
Halifax	Weldon Water System	1,575	2019-2022	5.5	3.3	1.9	1.5		
Harnett	City of Dunn	12,334	2015-2024	14	30		14		5.2
Harnett	Harnett Co Dept of Public Utilities	101,389	2019-2024	14	20		7.3	3.7	5.0
Harnett	Lillington Water System	3,883	2023	11	7.9		5.8		3.8
Henderson	Kerr Lake Regional Water System	14,852	2019-2024	4.8	2.9				
Iredell	Diamond Head S/D	1,433	2023		4.6		5.8		4.9
Johnston	Clayton	19,822	2024	5.1	4.3		3.2		
Johnston	Johnston Co – East	31,350	2023	7.5	7.7		5.5		3.8
Johnston	Johnston Co – West	58,354	2019-2022	9.7	8.3	0.2			4.0
Johnston	Town of Selma	642	2023	6.6	5.7		4.6		
Johnston	Town of Smithfield	12,400	2019-2022	12	8.8				3.8
Lee	City of Sanford	45,649	2019-2023	16	9.4		15		5.3
Lee	Farm Water Works	162	2023	4.2					7.7
Lee	Pilgrim's Pride Water System	1,040	2019-2022	8.6	5.2				
Lenoir	Neuse Reg. Water & Sewer Authority	93,238	2019-2022	15	7.0	0.3	2.0		5.1
Lenoir	North Lenoir Water Corp.	14,669	2023	10	6.0		4.8		6.8
Lincoln	City of Lincolnton	12,352	2019-2022	2.2	5.3				
Martin	Martin Co Reg. WASA	10,162	2019-2022	5.5	4.3	1.4			
Martin	Town of Williamston	7,650	2023	4.7					

Mecklenburg	Lamplighter South-Danby	3,315	2023	5.4			8.9		4.5
Montgomery	Montgomery Co Water System	15,102	2019-2022	6.7	3.5				
Moore	Moore Co Public Utility – Pinehurst	20,947	2013-2023	76	23		14		42
Nash	Central Nash Water & Sewer	5,883	2023	10	6.3				
Nash	City of Rocky Mount	54,886	2019-2022	8.9	8.6	0.2	1.1	2.5	
New Hanover	Bradley Creek Marina	414	2019	6.2	4.0	11	1.2		3.2
New Hanover	Cape Fear Public Utility Authority	153,202	2019-2023	21	10	25	1.6		7.3
New Hanover	College View MHP	90	2019	29	12	1.7	22	1.0	6.1
New Hanover	Corning Inc.	1,060	2019	14	11	29	7.3	1.2	6.7
New Hanover	Fellowship Bapt. Church	100	2019	4.5	0.9	1.5	2.3		
New Hanover	Glynnwood MHP	208	2019	12	6.3		2.6		4.7
New Hanover	Oakley MHP	92	2019	16	6.6		4.5		2.4
New Hanover	Treasure Cove	760	2019	12	3.3		1.9		3.2
New Hanover	Willow Woods Arbor	160	2019	12	4.1	3.8	1.2		6.2
Northampton	Lake Gaston	3,784	2023	6.2					
Orange	Orange Water & Sewer Auth.	83,300	2014-2022	19	30				
Pender	Pender Co Utilities	24,236	2019-2023	17	8.3	29	5.3		6.5
Pitt	Bell Arthur Water Corp.	10,310	2014	50					
Pitt	Eastern Pines Water Corp.	22,230	2023-2024	10	6.1		4.4		5.3
Pitt	Greenville Utilities Comm.	103,140	2019-2023	6.3	7.6		6.1		2.2
Pitt	Town of Winterville	9,445	2023	6.6	4.7		3.3		
Randolph	City of Archdale	12,700	2023-2024	8.5	5.2		3.6		4.7
Randolph	City of Asheboro	25,791	2019-2022	20	12		4.7		4.5
Randolph	Piedmont Triad Regional	367,681	2019-2022	13	7.3		4.2	4.6	7.1
Randolph	Town of Liberty	3,558	2019-2022	22	2.0		2.2		7.2
Richmond	City of Rockingham	13,233	2019-2023	4.9	4.4		1.2		3.2
Richmond	Richmond Co Water System	21,755	2019-2024	4.7	3.7		3.1		

