OFFICIAL NOTICE AND AGENDA
of a meeting of a City Board, Commission, Department Committee, Agency, Corporation, Quasi-Municipal Corporation, or Sub-unit thereof.

A Meeting of **Wausau Water Works Commission "Special Meeting"** will be held in the **Council Chambers, 1st Floor City Hall, Wausau, WI 54403** at **9 : 00 a.m.** on **Tuesday, February 15th, 2022.**

Members: Katie Rosenberg (President), Dawn Herbst, Jim Force, Joe Gehin, John Robinson

AGENDA

1. Pre- Registered Citizens for Matters Appearing on the Agenda and Other Public Comment.
2. Presentation and Discussion on Perfluoroalkyl and Polyfluoroalklyl (PFAS) in City Water.
3. Discussion and Possible Action on Short Term PFAS Removal Options.

Adjourn.

Per Wisconsin State Statute 19.84 (3), Less than 24 hours' notice is given for good cause.

Next meeting scheduled for **March 1st, 2022 at 1:30 P.M.*

It is possible and likely that members of, and possibly a quorum of the Council and/or members of other Committees of the Common Council of the City of Wausau may be in attendance at the above-mentioned meeting to gather information. **No Action will be taken by any such groups at the above-mentioned meeting other than the committee specifically referred to in this notice.**

THIS NOTICE POSTED AT CITY HALL AND EMAILED TO CITY PAGES AND DAILY HERALD: February 14th, 2022 at 8:45 a.m.

This meeting is being held in person and via teleconference by calling 1-408-418-9388. The Access Code is 2489 188 0425 and the password is WausauH2O. All public participants' phones will be muted during the meeting. Members of the public who do not wish to appear in person may view the meeting live over the internet on the City's YouTube Channel http://tinyurl.com/WAAMedia, live by cable TV, Channel 981, and a video is available in its entirety and can be accessed at https://tinyurl.com/wausaucitycouncil. Any person wishing to offer public comment who does not appear in person to do so, may e-mail michelle.weasler@ci.wausau.wi.us with "Water Commission Public Comment" in the subject line prior to the meeting start. All public comment, either by email or in person, will be limited to items on the agenda at this time. The messages related to agenda items received prior to the start of the meeting will be provided to the Chair.

In accordance with the requirements of Title II of the Americans with Disabilities Act of 1990 (ADA), the City of Wausau will not discriminate against qualified individuals with disabilities on the basis of disability in its services, programs or activities. If you need assistance or reasonable accommodations in participating in this meeting or event due to a disability as defined under the ADA, please call the ADA Coordinator at (715) 261-6590 or ADAServices@ci.wausau.wi.us to discuss your accessibility needs. We ask your request be provided a minimum of 72 hours before the scheduled event or meeting. If a request is made less than 72 hours before the event the City of Wausau will make a good faith effort to accommodate your request.

From:	Michelle Weasler
To:	Gina Vang
Subject:	FW: [EXTERNAL] Water Commission public comment
Date:	Monday, February 14, 2022 1:17:34 PM

From: Cheryl Posner <cheryl.posner@yahoo.com>
Sent: Monday, February 14, 2022 1:15 PM
To: Michelle Weasler <Michelle.Weasler@ci.wausau.wi.us>
Subject: [EXTERNAL] Water Commission public comment

Dear Mayor Rosenberg and members of the Water Commission:

I appreciate the chance to submit a comment before the Water Commission's discussion of how best to lower PFAS levels in Wausau's public drinking water. This issue concerns me, especially as scientists are still trying to ascertain how much PFAS ingested through food and water is hazardous to our health.

After reading Public Works' three proposed PFAS action plan scenarios, I would like to recommend:

1. Simultaneously implement scenarios #1 and #2, addressing both the mid- to long-term safety of our drinking water while offering a short-term option for Wausau residents like me who would rather not drink or cook with the tap water as it is now.

2. Avoid scenario #3, as public water filling stations expose people to possible bacterial and other kinds of contamination if the reusable bottles, jugs, and other vessels we bring to fill have not been properly cleaned and sanitized before filling. Providing bottles and jugs already filled, described in scenario #2, would be safer.

This issue is a difficult one, and bound to be expensive to resolve, but keeping Wausau's water safe to drink is imperative. Thank you for exploring and addressing possible solutions.

Sincerely,

Cheryl Posner
Wausau

From: Scott Boers
To: Gina Vang
Subject: Fwd: [EXTERNAL] Question from Website on PFAS
Date: Tuesday, February 15, 2022 7:00:19 AM

Sent from my iPhone

Begin forwarded message:

From: Wausau WaterWorks <Wausau.WaterWorks@ci.wausau.wi.us>
Date: February 14, 2022 at 1:58:25 PM CST
To: Scott Boers <Scott.Boers@ci.wausau.wi.us>
Subject: FW: [EXTERNAL] Question from Website on PFAS

From: Jim & Debi Swanson <jimdebswan@gmail.com>
Sent: Monday, February 14, 2022 12:45 PM
To: Wausau WaterWorks <Wausau.WaterWorks@ci.wausau.wi.us>
Subject: [EXTERNAL] Question from Website on PFAS

Greetings Mr Boers,
I been listening to tv coverage on PFAS levels in the drinking water. I don't believe many people understand the significance of a level of 30 parts per trillion.
If my math is correct if a person was to drink 2 gallons of water at that level of contamination every day for 75 years they would only ingest 0.006 grams of PFAS. If the water usage is 100 gallons a day that goes to 0.3 grams of PFAS over 75 years.
Where is the common sense in the news reporting?

Regards,
Jim Swanson

Department of Public Works
and Utilities

Eric Lindman, P.E.
Director of Public Works and Utilities

TO: Wausau Waterworks Commission

FROM: Eric Lindman, P.E.
Director of Public Works & Utilities

DATE: February 15, 2022

SUBJECT: **Wausau Water Works PFAS Status & Communication**

Wausau Water Works has and continues to meet all safe drinking water standards.

Wausau Water Works (WWW) is presenting this information to clarify what the recent PFAS results mean for the utility and to reassure the public action is already being taken to proactively establish PFAS removal in the new treatment facility. Since last week the message has gotten completely lost and has created panic, fear, and erosion of confidence in WWW. WWW is presenting the following factual information to inform the public there are no known immediate health concerns with Wausau Drinking Water, if there were I am confident the WDNR would have issued WWW an immediate correction plan.

Wausau Water works remains compliant with all Safe Drinking Water Standards. The PFAS test results from 2019 and 2022 remain below the EPA Health Advisory Level, PFAS remains unregulated by both state and federal governments. Test results may be found on the city website. Information and links to other health information related to PFAS may also be found on the city website. The test results were first presented to the WWW Commission in 2020 and stated PFAS may be a contaminant that will need to be managed in the future.

It is important to hear the message from WWW as we have and will continue to follow all requirements and regulations related to Safe Drinking Water Standards. WWW has taken the approach to be proactive which is why testing was conducted in 2022 as a request from the WDNR. Testing was conducted voluntarily to ensure WWW stays at the forefront of planning in order to address issues with these types of emerging contaminants. The WDNR is the regulatory authority over drinking water facilities in WI and actions taken by WWW are directed by the WDNR. Below is a list of facts related to the latest round of sampling and what WWW is pursuing to remain compliant with all future Safe Drinking Water Standards:

- PFAS is an unregulated “emerging contaminate”.
- The USEPA has a Health Advisory Level established at 70 ppt. There are no requirements or regulations on PFAS established by the USEPA or WDNR.
- The WDNR is proposing to establish a drinking water standard of 20ppt, still in the review process.
- The WDNR first approached WWW to test Wausau Water for PFAS in December 2021. This was prompted by other municipalities discovering PFAS levels exceeding 70ppt and the WDNR has requested many other municipalities to conduct voluntary testing also. WWW agreed to sample the water to be proactive and continue planning for the future.
- WWW PFAS results remain below Health Advisory Levels and it was recommended by the WDNR to put out a public notice related to the results.
- A press release was issued and a press conference was held last week to answer questions about PFAS. The following statements and recommendations were made by WDNR and DHS respectively:
    - *Long term exposure to high levels of the PFAS may increase cholesterol levels, reduce antibody levels, and reduce a woman’s fertility.* ***Wisconsin Department of Health Services (DHS) recommends people limit their intake of PFAS compounds. People can reduce exposure to PFAS by limiting their consumption of Wausau’s drinking water.***
    - *The level of PFAS in Wausau’s water is above level of health concern. This is why we recommend that people take action to limit consumption of the water.*
- WWW understands these statements are ambiguous and very confusing as there is no definition of what “limit” means and no definition of what “long term” means. WWW and other municipalities rely on regulatory agencies to provide clear direction and in this instance, there is nothing clear about the message.
- The fact is that Wausau Water meets all state and federal drinking water standards, and we are continuing to position ourselves to manage and appropriately address these types of emerging contaminants.
- WDNR has NOT required WWW to take any additional action or make any changes to the provision of Wausau’s Drinking Water. Should WWW receive any guidance or direction from the WDNR to take action this will be communicated to elected officials and citizens.

WWW has taken a proactive approach to PFAS and is pursuing a pilot study for possible PFAS removal options, again this is not required but is a proactive measure to ensure WWW is ready to present options as soon as possible for taking action, should any regulations be adopted in the future by USEPA/WDNR.

WWW, over the past two years, has also been pursuing removing Well 3 from the distribution system. The USEPA needs to approve the proposed discontinuance of this well and we continue to pursue this option. Well 3 has some of our poorest water quality.

WWW was proactive designing the new treatment facility to meet future regulations. These concepts during design included space for additional buildings and treatment processes and being able to adapt the anion exchange vessels to use different resin media types to remove PFAS and other possible contaminants. This pilot study will provide WWW proven option scenarios to determine the best approach to removing PFAS in the drinking water.

Attachments:
Mayor's Memo and Press Release
PFAS Action Scenarios
MEG/League/WRWA Comments 2-8-22
MEG PFAS Comments 7-28-21
PFAS WRWA Approval Process Update

Office of the Mayor
Katie Rosenberg

TEL: (715) 261-6800
FAX: (715) 261-6808

8 February 2022

Dear City of Wausau Common Council Members and Members of the Wausau Water Works Utility Commission,

In January Wausau Waterworks worked with the Wisconsin Department of Natural Resources and Department of Health Services to voluntarily test every city well for per- and polyfluoroalkyl substances, also known as PFAS. All six city wells contained levels of PFAS that are less than the EPA Health Advisory but exceed the proposed DNR drinking water standard. The levels of PFAS range from 23 parts per trillion to 48 parts per trillion depending on the well. The treated water has similar results and that tells us that the current treatment facility is not removing PFAS. PFAS testing results are available here on the city website.

Wausau Water Works is not in violation of any drinking water standards or regulations and has taken actions proactively to inform and protect the health of its customers.

I am writing this memo for two main reasons:

1) Inform you about the testing that found PFAS in Wausau's water.
2) Respectfully request meetings as quickly as feasible of both the Wausau Water Works Commission and Wausau City Council to begin the process of putting solutions in place for removing PFAS from Wausau's water supply. We have already begun investigating temporary options for PFAS removal but they will require policy body action and budgeting.

What are PFAS?

PFAS are considered emerging contaminants. According to the Environmental Protection Agency, PFAS are a group of manufactured chemicals that have been used in industry and consumer products since the 1940s. There are thousands of different PFAS. Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS) are two of the most widely used and studied chemicals in the PFAS group.

PFAS are found in non-stick cookware, water-repellent clothing, stain resistant fabrics and carpets, some cosmetics, some firefighting foams, and products that resist grease, water, and oil.

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According to the DHS, over half of our contact with PFAS comes from food including, eating food that was packaged in material that contains PFAS, eating fish caught from water contaminated by PFAS, drinking contaminated water, or accidentally swallowing contaminated soil or dust.

Why are we concerned about PFAS?

PFAS break down very slowly and can build up in people, animals, and the environment over time. The EPA, the Wisconsin DNR, the Centers for Disease Control, the Wisconsin Department of Health Services,

and the current body of scientific research are aligned and indicate that high levels of PFAS exposure are hazardous to human health. However, research is still ongoing to determine the level at which exposure to different PFAS would lead to adverse health effects.

What are the current PFAS regulations?

There are technically no PFAS regulatory standards from state or federal authorities. However, the science is still emerging and PFAS are considered a hazard. Both the DNR and the EPA have issued health advisories about PFAs that are found in the water supply. The EPA currently advises remediation if 70 parts per trillion are found. The DNR currently advises remediation if 20 parts per trillion are found. Both state and federal levels are working on regulatory standards but the reality is that it could be anywhere between 70 parts per trillion, 20 parts per trillion, or even lower based on the continued research. The federal government appears poised for a recommendation by October 2022. The DNR board will discuss their suggested regulatory standard at their meeting later this month.

What can we do to address PFAS in our water?

Here's what we've already done:

1) The City has been discussing PFAS in utility and economic development meetings since the DNR, DHS, and EPA issued health advisories. When the DNR and DHS made that PFAS health advisory, the Wausau Fire Department immediately ceased buying and using firefighting foam that contains PFAS, switching to a more expensive but PFAS-free foam.
2) Wausau Water Works also voluntarily tested in 2019 and again this year, 2022.

Office of the Mayor
Katie Rosenberg

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3) Wausau Water Works is working with the current Drinking Water Treatment Facility (DWTF) engineer design team to plan and implement a pilot study for the removal of PFAS. The engineering team would prepare 2-3 PFAS removal processes and run them in parallel at the existing treatment facility. One treatment process would be using the proposed resin media for the DWTF.

There are several potential solutions for the Wausau Water Works Commission and the Wausau City Council to consider. They range from setting up mobile carbon filtration systems that could connect to our plant, to purchasing and distributing water filters or bottled water, to establishing drinking water filling stations.

Each one of these options require policy body action and budget authorization. I am currently in contact with state and federal officials about potential funding sources in addition to other solutions. The federal government authorized $10 billion in the infrastructure bill for PFAS remediation, but congress hasn't established the criteria for usage yet. In the short term, the Wausau City Council and Wausau Water Works are likely looking at funding from utility and/or city resources.

My goal is to provide city residents with drinking water below the DNR's advisory of 20 parts per trillion as quickly as possible. It is critical that we act quickly to ensure we're meeting the public's expectations for health and safety, even though there is no federal or state regulatory standard.

If you encounter questions from constituents, the Marathon County United Way will be briefed and ready to begin answering community questions about PFAS in drinking water by 11am today. You can encourage folks to call the 211 line.

Thank you for your swift action on this.

Katie Rosenberg

For Immediate Release
February 9, 2022

Contact: Eric Lindman, Director of Public Works & Utilities
engineering@ci.wausau.wi.us
715-261-6740

PFAS detected in City of Wausau Wells

Wausau, Wis. – The City of Wausau and Wausau Water Works recently conducted voluntary testing of all municipal drinking water supply wells for per- and polyfluoroalkyl substances (PFAS) to determine if these emerging contaminates may need to be addressed in light of the Wisconsin Department of Natural Resources' (WDNR) proposed drinking water standard. As a result, PFAS was detected in all city wells at levels that are less than the USEPA Health Advisory level of 70 parts per trillion (ppt) but exceed the proposed WDNR future drinking water standard of 20 ppt based on a recommendation from the Wisconsin Department of Health Services (DHS). PFAS levels in Wausau's municipal wells ranged from 23 to 48 parts per trillion (ppt).

Wausau Water Works is not in violation of any drinking water standards or regulations and has taken actions proactively to inform and protect the health of its customers. Wausau residents do not need to immediately stop drinking or using the city's water. However, long-term exposure to high levels of PFAS may contribute to negative health impacts. Wisconsin Department of Health Services (DHS) recommends people limit their intake of PFAS compounds. It should be noted that boiling water does not remove PFAS.

The City of Wausau, in collaboration with the WDNR and DHS, will host a virtual information session/press conference at 11:00 am on Wednesday, February 9, to update local residents about PFAS in drinking water. The press conference link may be accessed here: https://tinyurl.com/WausauCityCouncil

Any resident who is concerned about their PFAS exposure may limit their consumption from drinking water by consuming water from an alternative source:

- Filtered water from a pitcher, sink, or whole-house filter system with a certified filter technology. A granular activated carbon (GAC) filter that meets ANSI/NSF Standard 53 or a reverse osmosis (RO) filter with an included GAC component can filter out PFAS. These numbers will be printed on the filter and/or packaging. More information about filtering out PFAS from drinking water is available here: Reducing PFAS in Your Drinking Water.
- Purified or filtered bottled water
- Other sources of water that have been tested for PFAS and do not have levels above recommended standards.

PFAS are a large group of human-made chemicals, are an emerging contaminant and are currently not regulated by the EPA or DNR. These chemicals have been used for decades in many industrial applications and consumer products such as carpeting, waterproof clothing, upholstery, food paper wrappings, personal care products, fire-fighting foams, and metal plating. PFAS have been found at low levels both in the environment and in blood samples of the general US population.

Testing of the municipal wells was conducted voluntarily by the City in consultation with the Wisconsin Department of Natural Resources (WDNR) and Wisconsin Department of Health Services (DHS). PFAS test results are available here on the city website.

This sampling was conducted as a proactive measure to ensure continued safe drinking water and to better understand what emerging contaminants may need to be addressed with the new Drinking Water Treatment Facility (DWTF). The DWTF is well suited to provide the ability for removal using the Anion Exchange Treatment process, originally designed to remove Total Organic Carbon (TOC), with the potential for removal of other emerging contaminants. Based on these recent test results, Wausau Water Works is currently working to set up a pilot study to determine the potential for PFAS removal with the DWTF.

Resources and additional information:

- DHS: Reducing PFAS in Your Drinking Water
- DNR: PFAS webpage
- City of Wausau: PFAS webpage
- DHS: PFAS webpage
- EPA: PFOA/PFAS Update
- DNR: Drinking Water Standards Update

MEDIA NOTE: City of Wausau Public Works Director Eric Lindman, Water Plant Supervisor Scott Boers, and Mayor Katie Rosenberg, along with Kyle Burton from the Wisconsin DNR, and representative from Wisconsin Health Services will be available at a virtual press conference for questions at 11:00 a.m. on Wednesday, February 9, 2022. The press conference link may be accessed here: https://tinyurl.com/WausauCityCouncil

Department of Public Works
and Utilities

Eric Lindman, P.E.
Director of Public Works and Utilities

TO: Wausau Waterworks Commission

FROM: Eric Lindman, P.E.
Director of Public Works & Utilities

DATE: February 15, 2022

SUBJECT: **Possible PFAS Action Plan Scenarios**

PFAS Action Plan Scenarios

Each of the following scenarios may be approved as a stand alone plan or parts of one scenario may be combined with another scenario. **Staff recommends option #1 below unless otherwise directed by the WDNR.**

1. **Prepare a pilot study for removing PFAS (Currently in process)**
    a. **Description**
    The utility would work with the current Drinking Water Treatment Facility (DWTF) engineer design team to plan and implement a pilot study for the removal of PFAS. The engineering team would prepare multiple PFAS removal processes and run them in parallel at the existing treatment facility. One treatment process would be using the proposed resin media for the DWTF.
    b. **Actions to implement**
        - Utility is working with consultant engineers to prepare plans and determine best media options for PFAS removal testing
        - Plans shared with DNR for approval
        - Plans will be shared with contractors/consultants to provide costs for materials and set up of the cylinders and test media
        - Utility orders the cylinders and sets them up in the existing treatment facility

c. **Timeline for implementation**
    - Plans and costs determined by February 18, 2022
    - Funding approval by February 22, 2022
    - Based on current information begin pilot testing tentatively in March 2022
    - Begin sampling treated water within days of set up
    - Continue communication plan with city council, partners and rate payers as to timeline, results and implementation of removal strategy options as necessary.
d. **Funding**
    - Anticipated funding through utility operating budget

2. **Possible purchasing and make available bottled water & filter pitchers**

a. **Description**
   The utility would procure pitcher filters and/or bottled water for residents that may be concerned about PFAS in city water. These may be distributed and/or available for pick up.
b. **Actions to implement**
    - Establish volume of water to purchase
    - Establish number of pitchers to order
    - Receive quotes for purchase amount
    - Establish distribution locations with MCHD and local partners
c. **Timeline for implementation**
    - Receive quotes for purchase amount
    - Funding approval by February 22, 2022
    - Anticipated delivery timeline TBD
    - Continue communication with city council, partners and rate payers
d. **Funding**
    - Funding through City budget
    - Likely the PSC will not authorize utility revenues for purchase as per discussion this would be for targeted populations and there is no drinking water standard violations

e. **Staff concerns**
    - There are only certain bottled water that is tested as PFAS free.
    - The level of PFAS removal from over the counter carbon filters is unknown. The life of the filters is also unknown as this is based on water chemistry. No testing has been done with these filters with Wausau Water.

3. **Establish multiple reverse osmosis filling stations around the city**

    a. **Description**
    The utility would procure multiple mobile water filtering stations. These are reverse osmosis units that may be placed at almost any location where water connection is available. Each mobile station would have water from the distribution system connected to it and it would provide a defined number of treated gallons of water per day. Residents could pull up to the station, fill water bottles or larger containers up to 5-gallons to take home.

    b. **Actions to implement**
    - Receive quotes from vendor for mobile units and for delivery and set up
    - Establish strategic locations to ensure sites are accessible for the entire community
    - Establish number of units to order based on determined locations
    - Receive quotes for up to a 12-month maintenance contract

    c. **Timeline for implementation**
    - Receive quotes for number of units to purchase and set up and establish 12-month maintenance contract
    - Receive approval from DNR on plan implementation and necessary requirements.
    - Funding approval once approved by DNR
    - Anticipated delivery timeline TBD
    - Continue communication with city council, partners and rate payers

    d. **Funding**
    - Funding through City budget
    - Likely PSC will not authorize utility revenues for purchase as there is no drinking water standard violations at this time

    e. **Staff concerns**
    - Ability to ensure water at these stations remains safe to drink.
    - We would need confirmation from the vendors in writing these produce PFAS free water.
    - Implementation in winter will require temporary heating and freezing prevention, makes establishing these stations much more challenging.

4. **Set up and deploy a mobile carbon filtration system for all distributed water**

    a. **Description**
    The utility would rent/lease a large activated carbon treatment system that would be brought on site to the water treatment facility. This mobile treatment facility would likely consist of multiple units and be connected to the finished water coming out of the exiting treatment facility to remove PFAS. The treated water would then be pumped to the distribution system. This would be a secondary treatment system that would treat all water distributed daily, about 4-4.5 million gallons a day.

    b. **Actions to implement**
        - Prepare lease/agreement with vendor that has capability to provide these units.
        - Prepare engineering plans for the location of the units and how the units will be connected to the water system.
        - Receive approval of the plan implementation by the DNR
        - Receive quotes for connection of the units

    c. **Timeline for implementation**
        - Anticipated delivery timeline TBD

    d. **Funding**
        - Funding through City budget
        - Likely the PSC will not authorize utility revenues for purchase/rental as there is no drinking water standard violations
        - Estimated costs for this option are $2,000,000

    e. **Staff concerns**
        - Changing source water chemistry that will be introduced to the distribution system may significantly increase risks of compromising our corrosion control treatment.
        - Compromising the corrosion control treatment may lead to higher levels of lead leaching from existing lead piping within the distribution system.
        - **Without significant pilot testing and approval from the DNR as well as an approved monitoring plan from the DNR this option offers many risks to the utility.**

February 8, 2022

Submitted Via Email

Wisconsin Natural Resources Board
c/o Laurie Ross, Board Liaison
P. O. Box 7921
Madison, Wisconsin 53707-7921

Laurie.Ross@wisconsin.gov

RE: Comments on DG-24-19
Revisions to ch. NR 809 related to the promulgation of new drinking water MCLs for PFOA and PFOS

Dear Chairman Kazmierski and Board Members:

The League of Wisconsin Municipalities, Municipal Environmental Group - Water Division, and Wisconsin Rural Water Association have each filed comments asking the Department to wait for EPA to promulgate federal drinking water standards before proceeding to adopt state drinking water standards for PFOA and PFOS. Wisconsin has never before adopted a state drinking water standard in the absence of a federal standard and we are concerned with the precedent that this proposal would establish. Copies of the comments that the League, MEG-Water and WRWA previously submitted to the Department on this proposed rule are attached.

This letter responds to statements made by DNR Staff at the Natural Resources Board's December 2021 meeting. At that meeting, DNR Staff suggested that waiting for EPA to promulgate a federal standard for PFOA and PFOS could take many years and jeopardize the ability of water utilities to use new federal funding for PFAS. These comments are not accurate.

Anticipated Federal Standards for PFOA/PFOS

EPA has indicated that it intends to issue a proposed PFOA/PFOS regulation in Fall 2022 and a final regulation in Fall 2023. *EPA, PFAS Strategic Roadmap: EPA's Commitments to Action 2021-2024, p. 12-13.*

In just seven to eight months, therefore, we should know the federal drinking water standards for PFOA/PFOS that EPA proposes be applied throughout the United States. This is not too long to wait in order to ensure that PFOA/PFOS drinking water standards in Wisconsin are consistent with national standards applicable throughout the United States.

In less than two years, we should have a final federal drinking water standard for PFOA/PFOS. The federal PFOA/PFOS rule will set a time by which water systems are to be in compliance with the new standards. Typically this compliance date is 3 years after the regulations are finalized unless the EPA Administrator determines an earlier compliance date is practicable. (SDWA § 1412(b)(1); 42 U.S.C. § 300g-1(b)(10).)

Federal Funding and PFAS Standards

Wisconsin communities will be able to access PFAS related funding under the federal Bipartisan Infrastructure Law even if state drinking water standards for PFOA/PFOS are not adopted now.

The Infrastructure Law specifically includes $4 Billion to address emerging contaminants (like PFAS) through the Drinking Water State Revolving Fund. Funding is to be provided to States over a five-year period and Wisconsin's estimated 2022 allotment of this funding is $12.85 Million.

The Infrastructure Law provides that this allocation is "to address emerging contaminants in drinking water with a focus on perfluoroalkyl and polyfluoroalkyl substances through capitalization grants under section 1452(t) of the Safe Drinking Water Act for the purposes described in section 1452(a)(2)(G) of such Act." Section 1452(a)(2)(G) of the SDWA requires that these funds only be used to provide grants for the purpose of addressing emerging contaminants with a focus on perfluoroalkyl and polyfluoroalkyl substances. This funding is not contingent upon PFAS standards being in place.

This PFAS funding is in addition to the $11.7 Billion included under the Infrastructure Law for the Drinking Water State Revolving Loan Fund generally. This Revolving Loan Fund provides funding for drinking water projects eligible under each State's separate Revolving Loan program. Under Wisconsin's Drinking Water State Revolving Loan Fund program, drinking water projects that address PFAS are eligible for funding. With regard to PFAS, Wisconsin's plan provides that:

> In addition, we are clarifying that projects that address PFAS or other emerging contaminants currently are eligible projects under the SDWLP. Until an MCL has been established, these projects would receive points under Section I (Risk to Human Health) as an anticipated exceedance. For PFAS, a project would receive 20 points as an anticipated exceedance of a Synthetic Organic Chemical (SOC) under question HH2 d. Once an MCL has been established, a PFAS project could receive up to 250 points under question HH1 d. for elimination of an MCL violation of a chronic contaminant (SOC).

State of Wisconsin, Drinking Water Loan Program Intended Use Plan for FFY 2021 Funds for the SFY 2022 Funding Cycle, page 12. Enforceable PFAS standards, therefore, are not required to access these funds either.

Conclusion

Thank you for the opportunity to provide the Natural Resources Board with this additional information. If you have any questions, please do not hesitate to contact any one of us.

League of Wisconsin Municipalities:	Toni Herkert, 608-267-3294
Municipal Environmental Group – Water Division	Lawrie Kobza, 608-283-1788
Wisconsin Rural Water Association	Caty McDermott, 608-258-9506

Sincerely,

LEAGUE OF WISCONSIN MUNICIPALITIES

/s/ Toni Herkert

Toni Herkert
Government Affairs Director, Wisconsin League of Municipalities

MUNICIPAL ENVIRONMENTAL GROUP – WATER DIVISION

/s/ Lawrie J. Kobza

Lawrie J. Kobza
Legal Counsel

WISCONSIN RURAL WATER ASSOCIATION

/s/ Caty McDermott

Caty McDermott
Registered Lobbyist

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LEAGUE OF WISCONSIN MUNICIPALITIES

131 W. Wilson St., Suite 505
Madison, Wisconsin 53703
phone (608) 267-2380; (800) 991-5502
fax: (608) 267-0645
league@lwm-info.org; www.lwm-info.org

December 8, 2021

Department of Natural Resources
Attn: Adam DeWeese– DG/5
P.O. Box 7921
101 S. Webster Street
Madison, WI 53703

Via Email – Adam.DeWeese@wisconsin.gov and DNRAdministrativeRulesComments@wisconsin.gov

RE: Comments on DG-24-19 Revisions to ch. NR 809 Related to the Promulgation of Drinking Water MCLs for PFOA and PFOS

Mr. DeWeese:

The League of Wisconsin Municipalities, a nonprofit and nonpartisan association of 594 cities and villages, welcomes the opportunity to submit the following comments on the proposed revision of ch. NR 809 related to the promulgation of new drinking water maximum contaminant levels for PFOA and PFOS.

It needs to be emphasized at the outset of our comments that the fundamental and most important goal of municipal water systems throughout the state is the provision of safe reliable drinking water to their customers. There are approximately 514 municipal water utilities in Wisconsin. Each of these systems tests its water to ensure the protection of public health. In the 2020 Annual Drinking Water Report, DNR noted that more than 98% of Wisconsin's public water systems provided water that met all health-based maximum contaminant level standards.

Timing:

The League supports the establishment of federal drinking water standards for PFAS but does not support the Department's creation of state standards at this time. EPA is moving forward to regulate PFAS in drinking water. On March 3, 2021, EPA published its final regulatory determination to regulate PFOA and PFOS under the Safe Drinking Water Act (SDWA). On October 18, 2021, EPA announced its PFAS Strategic Roadmap, which included issuing a proposed rule establishing federal maximum contaminant levels (MCLs) for PFOA and PFOS by fall 2022 with a final rule issued by fall 2023. The League recommends the Department wait for EPA to promulgate federal drinking water MCLs before proceeding to adopt state standards.

To date, all drinking water MCLs have been first established by EPA pursuant to the Safe Drinking Water Act (SDWA) process and then adopted by the State of Wisconsin. It is our understanding that Wisconsin has never adopted a drinking water MCL without a federal counterpart adopted prior to state action.

Unknown Costs Associated with the Recommended Standards:

Based on the final EIA, the League would contest that the department has insufficiently examined the overall economic impact of the PFOA and PFOS maximum contaminant levels. This does a disservice to

the state and our member utilities that Wisconsin residents rely upon to provide them with safe drinking water. An accurate economic impact of PFAS regulation is necessary to understand the level of economic assistance and/or ratepayer support that will be required for communities and water utilities to respond and continue to provide the public the safe drinking water we all expect.

The environmental impact assessment developed for the rule revision utilizes the third Unregulated Contaminant Monitoring Rule (UCMR 3), tested between January 2013 and December 2015, when making predictions on percentage of systems that will have a result greater than the proposed standard of 20 ppt. However, on March 11, 2021, EPA published the fifth Unregulated Contaminant Monitoring Rule (UCMR 5), which requires sample collections for 30 chemical contaminants between 2023 and 2025. Since the time of the testing associated with UCMR 3, the Safe Drinking Water Act was amended to require data not only from large systems serving over 10,000 people and a random sample of small systems to now include all small systems serving 3,300 to 10,000 and a random sample of systems serving less than 3,300. Therefore, with an increased number of systems that will soon test with more advanced testing methodologies, the number of exceedances for PFOA and PFOS (and other PFAS compounds) and the costs that are necessary to remediate those systems will certainly increase. The information from UCMR 5 has yet to be collected, but nevertheless, the department is moving forward with statewide regulatory standards despite an incomplete picture of the overall statewide problem and the costs associated.

The League believes the department needs to follow EPA's lead and wait for the federal process to unfold. The department is currently working with water utilities to monitor and test for PFAS. Our municipal water utilities have provided and will continue to provide safe drinking water for our communities and to our residents. We can wait for the federal safe drinking water process to be completed and for federal maximum contaminant levels (MCLs) to be promulgated.

The department should continue working with communities. It should be prepared to analyze the results of the UCMR 5 testing when it is available. It should support and evaluate additional research and development of effective treatment and disposal options. It should better evaluate the capital costs (regardless of Safe Drinking Water loans) to construct or install treatment methods, including secondary capital costs associated with treatment related to additional piping, connection systems, pumping facilities, and disposal costs. But the department should not promulgate state PFAS drinking water standards at this time.

In addition, to the comments outlined above, the League fully endorses the comments submitted by Lawrie Kobza on behalf of the Municipal Environmental Group Water Division on December 7, 2021.

Thank you for the opportunity to provide comments on NR 809 related to the promulgation of drinking water MCLs for PFOA and PFOS. The League continues to be supportive of federal safe drinking water standards and regulating these emerging compounds in a scientifically sound and technically and economically feasible manner.

Kind Regards,

Toni R Herkert

Toni Herkert, Government Affairs Director, Wisconsin League of Municipalities

MEG Water Division
Municipal Environmental Group

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December 7, 2021

Filed Via Email
Adam.DeWeese@wisconsin.gov
DNRAdministrativeRulesComments@wisconsin.gov

Department of Natural Resources
Attn: Adam DeWeese - DG/5
P.O. Box 7921
101 S. Webster Street
Madison, WI 53707-7921

RE: Comments on DG-24-19
Revisions to ch. NR 809 related to the promulgation of new drinking water MCLs for PFOA and PFOS

Dear Mr. DeWeese:

These comments are filed on behalf of the Municipal Environmental Group - Water Division (MEG - Water). MEG - Water is an association of 69 municipal water systems that provides input on legislative and regulatory issues involving water supply.

MEG - Water supports the establishment of federal drinking water standards for PFAS but does not support the Department's establishment of state standards at this time. EPA has made it clear that it is moving ahead to regulate PFAS in drinking water. On March 3, 2021, EPA published its final regulatory determination to regulate PFOA and PFOS under the Safe Drinking Water Act (SDWA). On October 18, 2021, EPA announced its PFAS Strategic Roadmap which included issuing a proposed rule establishing federal maximum contaminant levels (MCLs) for PFOA and PFOS by fall 2022 with a final rule issued by fall 2023. MEG - Water asks the Department to wait for EPA to promulgate federal drinking water MCLs before proceeding to adopt state standards.

When EPA promulgates federal drinking water standards, EPA follows the SDWA standard-setting process. Under the SDWA standard-setting process, a health goal is set that considers risks to the most sensitive populations including infants, pregnant women, and the immuno-compromised. The next step sets the enforcement standard (the MCL) to be as close to the health goal as feasible, considering available treatment technologies and costs. This cost-benefit analysis is a critical component of the SDWA standard-setting process.

Under the SDWA standard-setting process, drinking water standards are not set at the lowest possible level regardless of cost, treatment feasibility, and relative health benefit returns. The SDWA cost-benefit analysis provides assurance that the health benefits achieved by a new

standard justifies the cost of meeting that standard, and that comparable health benefits could not be achieved with a higher standard that would be less costly to meet.

The Department did not follow the SDWA standard-setting process in proposing the state standards for PFOA and PFOS in Rule No. DG-24-19. Instead, the Department set the proposed standards for PFOA and PFOS based on the Wisconsin Department of Health Services' proposed groundwater standards without conducting a cost-benefit analysis of the proposed state standards. The Department did not consider whether comparable health benefits could be achieved with a higher standard and a lower cost.

MEG - Water is concerned with the Department's proposal to establish drinking water standards without weighing the relative costs and benefits of those standards and the precedent that this may set for establishing future state drinking water standards for other emerging contaminants. MEG - Water questions the Department's authority to establish state drinking water standards in this way. While Wis. Stat. § 281.17(8)(a) provides that "the department may establish, administer and maintain a safe drinking water program no less stringent than the requirements of the safe drinking water act, 42 USC 300f to 300j-26," this subsection does not provide permission for the Department to set state drinking water standards where there is no comparable federal drinking water standard.

Under Wis. Stat. § 227.10(2m) an agency is prohibited from implementing any standard unless that standard "is explicitly required or explicitly permitted by statute or by a rule." To MEG - Water's knowledge, no statutory or regulatory authority explicitly permits the Department to establish a state drinking water standard in the absence of a federal drinking water standard. This likely explains why the Department has never before adopted a drinking water standard without there first being a federal drinking water standard in place.

MEG - Water supports the development and implementation of ***federal*** PFAS MCLs using the SDWA rulemaking process. MEG - Water also supports the Department's efforts to obtain additional information about the presence of PFAS in Wisconsin, to provide public information about PFAS, and to encourage action where PFAS levels are elevated. But MEG - Water does not support establishing state PFAS standards in the absence of federal drinking water standards nor in a manner that is inconsistent with the SDWA standard-setting process and that does not consider the relative costs and benefits of the proposed standards.

Public water systems are charged with protecting public health and they take this responsibility extremely seriously. Public water systems currently face a host of expensive challenges to ensure the continued protection of public health – like eliminating lead service lines, replacing old infrastructure, implementing corrosion control treatment to prevent leaching from lead pipes, and treating for contaminants like radium, arsenic, and nitrate. At the same time, there are concerns about public water supply remaining affordable.

As we respond to emerging contaminants, like PFAS, it is important that these emerging contaminants receive the same scrutiny and analysis as was given to the contaminants that already have MCLs. This is best done by having EPA develop federal drinking water standards for PFAS using the SDWA standard-setting process. If drinking water standards for PFAS are

established based upon the same uniform and consistent methodology used to establish standards for other drinking water contaminants, public water systems and the public at large can be assured that PFAS and all drinking water contaminants with federal standards are receiving the attention and resources that they deserve.

Thank you for this opportunity to provide the Department with our additional input. If you have any questions, please do not hesitate to contact us.

Sincerely,

MUNICIPAL ENVIRONMENTAL GROUP – WATER DIVISION

Lawrie J. Kobza
Legal Counsel

cc: MEG - Water Members (*via email*)

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Wisconsin Rural Water Association
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December 9, 2021

Department of Natural Resources
Attn: Adam DeWeese - DG/5
P.O. Box 7921
101 S. Webster Street
Madison, WI 53707-7921

Re: Comments on DG-24-19 Revisions to ch. NR 809 related to the promulgation of new drinking water MCLs for PFOA and PFOS

The Wisconsin Rural Water Association (WRWA) submits these comments relating to clearinghouse rule DG-24-19 - revisions to ch. NR 809 related to the promulgation of new drinking water MCLs for PFOA and PFOS. WRWA is a nonprofit association that represents 586 municipal water and wastewater system members and provide services to over four million Wisconsin residents and is focused on assisting small and rural communities that serve less than 10,000 people.

We understand and acknowledge the concerns of PFAS in our environment. The public wants to know what levels of PFAS in drinking water are safe or unsafe. As the public stewards of safe drinking water, our members want to address this issue – however we strongly impress that PFAS standards be based on credible science, ratepayer effects, and due deliberation of costs.

WRWA members believe the best course for the state at this juncture is to not set a state-specific standard, but rather defer to the federal government to regulate and set the PFAS standards. Since the department began the rulemaking process, EPA has taken significant steps forward to regulate PFAS in drinking water. In October 2021, EPA published a PFAS Strategic Roadmap and committed to "establishing a national primary drinking water regulation for PFOA and PFOS that would set enforceable limits and require monitoring of public water supplies, while evaluating additional PFAS and groups of PFAS." EPA estimates the proposed rule will be released in the fall 2022 and the final rule in fall of 2023.

To date, all of Wisconsin's drinking water standards have been set using the standard setting process under the Safe Drinking Water Act (SDWA). Under the SDWA process, the MCL is set weighing the marginal benefit of a stricter standard versus the incremental cost to meet such a standard. As such, a stricter standard will generate more costs, which could outweigh any health benefits.

This is especially critical for small systems. Currently, when the EPA sets new primary standards, they consider the compliance costs and affordability for small systems (under 10,000).

Research has found that even the known treatments for PFOA and PFOS vary depending on the type of method (e.g. granular activated carbon, ion exchange, reverse osmosis) and the corresponding MCL limit. For these reasons, WRWA requests the state adopt the federal standard to ensure that the PFAS standards are set under the SDWA process.