Robeson	City of Lumberton	25,803	2019-2022	15	15	1.2	4.0		5.1
Robeson	Robeson Co Water System	64,295	2019-2023	6.1	30	34	8.5		8.4
Scotland	Town of Wagram	965	2019-2022	11	8.2		1.3		3.4
Stanly	City of Albemarle	17,874	2019-2022	6.4	2.9				
Stanly	Town of Norwood	4,109	2019-2022	7.5	3.3	2.8			
Union	Town of Wingate	3,950	2023	4.9					
Union	Union Co Water System	134,066	2023	4.9	4.2				
Wake	City of Raleigh	603,000	2019-2023	5.6	3.1		4.0		
Wake	Harris Nuclear Plant Water System	1,001	2019-2022	4.6	7.1	2.8		5.6	
Wake	Town of Cary	192,250	2019-2022	12	8.6	0.3			
Wake	Town of Fuquay-Varina	30,424	2014-2023	11	30		15		4.4
Wayne	City of Goldsboro	34,959	2019-2022	9.4	6.3	0.3	5.8		2.7
Wilson	City of Wilson	50,866	2019-2022	4.1	2.9	0.4			
Wilson	Town of Sims	304	2019	6.2	3.6		2.3		2.1

Appendix C

2022 DEQ Municipal System Sampling

The table below shows the results from DEQ municipal water system sampling for PFOS, PFOA, and GenX in 2022. They completed sampling at 50 sites who had PFOS, PFOA, and/or GenX levels above the 2022 EPA Interim Health Advisory based off 2019 PFAS Testing Network sampling. The table below represents averages of all the samples taken at each site throughout 2022. The sites below are only those whose samples are in violation of one or more MCLs under the National Primary Drinking Water Regulation. See the full results of the 2022 DEQ municipal system sampling here.

County	System Name	Sample Location	PFOS (ppt)	PFOA (ppt)	GenX (ppt)
Alamance	City of Burlington	Intake	17.60	11.66	
Alamance	City of Graham	Intake	7.90	5.78	
Anson	Anson County Water System	Intake	6.44	3.14	
Bladen	Bladen Bluffs Water System	Intake	11.49	6.135	6.97
Bladen	Bladen Co Water District – East	Well			16.72
Brunswick	Brunswick County Water System	Intake	12.92	5.92	5.71
Brunswick	The Village of Bald Head Island	Well	1.90	10.24	4.45
Cabarrus	City of Concord	Intake	15.62	3.77	
Chatham	Town of Pittsboro	Intake	7.36	4.80	0.078
Chatham	Town of Siler City	Intake	5.00	1.95	
Columbus	International Paper Company	Intake	8.40	5.04	4.11
Cumberland	Fayetteville Public Works Comm.	Intake	18.48	6.70	0.608
Davidson	Town of Denton	Intake	5.01	2.48	
Durham	City of Durham	Intake	7.31	3.91	
Gaston	City of Bessemer	Intake	2.36	6.79	
Granville	South Granville Water & Sewer Auth.	Intake	19.95	8.92	
Guildford	City of Greensboro	Intake	32.53	4.96	
Guilford	City of High Point	Intake	10.38	3.67	
Halifax	Weldon Water System	Intake	4.36	2.68	1.43
Johnston	Johnston Co – West	Intake	8.76	7.18	0.067
Johnston	Town of Smithfield	Intake	8.86	7.14	
Lee	Pilgrim’s Pride Water System	Intake	7.83	4.48	
Lenoir	Neuse Regional Water & Sewer Auth.	Intake	12.48	6.10	0.169
Lincoln	City of Lincolnton	Intake	1.83	4.76	
Martin	Martin Co Regional WASA	Intake	4.35	2.83	1.20
Montgomery	Montgomery Co Water System	Intake	6.07	2.93	
Nash	City of Rocky Mount	Intake	8.19	7.94	0.071
New Hanover	Cape Fear Public Utility Auth.	Intake	11.28	6.17	6.29
Orange	Orange Water & Sewer Auth.	Intake	8.17	9.87	
Pender	Pender Co Utilities	Intake	7.47	4.98	5.53
Pitt	Greenville Utilities Comm.	Intake	4.75	4.28	

Randolph	City of Asheboro	Intake	16.28	10.56	
Randolph	Piedmont Triad Regional	Intake	11.11	5.75	
Randolph	Town of Liberty	Well	18.52	1.64	
Robeson	City of Lumberton	Intake	9.77	11.59	0.630
Rowan	City of Kannapolis	Intake	5.46	2.93	
Scotland	Town of Wagram	Well	9.40	6.93	
Stanly	City of Albemarle	Intake	5.10	2.32	
Stanly	Town of Norwood	Intake	5.80	2.39	
Wake	Town of Cary	Intake	6.31	5.24	0.208
Wayne	City of Goldsboro	Intake	8.18	5.69	0.230

Appendix D

2023 DEQ Small System Sampling

In 2023, the DEQ completed sample for over 530 small water systems in North Carolina. The results from this sampling can be seen below. Only the sites that had PFAS concentrations violating one or more of the MCLs or HI under the National Primary Drinking Water Regulation were included in this table. See the full results of the 2023 DEQ small system sampling here.