Revised EIA

WRWA members continue to have concerns that the fiscal estimates reflected in the revised Economic Impact Analysis are not reflective of all costs a system could face to comply.

For example, the department states in the EIA that there are three options for systems to mitigate PFAS in drinking water – 1) drill a new well, 2) abandon the affected source, or 3) install treatment. We believe this is an oversimplistic way to consider the costs to municipal water utilities, as there are other related costs with all these options.

The department assumes that a new well at a small community system is estimated to average $50,000. This is drastically lower than the costs our members report. A basic well generally costs between $1 million-$1.5 million. If the well needs to be relocated some distance away from the present location this leads to land costs, test boring costs, test costs, new buildings, new treatment equipment and chemicals and could increase costs substantially. If several wells are condemned and re-built, this cost could be multiplied several times. This is a significant impact to a small community and subsequently those costs would impact the water utility's ratepayers.

WRWA appreciates the department's willingness to consider the impact on water utilities from across the state. Based on the information from the National Rural Water Association, WRWA is confident that EPA is moving expeditiously to set a MCL standard for PFOA and PFOS. WRWA supports national-based standards to avoid confusion and uniformity of testing and treatment protocols.

Thank you for your consideration of these comments.

Sincerely,

Chris Groh
Executive Director
Wisconsin Rural Water Association

MEG Water Division
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July 28, 2021

FILED VIA EMAIL

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RE: Comments on Economic Impact Analysis for DG-24-19
Revisions to ch. NR 809 related to the promulgation of new drinking water MCLs for PFOA and PFOS

Dear Mr. DeWeese:

These comments are filed on behalf of the Municipal Environmental Group - Water Division (MEG - Water). MEG - Water is an association of 69 municipal water systems that provides input on legislative and regulatory issues involving water supply.

The Department has prepared a draft Economic Impact Analysis (EIA) and is soliciting comments and additional information before finalizing its EIA and submitting it to the Legislative Council. As the Department recognizes, Wis. Stat. § 227.137(3)(b) requires the Department to provide an estimate of the total implementation and compliance costs that are reasonably expected to be incurred by or passed along to businesses, local government units, and individuals, expressed as a *single dollar figure*. The Department must also make a determination as to whether $10 million or more in implementation or compliance costs are reasonably expected to be incurred by or passed along to businesses, local government units, and individuals *over any 2-year period* as a result of the proposed rule.

In its draft EIA, the Department has provided a preliminary assessment of initial monitoring costs to be $1.025 million and states that "[m]itigation and monitoring costs are unknown." With respect to the question whether implementation and compliance costs would be $10 million or more over any 2-year period, the draft EIA states: "Indeterminate. The department is seeking public comment to fully assess the economic impact of implementation and compliance with the proposed rule."

In light of the Department's lack of information for the State of Wisconsin, MEG-Water submits that the Department should look to the economic analysis prepared by the State of New Hampshire. New Hampshire originally proposed a PFOA MCL of 38 ppt and a PFOS MCL of 70 ppt and prepared an economic analysis for those standards. **Attachment A** to these comments is New Hampshire's January 2019 document describing its original economic analysis. After public comment, New Hampshire lowered its final standards to a PFOA MCL of 12 ppt and a PFOS MCL of 15 ppt (comparable to what is being proposed in Wisconsin). New Hampshire

then updated its economic analysis for the lower limits. **Attachment B** is New Hampshire's updated economic analysis.

New Hampshire's economic analysis shows that its PFAS standards at the low end of its economic estimate will have more than a $10 million impact over a 2-year period.

	From New Hampshire Economic Analysis* *Low End of Estimated Range*	2-Years of Costs
Initial Treatment Costs (Capital)	$65,046,987	
Annual Debt Service for Initial Treatment	$3,783,110 **	$7,566,220
Annual O&M Costs	$6,914,552	$13,829,104
Initial Sampling	$1,102,500	
Annual Sampling	$174,257	$348,514
TOTAL		**$21,743,838**

*Source: New Hampshire Department of Environmental Services, Rules Related to Per- and Polyfluoroalkyl Substances (PFAS), Summary of Comments on Initial Proposals with NHDES Responses, June 28, 2019, Attachment 2: Update on Cost and Benefit Considerations, page 3.

**Assumes financing of initial treatment project with Safe Drinking Water Loan Program for 20 years at the current interest rate of 1.485%.

Given this economic analysis information from a smaller state with fewer systems,[1] and given the Department's lack of its own information, MEG-Water believes that the Department's reasonable estimate of the economic impact from Department's proposed PFOS/PFOA standard must exceed $10 million over a 2-year period. MEG-Water does not believe the Department has sufficient information to conclude otherwise.

MEG-Water also offers the following comments on the draft Economic Impact Analysis.

1. The Department's preliminary assessment estimates the initial monitoring cost for all systems to be $1.025 Million. It appears that this estimate was calculated by multiplying the number of entry point samples to be collected by the cost of sample analysis. No costs were included for the costs a system would incur to retain outside assistance to collect the samples. PFAS sampling requires a heightened level of rigor to avoid cross-contamination and achieve the level of accuracy and precision required given the very low parts per trillion standards. MEG-Water believes that outside sample collection costs should be included in the estimate.

[1] New Hampshire has 1,575 public water systems (not including TNCWS) and a population of approximate 1.6 million. Wisconsin has 1,975 public water systems and a population of 5.822 million.

2. The draft EIA states that "Wisconsin has not conducted a comprehensive study of potential PFAS levels in public wells. Without such data, for the purpose of this Economic Impact Analysis, the department at this time cannot predict the number of public water systems with MCL exceedances." It is our understanding that the Department will be conducting PFAS testing at approximately 100 public water utilities beginning this fall. This information would provide information that the Department could use to evaluate the economic impact from this rule in Wisconsin. Proceeding with the EIA before this testing is done seems premature.

3. The Department notes that several states have completed sampling programs that provide occurrence data that can be referenced for comparison. MEG-Water has reviewed the information cited in Attachment A of the draft EIA and it is unclear whether the Department is comparing apples-to-apples. Attachment A identifies the number of systems sampled in Ohio, Michigan and New Hampshire, but it is not clear that the number really refers to systems, instead of referring to entry points (like Table 1 does in the draft EIA for Wisconsin) or water sources (wells). If Attachment A does refer to systems, it is unclear whether it refers to both community and non-transient non-community (NTNC) public water systems or only community systems. New Hampshire's number, for example, appears to only include municipal systems.

4. For Wisconsin's program, the Department provided numbers on the "entry points" to be sampled. The number of entry points a municipal system has varies depending upon how the system is configured. For example, it is MEG-Water's understanding that the Madison Water Utility has 21 wells and 21 different entry points, while Eau Claire has 16 wells and only 1 entry point. The different configurations of water systems will have a significant impact on where and how remediation is installed, the amount of water to be treated, and the cost of that remediation. Information from one system cannot be extended to other systems that would have very different configurations.

5. Regarding mitigation costs, the draft EIA states that the three main options for mitigating PFAS in drinking water are to (1) drill a new well not affected by PFAS, (2) abandon the affected source, or (3) install treatment. MEG-Water believes that this characterization of mitigating PFAS in drinking water is too simplistic. As to the first alternative, if the groundwater is contaminated by PFAS, a water system cannot assume that it will be able to escape the PFAS by simply drilling a new well. Significant investigation will need to take place before drilling a new well and the cost of this investigation must be included in the EIA. The Department's $11,000 estimate for a small system (presumably a non-community system) to drill a new well does not include this investigative cost or any property acquisition costs for a new well site.

As to the second alternative, abandoning an impacted well, and losing the capacity provided by that well, is not a mitigation measure. The cost of replacing that abandoned well, either with a new well or by connecting to another source, must be included in the EIA.

In MEG-Water's view, the third alternative -- the installation of treatment -- is the mitigation measure that should be evaluated in the EIA. The costs of treatment include both capital costs and yearly operation and maintenance costs. With respect to capital costs, the Department stated in the draft EIA that the Department anticipates that municipalities will use the Safe Drinking Water Loan program (SDWLP) to finance the cost of compliance. Even if

municipalities use the SDWLP to finance the capital costs of the installed treatment, municipalities will be responsible for the yearly debt service for the capital costs of the installed treatment system. As the Department notes, the typical loan period for one of these loans is 20 years.

With respect to the comparison to New Hampshire's economic analysis discussed on page 2 of this letter, MEG-Water included 2 years of debt service for capital costs to address PFOS/PFOA in the analysis assuming capital costs were financed at the interest rate available under the SDWLP. In New Hampshire, two years of annual debt service and operation and maintenance costs were estimated to exceed $20 million.

6. The draft EIA states that the process for this proposed rule is consistent with the process for establishing rules of other drinking water contaminants regulated under the federal Safe Drinking Act. MEG-Water disagrees. This rulemaking is not consistent with SDWA rulemaking.

When EPA promulgates federal drinking water standards, it follows the SDWA standard-setting process. Under the SDWA standard-setting process, a health goal is set that considers risks to the most sensitive populations including infants, pregnant women, and the immuno-compromised. The next step sets the MCL to be as close to the health goal as feasible, considering available treatment technologies and costs. This cost-benefit analysis is a critical component of the SDWA standard-setting process.

Under the SDWA standard-setting process, drinking water standards are not set at the lowest possible level regardless of cost, treatment feasibility, and relative health benefits. The SDWA cost-benefit analysis provides assurance that the health benefits achieved by a new standard justifies the cost of meeting that standard, and that comparable health benefits could not be achieved with a higher standard that would be less costly to meet.

The Department has not followed the SDWA standard-setting process for this rulemaking. The Department has not conducted a cost-benefit analysis of the proposed state standards. The Department has not considered whether comparable health benefits could be achieved with a higher standard and a lower cost.

The cost differential between different standard levels is large. The American Water Works Association estimated those costs in an August 8, 2019 comment letter to the Congressional Budget Office (**Attachment C**). In that submission, AWWA estimated capital costs and annual operation and maintenance cost would increase by 250% if the PFOA/PFOS standard was 40 ppt instead of 70 ppt, and it would increase by another 400% if the PFOA/PFOS standard was set at 20 ppt instead of 40 ppt.

The relevant charts from this AWWA letter to the Congressional Budget Office are reproduced below.

National Capital Cost to Install Treatment

Treatment Objective	Capital Costs ($ millions)		
	Granular Activated Carbon	Ion Exchange	Reverse Osmosis
< 70 ng/L	$2,100 - $4,400	$1,900 - $4,100	$5,700 - $12,000
< 40 ng/L	$5,600 - $12,000	$5,400 - $12,000	$15,000 - $33,000
< 20 ng/L	$23,000- $50,000	$22,000 - $48,000	$63,000 - $140,000
Treatment Technique	$140,000 - $290,000	$130,000 - $280,000	$370,000 - $800,000

National Annual Operating and Maintenance Cost for Installed Treatment

Treatment Objective	Annual Recurring Costs ($ millions)		
	Granular Activated Carbon	Ion Exchange	Reverse Osmosis
≤ 70 ng/L	$44 - $90	$210 -$460	$190 - $410
≤ 40 ng/L	$110 - $240	$540 - $1,200	$480 -$1,000
≤ 20 ng/L	$460 - $980	$2,200 - $4,800	$2,000 - $4,200
Treatment Technique	$2,700 - $5,800	$13,000 - $28,000	$12,000 - $25,000

The Department has done no analysis to evaluate whether the incremental health benefits achieved from a 20 ppt PFOS/PFOA standard justifies the costs of meeting that standard or whether comparable health benefits could be achieved with a higher standard that would have substantially lower costs. This is the type of sensible cost-benefit analysis that would be done under the SDWA.

Public water systems are charged with protecting public health and they take this responsibility extremely seriously. Public water systems currently face a host of expensive challenges to ensure the continued protection of public health -- like eliminating lead service lines, replacing old infrastructure, implementing corrosion control treatment to prevent leaching from lead pipes, and treating for contaminants like radium, arsenic, and nitrate. At the same time, there are concerns about public water supply remaining affordable.

As we respond to emerging contaminants, like PFAS, it is important that these emerging contaminants receive the same scrutiny and analysis as was given to the contaminants that already have MCLs. MEG-Water believes this is best done by having EPA develop federal drinking water standards for PFAS using the SDWA standard-setting process. If drinking water standards for PFAS are established based upon the same uniform and consistent methodology used to establish standards for other drinking water contaminants, public water systems and the

public at large can be assured that PFAS is receiving the attention and resources that it deserves.

Thank you for this opportunity to provide the Department with our input on the draft EIA. If you have any questions, please do not hesitate to contact us.

Sincerely,

MUNICIPAL ENVIRONMENTAL GROUP – WATER DIVISION

/s/ Lawrie J. Kobza

Lawrie J. Kobza
Legal Counsel

cc: MEG - Water Members (*via email*)

ATTACHMENT A

R-WD-19-01

SUMMARY REPORT ON THE NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES DEVELOPMENT OF MAXIMUM CONTAMINANT LEVELS AND AMBIENT GROUNDWATER QUALITY STANDARDS FOR PERFLUOROOCTANESULFONIC ACID (PFOS), PERFLUOROOCTANOIC ACID (PFOA), PERFLUORONONANOIC ACID (PFNA), AND PERFLUOROHEXANESULFONIC ACID (PFHxS)

Prepared by
New Hampshire Department of Environmental Services

Robert R. Scott, Commissioner
Clark B. Freise, Assistant Commissioner

January 4, 2019

PO Box 95, Concord, NH 03302-0095
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LIST OF COMMON ACRONYMS

AGQS – Ambient Groundwater Quality Standard

ATSDR – Agency for Toxic Substances and Disease Registry

CDC – Centers for Disease Control

COC – Contaminant of Concern

DWEL – Drinking Water Equivalency Level

EPA – United States Environmental Protection Agency

HED – Human Equivalent Dose

MCL – Maximum Contaminant Level

MRL – Minimum Risk Level

NHDES – New Hampshire Department of Environmental Services

NHDHHS – New Hampshire Department of Health and Human Services

NOAEL – No Observed Adverse Effect Level

PFAS – Per- and polyfluoroalkyl substances

PFHxS – Perfluorohexanesulfonic Acid

PFOA – Perfluorooctanoic Acid

PFOS – Perfluorooctanesulfonic Acid

PFNA – Perfluorononanoic Acid

PoD – Point of Departure

PWS – Public Water System

RfD – Reference Dose

RSC – Relative Source Contribution Factor

SDWA – Safe Drinking Water Act

UFs – Uncertainty Factors

1. Background

Perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), and perfluorohexanesulfonic acid (PFHxS) are part of a large class of chemicals known as perfluorinated compounds (PFCs) and more broadly as per- and polyfluoroalkyl substances (PFAS). They have been widely used since the 1940s in commercial, industrial, and household products and applications, including production of water resistant materials, fire suppression foams, non-stick cookware, stain removers, etc. All four compounds have been detected in New Hampshire's groundwater and surface water. Because of their widespread use, persistence and mobility in the environment and bioaccumulative properties, these compounds have been detected in blood serum in humans and animals worldwide and have been studied for their toxicity and health effects. The health effects associated with PFAS exposure are currently being researched extensively by toxicologists and epidemiologists worldwide, resulting in numerous publications being released on a continuous basis. The New Hampshire Departments of Environmental Services (NHDES) and Health and Human Services (NHDHHS) continue to review and evaluate the toxicity and health effects of these compounds as research becomes available. According to the Centers for Disease Control's (CDC) Agency for Toxic Substances and Disease Registry (ATSDR), some, but not all, studies in humans have shown health effects possibly associated with PFAS exposure including:

- Altered growth, learning and behavior of infants and older children.
- Lowering a woman's chance of getting pregnant.
- Interference with the body's natural hormones.
- Increased cholesterol levels.
- Modulation of the immune system.
- Increased risk of certain cancers.

For additional information on the toxicity and health effects of these compounds, please visit the ATSDR webpage at: https://www.atsdr.cdc.gov/pfas/health-effects.html.

New Hampshire Chapter Laws 345 of 2018 (i.e., SB309, see Appendix 1) authorize NHDES to consult with NHDHHS and to initiate rulemaking to adopt maximum contaminant levels (MCLs) for PFOA, PFOS, PFHxS and PFNA by January 1, 2019. The legislation requires that NHDES consider, 1) the extent the contaminant is found in New Hampshire; 2) the ability to detect the compound; 3) the ability to treat the contaminant; 4) benefits associated with adopting an MCL; and 5) the costs associated with adopting an MCL. MCLs are water quality standards that apply to public water systems (PWS). Most MCLs , including those proposed in this report, are set for long-term, chronic exposure to a contaminant and only apply to non-transient public water systems (water systems serving 25 or more of the same population of people, six months of the year). Public water systems (PWS) sample all of their water sources for compounds with MCL standards, and submit the results to NHDES to demonstrate compliance with water quality standards.

Existing state law requires NHDES to adopt rules establishing Ambient Groundwater Quality Standards (AGQS) that are the same as any MCLs established by NHDES. Existing state law also requires that AGQS be the same or more stringent than any federal MCL or health advisory established under the federal Safe Drinking Water Act (SDWA). AGQS are the standards used to require site investigations and remedial action at and around contamination sites. AGQS are also used to identify where the provision of alternative drinking water is required when contaminated sites impact offsite private and/or public water supply wells. An AGQS also dictates the conditions under which wastewater and wastewater residuals may be discharged to groundwater. Although NHDES adopted an AGQS for PFOA and PFOS of 70 nanograms per Liter (ng/L) [or

parts per trillion (ppt)[1]] for these two compounds combined in May of 2016, the laws enacted in 2018 require NHDES to re-assess these standards and to also adopt AGQS for PFHxS and PFNA.

This report provides information on how New Hampshire's proposed MCLs and AGQSs for PFOA, PFOS, PFNA and PFHxS were developed to ensure they are protective of human health at all life stages. The report also provides information on the criteria that the law requires NHDES to consider when establishing MCLs including: occurrence in drinking water, the ability to detect the contaminant, the ability to treat to achieve compliance with the MCLs, and the costs and benefits to parties affected by establishing the standards.

It is important to note that New Hampshire, like most other states, has always relied on the U.S. Environmental Protection Agency (EPA) to set MCLs. EPA and the few other states that set drinking water standards employ a variety of experts who derive protective health-based standards (e.g., toxicologists and health risk assessors), economists trained in cost and benefit analysis, and chemists and engineers who can determine lab and treatment capabilities. SB309 included funding for a toxicologist and health risk assessor, who both began work at NHDES on October 12, 2018. NHDES was also able to engage the services of an outside expert to provide some additional assistance in the review of toxicological information. NHDES did not have resources to fully evaluate costs and benefits, as would have been done on the federal level, but has attempted to provide an analysis of each based upon available information.

The majority of the work NHDES has performed to date has been focused on deriving the individual standards for PFOA, PFOS, PFNA and PFHxS. During the rulemaking process, NHDES expects to continue researching health studies on these chemicals as well as risk management approaches that are scientifically valid and could address any compounding effects between chemicals when the chemicals are found in combination in a drinking water source. Further exploration on quantifying benefit to affected parties will also occur. This continued effort will be done in tandem with considering public comments received on the initial rule proposal.

2. Proposed MCLs and AGQSs

Establishing MCLs is done in accordance with guidance developed by EPA and other health agencies and programs. Details of how health protective drinking water standards are usually developed are presented in Appendix 2. The sequence of steps is summarized below:

- The most sensitive adverse effect that is thought to be relevant to humans is chosen. The lowest dose that has no significant toxic effect is the usual initial starting point (a no observed adverse effect level or NOAEL).

- The NOAEL or the *lowest* observed adverse effect level (LOAEL), if there is no NOAEL, is converted to a human equivalent dose (HED) through physiological models or other dose adjustment methods. The HED becomes the point of departure (PoD) for deriving the ultimate drinking water standard.

- The PoD is reduced by uncertainty factors (UFs) of either 10- or 3-fold to take into account incomplete knowledge regarding critical factors such as when there is incomplete knowledge of human variability and sensitivity; in cases where short-term studies are used to protect against

[1] Both the MCL and the AGQS are specified in nanograms per Liter (ng/L), a unit of concentration that is equivalent to parts per trillion (ppt) in water. In this document, concentrations are stated in ppt except in quoted references and tables that use ng/L.

effects from long-term exposure, and when the usual required studies to set a standard (e.g., reproductive effects studies, developmental studies or cancer studies) are missing.

- The toxicity value developed, which EPA refers to as a Reference Dose (RfD) and ATSDR refers to as a Minimal Risk Level (MRL), is converted to an equivalent dose in drinking water by selecting a sensitive human receptor and using their body weight and drinking water ingestion rate to calculate a drinking water equivalency level (DWEL). The DWEL is 100% of a dose not expected to cause any toxic effects to even the most sensitive subpopulation.

- For most chemicals, exposure from sources other than drinking water, such as from air, food and soil, is also possible. Therefore, the DWEL must be reduced by estimated doses coming from all other potential sources using a relative source contribution factor (RSC), so that the total exposure dose does not exceed 100% of the RfD, MRL or DWEL.

It is important to understand that drinking water standards for the same chemical often differ depending on the entity setting them. This is not unexpected, since standard setting guidance is not simply a mathematical formula and anticipates the need for professional judgment, which is involved in several stages of the standard setting process. Information about the relevancy of effects on animals to humans is often incomplete and contradictory, which will influence the toxic effect that is chosen. The selection of appropriate UFs is another area where judgment is critical. Whether a full UF of 10 or a partial one of 3 is used for an UF, it will change the resulting standard by just over 3-fold. The RSC chosen can also have a significant influence on the final standard. If one Risk Assessor determines that the data required to select an RSC are inadequate, EPA's guidance recommends using a default RSC of 20%. Another Assessor may determine the data on background exposure are adequate and choose an RSC of 60% based on them. The choice between those two RSCs will also change the standard selected by 3-fold. In a world of complete knowledge about a chemical's effects, relevance to humans and background exposure, health-protective drinking water standards calculated by different practitioners should be identical. However, in the real world, the lack of knowledge about a chemical and the appropriate degree of protectiveness to apply in the face of uncertainty results in differing choices, which can change the value selected for a standard.

In order to ensure that NHDES was aware of all the current, relevant health studies and information available in deriving the proposed MCLs/AGQSs, the agency solicited input from stakeholders through a series of public meetings held for this purpose. A list of the documents/references received following these meetings is available on the NHDES website at: https://www4.des.state.nh.us/nh-pfas-investigation/wp-content/uploads/2018/11/Draft_PFAS-Reference-List-as-of-11-07-18_For-Posting-to-Website.pdf. Comments received are available on the NHDES website at: https://www.des.nh.gov/organization/commissioner/max-contaminant-levels.htm. Studies selected and utilized in the derivation of the standards are listed in Appendix 8.

The following Table (Table 1) provides an overview of the proposed derived standards and the factors selected to derive the proposed MCL/AGQS. Appendices 4-7 include a description for each of the chemicals and how the standard was derived. These derivations were reviewed by Dr. Stephen M. Roberts, Ph.D., who also assisted NHDES with the review of ATSDR's Draft Toxicological Profile released in June 2018. In addition to the individual standards for PFOA and PFOS, the proposed rulemaking keeps the combined 70 ppt for PFOA and PFOS as an AGQS and also proposes that it be adopted as an MCL. This is consistent with existing law, which requires that an AGQS shall be no less stringent than an EPA health advisory.

Table 1: Summary of MCL Derivation Factors				
	PFOA*	PFOS*	PFHxS	PFNA
Health Effect Endpoint	Altered Liver Size/Function	Delayed Development	Impaired Reproduction	Altered Liver Size/Function
Animal Serum Dose (ng/mL)	4,351[a]	6,260[b]	27,200[c]	4,900[d]
Total Uncertainty Factor HUF x AUF x MF[e]	100 10 x 3 x 3	100 10 x 3 x 3	300 10 x 3 x 10	300 10 x 3 x 10
Target Human Serum Dose (ng/mL)	43.5	62.6	90.7	16.3
Human Half-life (years)	2.7[f]	3.4[f]	5.3[f]	2.5[g]
Dosimetric Adjustment Factor (L/kg/d)	$1.20E^{-04}$	$1.28E^{-04}$	$1.03E^{-04}$	$1.52E^{-04}$
Reference Dose (ng/kg/d)	5.2	8.0	9.3	2.5
Relative Source Contribution[h]	40%	50%	50%	50%
Water Ingestion Rate[i]	0.055 L/kg d	0.055 L/kg d	0.055 L/kg d	0.055 L/kg d
MCL/AGQS ppt (ng/L)	**38**	**70[j]**	**85**	**23**

[a] Loveless et al., 2006, NJ DWQI 2017, increased relative liver weight in mice;
[b] Luebker et al., 2005a, EPA 2016b, reduced pup weight and developmental delays in rats;
[c] Chang et al., 2018, reduced litter size in mice;
[d] Das et al., 2015, NJ DWQI 2018, increased relative liver weight in mice;
[e] HUF (Human-to-Human Uncertainty) x AUF (Animal-to-Human Uncertainty) x MF (Modifying Factor)
[f] Li et al., 2017, serum-derived half-life estimates from men and women exposed to PFAS via drinking water;
[g] Zhang et al., 2013, ATSDR 2018, urine-derived half-life from community exposure to PFNA;
[h] The RSC was derived using NH-specific blood data from high-exposed populations of Pease and Southern NH. This was calculated using the subtraction method described in the EPA 2000 Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health. Details about this approach are summarized in Appendices 4-7;
[i] EPA 2011 Exposure Factors Handbook, lactating women 95th percentile;
[j] PFOS rounded down to 70 ppt from 73 ppt, per the current EPA Health Advisory for PFOS.

*The derivation of the 70 ppt standard for PFOA and PFOS combined is based on the U.S. Environmental Protection Agency's November 2016 Health Advisory (https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos)

Each MCL/AGQS was calculated through a risk assessment process that: 1) assessed sensitive and human-relevant health effects of each PFAS in rodent models, 2) evaluated non-cancer endpoints due to uncertainty about cancer endpoints observed in rodent models, and 3) estimated health-protective doses for exposure to individual compounds across sensitive life stages. Under State law, development of MCLs necessitates evaluation of, and possible modification based on, the availability and accuracy of detection and treatment technology, as well as the costs associated with compliance. While these factors were considered, NHDES has determined that, for these compounds at this time, adjustments to the standards based on detection/treatment technology or projected compliance costs are not warranted, as both technology challenges and compliance costs can be addressed by means other than standards that do not adequately protect health. Therefore, NHDES has proposed the health-protective levels calculated using the science-based process as both the drinking water standard and the ambient groundwater standard for New Hampshire.

Animal studies, namely rodents, served as the basis for the derived dose of each MCL/AGQS. Human epidemiology studies were evaluated to identify relevant health effects observed in rodent models, but did not serve as the basis for dose calculation. The use of animal studies for risk assessment is consistent with the approach of other states (e.g., Minnesota, New Jersey, and New York) and federal agencies (EPA and ATSDR). Due to differences in methodology, exposure history and data reporting, the existing human epidemiological studies alone were determined to be insufficient for deriving the dose for MCL/AGQS in a manner that would be consistent with other drinking water standards. Although a novel method for epidemiology-based risk assessment has been applied by a single European agency (European Food Safety Authority 2018), this approach is self-acknowledged to either overestimate or underestimate reference doses and has not been adopted by other U.S. regulatory bodies.

The critical health effects selected from the toxicology literature were non-cancer endpoints, including liver enlargement (PFOA and PFNA), delayed development (PFOS) and impaired reproduction (PFHxS). Recognizing that epidemiological studies have identified associations between certain PFAS and cancer, NHDES also considered the feasibility of deriving a MCL/AGQS for a cancer endpoint using its standard risk assessment approach. Of the four PFAS assessed by NHDES, only PFOA had a study for consideration of a cancer-based endpoint. However, this study (Butenhoff et al., 2012) had technical limitations that hinder extrapolation of serum doses, as well as uncertainty regarding the biological relevance to humans. Thus, it was determined that there was insufficient information to conduct an accurate risk assessment for a cancer endpoint given the existing scientific literature. This has similarly been studied by both EPA and ATSDR, and both determined that if a cancer endpoint would have been chosen, the resulting standard would have been at a higher (less protective) level and therefore, the endpoint chosen is fully protective for all health effects.

Due to the current lack of information on the toxicity of PFAS mixtures, NHDES conducted its risk assessment for each compound on an individual basis. There is emerging evidence that suggests various PFAS may affect similar organ systems, but these effects occur at differing doses depending on experimental design and their relative potency has not been quantified. To address this concern for mixture effects, other states have exercised a risk management strategy, instead of risk assessment, by applying a combined standard for the sum total of multiple PFAS. While perceived as protective, this risk management strategy lacks a scientific basis as the combined toxicity of multiple PFAS is poorly understood. As there is uncertainty about the specific health effects of PFAS and the growing number of different PFAS identified in the environment, the scientific and practical merits of any risk management approach should be carefully

evaluated as an alternative to standard risk assessment. NHDES continues to study developments in scientifically based approaches to regulating combinations of PFAS.

Consistent with the previous points, Michigan recently released a report summarizing the challenges for deriving health-based standards for PFAS under the current risk assessment paradigm. This report was prepared by an independent panel of scientists from government and academic institutions with technical expertise on PFAS health effects, exposure and remediation. Given the current limitations of animal studies and human epidemiology, the expert panel recommended developing regulatory approaches that consider both of these lines of scientific evidence. Yet they did not provide technical guidance on how that might be achieved. The panel also stated that the non-cancer endpoint of PFAS seem to be more sensitive than cancer endpoints and may be more important for setting regulatory limits. Furthermore, the panel emphasized caution in using combined regulatory approaches due to the lack of quantitative evidence for assuming similar potency of different PFAS. Additional discussion of these technical issues and their relation to the derivation of the proposed MCL/AGQS are detailed in Appendices 3-7.

Finally, it is important to note the toxicity values for the MCL/AGQS were derived from the lowest doses in animal studies that were determined to be relevant to human health. This included selection of health effects associated with developmental delays from *in utero* exposure (i.e. PFOS), or other effects that occur at lower doses than those that induce developmental defects in animals (i.e., liver toxicity for PFOA and PFNA, and impaired reproduction for PFHxS). To afford additional protection for chronic exposure, daily water intake was assumed to be that of the 95th percentile for lactating women, which is the highest water in-take rate for adults (i.e., for a 175 lb. person, this would equal about 4.4 liters of water consumed each day. By using this rate of water intake to calculate the MCLs, the levels are expected to be safe for pregnant mothers and their fetuses, lactating mothers and their infants, and all children, adolescents, and adults). This high intake rate was assumed "through life" as a protective measure.

3. Occurrence, Ability to Reliably Quantify and Ability to Treat

The statute concerning how the State develops MCLs was amended in 2018 to clarify that New Hampshire's process should align with the process followed by EPA and most of the few other states that set MCLs. This section addresses three of the criteria that the law now requires be considered in the development of an MCL. It is important to note that no additional resources were provided to NHDES to produce information on these considerations or for cost and benefit estimates. Accordingly, NHDES used available data and work done under other investigations/projects or by others to address these aspects of determining a MCL.

3.1 Occurrence in Drinking Water

In New Hampshire, two contaminated sites, one involving contamination of Portsmouth, New Hampshire's municipal water system wells at the Pease Tradeport and another involving contamination of wells used as a source of water for Merrimack Village District in Merrimack, New Hampshire, raised awareness of these compounds and led NHDES and others to perform state-wide sampling at public water systems and other suspected sites. Based on these data, PFOA, PFOS, PFHxS, and PFNA occur in drinking water, groundwater and surface water in New Hampshire in proximity to releases of these contaminants to the environment. The following table describes the results of analysis for these chemicals at 402 of the 1,880 sources of drinking water that supply non-transient public water systems in New Hampshire.

Table 2: PFAS Concentrations Detected in Sources of Drinking Water for Non-Transient Public Water Systems (data provided by NHDES Sampling or PWS voluntary sampling conducted March 2016 to December 2018)

	Number of PFAS Sources			
Concentration (ppt)	**PFHxS**	**PFNA**	**PFOS**	**PFOA**
Not Detected	357	390	336	253
Detected at less than 10 ppt	35	6	47	125
10-20 ppt	2	3	14	13
20-40 ppt	7	3	2	8
40-60 ppt	1	0	2	0
Greater than 60 ppt	0	0	1	3

3.2 Ability to Reliably Quantify in Drinking Water

The following excerpt from the Association of State Drinking Water Administrator's PFAS Lab Testing Primer (https://www.asdwa.org/wp-content/uploads/2018/10/ASDWA-PFAS-Lab-Testing-Primer-10-10-18-Final.pdf) describes the current status of the ability to reliably quantify PFAS, including the four subject compounds, in drinking water:

"Laboratory analytical methods with reporting limits (RL) of at least 2-4 nanograms per liter (ng/L) parts-per-trillion (ppt) should be utilized. Many commercial labs are achieving reporting limits of less than 1 ng/L ppt. Additional health studies are rapidly evolving and some states have determined that PFAS health advisory concentrations in drinking water should be based on the additive effect of PFAS compounds. Obtaining water quality results with low RL will improve the utility of the data in the event health guidance or standards are changed or that the state you are in develops health guidance or standards based on the additive effects of PFAS.

It is important to understand the difference between a reporting limit (RL) and a detection limit (DL). An RL or reporting detection limit is the limit of detection in which the concentration of a contaminant can be reliably quantified. In contrast, the DL or method DL is lower than the RL and is below the point of calibration such that results reported below the RL are unreliable and as such, must be qualified as estimated values by carrying a "J" or "E" (NELAP) qualifier/flag."

Typical PFAS Reporting Limits	
Method 537	Range from 2.9 to 14 ng/L
Isotope Dilution	Varies by lab and compound but can be: • Below 1 ng/L for some compounds and • Up to 3 ng/L for others

3.3 Ability to Treat Drinking Water

Based on published literature, PFOA, PFOS, PFNA and PFHxS can be removed from drinking water with varying success using a number of treatment options. The most common treatment for PFAS removal, both in the literature and in practice, including at wells in New Hampshire, is granulated activated carbon (GAC). Data from a variety of sites, including at full-scale and fully operational municipal wells, clearly demonstrate that compliance with the proposed MCLs can be achieved using GAC or other approaches such as combining GAC with resin.

4. Costs to Affected Parties

NHDES used available water quality data to estimate potential costs to affected parties of compliance with the MCLs/AGQSs. For certain types of waste and groundwater discharge sites, this involved determining the frequency of exceeding the proposed standards for the sites sampled and applying that to the universe of sites. For other types of sites for which there are limited data, a qualitative description of anticipated costs is provided. As noted previously, with existing resources and expertise, NHDES was unable to analyze costs in keeping with EPA and Office of Management and Budget guidance, which entails determining costs associated with a number of different potential standards and capturing marginal costs.

For affected parties such as public water systems, landfill and hazardous waste site owners, and groundwater discharge permittees, NHDES had sufficient sampling data to estimate a cost range associated with setting these standards. In the case of affected public water systems that have already made significant investment in meeting the current AGQS, these costs were not included as new costs resulting from setting the standards. In the case of waste and discharge sites, where only initial sampling has occurred, the costs of compliance with the existing and new standards are included. The assumptions and analysis used to derive costs is included as an appendix to this report.

4.1 Estimated Costs to Public Water Systems to Comply with New MCLs

The MCLs for PFOA, PFOS, PFNA and PFHxS will apply to PWSs that serve residential populations (community PWSs) and those that serve the same 25 or more people each day for at least 6 months of the year (non-transient, non-community PWSs), such as schools and places of work with their own wells. There are currently 1,880 sources of water for PWSs that would be subject to the adoption of these MCLs. The costs incurred by these PWSs include the cost of routine sampling, the frequency of which will depend on compliance with the MCLs. For public water systems that exceed any of the MCLs based on a running annual average, the costs will also include treatment such as GAC, and operation and maintenance costs associated with the installed treatment. The methodology and assumptions made for estimating each of these costs is contained in Appendix 9. To summarize, NHDES estimated the following:

The initial cost of sampling for PWSs is estimated to be $1,102,500 - $2,836,000. Based on the anticipated percentage of detections, the costs of sampling for non-transient PWSs in year 2 thru 9 after the MCLs are established are estimated to be $73,055 - $184,825.

To date, sampling has occurred at 402 of the 1,880 sources of non-transient public drinking water in New Hampshire (see Table 2 in the Occurrence in Drinking Water subsection). Comparing these analytical results to the proposed standards allows estimation of the number of public water systems that will require treatment. The cost of treatment at PWSs associated with these standards is estimated to range from $1,800,000 - $5,200,000.

NHDES utilized operation and maintenance estimates from PWSs that have developed cost estimates for maintaining PFAS treatment systems under construction to comply with the current PFOA and PFOS 70 ppt combined AGQS to estimate operation and maintenance costs associated with the new MCLs. Operation and maintenance costs are estimated to range from $114,912 - $223,439 per year.

New Hampshire does not require drinking water not supplying public water systems to comply with MCLs. However, it is anticipate that homeowners and others with private wells will incur costs to ensure

their drinking water meets health based standards. NHDES estimates that 3,125 of the 250,000 private wells in New Hampshire will have drinking water that exceeds the MCLs. The cost of point-of-entry treatment for those wells is estimated to be $9,375,000, with an annual maintenance cost of $2,812,500.

4.2 Estimated Costs to Comply with New and Existing AGQS

4.2.1 Municipal Solid Waste Facilities (Groundwater Management/Release Detection Permits)

The vast majority of the unlined/lined solid waste disposal facilities or synthetic lined waste water treatment lagoons in New Hampshire are municipally owned, and as such, the municipality is responsible for maintaining the water quality systems and monitoring water quality associated with a permit. There are roughly 200 of these facilities that currently have groundwater release detection or groundwater management permits that have been issued by NHDES, in accordance with its administrative rules. These permits prescribe programs for periodic groundwater quality monitoring and reporting, provide for groundwater remediation either through active measures or natural attenuation, specify performance standards for remedies, and describe procedures for performing site investigations and implementing remedial action plans.

NHDES has required sampling for PFAS at all of these sites. To date, 58% have sampled and approximately 42% of those have exceedances of the current AGQS for PFOA and/or PFOS. Based on the proposed MCLs, 44% are estimated to have exceedances. NHDES has assumed that 25% to 50% of these sites will require either an expansion of the existing groundwater management zone where PFAS is already an established contaminant of concern (COC) or will require investigation where PFAS will become a new COC. The capital costs are estimated to be in the range of $380,000 - $755,000, and the annual operating costs could range from $260,000 - $390,000 per year. This includes assumptions concerning the cost to install additional monitoring wells, comply with permit sampling and reporting requirements, sample private wells and provide treatment to some percentage of the private wells tested, and administration of the permits. The worksheet that includes the assumptions and unit costs is provided in Appendix 10.

4.2.2 Hazardous Waste Remediation Sites (Groundwater Management Permits)

Hazardous waste remediation sites include all sites where a hazardous substance or waste has been released, and often have a long-term remediation and management component prescribed and regulated through an NHDES-issued groundwater management permit or remedial action plan. There are roughly 515 waste sites, including State-listed hazardous waste, CERCLA, and brownfields sites, that have an open status and are currently regulated by NHDES.

NHDES has required waste sites that meet certain criteria to complete an initial screening for the presence of PFAS. To date, 27% have sampled and approximately 49% of those have exceedances of the current AGQS for PFOA and/or PFOS. Based on the proposed MCLs, 53% are estimated to have an exceedance. NHDES has assumed that 25% to 50% of these sites will require either an expansion of the existing groundwater management zone where PFAS is already an established COC or will require investigation where PFAS will become a new COC. Assuming these percentages of non-compliance for the universe of waste sites, with the exceptions noted below, the capital costs are estimated to be in the range of $1,150,000 - $2,310,000 and the annual operating costs could range from $570,000 - $1,020,000 per year. Not included in the estimate above are costs associated with a few unprecedented, large-scale site investigations and associated response actions currently ongoing in southern New Hampshire to mitigate PFAS-contaminated drinking water. Response

actions at these sites have included providing treatment or alternative water sources to affected properties. Based on site-specific data collected to date, it is estimated that the proposed MCLs will result in an expanded area requiring investigation and additional properties requiring sampling and treatment. The additional capital costs unique to these southern New Hampshire sites are estimated to be in the range of $1.52M - $2.53M and the additional annual operating costs could range from $220,000 - $365,000 per year.

The cost estimates for waste sites include assumptions concerning the cost to install additional monitoring wells, comply with permit sampling and reporting requirements, sample private wells and provide treatment to some percentage of the private wells tested, and administration of the permits. The worksheet that includes the assumptions and unit costs is provided in Appendix 10.