County	System Name	Pop. Served	PFOS (ppt)	PFOA (ppt)	GenX (ppt)	PFBS (ppt)	PFNA (ppt)	PFHxS (ppt)
Alamance	Circle K Park	97	33.3	75.3		18.2	0.897	28.2
Alamance	Holly Tree Village	198	3.19	6.43		1.81		3.79
Alamance	Maple View MHP	96	11.8	18.5		2.74	1.16	20.9
Alamance	Park Place	97	19.7	14		2.95		5.67
Alamance	Rae McKenzie MHP	100	3.94	5.18		4.76		3.79
Avery	Grandfather Golf & Country Club	250	10.3	2.5		1.4		4.73
Buncombe	Rangeview Acres MHP	150	1.49	7.27		2.19		4.15
Burke	Jonas Ridge Rest Home	80	7.54	1.4		0.839	0.714	0.662
Cabarrus	Green Oaks S/D	46	6.42	3.77		3.48		2.81
Cabarrus	Pine Ridge MHP No 1	51	6.86	5.16		2.26		2.52
Cabarrus	Poplar Trails Water System	180	3.79	4.24		3.4		3.02
Cabarrus	Private Acres S/D	124	3.21	5.96		1.96		2.37
Carteret	Lighthouse Way MHP & Apts	79	5.53	5.35	0.211	1.97		1.21
Carteret	Mann's MHP	40	5.84	3.43				2.25
Carteret	Riverstone	99	3.53	14.7		0.585		1.56
Caswell	West Yanceyville Water Assoc	180	12.9	5.26		4.29		3.54
Catawba	Lake Hickory RV Resort	200	8.64	11.2		0.874		1.96
Catawba	Pine Haven MHP	53	2.52	5.07		1.48		2.84
Chatham	Cedar Village II	25	11.6	11.5		6.32		4.16
Chatham	Chatham Pines LLC	98	5.44	7.47		10		4.29
Cumberland	New Town Apts LLC	258	21.9	17.4	0.446	5.61	1.34	13.7
Currituck	Ponderosa MHP	300	8.43			1.06		6.83
Durham	Whispering Pines MHP	305	8.73	2.92		4.54		2.69
Edgecombe	Winstead Mobile Terrace	200	8.94	7.88		9.88		1.6
Forsyth	Clemmons Learning Center	75	2.08	4.53		1.48		1.75
Forsyth	McBride's MHP	190	30.6	35.8		6.4	0.631	18.2
Franklin	Fox Park MHP	158	3.48	9.6		12.6	1.73	3.55
Franklin	Kids Zone Daycare	63	12.6	9.24		1.77		1.61
Franklin	Montgomery Mobile Estates	0	3.54	33.7		2.91		11.3
Gaston	Azalea Hills MPH	80	10.8	20.7		31.2	1.72	62.9
Gaston	Belmont Abbey College	1325	5.55	2.93		1.88		1.7
Gaston	Brentwood MHP	99	4.15	4.37		2.6		4.35
Gaston	Chapel Acres MHP	231	1.05	4.17		5.72		4.33
Gaston	Chapel Grove MHP	110	1.05	6.47		6.18		10.6