4.2.3 Oil Remediation Sites (Groundwater Management Permits)
Oil remediation sites include all sites where long-term remediation and management of petroleum contamination occurs primarily through a NHDES-issued groundwater management permit or remedial action plan. There are approximately 1,500 active petroleum sites, including, but not limited to, leaking underground/above ground storage tank sites, and spill sites that have an open status and are currently regulated by NHDES.

NHDES has recently undertaken an initiative requesting a small initial subset of these petroleum sites to voluntarily complete an initial screening for the presence of PFAS. To date, only an estimated 1% of all petroleum sites have sampled for PFAS. The data indicate that some percentage of sites will have exceedances of the proposed MCLs. However, based on the limited nature of information and the types of releases/release mechanisms associated with petroleum sites, the capital and annual costs associated with the proposed MCLs is indeterminate at this time.

4.2.4 Wastewater Disposal to Groundwater (Groundwater Discharge Permits)
A number of municipalities and some private entities dispose of wastewater to the ground through such practices as discharges to lagoons, rapid infiltration basins, spray irrigation systems and very large leach fields. There are 96 of these facilities that currently have a groundwater discharge permit, which allows the discharge in accordance with rules that protect against impact to other properties and wells. NHDES has required sampling for these and other PFAS at all of these sites. To date, 44% have sampled and, of those, 29% have exceeded one or more of the proposed MCLs. Assuming this same percentage of non-compliance for the universe of sites, the capital costs are estimated to be approximately $1,100,000 and the annual operating costs are estimated in the range of $200,000 - $400,000. This includes assumptions concerning the cost to install additional monitoring wells at these sites, sample private wells and provide treatment to some percentage of the private wells tested. Given the variety of groundwater discharge sites and that wastewater discharge volumes at many permitted facilities are on the order of hundreds of thousands of gallons per day, available treatment technologies would not suitably treat these flows in a manner that is cost effective. The worksheet that includes the assumptions and unit costs is provided in Appendix 11.

4.2.5 Biosolids and Sludge Processing and Application Sites and Septage Land Spreading.
Biosolids are produced by municipally owned wastewater treatment facilities when they receive a sludge quality certification from NHDES approving the material for beneficial use as a fertilizer in New Hampshire. Some industrial sludge, such as short paper fiber or water treatment residuals, may also be approved for land application for their organic content or ability to bind phosphorous,

respectively. Before biosolids or sludge can be applied to the land for agricultural purposes, they must receive a Sludge Quality Certification that ensures that over 159 potential contaminants are at acceptable levels, following strict screening guidelines that protect groundwater and human contact. Until a leaching standard (the amount that can be in the biosolid or sludge without its land application resulting in an exceedance of AGQS) is set for these four PFAS, it is impossible to quantify the costs resulting from establishing these standards. In some cases, biosolids and sludge that are now being applied for beneficial purposes (i.e., fertilizer or organic material) may no longer be able to be used and communities and industry may see a rise in their biosolid and sludge disposal costs. A similar cost increase could occur at the five domestic septage (i.e., material pumped from residential septic tanks) land spreading sites if PFOA, PFOS, PHNA, PFHxS are found to leach into groundwater at unacceptable levels (i.e., causes an exceedance of AGQSs set for the four PFAS).

At the present time, New Hampshire has only one biosolids processing site that must sample and comply with the four PFAS AGQSs that are established as a result of setting the MCLs. This facility is currently sampling for PFAS, specifically to comply with the existing combined standard for PFOA and PFOS of 70ppt. The new AGQSs may require the installation of new sampling wells and modification of the facility to protect groundwater by controlling and treating runoff, etc. These costs are unknown at this time. This facility primarily serves municipalities and any increase in costs is likely to be reflected in increased tipping fees paid for by the New Hampshire municipalities who utilize this facility.

4.2.6 Fire Station/Fire Foam Sites

A known source of PFAS in the environment is the use of certain formulations of firefighting foams, referred to as Class B foam or aqueous film-forming foam (AFFF), which contains PFAS. Certain fire training areas and discrete locations across the state where AFFF has been applied historically are currently undergoing remedial investigation and/or cleanup of PFAS-contaminated groundwater. The recent discovery of contamination in drinking water wells at fire stations has prompted additional sampling in the vicinity of those fire departments, and has resulted in the detection of elevated PFAS concentrations in nearby private and public drinking water supply wells. Of the 16 fire departments that have sampled their private water supply wells and provided results to NHDES, five (or 31%) would exceed the proposed MCLs.

Based on review of available information, there are an estimated 293 fire stations in New Hampshire of which potentially just over 175 may be serviced by a private water supply well. Furthermore, information suggests that there are over 120 active public water supplies and potentially over 4,600 private wells within 1000 feet of a known fire station. Given the limited information, the capital and annual costs associated with the existing AGQS and the proposed MCLs is indeterminate at this time.

4.2.7 Air Deposition Sites

In addition to instructing NHDES to set MCLs, which in turn become AGQSs, for PFOA, PFOS, PFNA, PFHxS, SB 309 also require the agency to limit air emissions from facilities that cause or contribute to an exceedance of an AGQS and otherwise address the contamination caused. It is not possible to determine the number of facilities that have emissions that cause or contribute to contamination above the AGQS(s) or the costs associated with treatment, investigation and remediation.

NHDES has identified one current and one former industrial facility that have emissions that resulted in the exceedance of the current AGQS for PFOA and PFOS and is evaluating Best Available Control

Technology for PFAS emissions for the current facility. Estimated capital costs for the control devices under consideration range from $2,000,000 - $3,000,000 with annual operating costs of $200,000 - $400,000. In addition, the facility would be subject to air emission stack testing that could cost approximately $100,000 per test, depending on testing methodologies employed. Other potentially affected parties include:

1. Facilities with evaporators used to reduce the volume of liquid wastes if the liquid contains PFAS compounds.

2. Landfill gas (LFG) emissions at solid waste landfills, if it is determined that LFG contains PFAS. Further study as to the effectiveness of combustion of LFG in boilers, engines, turbines or flares as well as current treatment occurring at some LFG to energy facilities would be necessary to identify the impact from this potential source.

3. Other industrial facilities identified as using PFAS where emissions to air might be of concern. Specifically, this could be chrome plating operations that historically used PFAS mist suppressants.

4.2.8 Miscellaneous Sources

Highly fluorinated chemicals can be found in commercially available products and that are used in households, institutions and commercial and industrial facilities. Examples of items that *may* contain PFAS include but are not limited to:

1) Paints.
2) Sealants, including products used on grout, countertops and floor treatments.
3) House cleaners and stain removers.
4) Floor wax removers.
5) Stain-resistant textiles (or chemicals used to treat textiles in homes and businesses) including, but not limited to, carpets, shoes and clothing.
6) Furniture with stain-resistant fabric.
7) Water proof textiles.
8) Food cooking ware and utensils.
9) Ski and boat waxes.
10) Dental floss, cosmetics, sunscreen and other personal care products.
11) Construction materials, including caulk sealants and plumbing sealants.
12) Pesticides.
13) Treated paper.
14) Chemical coatings for metal roofing.
15) Solar panels.
16) Purchased garden soils.
17) Automotive supplies, including waxes, cleaners, windshield wipers and additives to fluids used in automobiles.
18) Camping and other outdoor gear.
19) Spray- and grease-based lubricants.
20) Inks.

The possible presence of PFAS in these items not only presents other exposure potential for PFAS to individuals in the home and at businesses, but also another potential source of contamination to

wastewater, groundwater, storm water and/or surface water. NHDES lacks sufficient data to estimate the potential costs to facility owners of addressing contaminated sites that result from the use of these products.

5. Benefits to Affected Parties

In general, it is difficult to quantify the monetized benefits for environmental and public health standards, and often the case is made that EPA's guidance on deriving benefits for MCLs underestimates benefit, particularly in the area of indirect costs such as reduced quality of life for both the sick individual and their family caregivers. *Contingent valuation,* which is a survey-based economic method for valuing non-market resources (e.g., asking people what they would pay to lower the risk of an adverse health outcome) is a widely accepted economic method to evaluate benefits in such cases as establishing a MCL when reduction in risk can be reasonably quantified. Contingent valuation is based on the economic principle that value equates to willingness to pay. Unfortunately, the type of information needed to use contingent valuation is not yet available for PFAS. While PFOA, PFOS, PFHxS and PFNA have clearly been associated with numerous adverse health outcomes in animals, the mechanism for, and risks related to, similar outcomes in humans are not well understood. Accordingly, NHDES currently has no quantified value of benefit, although there is likely significant benefit to reducing exposure to these compounds through drinking water given the findings of the few previous direct exposure studies and the emerging findings from current epidemiological studies. Qualitatively, given the potential for direct health care treatments costs, associated losses of economic production and income of those impacted, and associated impacts to families and caregivers, limiting exposure to PFOA, PFOS, PFNA and PFHxS at unsafe levels may result in numerous and significant avoided costs.

NHDES researched the subject of benefit quantification and spoke with experts, including a group of professors and researchers at the University of New Hampshire (UNH), with whom NHDES recently contracted to quantify the benefits of reducing the arsenic MCL. NHDES intends to further evaluate the possibility of quantifying benefit of these standards with the group at UNH to see whether studies exist or emerge that would allow the department to do so. In addition, through previous stakeholder engagements, a number of stakeholder groups have been engaging with other research institutions throughout the United States to find recent methods or studies that can help quantify the benefits.

APPENDICES

Appendix 9: Analysis of Increased Costs for PWS to comply with Proposed MCLs for PFOA, PFOS, PFNA, PFHxS

Appendix 9: Cost of Compliance with Proposed MCL for PFOA, PFOS, PFNA & PFOA/PFOS Combined for PWS and Private Wells

1.0 PFAS Treatment Costs

Costs to operate and maintain treatment systems to remove PFAS has been prepared assuming treatment is required when

a. PFOS & PFOA combined exceeds 70 parts-per-trillion (ppt);
b. PFOA exceeds 38 ppt;
c. PFNA exceeds 23 ppt; or
d. PFHXS exceeds 85 ppt.

1.1 Occurrence Information

The PFAS sampling results for non-transient PWS were reviewed. Four hundred and two sources of water associated with non-transient PWS were sampled. Two sources of water (0.5% of the sources sampled) equaled or exceeded 70 ppt for PFOA and PFOS combined. Three sources of water (0.75% of the sources sampled) equaled or exceeded 38 ppt for PFOA. Three sources of water exceeded 23 ppt for PFNA, however two of these three sources of water already exceeded the standard for PFOA and PFOA and PFOS combined. None of the results exceeded 85 ppt for PFHxS. Non-transient PWS sources around the Saint Gobain site and the Haven well at Pease Tradeport are not included in the occurrence analysis above, as there are likely not any sources of public drinking water near the type of large scale contamination sources that impacted these wells.

1.2 Costs for Water Treatment for Water Sources Associated with Non-transient PWS With Sampling Results

All sources for PWS that exceed 38 ppt for PFOA and/or 70 ppt for PFOA and PFOS combined already exceed the existing 70 ppt AGQS for PFOA and PFOS combined and costs are already being incurred by these water systems to comply the current AGQS. Therefore, the proposed values of 38 ppt for PFOA and 70 ppt for PFOS and PFOA combined do not require the expenditure of additional funds.

1.3 Costs for Water Treatment for Water Sources Associated with Non-transient Public Water Systems Without Sampling Results

In order to estimate the volume of water that may require treatment for non-transient public water systems that were not sampled, the daily flow volumes for these systems were estimated based on the volume of flow associated with the wellhead protection area for each unsampled source. Generally, this flow volume is the maximum volume that would be used from a particular source.

The cost per gallon to treat water for PFAS can vary broadly. Issues such as the potential for the need to construct a new building, volume of flow, initial PFAS concentrations or pretreatment requirements for constituents such as iron, manganese and radon can cause costs to vary by up to 300% from source to source. The costs per unit of flow used in the estimate were based on the costs associated with treatment at sites in New Hampshire and New York. These are summarized below. The lowest cost per gallon ($2.91 for MVD 4 & 5) and the highest cost per gallons ($8.10 for Pease) were used to develop high and low end estimates.

PFAS Treatment Costs Associated with PWS in New Hampshire and New York:

	Gallons Per Day	Cost	Cost Per Gallon
MVD 4/5	1,152,000	$3,350,000	$2.90
MVD 7/8	1,800,000	$8,000,000	$4.44
Pease	1,728,000	$14,000,000	$8.10
Hooksick Falls	500,000	$3,000,000	$6
Marlow School	1,125	$4,000	$3.56

The treatment costs for sources of water associated with non-transient PWS were estimated. The production volumes associated with the wellhead protection area for the unsampled sources were summed and multiplied by the 0.5% to estimate treated costs associated with sources of water that may exceed 70 ppt PFOA and PFOS combined. Similarly, the production volumes were summed and multiplied by 0.75% to estimate the treatment costs for sources that may exceed 38 ppt for PFOA.

The spreadsheet used to complete the calculations is attached.

The total cost estimates are below:

	Low Estimate	High Estimate
PWS with Sampling Results	$0	$0
Unsampled Public Water Systems	$1,851,354	$5,171,022
Total Cost	$1,851,354	$5,171,022

1.4 Operation and Maintenance Costs for PFAS Water Treatment Systems for Public Water Systems

The operation and maintenance (O&M) cost estimates for PWS were developed using estimated O&M costs associated with the treatment system being constructed for Merrimack Village District's wells 4/5 and the estimated O&M costs associated with the treatment system being constructed at Pease. The estimated annual O&M cost based on the average daily volume that is anticipated to require treatment is $0.18 per gallon to $0.35 per gallon

The annual O&M costs are estimated to be *$114,912 - $223,439* per year.

The cost estimates do not include O&M costs for non-transient public water systems that currently exceed the current AGQS of 70 ppt for PFOA and PFOS combined.

1.5 Chemical Monitoring Costs

Upon the adoption of the proposed MCLs, all non-transient public water systems will be required to sample all sources of their water for four consecutive quarters. After the first year of initial sampling, the average concentration of PFOA, PFOS, PFNA and PFHxS will be calculated for each water source to determine compliance with the MCLs. After the first year of sampling, the frequency of future sampling will be dictated by the results of the first year of sampling. The tables below estimate the cost associated with testing all sources of water on a quarterly basis for the first year and estimated ongoing sampling costs after the first year of sampling.

Assuming Sample Analysis cost of $175 - $450 per sample
1st Year Laboratory Costs - Quarterly Compliance Sampling

Owner	# PWS	# Sites	Initial Cost
State	6	13	$9100 - $23,400
Federal	3	4	$2800 - $7200
Local	274	472	$330,400 - $849,600
Others	907	1086	$760,200 - $1,955,800
TOTAL	1190	1575	$1,102,500 - $2,836,000

Projected Percentage of PWS Sample Sites at Various Contaminant Levels

% of MCL	PFHXS	PFNA	PFOA	PFOS	PFOA + PFOS
ND	86.4%	92.8%	50.3%	79.7%	
<20%	11.4%	3.0%	37.1%	16.4%	38.3%
20 to 75%	2.2%	2.5%	10.7%	3.2%	8.9%
>75% to MCL	0%	1.0%	1.2%	0.5%	1.2%
>=100%	0%	0.7%	0.7%	0.2%	0.5%

Projected Annual Compliance Monitoring Laboratory Costs (years 2 - 9)

Contaminant Range	% of Sites	# of Sites	Sampling Frequency	Cost/Site/Year	Total Sampling Cost/Year
>MCL or Treatment	2%	32	Quarterly	$700 - $1800	$22,400 - $57,600
>75% to MCL	3%	47	Annually	$175 - $450	$8225 - $21,150
20 to 75%	15%	236	Every 3 Years	$60 - $150	$14,160 - $35,400
<20%	19.5%	307	Every 6 Years	$30 - $75	$9210 - $23,025
ND**	60.5%	953	Every 9 Years	$20 - $50	$19,060 - $47,650
				Average Annual Cost	$73,055 - $184,825

**Most sites that have any detection will exceed the threshold value for more than one contaminant. Preliminary study shows 243 out of 402 sites tested as having no detections (60.5%).

1.6 Other Potential Costs that Could Impact Public Water Systems

In southern New Hampshire, several square miles of soil have been contaminated with PFAS due to air emissions. Water utilities completing construction projects in these areas may incur increased costs associated with managing potentially contaminated soils and construction dewatering in these areas.

2.0 Cost Estimates for Private Wells

It is estimated that there are 250,000 private wells in New Hampshire. If it is assumed 0.75% of the private wells in the state will require treatment for PFOA exceeding 38 ppt and 0.5% of the private wells will require treatment for PFOA and PFOS exceeding 70 ppt, the treatment costs will be approximately *$9,375,000 for 3125 private wells*. This assumes there are 250,000 private wells and it will cost $3000 per well to install treatment. [(0.75% x 250,000 wells + 0.5% x 250,000 wells) x $3000/well]

It is estimated that it will cost $900 per year per well to sample and test and maintain treatment systems for PFOS and PFOA. *The total cost annual cost to test and maintain treatment systems for 3125 private wells is estimated to be $2,812,500*.

The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Robert R. Scott, Commissioner

Rules Related to Per- and Polyfluoroalkyl Substances (PFAS):
FP 2019-14, Env-Wq 402 amendments
FP 2019-15, Env-Or 603.03 amendments
FP 2019-16, Env-Dw 700-800 amendments

Summary of Comments on Initial Proposals with NHDES Responses
June 28, 2019

Three sets of proposed rules and rule amendments relate to four per- and polyfluoroalkyl substances (PFAS), specifically perfluorohexane sulfonic acid (PFHxS), perfluorononanoic acid (PFNA), perfluorooctane sulfonic acid (PFOS), and perfluorooctanoic acid (PFOA). The three sets of rules are as follows:

Env-Dw 700 & 800 (FP 2019-16) establishes maximum contaminant levels (MCLs, the drinking water standards with which public water systems must comply) for the four PFAS in public drinking water and adds monitoring, compliance, reporting, and public notice requirements for the four PFAS;

Env-Or 603.03 (FP 2019-15) establishes ambient groundwater quality standards (AGQS), for the four PFAS, that are required by statute to be equivalent to the MCLs established in Env-Wq 700; and

Env-Wq 402 (FP 2019-14) establishes water quality standards and procedures for discharges to groundwater of wastewater containing any of the four PFAS.

The purpose of this document is to summarize the comments NHDES received from the public on all three proposed rules and to identify the changes made to the proposed rules in response to the comments or explain the reason(s) why NHDES did not make changes. Comments received that were unrelated to the proposed rules are not addressed in this document. To provide a foundation for the comments and responses, brief explanations of the purpose of the rules and of the rulemaking process are provided, as well as a summary of the main provisions of the rules and an explanation of how the currently proposed MCLs/AGQS were derived. A list of commenters on the rules and all written comments received concerning the rules as well as the transcripts for the three public hearings can be found on the NHDES website by searching on "PFAS".

OLS also provided written comments, which have been addressed.

Purpose of Proposed Rules

Env-Dw 700 & 800 establishes MCLs and monitoring, compliance, reporting and public notice requirements for the four health-related regulated PFAS ("health-regulated PFAS") that will apply to all non-transient public water systems, as required by RSA 485:16-e. The final proposed MCLs and AGQSs are:

Contaminant	Final Proposed MCL/AGQS (Part Per Trillion (ppt))
PFHxS	18 ppt
PFNA	11 ppt
PFOS	15 ppt
PFOA	12 ppt

The rules also eliminate the requirement for the owner or operator (O/O) of a laboratory that is seeking approval for an alternate analysis method to identify the specific PWS for which the alternate method would be used, meaning that once an alternate method is approved, it could be used for any PWS.

Env-Or 603.03 is being amended to change the existing AGQS for PFOA and PFOS and to add AGQS for PFNA and PFHxS. As required by RSA 485-C:6, those AGQS are identical to the MCLs that are proposed to be established under Env-Dw 700.