Gaston	Country Time Inn	59	4.58	3.87		0.566		5.81
Gaston	Countryside Estates MHP	99	0.917	22.8		3.48		2.47
Gaston	Dellinger's MHP	53	8.84	10.8		10.4		6.28
Gaston	Don's MHP	112	26.5	13		9.88	0.868	9.11
Gaston	Gloria Acres MHP	122	10	4.35		11.2		29.8
Gaston	Hickory Grove MHP	69	6.18	8.31		6.34		7.19
Gaston	Hickory Village MHP	165	29.2	33.9		27.1	2.11	13.8
Gaston	Holly Faye MHP	60		8.63		3.28		1.08
Gaston	Mountain Village MHP	44	1.94	5.68		3.63		6.8
Gaston	Ragan Village Water Assoc	100		4.24		4.37		18.7
Gaston	Windsor Heights MHP	178	1.61	6.45		5.19		4.58
Granville	Granville Pines MHP	53	1.37	5.9				1.6
Guildford	Northwest Baptist Daycare	32	6.13	5.25		1.73		2.25
Guildford	Sterling Ridge S/D	104	6.89	7.46		2.15		2.87
Guilford	Bethlehem Child Care Center	64	4.98	7.66		0.983	1.79	1.12
Guilford	Clapp's Nursing Center	265	3.38	20.2		1.17	3.23	1.23
Guilford	Monroe's MHP	187	11.2	5.77		16.5		3.2
Guilford	Pleasant Garden Weeshine Preschool	60	15	8.41		8.35	1.34	9.4
Guilford	Tri City Junior Academy	226	6.12	3.7		1.09		1.52
Henderson	Jeter Mountain MHP	54	1.93	8.85		3.78		2.64
Henderson	Magnolia MHP	138	3.16	4.31		2.41		2.3
Henderson	Maple Hills MHP	185	2.69	4.99		3.41		1.83
Henderson	Oak Crest Retirement Estates	98	3.43	4.71		6.33		1.34
Iredell	Kings Landing S/D	142	1.85	5.87		1.92		1.72
Jackson	Cedar Creek Woods	122	1.54	1.17		0.713	9.55	0.788
Jackson	Riverside Apts	89	1.35	4.47		4.67		1.02
Macon	Cullasaja River S/D	53	28.4	1.23		3.02		20.4
Moore	Circle H MHP	68	10.4	17.4	0.2	19.2	0.838	6.09
Moore	Sunset Drive MHP	81	6.61	3.57		4.8		2.97
Nash	Riverside MHP	75	3.51	5.28		9.41		1.79
New Hanover	College View MHP	66	13	6.23	1.58	12.9	0.643	2.13
New Hanover	Oakley MHP	92	11.3	4.07		3.18		1.64
Orange	Arbor Hill MHP	85	22.1	10.4		3.47		5.2
Orange	Hill Top MHP	84	1.98	2.55		8.24		11.9
Orange	Orange MHP	81	43.5	26.3		23.6	3.01	11.8
Orange	Stonegate MHP S/D	81	9.7	5.05		2.64		3.28
Orange	Wood's MHP	51	6.38	4.79		2.02		2.39
Orange	Woodland Park	41	6.99	2.54		2.13		1.41
Randolph	Mt Calvary Christian School	98	6.5	5.99		1.84		3.25
Randolph	Scenic Oaks MHP	79	6.33	7.67		5.04		1.53
Randolph	West 49 MHP	93	8.25	10.8		1.55		4.43
Rockingham	Shady Acres MHP	90	1.13	4.25		1.59		2.53
Rockingham	Washburn MHP	83	3.74	6.95		1.17		1.88
Rowan	Edgewood S/D	259	2.74	6.32		6.17		5.4
Rowan	Fairfield Acres	158	6.54	8.62		6.44		3.21
Rowan	Gaddy MHP	76	11	12.3		7.66		4.65
Rowan	Mobile Lodge MHP	94	4.59	7.07		4.56		3.35
Rowan	Oakland S/D	119	3.17	4.68		2.54		1.97

Rowan	Tanglewood S/D	231	3.54	6.72		13.1		4.35
Stanly	Canton Heights MHP	132	7.62	8.3		5.74		2.9
Transylvania	Toxaway Point	79	21	9.71		1.93	0.967	4.93
Vance	Edgewood Estates	48		7.04		6.44		2.5
Vance	Imagination Station Academy, LLC	35		6.68		5.97		1.42
Wake	Aces of Space MHP	332	17.7	13.6		6.23		6.8
Wake	Buffaloe Road MHP	162	14.6	15.2		10.7		7.59
Wake	Camelot MHP	34	3.44	11.2		4.25	2.52	0.854
Wake	Cooley’s MHP	109	4.87	9.27		5.4		3.97
Wake	Creekside Mobile Village	165	7.73	1.26		2.33		2.06
Wake	Davis Town MHP	119	4.92	3.47		4.49		1.39
Wake	Farm Road Trailer Park	28	6.02	9.11		3.93		9.13
Wake	Glen Creek	229	14.1	17	1.11	1.88	1.96	3.87
Wake	Green Pines Park	66	12.5	9.79	0.213	4.78		4.85
Wake	Horseshoe Mobile Estates	255	10.1	12	0.239	4.88		13.4
Wake	Knightdale Estates MHP	285	46.7	4.7		5.62		49
Wake	Little River MHP	79	18.4	12.1		10.2		3.13
Wake	Mobile Hill Estate No 3	105	4.06	6.11	0.194	3.63		2.25
Wake	Olde Mill Trace S/D	394	1.58	5.17	0.26	1.49		2
Wake	Pineview Estates	83	2.28	4.54		11.7		9.63
Wake	Shady Acres MH Village	115	3.28	7.83		9.96		8.65
Wake	Southern Trace S/D	485	1.92	4.19		6.13		2.29
Wake	Watkin’s MHP	74	15.9	7.22		3.73		2.13