Env-Wq 402 is being amended to establish requirements for discharges to groundwater of wastewater containing any of the four PFAS. Those requirements reflect the proposed changes to the AGQS that would be established under Env-Or 603.03 and are intended to accommodate the lack of available technology to treat large quantities of wastewater that is contaminated with certain PFAS. Specifically, the rules would:

(1) Include residual PFOA, PFOS, PFNA, and PFHxS in the existing conditional exemption for meeting AGQS under certain circumstances;

(2) Establish a discharge limit for PFOA, PFOS, PFNA, and PFHxS in wastewater discharged to groundwater;

(3) Account for exceedances of the applicable limits for PFOA, PFOS, PFNA, and PFHxS; and

(4) Include PFOA, PFOS, PFNA, and PFHxS in the treatment/alternative response requirements established for 1,4-dioxane which includes identifying and eliminating contributing discharges to the wastewater stream.

Summary of Rule Development Process

Laws of 2018, Ch. 345 directed NHDES to initiate rulemaking related to PFOA, PFOS, PFHxS and PFNA by January 1, 2019, to:

(1) Establish MCLs for PFOA, PFOS, PFNA and PFHxS; and

(2) Re-evaluate the current AGQSs for PFOA and PFOS, which currently is 70 ppt combined, and to establish AGQSs for PFHxS and PFNA. AGQSs are clean-up standards for contaminated sites. Existing law (RSA 485-C:6) has always required an AGQS to be the same as any established MCL for a contaminant. The AGQS are also used to determine appropriate discharge limits for groundwater discharge permits.

The law provided funding for a toxicologist and health risk assessor position, which were filled in October of 2018. Also in October, NHDES held three technical sessions -- in Concord, Merrimack and Portsmouth (Pease Tradeport) -- to provide stakeholders with the opportunity to submit or identify studies and research pertinent to deriving health based standards and addressing other considerations required by law, including occurrence, ability to detect and treat as well as the anticipated costs and benefits. After careful review of appropriate studies and other states' approaches, NHDES began rulemaking by filing a Request for Fiscal Impact Statement with the Legislative Budget Assistant (*see* RSA 541-A:5) on December 31, 2018.

The initial proposal included the following levels for MCLs and AGQSs:

Contaminant	**Initial Proposed MCL/AGQS** (Part Per Trillion (ppt))
PFHxS	85 ppt
PFNA	23 ppt
PFOS	70 ppt
PFOA	38 ppt
PFOA & PFOS Combined	70 ppt

In conjunction with initiating the rulemaking, NHDES issued the "Summary Report on the New Hampshire Department of Environmental Services Development of Maximum Contaminant Levels and Ambient Groundwater Quality Standards for Perfluorooctane sulfonic Acid (PFOS), Perfluorooctanoic Acid (PFOA), Perfluorononanoic Acid (PFNA), and Perfluorohexane sulfonic Acid (PFHxS)" on January 4, 2019 ("January 2019 Report").

After filing the initial proposed rules and rulemaking notices, NHDES held public meetings in Merrimack and Portsmouth (Pease Tradeport) to explain how the proposed standards were derived. The public hearings on the

proposed rules required by RSA 541-A were held in early March 2019 in Merrimack, Portsmouth and Concord. In addition to soliciting comments on the initial proposal, participants were asked to comment on the use of a toxicokinetic model developed by the Minnesota Department of Health ("MN model") to assess blood serum levels of people exposed to PFOA, including breastfed and bottle-fed infants. In the press release announcing the public hearings, NHDES informed interested parties that a preliminary assessment indicated that using the model would likely lower the proposed standards.

The final proposed rules reflect further research and new studies, the use of the MN model, consideration of comments received, discussions with other state and academic toxicologists, and professional judgement on what health-based standards will be sufficiently protective of human health over all life stages. While NHDES is unable to quantify all the costs and benefits associated with these proposed rules due to the emerging nature of these contaminants and the science related to them, after considering what currently is known about costs and benefits NHDES believes that the benefit of adopting these rules is not outweighed by the costs of implementing the proposed health based standards.

Summary of Significant Differences Between Initial and Final Rulemaking Proposals

1. The proposed MCLs/AGQSs have been lowered, primarily due to using the MN model.

2. The term "per- and polyfluoroalkyl substances (PFAS)" has replaced the term "perfluorinated compounds (PFCs)" throughout the document. PFAS is the more inclusive term and was used in most of the comments received, even though the rules currently do not include any polyfluorinated compounds.

3. The implementation requirements for public water systems have changed to reduce initial sampling frequency to two quarters if both samples come back with non-detects and to limit the maximum time between performing sampling to three years.

Technical Explanation of Proposed Lower MCLs/AGQSs and Updated Costs and Benefit Information:

Attachment 1 is "New Hampshire Department of Environmental Services Technical Background for the June 2019 Proposed Maximum Contaminant Levels (MCLs) and Ambient Groundwater Quality Standards (AGQSs) for Perfluorooctane sulfonic Acid (PFOS), Perfluorooctanoic Acid (PFOA), Perfluorononanoic Acid (PFNA), and Perfluorohexane sulfonic Acid (PFHxS)" dated June 28, 2019 ("June 2019 Report"). It also includes findings of a peer review of NHDES's derivations conducted by Stephen M. Roberts, Ph.D.

Attachment 2 is an update on cost and benefit considerations.

Comments and Responses

General and technical comments concerning this rulemaking are categorized and listed below. Note that in addition to revisions discussed below, revisions have been made to each of the rules put the four compounds in alphabetical order.

General Comments Related to Proposed MCLs/AGQSs

Comments: The proposed MCLs and AGQS should be lower. A number of comments suggested the standards should be at 1 ppt combined. Others suggested that NHDES should adopt the lower advisory numbers adopted by other states or, in the case of New Jersey, its MCL for PFNA.

The proposed MCLs and AGQS should be higher. A few comments were received that urged NHDES to look at recently established health advisories in Canada and elsewhere that would increase the standards initially proposed.

Response: NHDES considered all of these comments and carefully reviewed all existing advisories and standards set elsewhere. However, the process used by NHDES incorporates long-established methodologies for setting standards that use the most current, defensible science and incorporates expert professional judgements. The resulting proposed standards are protective of human health at all life stages. Specific criticisms of factors used in the derivation of the standards are in the technical comments table.

ATTACHMENT 2

New Hampshire Department of Environmental Services

Update on Cost and Benefit Consideration

June 28, 2019

NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES

UPDATE ON CONSIDERATION OF THE COSTS AND BENEFITS RELATED TO FINAL PROPOSED MAXIMUM CONTAMINANT LEVELS AND AMBIENT GROUNWATER QUALITY STANDARDS FOR PERFLUOROOCTANESULFONIC ACID (PFOS), PERFLUOROOCTANOIC ACID (PFOA), PERFLUORONONANOIC ACID (PFNA), AND PERFLUOROHEXANESULFONIC ACID (PFHXS)

6/28/2019

Chapter Law RSA 345 requires the New Hampshire Department of Environmental Services to consider what is known about cost and benefit to affected parties when proposing maximum contaminant levels (MCLs) and ambient groundwater quality standards (AGQSs). This consideration was documented in the "Summary Report on the New Hampshire Department of Environmental Services Development of Maximum Contaminant Levels and Ambient Groundwater Quality Standards for Perfluorooctanesulfonic Acid (PFOS), Perfluorooctanoic Acid (PFOA), Perfluorononanoic Acid (PFNA), and Perfluorohexanesulfonic Acid (PFHxS)", dated January 4, 2019 (January 2019 report), for the initial proposed rules and is updated here for the final proposal. As was the case for the initial proposal, the emerging nature of PFAS contamination limits the availability of certain information that would be needed for a complete quantification of all the costs and benefits that will result from adopting these rules. Examples of these limitations include not having extensive sampling data for all potential contamination sources and public water systems statewide and having an incomplete understanding of all the health impacts associated with exposure to these four PFAS. Since the initial proposal, NHDES has continued to gather information and further research what is known about costs and benefits to consider in determining the standards to be included in the final proposal. Consideration of the updated information was performed and due to the clear, although difficult to quantify, health benefits in limiting exposure, the department chose to not alter the health based standards, despite recognizing the significant implementation costs.

Additional information on costs and benefits considered is provided below:

BENEFITS:

In the case of benefits, a number of new studies continue to suggest significant health impacts related to these four compounds, confirming that PFAS may:

- Increase cholesterol levels
- Increase liver enzyme levels
- Affect growth, learning, and behavior
- Interfere with the body's natural hormones, including thyroid hormone levels and sex hormone levels that could affect reproductive development and a woman's fertility
- Affect the immune system (e.g., decrease how well the body responds to vaccines)
- Increase the risk of certain types of cancers

These same health risks are identified by the Agency for Toxic Substances and Disease Registry (ATSDR) an agency within the Centers for Disease Control (CDC). https://www.atsdr.cdc.gov/pfas/health-effects.html

Additionally, the recent publication "A transgenerational toxicokinetic model and its use in derivation of Minnesota PFOA water guidance" provides a peer reviewed method to estimate blood serum levels that result from exposure to PFOA (later papers and one currently under peer review documented similar capabilities for PFOS, PFNA and PFHxS) in infants and children. As the statute specifically required that proposed standards provide "*an adequate margin of safety to protect human health at all life stages, including but not limited to pre-natal development*", this insight into how developmental-stage blood serum levels respond to different amounts of each of the four PFAS in drinking water strongly suggests that the proposed lower MCLs/AGQSs are necessary to keep infant and children blood serum levels below the levels that indicate enhanced risk of the various health endpoints identified by the ATSDR above.

As was described in the January 2019 report, NHDES was not able to monetize the avoided health impact costs. However, some of these impacts are clearly associated with the developmental stage of life and therefore can have significant through-life costs such as direct health care treatment costs, the associated losses of economic production and income of those impacted, and the associated impacts to families and caregivers. NHDES came to this conclusion after reviewing the most recent published research and speaking with experts, including a group of professors and researchers at the University of New Hampshire (UNH) with whom NHDES recently contracted to quantify the benefits of reducing the arsenic MCL. After filing the initial proposal, NHDES continued to reach out to experts and search for valid methods for quantifying benefit. Two recent studies were identified that have attempted to quantify benefits. The utility of both these studies is discussed below. The lack of science identifying direct causality between health impacts and these compounds continues to limit quantification of benefit, as was discussed in the January 2019 report related to utilizing contingent valuation studies. It should be noted that this is not unique to PFAS regulation in other states, other compounds have been regulated once the linkage to negative health impacts was documented, but before direct causality and dose/rate relationships were clearly known. This precautionary process is followed in drinking water regulation to limit the harm identified while the exact benefit is quantified through longer term studies. NHDES, based on the most recent studies, is confident that there is a clear and significant benefit to reducing exposure to these compounds through drinking water while additional studies will help to more accurately quantify the specific health care costs avoided from the known, and to be discovered, specific health impacts caused by these four PFAS compounds.

A new study produced by the Nordic Council of Ministers "The Cost of Inaction, A socioeconomic analysis of environmental and health impacts linked to exposure to PFAS" has attempted to quantify costs associated with low, medium and high risks of exposure to PFAS. This report assumes that PFAS as a group directly causes certain associated health impacts and then assumes a percentage of reported health events, for instance for kidney cancer, is caused by exposure to PFAS above certain levels. While not directly of utility to quantifying the health benefit associated with the proposed standards for these four compounds in New Hampshire, it does provide further estimation of the avoided costs that could be associated with reduced exposure to PFAS. A summary of the report is attached.

Similarly, a recent study used a previous study, that showed a clear link between low to moderate exposure to PFOA and reduced birth weights, to estimate health impact costs. This study, "Perfluorooctanoic acid and low birth weight: Estimates of US attributable burden and economic costs from 2003 through 2014", showed that while blood serum levels in the general US population are going down, there are still impacts to birth weights and attempted to quantify the through-life cost impacts of

those reduced birth weights. This is based on the National Health and Nutrition Examination Survey (NHANES) database where the general population is measured on a number of factors, including PFAS blood serum levels. It is important to note that a number of New Hampshire communities have measured blood serum levels significantly above those found in the NHANES data, which implies there is significant benefit in reducing exposures to better align with the national averages, as this study indicates there are still health impacts (reduced birth weight) that could be reduced by limiting exposure prior to and during pregnancy. While this study cannot be directly related to NH's population to quantify a benefit due to health cost mitigation, it did calculate (for the entire United States population) that the health impacts due to reduced birth weight were $347 million in 2013-2014. It is a consideration that the national averages for PFOA blood serum levels during this time period were half what has been measured recently in some impacted NH communities. The cost implications estimated in the study when the US population had similar blood serum levels to NH's impacted communities was approximately $2.7B. While this does not quantify the benefits of reduced PFAS exposure, it does imply that the benefits are significant.

Finally, the treatment that will be used at most public water systems that exceed an MCL(s) is granular activated carbon. This treatment may provide an ancillary benefit of removing many other substances such as any new emerging chemicals and other unregulated, not well studied PFAS.

COSTS

Where data was available to derive estimates of implementation costs, the information including all assumptions was provided in the January 4, 2019, report. These estimates have been updated based on the newly proposed standards (i.e. costs to public water systems, groundwater discharge permittees and landfill and hazardous waste site ground water management permittees). Public comments were broadly received commenting on the methods used by NHDES and providing recent quotes for treatment systems in design or implementation. Some of these updated costs validated the methods used by NHDES and none of the comments identified any systemic flaws in the approach used. Therefore, NHDES has chosen to continue to use the original assumptions which provide uniformity across source types and allow direct comparison of the costs resulting from the lowered standards. The following table provides the summary of the initial cost estimates and the new estimated costs.

PFAS Source Type	Initial Proposal Estimate	Final Proposal Estimate
Public Water Systems*	Initial Treatment Costs: $1,851,354 - $5,171,022 Initial Sampling: $1,102,500 - $2,836,000 Annual O&M Costs: $114,912 - $223,439 Annual Sampling Costs $73,055 - $184,825	Initial Treatment Costs: $65,046,987 - $142,822,884 Initial Sampling: $1,102,500 - $2,836,000 Annual O&M Costs: $6,914,552 - $13,444,963 Annual Sampling Costs $174,257 - $444,409
Active Hazardous Waste Sites*	Initial Corrective Action Costs:	Initial Corrective Action Costs:

	$1,350,000 _ $2,310,000 Annual Operating Costs: $570,000 - $1,020,000	$2,315,000 - $4,440,000 Annual Operating Costs: $980,000 - $1,795,000
Municipal Landfills*	Initial Corrective Action Costs: $380,000 – 755,000 Annual Operating Costs: $260,000 - $390,000	Initial Corrective Action Costs: $935,000 - $1,755,000 Annual Operating Costs: $465,000 - $770,000
Wastewater Discharges to Groundwater*	Initial Corrective Action Costs: $1,100,000 Annual Operating Costs: $200,000 - $400,000	Initial Corrective Action Costs: $5,000,000 Annual Operating Costs: $ 849,000 - $1,600,000

* Assumptions for public water systems are contained in the January 9, 2019, report and include treatment of sources that exceed the MCL verses taking the well off line, blending or inter-connecting. For all other costs categories, see attached tables that provide assumptions and calculations used to create these estimates.

Adopting MCLs and AGQSs does not require private well owners to test for or treat their water supplies. However, given the publicity concerning these contaminants and the low standards for them in public drinking water, it is likely that many homeowners may voluntarily choose to test and install treatment in their homes. Based on sampling in areas without likely sources of PFAS contamination, NHDES estimates that as much as 9% of the estimated 250,000 private wells will exceed the proposed standards which could result in an estimated initial cost of treatment of $70,895,522 and annual maintenance cost of $21,268,657. This is likely an overestimation since some homeowners will choose not to test, and some who test will choose not to treat.

In general, the qualitative explanation for sites that may be potential sources of contamination for which we have no or very limited data remains the same as what was presented in the January report. An exception to this is municipal fire stations. Based on an ongoing initiative to test 34 fire stations that may have used AFFF foams and are located in close proximity to wells, only 2 have levels above the proposed standards to date. This suggests there may be limited occurrence of PFAS at levels above the proposed standards near fire stations and accordingly costs associated with this potential source type may be overestimated in the January 9, 2019 report.

ATTACHMENT C

American Water Works Association
Dedicated to the World's Most Important Resource™

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August 8, 2019

Lilia Ledezma
Analyst, Public and Private Mandates Unit
Congressional Budget Office
Ford House Office Building, Room 441 A
Second and D Streets, SW
Washington, DC 20515-6925

RE: S.1507 - PFAS Release Disclosure Act

Dear Ms. Ledezma,

The American Water Works Association has compiled the following information in response to your information request. The following is preliminary, reflecting the need to gather information quickly so as to be timely and useful to the Congressional Budget Office's work.

AWWA focused on responding to the following questions:

1. How would bill S. 1507 affect private and public water systems, state, local and tribal governments?
    a. setting new monitoring and testing processes (if needed)
        i. testing, monitoring, and reporting new requirements to the Safe Drinking Water Act including collecting samples, training personnel, reporting.
    b. remediation costs, including
        i. new treatment technology to remove substances
        ii. new personnel
        iii. training personnel
    c. coordination with nearby industries that may release the contaminants

2. Where is there a recent report estimating testing and data collection costs relevant to S. 1507?

The questions posed do not address the public health benefits associated with the control of per- and polyfluoroalkyl substances (PFAS). We would refer you to the Office of Groundwater and Drinking Water at the U.S. Environmental Protection Agency for assistance estimating the benefits of S. 1507 requirements.

As you will see in the attached several EPA documents can be referenced in estimating the administrative burden and monitoring and reporting requirements associated with the S.1507. There are a number of data gaps associated with estimating the cost of drinking water treatment associated with the legislation. The attached includes a discussion of the information sources and considerations for such an analysis. AWWA also prepared a preliminary estimate to illustrate the analysis that is feasible with available information, particularly recognizing the limited time available to your office to prepare an estimate.

- Depending on how the legislation is finalized we found the potential capital costs associated with implementing drinking water treatment to remove perfluorooctanoic acid (PFOA); and perfluorooctane sulfonic acid (PFOS) in drinking water to quickly exceed $3 billion and, if federal implementation were to mirror the direction of state-level efforts, capital costs would exceed $38 billion.
- In addition to debt service, recurring annual operation and maintenance (O&M) costs reach $150 million, and could reach $1.3 billion for a drinking water maximum contaminant level (MCL) for PFOA and PFOS.
- There is the potential, given the limited understanding of PFAS removal that a treatment standard would be based on reverse osmosis and entail more than $530 billion in capital investment and over $16 billion in annual O&M costs.

In preparing this analysis we were not able to adequate represent all consequences of the legislative text, e.g.,

- Community-level response, including the addition of water treatment, in response to health advisories for PFAS as described in S.1507
- Loss of water supply and associated water system resiliency
- Implications for state revolving loan fund allocation
- Availability of funds for other infrastructure investments like implementation of the Long-Term Lead and Copper Rule.

Please see the attached responses to the questions posed in the attached. An extract of the relevant S.1507 legislative text is also included for reference.

If you have any questions regarding the attached, please contact Steve Via or Chris Moody at (202) 628-8303.

Best regards,

G. Tracy Mehan, III
Executive Director for Government Affairs
American Water Works Association

cc: Jennifer McLain, EPA/OW/OGWDW
Andrew Hanson, EPA/IGA

Who is AWWA

The American Water Works Association (AWWA) is an international, nonprofit, scientific and educational society dedicated to providing total water solutions assuring the effective management of water. Founded in 1881, the Association is the largest organization of water supply professionals in the world. Our membership includes more than 4,000 utilities that supply roughly 80 percent of the nation's drinking water and treat almost half of the nation's wastewater. Our 50,000-plus total membership represents the full spectrum of the water community: public water and wastewater systems, environmental advocates, scientists, academicians, and others who hold a genuine interest in water, our most important resource. AWWA unites the diverse water community to advance public health, safety, the economy, and the environment.

ATACHMENT 1. RESPONSES TO QUESTIONS POSED

How would bill S. 1507affect private and public water systems, state, local and tribal governments?

Under the Safe Drinking Water Act (SDWA), there is no distinction between private and public water systems. All are treated the same. In either instance, the cost of implementing federal requirements are passed on directly to ratepayers. Relevant SDWA definitions (42 U.S. Code § 300f. Definitions) include:

> Public Water System -- "The term "public water system" means a system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if such system has at least fifteen service connections or regularly serves at least twenty-five individuals. …"
>
> Community water system (CWS)– "means a public water system that—(A) serves at least 15 service connections used by year-round residents of the area served by the system; or (B) regularly serves at least 25 year-round residents."
>
> Noncommunity water system (NCWS)– "a public water system that is not a community water system."

Note that standards set under SDWA do not apply to individual, household wells.

CWSs may be operated by local government (e.g., a village, town, city, county), a creature of local government (e.g., a public service authority), or a creature of the state (e.g., Massachusetts Water Resource Authority). Local government may also contract or sell the operation of water infrastructure to a private utility (e.g., a for-profit company, non-profit cooperative, etc.). In any of these instances, local government is directly or indirectly engaged in oversight of the CWS.

Based on data from the Safe Drinking Water Information System (SDWIS), 46% of CWSs are privately owned. Importantly the majority of those CWSs that are privately owned serve less than 500 persons. These CWSs may be subdivisions, manufactured home communities, public housing developments or apartment buildings that have their own water system. These CWSs would, like municipally-based systems, pass the cost of regulatory implementation on to the year-round residents, if not through rates, through other fee / cost mechanisms.

Seventy percent of Non-transient NCWSs (NTNCWSs) are privately owned reflecting the nature of NTNCWSs (e.g., schools, factories, office buildings, and hospitals which have their own water systems). These NTCWSs would incorporate the cost of compliance into their operating budgets, passing those costs on as necessary. For example, in the case of public schools these costs come back to local government budget processes.

While states may own / operate water systems that are regulated under SDWA, the primary burden on states is the oversight of rule implementation. Implementation of SDWA is delegated to states and some

tribes also implement SDWA. EPA provides direct implementation in the District of Columbia, Wyoming, and U.S. territories. Oversight entails:

1. Changing appropriate state regulations to incorporate and implement the new federal requirements (such changes can require state legislative action)
2. Modifying existing data systems in collaboration with EPA to track compliance
3. Informing systems of compliance obligations
4. Supervising system compliance strategies including construction of capital facilities
5. Processing of compliance monitoring data and PWS reports (e.g., monthly operating reports)
6. Modification and execution of sanitary surveys and other mechanisms used to ensure compliance (beyond monitoring compliance data)
7. Modification of operator certification testing
8. Ensuring that training is available to support operator certification
9. Directing state capacity assistance programs and associate support programs to assist systems (typically small systems) with compliance challenges

The Association of State Drinking Water Administrators has prepared a recent analysis of state oversight program costs for potential revisions to the Lead and Copper Rule. While that analysis does not directly address the cost of implementing a new MCL it does illustrate the nature of rule implementation. The study, Costs of States' Transactions Study (CoSTS) For Potential Long-Term Revisions to the Lead and Copper Rule (LT-LCR) (April, 2018) is available at https://www.asdwa.org/wp-content/uploads/2018/05/CoSTS-Report-Final-2018.pdf.

Section 5 of EPA's Health Risk Reduction and Cost Analysis of the Proposed Perchlorate National Primary Drinking Water Regulation illustrates the burden of rule implementation (May 2019, EPA 816-R-19-004, (EPA-HQ-OW-2018-0780-0124), Available at https://www.regulations.gov/document?D=EPA-HQ-OW-2018-0780-0124). In referencing this material, note that perchlorate in an inorganic contaminant within the SDWA Standard Monitoring Framework and consequently less frequent monitoring requirements apply.

Number of Systems to Consider in Evaluating Treatment and Monitoring Costs

The number of impacted systems is based on data available from SDWIS. If previous rules offer insight into implementation of S. 1507 requirements, then provisions are likely applicable to both CWSs and NTNCWSs. There are 49,678 CWSs and 17,558 NTNCWSs that are currently identified as active in SDWIS, which would likely be required to comply with regulatory requirements under S.1507 provisions and thus undertake monitoring and potentially incur the cost of additional drinking water treatment.

Number of CWS and NTNCWS by System Size

Size Category	Population Range	System Count		
		CWS	NTNCWS	Total
1	0–100	11,788	8,456	20,244
2	101–500	15,207	6,465	21,672
3	501–1,000	5,342	1,569	6,911
4	1,001–3,300	7,999	874	8873
5	3,301–10,000	4,994	154	5148
6	10,001–50,000	3,343	38	3381
7	50,001–100,000	567	1	568
8	100,001–1,000,000	414	1	415
9	> 1,000,001	24	0	24
	Total	49,678	17,558	67,236

More detailed population category breakdowns are available through SDWIS.

Roughly 15% of CWS and NTNCWS are consecutive systems. That is, they purchase water from another water system. This is an important distinction for estimating the impacts of legislative action in that:

1. All water systems must comply with SDWA provisions independently (every PWS stands alone when it comes to compliance).
2. All water systems subject to a rule must conduct the associated monitoring.
3. When a new requirement takes effect, water systems must evaluate how best to comply, it may be that:
    a. The wholesale water system supplying water to a consecutive system does not have elevated contaminant levels warranting treatment.
    b. The wholesale system must install treatment and pass that cost on to its own customers and it wholesale accounts.
    c. The combination of supplies available to the consecutive system are such that it must install treatment itself, build / utilize an intertie with an alternative wholesale system, or develop a new source of supply.
    d. The consecutive system's customers are best served by consolidating with another water system in order to comply.

Regardless of whether a wholesale system or the consecutive system constructs additional treatment facilities to comply with requirements, additional treatment capacity is required to meet the water supply demand of all of impact system's service population.

Number of CWS and NTNCWS by Source of Supply

Size Category	Population Range	Ground Water	Surface Water	Purchased
1	0–100	18,656	555	1,015
2	101–500	18,268	745	2,648
3	501–1,000	5,214	368	1,325
4	1,001–3,300	5,796	931	2,143
5	3,301–10,000	2,716	977	1,454
6	10,001–50,000	1,321	978	1,082
7	50,001–100,000	157	221	190
8	100,001–1,000,000	72	246	97
9	> 1,000,001	2	21	1
	Total	52,202	5,042	9,955

Note – Incomplete information in SDWIS leads to discrepancies in totals.

Where is there a recent report estimating testing and data collection costs relevant to S. 1507?

S. 1507 includes two different sampling requirements:

1. Expansion of Unregulated Contaminant Monitoring to include all PFAS for which there is an analytical method and
2. Monitoring to support implementation of the required primary drinking water standard for PFAS.

There are a number reference documents CBO should be aware of with respect to estimating the federal, state and system level costs associated with monitoring. Those references include:

1. Information Collection Request Summaries for the Unregulated Contaminant Monitoring Rule
    a. Statistical Design and Sample Selection for the Unregulated Contaminant Monitoring Regulation (1999), August 2001, EPA 815-R-01-004 (EPA-HQ-OW-2009-0090-0131), (Available at https://www.regulations.gov/document?D=EPA-HQ-OW-2009-0090-0131)
    b. Information Collection Request Renewal for the Unregulated Contaminant Monitoring Rule (UCMR 3), March 2012, (EPA-HQ-OW-2009-0090-0143) (Available at https://www.regulations.gov/document?D=EPA-HQ-OW-2009-0090-0143)

c. Information Collection Request Renewal for the Unregulated Contaminant Monitoring Rule (UCMR 4), EPA 815-B-15-003, November 2015. (EPA-HQ-OW-2015-0218-0056) Available at (file:///C:/Users/svia/Downloads/EPA-HQ-OW-2015-0218-0056%20(1).pdf)

2. Information Collection Request Summaries for the SDWA Inorganic Contaminant Rule

   a. Information Collection Request (ICR): Disinfectants/Disinfection Byproducts, Chemical, and Radionuclides Information Collection Request, April 2004 (EPA-HQ-OW-2004-0009-0002) Available at file:///C:/Users/svia/Downloads/EPA-HQ-OW-2004-0009-0002.pdf

   b. ICR History is available at https://www.reginfo.gov/public/Forward?SearchTarget=PRA&textfield=+2040-0204

Unregulated Contaminant Monitoring Rule Monitoring

Section 2021 of the America's Water Infrastructure Act of 2018 (P.L. 115-270, Available at https://www.congress.gov/bill/115th-congress/senate-bill/3021?q=%7B%22search%22%3A%5B%22Public+Law+115%5Cu2013270%22%5D%7D&s=7&r=1) requires EPA, if funds are available, to collect data from all public water systems serving more than 3,300 persons and a statistically valid sample of smaller systems in future UCMR cycles. There is parallel text with respect to UCMR monitoring in S. 1507 for the required PFAS monitoring. EPA-HQ-OW-2009-0090-0131 provides an explanation of the statistical basis for the UCMR sampling. All public water systems (PWS) serving more than 10,000 persons incur all UCMR monitoring costs while EPA is to fund sampling, analysis, and related shipping (e.g., bear the cost of monitoring). If implemented as drafted, the cost of this provision would be in addition to monitoring costs for the fifth round of UCMR monitoring rather than a component of UCMR5.

The implication of this guidance as discussed by EPA at its July 16, 2019, UCMR5 stakeholder meeting is that future UCMRs will involve sampling from all public water systems serving more than 3,300 persons (9,512 systems) and a sample of more than 800 systems serving less than 3,300 persons.[1] Whether additional federal funding will be available to extend monitoring to include these 5,147 water systems is unknown. Past UCMR implementation costs are captured in a few specific tables in the EPA information collection request justifications:

- EPA-HQ-OW-2009-0090-0143 illustrates the cost burdens associated with UCMR monitoring for PFAS under UCMR3. EPA-HQ-OW-2015-0218-0056 illustrates cost burdens for the current UCMR4 cycle but does not specifically include monitoring for PFAS compounds.
- Exhibit 7 and 8 in EPA-HQ-OW-2004-0009-0002 summarize the burden of ongoing monitoring under SDWA including the Volatile Organic Compound and Synthetic Organic Contaminants monitoring which would be models for monitoring to support PFAS MCLs.

[1] The presentation materials are not yet posted to the EPA UCMR website but are anticipated in the near future (https://www.epa.gov/dwucmr/unregulated-contaminant-monitoring-rule-ucmr-meetings-and-materials).

During the UCMR5 stakeholder meeting in July EPA indicated that it would have two PFAS analytical methods available (EPA Method 537.1 and 533). Method 537.1 is currently available for use; Method 533 is still in development, consequently cost and performance information is incomplete at this time.

The cost of implementing UCMR at the federal, state, and water system level is a five-year endeavor. While the direct costs associated with monitoring occur over a three-year window, there is a year of pre-monitoring preparation, and for EPA, states, and some systems a final year of data quality control and report generation. It is likely that the costs of expanding the current program to the larger sample as directed in AWIA / S.1507 will require additional investment in federal and state personnel, contractor support, and improvement of data systems, above and beyond extrapolation of the current implementation costs to 5,147 more systems.

Compliance Monitoring

Currently, requirements for monitoring regulated VOCs and SOCs adhere to the SDWA "Standard Monitoring Framework." The monitoring framework is summarized in two documents:

1. Standard Monitoring Framework, February 1991. (EPA 570/F-91-045) (Available at https://nepis.epa.gov/Exe/ZyPDF.cgi/10003I17.PDF?Dockey=10003I17.PDF)
2. The Standardized Monitoring Framework: A Quick Reference Guide, March 2004, (EPA 816-F-04-010) (Available at https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=3000667K.txt)

Important elements to reflect in costing compliance monitoring for PFAS include:

1. Costs are likely to be borne by all CWS and NTNCWS (i.e., approximately 67,236 systems).
2. The cost of monitoring of analytical methods like EPA Method 537.1 is as much as $500 per sample (EPA Method 537.1 would be adequate to support PFOA an PFOS monitoring; it could also support monitoring other PFAS for which EPA is preparing risk assessments).
3. Sample costs are by entry-point-to-the distribution system, not water system. Most water systems have multiple EPTDSs. EPA has a standard table of EPTDS/system as a function of system size based on the Community Water System Survey (last published in 2009, Available at https://www.epa.gov/dwstandardsregulations/community-water-system-survey). See following table.

Number of EPTDS and Associated Design Flows as a Function of System Size

Size Category	Population Range	Entry Points/ System	Design Flow from each Entry Point (gpm)
1	0–100	2.4	5
2	101–500	2.0	35
3	501–1,000	2.1	82
4	1,001–3,300	1.9	252
5	3,301–10,000	2.2	657
6	10,001–50,000	3.1	2,027
7	50,001–100,000	4.1	3,767
8	100,001–1,000,000	6.6	16,283
9	> 1,000,001	14.5	19,906

4. As described in EPA 816-F-04-010 it is possible for systems to be allowed to take smaller numbers of samples over time, but at a minimum sampling is quarterly for the initial three years of sampling. At which time the system may be eligible for reduced monitoring at the primacy agency's discretion. In current practice, detection of a contaminant means that sampling will be ongoing on at least an annual basis and observation at levels closer to the MCL warrant more regular monitoring. There is variability in burden as a function of system size and whether the supply is groundwater or surface water. Groundwater is generally judged to be less variable over time than surface water, so reduced monitoring is available more rapidly.
5. The EPA summary of current compliance monitoring costs reflect ongoing mature monitoring costs, where there are monitoring waivers or reduced monitoring in place, rather than reflecting start-up monitoring.
6. The fact sheet, Per- and Polyfluoroalkyl Substances (PFASs) Monitoring, Sampling, and Analysis (July 2019, Available at https://www.awwa.org/LinkClick.aspx?fileticket=ufb-Vl3VrVY%3d&portalid=0) provides a brief overview of PFAS analytical methods.

New Treatment Technology to Remove Substances

S. 1507 directs EPA to regulate perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS). It also directs EPA to evaluate a regulatory option where a measure of total PFAS is employed.

The national cost of a regulation for PFAS will vary significantly based on two regulatory decisions: (1) the specific PFAS that are included in the regulation and (2) the maximum contaminant levels (MCLs). These two factors will determine the number of systems that are impacted as well as the treatment objectives of the facilities, which may require different, or multiple, types of treatment technology for compliance.

Should EPA finalize risk assessments for additional PFAS, six such assessments are underway, then these too would lead to addition of drinking water treatment in some communities. There is not enough information from these risk assessment processes, treatment studies, and occurrence data to adequately

inform the current effort. Several of these PFAS are less amenable to drinking water treatment than PFOA and PFOS.

Approach to Preparing Preliminary Cost Estimation

AWWA prepared an illustrative national cost analysis using available information to demonstrate both the challenges of developing such an analysis and the policy relevance of an estimate. The following cost estimate is based on:

1. Data from Safe Drinking Water Information System (SDWIS) to determine the number of systems in each size category.
2. Water Treatment Plant design flows and numbers of treatment facilities per water system size category as utilized by EPA in its cost analyses. (see above table).
3. Initial capital cost and recurring annual operation and maintenance (O&M) costs from representative projects with similar treatment technologies and/or with the objective of PFAS removal. Data was used to develop cost models to project these costs based on the water system size. Cost data was collected for treatment processes relevant to PFAS including activated carbon, ion exchange and reverse osmosis. These processes were considered since they are the most studied, and most effective, processes for removing PFOA and PFOS. It is important to note that these treatment processes have more limited research on removal of other PFAS and typically have varying degrees of removal success based on the individual PFAS in the drinking water.
4. PFAS monitoring data from the Third Unregulated Contaminant Monitoring Rule, which was used along with SDWIS data to determine the number of water systems in each size category that would be impacted by potential PFAS regulations of 20 ppt, 40 ppt, and 70 ppt. Importantly, these estimates are based on occurrence data for PFOA and PFOS, not all PFAS, in public water systems.

In the rulemaking process, EPA will prepare a more detailed cost analysis. When EPA conducts its analysis, its practice is to estimate the number of systems that are likely to be triggered to install treatment and to forecast the distribution of treatment technologies that will be applied (e.g., x percent will utilize granular activated carbon, y percent will utilize ion exchange). Because such forecasts require more information than is currently available the best option for a planning level national cost estimate is to represent the national cost assuming all systems used a particular technology (e.g., all systems used GAC, all systems used IX, all systems used reverse osmosis). EPA will also be better positioned to take into account the impact of individual state regulations on the number of water systems that will make treatment changes to comply with requirements resulting from S.1507.

While the treatment technologies used for this estimate are well known, their applicability on PFAS is still a topic of active research. The choice of a particular technology, or combination of technologies, is not only dependent on treatment objectives for PFAS but also the system's existing facilities, other treatment objectives or requirements, and the characteristics of the water they are trying to treat. As noted above, the costs reflected here are for treatment based on PFOA and PFOS occurrence, not the level of treatment required. Some PFAS are not as readily removed as others leading to more rapid breakthrough of GAC and IX media, consequently some systems may have more expensive treatment processes based on the need to replace media more often. Setting individual compound treatment goals at lower

concentrations or summing more compounds within a single numeric limit has a similar effect – necessitating more frequent replacement of the media.

National Capital Cost to Install Treatment

Treatment Objective	Capital Costs ($ millions)		
	Granular Activated Carbon	Ion Exchange	Reverse Osmosis
< 70 ng/L	$2,100 - $4,400	$1,900 - $4,100	$5,700 - $12,000
< 40 ng/L	$5,600 - $12,000	$5,400 - $12,000	$15,000 - $33,000
< 20 ng/L	$23,000- $50,000	$22,000 - $48,000	$63,000 - $140,000
Treatment Technique	$140,000 - $290,000	$130,000 - $280,000	$370,000 - $800,000

National Annual Operating and Maintenance Cost for Installed Treatment

Treatment Objective	**Annual Recurring Costs ($ millions)**		
	Granular Activated Carbon	Ion Exchange	Reverse Osmosis
≤ 70 ng/L	$44 - $90	$210 -$460	$190 - $410
≤ 40 ng/L	$110 - $240	$540 - $1,200	$480 -$1,000
≤ 20 ng/L	$460 - $980	$2,200 - $4,800	$2,000 - $4,200
Treatment Technique	$2,700 - $5,800	$13,000 - $28,000	$12,000 - $25,000

In describing treatment costs, it is important to consider both capital and O&M costs. When making site-specific treatment decisions water systems will try to achieve reliable treatment while managing project life-cycle costs, and do so with a margin of safety. Consequently, in some scenarios what in general looks like the least cost option will not be the most effective investment for a given water system. Because investments in advanced treatment are long-term investments, uncertainty in treatment objectives leads to conservatism beyond simply assuring reliable compliance with an MCL; this too leads actual system improvements toward consideration of more conservative treatment goal, use of multiple unit operations and selection of more expensive treatment technologies.

As noted above, the treatment objective is a significant determinant of cost. The above tables illustrate four different regulations. These national estimates are a function of the number of systems estimated to require additional treatment based on combined PFOA and PFOS levels exceeding the regulatory limits. While we have information from UCMR 3 and state level efforts, which can be used estimate the occurrence of PFOA and PFOS, there is not an analysis of the occurrence of PFAS as a class, or a surrogate measure of PFAS. The above estimates based on treatment objectives of 70, 40, and 20 ng/L reflect reported UCMR occurrence data and subsequent re-analysis of UCMR data. The final row in the table reflects a duty by all CWS and NTNCWS to meet a treatment standard. This is a regulatory approach that is used when an adequate analytical method is not available for a contaminant.

As noted above, EPA has a duty under SDWA to prepare a sound benefit-cost estimate for a rulemaking, that estimate will need to overcome significant limitations in the above analytical approach by:

1. Being based on demonstrated removal efficiencies for all of the target contaminants.
2. Forecasting the distribution of treatment technologies taking the actual target contaminants and water matrix effects into account.
3. Incorporating the additional SDWA treatment requirements associated with adding advanced treatment to what are now small groundwater systems without treatment.

EPA will also be better able to take into account consequences of this and other legislative actions. To the extent that state or federal legislation action impacts (1) stack emissions from GAC regeneration (e.g., controls on stack emissions), (2) requires disposal of GAC or IX media as hazardous waste, or (3) restricts the release of PFAS through NPDES permits, those costs will need to be incorporated into the cost of drinking water treatment. The costs associated with residual stream management can be quite significant. While data is not available for PFAS, analyses conducted to inform the California Hexavalent Chromium MCL process demonstrate the impact of residuals management on treatment option selection and implementation costs.[2] To the extent that compliance is reliant on technologies like reverse osmosis, in the absence of significant technological advances, brine disposal for many communities relies on disposal in Underground Injection Control program wells.

Note that as the CBO request included a specific query on administration and monitoring costs, the above treatment costs do not include either – they are simply a planning level estimate (i.e., -30% /+50% estimate for the cost of implementing necessary treatment facilities to address PFAS in drinking water systems. A cost estimate should also consider the following financial implications due to the new regulations with respect to system resiliency, e.g.,

- If, and how, the investment in treatment might increase, or decrease, protection against other likely water quality risks?
- To what degree will available water supplies be reduced (e.g., water supply wells taken off-line, impacts on ongoing aquifer storage and recovery programs, creation of brine streams, etc.)?
- How will the treatment investment impact funding availability for other infrastructure investments like implementation of the Long-Term Lead and Copper Rule?

[2] Arcadis. Final Report – Hexavalent Chromium Treatment Residuals Management, March 27, 2012, (Prepared for the Association of California Water Agencies and the City of Glendale Water and Power.
Chad J. Seidel, Issam N. Najm, Nicole K. Blute, Christopher J. Corwin, XueyiNg Wu, National and California treatment costs to comply with potential hexavalent chromium MCLs, Journal AWWA, First published: 01 June 2013 https://doi.org/10.5942/jawwa.2013.105.0080.

ATTACHMENT 2. REFERENCES FOR TREATMENT COST ESTIMATE

PFAS Treatment Project References for Treatment Cost Estimate

Facility	Treatment Capacity	Treatment Option	Capital Cost Estimate	Annual O&M Estimate
Cape Fear Public Utility Authority[1]	44 MGD	GAC	$46M	$2.7M
		IX	$46M	$2.1M
		RO	$150M	$4.7M
Brunswick County Public Utilities[2]	36 MGD	RO	$99M	$2.9M
		Ozone w/Biofiltration and GAC	$99M	$4.7M
		GAC w/IX and UV-AOP	$84M	$4.7M
Merrimack Village District (MVD)[3]	2.88 MGD	GAC	$3.6M to $4.3M	$0.13M to $0.27M
		IX	$4.4M to $5.1M	$0.12M to $0.19M
	1.44 MGD	GAC	$6.9M	$0.12M to $0.19M
		IX	$7.4M	$0.25M to $0.61M
	4.32 MGD	GAC	$10.9M	$0.24M to $0.43M
		IX	$12.2M	$0.52M to $1.4M
City of Portsmouth (Pease)[4]	1.67 MGD	GAC	$13M	$0.16M
West Morgan East Lawrence Water Authority[5]	8 MGD	GAC	$4M	$0.6M
		RO	$40M to $80M	N/A
Ann Arbor, MI[6]	22 MGD	GAC	N/A	$0.35M
Issaquah, WA[7,8]	0.36 MGD	GAC	$1M	N/A

1. https://www.cfpua.org/DocumentCenter/View/11386/BlackVeatch_FinalReport
2. https://www.brunswickcountync.gov/wp-content/uploads/2018/04/CDM-Smith-Brunswick-Final-Report-April-2018.pdf
3. http://www.mvdwater.org/wp-content/uploads/2018/12/PFAS-Treatment-Feasibility-Report-237-8-Final.pdf
4. http://files.cityofportsmouth.com/publicworks/Pease%20Well%20Treatment%20Cost%20Alternative%20Report%20-%20June%202017%20(Final).pdf
5. https://www.waaytv.com/content/news/WAAY-31-I-Team-Investigation-Cleaning-contaminated-water-483249661.html
6. https://energycommerce.house.gov/sites/democrats.energycommerce.house.gov/files/documents/05.15.19 Witness Testimony_Steglitz.pdf
7. https://pfasproject.com/issaquah-washington/
8. https://www.issaquahwa.gov/DocumentCenter/View/2810

Similar Treatment Process Project References for Treatment Cost Estimate

Facility	Treatment Capacity	Treatment Option	Capital Cost Estimate	Annual O&M Estimate
Aurora, CO[1]	10 MGD	Brackish RO	$33M	N/A
Multiple Systems, TX[2]	1.2 to 27.5 MGD	Brackish RO	$2.75M to $118M[4]	$0.5M to $6.5M[4]
Multiple Systems, FL[4]	2.0 to 10 MGD	IX	$0.85M to $4M	N/A
State of Industry Model[5]	2.7 to 27 MGD	Brackish RO	$9.5M to $60M[4]	N/A
	0.1 to 10 MGD	Brackish RO	N/A	$0.06 to $2M[4]

1. https://awwa.onlinelibrary.wiley.com/doi/pdf/10.5942/jawwa.2017.109.0020
2. http://www.twdb.texas.gov/innovativewater/desal/doc/Cost_of_Desalination_in_Texas_rev.pdf
3. In some cases, reported cost estimates are greater than 5 years old and have been updated to reflect inflation.
4. https://scholarcommons.usf.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=7837&context=etd
5. https://wrrc.arizona.edu/sites/wrrc.arizona.edu/files/programs/conf2011/pdf/Lozier.pdf

ATTACHMENT 3. EXCERPT OF RELEVANT TEXT FROM S.1507 - PFAS RELEASE DISCLOSURE ACT

TITLE II—DRINKING WATER

SEC. 201. NATIONAL PRIMARY DRINKING WATER REGULATIONS FOR PFAS.

Section 1412(b)(2) of the Safe Drinking Water Act (42 U.S.C. 300g–1(b)(2)) is amended by adding at the end the following:

"(D) PERFLUOROALKYL AND POLYFLUOROALKYL SUBSTANCES.—

"(i) IN GENERAL.—Not later than 2 years after the date of enactment of this subparagraph, the Administrator shall promulgate a national primary drinking water regulation for perfluoroalkyl and polyfluoroalkyl substances, which shall, at a minimum, include standards for—

"(I) perfluorooctanoic acid (commonly referred to as 'PFOA'); and

"(II) perfluorooctane sulfonic acid (commonly referred to as 'PFOS').

"(ii) ALTERNATIVE PROCEDURES.—

"(I) IN GENERAL.—Not later than 1 year after the validation by the Administrator of an equally effective quality control and testing procedure to ensure compliance with that national primary drinking water regulation to measure the levels described in subclause (II) or other methods to detect and monitor perfluoroalkyl and polyfluoroalkyl substances in drinking water, the Administrator shall add the procedure or method as an alternative to the quality control and testing procedure described in that national primary drinking water regulation by publishing the procedure or method in the Federal Register.

"(II) LEVELS DESCRIBED.—The levels referred to in subclause (I) are—

"(aa) the level of a perfluoroalkyl or polyfluoroalkyl substance;

"(bb) the total levels of perfluoroalkyl and polyfluoroalkyl substances; and

"(cc) the total levels of organic fluorine.

"(iii) INCLUSIONS.—The Administrator may include a perfluoroalkyl or polyfluoroalkyl substance or class of perfluoroalkyl or polyfluoroalkyl substances on—

"(I) the list of contaminants for consideration of regulation under paragraph (1)(B)(i); and

"(II) the list of unregulated contaminants to be monitored under section 1445(a)(2)(B)(i).

"(iv) MONITORING.—When establishing monitoring requirements for public water systems as part of a national primary drinking water regulation under clause (i) or clause (vi)(II), the Administrator shall tailor the monitoring requirements for public water systems that do not detect or are reliably and consistently below the maximum contaminant level (as defined in section 1418(b)(2)(B)) for the perfluoroalkyl or polyfluoroalkyl substance or class of perfluoroalkyl or polyfluoroalkyl substances subject to the national primary drinking water regulation.

"(v) HEALTH RISK REDUCTION AND COST ANALYSIS.—In meeting the requirements of paragraph (3)(C), the Administrator may rely on information available to the Administrator with respect to 1 or more specific perfluoroalkyl or polyfluoroalkyl substances to extrapolate reasoned conclusions regarding the health risks and effects of a class of perfluoroalkyl or polyfluoroalkyl substances of which the specific perfluoroalkyl or polyfluoroalkyl substances are a part.

"(vi) REGULATION OF ADDITIONAL SUBSTANCES.—

"(I) DETERMINATION.—The Administrator shall make a determination under paragraph (1)(A), using the criteria described in clauses (i) through (iii) of that paragraph, whether to include a perfluoroalkyl or polyfluoroalkyl substance or class of perfluoroalkyl or polyfluoroalkyl substances in the national primary drinking water regulation under clause (i) not later than 18 months after the later of—

"(aa) the date on which the perfluoroalkyl or polyfluoroalkyl substance or class of perfluoroalkyl or polyfluoroalkyl substances is listed on the list of contaminants for consideration of regulation under paragraph (1)(B)(i); and

"(bb) the date on which—

"(AA) the Administrator has received the results of monitoring under section 1445(a)(2)(B) for the perfluoroalkyl or polyfluoroalkyl substance or class of perfluoroalkyl or polyfluoroalkyl substance; or

"(BB) the Administrator has received finished water data or finished water monitoring surveys for the perfluoroalkyl or polyfluoroalkyl substance or class of perfluoroalkyl or polyfluoroalkyl substances from a Federal or State agency that the Administrator determines to be sufficient to make a determination under paragraph (1)(A).

"(II) PRIMARY DRINKING WATER REGULATIONS.—

"(aa) IN GENERAL.—For each perfluoroalkyl or polyfluoroalkyl substance or class of perfluoroalkyl or polyfluoroalkyl substances that the Administrator determines to regulate under subclause (I), the Administrator—

"(AA) not later than 18 months after the date on which the Administrator makes the determination, shall propose a national primary drinking water regulation for the perfluoroalkyl or polyfluoroalkyl substance or class of perfluoroalkyl or polyfluoroalkyl substances; and

"(BB) may publish the proposed national primary drinking water regulation described in subitem (AA) concurrently with the publication of the determination to regulate the perfluoroalkyl or polyfluoroalkyl substance or class of perfluoroalkyl or polyfluoroalkyl substances.

"(bb) DEADLINE.—

"(AA) IN GENERAL.—Not later than 1 year after the date on which the Administrator publishes a proposed national primary drinking water regulation under item (aa)(AA) and subject to subitem (BB), the Administrator shall take final action on the proposed national primary drinking water regulation.

"(BB) EXTENSION.—The Administrator, on publication of notice in the Federal Register, may extend the deadline under subitem (AA) by not more than 6 months.

"(vii) LIFETIME DRINKING WATER HEALTH ADVISORY.—

"(I) IN GENERAL.—Subject to subclause (II), the Administrator shall publish a health advisory under paragraph (1)(F) for a perfluoroalkyl or polyfluoroalkyl substance or class of perfluoroalkyl or polyfluoroalkyl substances not later than 1 year after the later of—

"(aa) the date on which the Administrator finalizes a toxicity value for the perfluoroalkyl or polyfluoroalkyl substance or class of perfluoroalkyl or polyfluoroalkyl substances; and

"(bb) the date on which the Administrator validates an effective quality control and testing procedure for the perfluoroalkyl or polyfluoroalkyl substance or class of perfluoroalkyl or polyfluoroalkyl substance, if such a procedure did not exist on the date on which the toxicity value described in item (aa) was finalized.

"(II) WAIVER.—The Administrator may waive the requirements of subclause (I) with respect to a perfluoroalkyl or polyfluoroalkyl substance or class of perfluoroalkyl and polyfluoroalkyl substances if the Administrator determines that there is a substantial likelihood that the perfluoroalkyl or polyfluoroalkyl substance or class of perfluoroalkyl or polyfluoroalkyl substances will not occur in drinking water.".

SEC. 202. MONITORING AND DETECTION.

(a) MONITORING PROGRAM FOR UNREGULATED CONTAMINANTS.—

(1) IN GENERAL.—The Administrator shall include each substance described in paragraph (2) in the fifth publication of the list of unregulated contaminants to be monitored under section 1445(a)(2)(B)(i) of the Safe Drinking Water Act (42 U.S.C. 300j–4(a)(2)(B)(i)).

(2) SUBSTANCES DESCRIBED.—The substances referred to in paragraph (1) are perfluoroalkyl and polyfluoroalkyl substances and classes of perfluoroalkyl and polyfluoroalkyl substances—

(A) for which a method to measure the level in drinking water has been validated by the Administrator; and

(B) that are not subject to a national primary drinking water regulation under clause (i) or (vi)(II) of subparagraph (D) of section 1412(b)(2) of the Safe Drinking Water Act (42 U.S.C. 300g–1(b)(2)).

(3) EXCEPTION.—The perfluoroalkyl and polyfluoroalkyl substances and classes of perfluoroalkyl and polyfluoroalkyl substances included in the list of unregulated contaminants to be monitored under section 1445(a)(2)(B)(i) of the Safe Drinking Water Act (42 U.S.C. 300j–4(a)(2)(B)(i)) under paragraph (1) shall not count towards the limit of 30 unregulated contaminants to be monitored by public water systems under that section.

(b) APPLICABILITY.—

(1) IN GENERAL.—The Administrator shall—

(A) require public water systems serving more than 10,000 persons to monitor for the substances described in subsection (a)(2);

(B) subject to paragraph (2) and the availability of appropriations, require public water systems serving not fewer than 3,300 and not more than 10,000 persons to monitor for the substances described in subsection (a)(2); and

(C) subject to paragraph (2) and the availability of appropriations, ensure that only a representative sample of public water systems serving fewer than 3,300 persons are required to monitor for the substances described in subsection (a)(2).

(2) REQUIREMENT.—If the Administrator determines that there is not sufficient laboratory capacity to carry out the monitoring required under subparagraphs (B) and (C) of paragraph (1), the Administrator may waive the monitoring requirements in those subparagraphs.

(3) FUNDS.—The Administrator shall pay the reasonable cost of such testing and laboratory analysis as is necessary to carry out the monitoring required under paragraph (1) from—

(A) funds made available under subsection (a)(2)(H) or (j)(5) of section 1445 of the Safe Drinking Water Act (42 U.S.C. 300j–4); or

(B) any other funds made available for that purpose.

SEC. 203. ENFORCEMENT.

Notwithstanding any other provision of law, the Administrator may not impose financial penalties for the violation of a national primary drinking water regulation (as defined in section 1401 of the Safe Drinking Water Act (42 U.S.C. 300f)) with respect to a perfluoroalkyl or polyfluoroalkyl substance or class of perfluoroalkyl or polyfluoroalkyl substances for which a national primary drinking water regulation has been promulgated under clause (i) or (vi) of subparagraph (D) of section 1412(b)(2) of the Safe Drinking Water Act (42 U.S.C. 300g–1(b)(2)) earlier than the date that is 5 years after the date on which the Administrator promulgates the national primary drinking water regulation.

SEC. 204. DRINKING WATER STATE REVOLVING FUNDS.

Section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j–12) is amended—

(1) in subsection (a)(2), by adding at the end the following:

"(G) EMERGING CONTAMINANTS.—

"(i) IN GENERAL.—Subject to clause (ii), amounts deposited under subsection (t) in a State loan fund established under this section may be used to provide grants for the purpose of addressing emerging contaminants, with a focus on perfluoroalkyl and polyfluoroalkyl substances.

"(ii) REQUIREMENTS.—

"(I) SMALL AND DISADVANTAGED COMMUNITIES.—Not less than 25 percent of the amounts described in clause (i) shall be used to provide grants to—

"(aa) disadvantaged communities (as defined in subsection (d)(3)); or

"(bb) public water systems serving fewer than 25,000 persons.

"(II) PRIORITIES.—In selecting the recipient of a grant using amounts described in clause (i), a State shall use the priorities described in subsection (b)(3)(A).";

(2) in subsection (m)(1), in the matter preceding subparagraph (A), by striking "this section" and inserting "this section, except for subsections (a)(2)(G) and (t)"; and

(3) by adding at the end the following:

"(t) EMERGING CONTAMINANTS.—

"(1) IN GENERAL.—Amounts made available under this subsection shall be allotted to a State as if allotted under subsection (a)(1)(D) as a capitalization grant, for deposit into the State loan fund of the State, for the purposes described in subsection (a)(2)(G).

"(2) AUTHORIZATION OF APPROPRIATIONS.—There is authorized to be appropriated to carry out this subsection $100,000,000 for each of fiscal years 2020 through 2024, to remain available until expended."

WRWA Member Update
PFAS Rulemaking

In February, the Wisconsin Natural Resources Board (NRB) is expected to take up three draft rules regulating PFAS:

- NR 105 **Surface Water** Quality Criteria Changes — Rule — Economic Impact Analysis
- NR 140 **Groundwater** Quality Standards (Cycle 10) — Rule — Economic Impact Analysis
- NR 809 **Safe Drinking** Water Standards — Rule — Economic Impact Analysis

Working with the Municipal Water Coalition, WRWA has been engaged in this rulemaking process. In December, WRWA submitted comments on NR 809 urging DNR to wait for the federal rules.

NRB will meet on February 23 to decide the fate of these three rules. DNR staff will present all three rules to the NRB for approval. For each proposed rule, the NRB has a few options:

Approve	**Reject**	**Revise**
If NRB approves the rule, the rule will head to the Governor for approval, Legislature for review, first by the appropriate standing committees and then by the Joint Committee for Review of Administrative Rules (JCRAR). ↓	*If NRB votes to reject the rule, the time for DNR to complete the rule will expire and the agency will need to start the process over.*	*While unlikely, the NRB could ask the DNR to modify the rules, however the timeline for this is extremely tight. The Scope Statements for these rules will expire in March, requiring the agency to start the process over.*
*The Legislature may adjourn before their review period ends; in that case, the time for the rule review will not progress until the legislature reconvenes, likely **January 2023.***		

WRWA will continue to keep members aware of the status of these rules after the February NRB meeting.

2019

HEALTH-BASED DRINKING WATER VALUE RECOMMENDATIONS FOR PFAS IN MICHIGAN

Michigan Science Advisory Workgroup

DR. JAMIE DEWITT
MR. KEVIN COX
DR. DAVID SAVITZ

Executive Director's Foreword

This report accomplishes a key milestone in Michigan's effort to identify and reduce exposures to per- and polyfluoroalkyl substances (PFAS) contamination. With it, we are now one step closer to developing state drinking water standards for PFAS.

Michigan is a national leader at addressing PFAS contamination. Through our unique, multi-agency approach, Michigan's PFAS Action Response Team (MPART) is systematically identifying sources of PFAS contamination and getting a better understanding of their occurrence throughout our environment.

By using analytical techniques capable of finding PFAS as low as 2 parts per trillion, we have found the presence of PFAS in the drinking water from thousands of private residential wells near contaminated sites. We have also found PFAS in public water supplies across the state. We tested over 1,700 supplies covering all community water supplies plus schools and larger day cares with their own wells. We found PFAS in ten percent of the supplies. While most of the PFAS levels were very low, three percent of the supplies have required follow-up actions, and a few have required an alternate water source.

Unfortunately, we do not have federal drinking water standards, despite knowing they are in our drinking water and that some PFAS have been associated with adverse health effects. Recognizing that the USEPA is still likely several years away from providing any leadership on PFAS drinking water standards, Michigan, like other states, was left to develop our own.

With Governor Gretchen Whitmer's leadership, MPART formed a Science Advisory Workgroup to navigate the science and standards from across the country to advise Michigan on drinking water health-based values for PFAS. These health-based values will be used to inform the next step of the drinking water rule-making process, which includes stakeholder involvement where other factors will be considered.

I could not be more impressed with the thoughtful deliberation of our workgroup and the tireless technical support from our staff. As the information in this report is given to EGLE for consideration during the development of drinking water standards, we all owe them our sincere appreciation for giving us a firm foundation on which to move forward with protecting Michiganders from unacceptable levels of PFAS in their drinking water.

Steve Sliver,
Executive Director,
Michigan PFAS Action Response Team

Michigan Science Advisory Workgroup

Dr. Jamie DeWitt
Mr. Kevin Cox
Dr. David Savitz

Agency Support Staff to the Panel

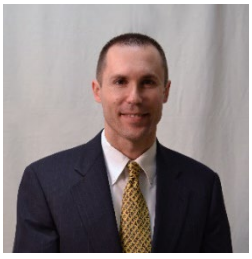
Mr. Steve Sliver, Michigan Department of Environment, Great Lakes, and Energy
Mr. Kory Groetsch, Michigan Department of Health and Human Services
Dr. Jennifer Gray, Michigan Department of Health and Human Services
Dr. Eric Wildfang, Michigan Department of Environment, Great Lakes, and Energy
Ms. Chelsea Dickerson, Michigan Department of Environment, Great Lakes, and Energy

Report developed for the Michigan PFAS Action Response Team,
Lansing, Michigan
June 27, 2019

The Michigan Science Advisory Workgroup

Dr. David Savitz

Dr. David Savitz, who chairs the advisory Workgroup, is a professor of epidemiology in the School of Public Health at Brown University. He also serves as associate dean for research, and holds joint appointments in obstetrics and gynecology, and pediatrics in the Alpert Medical School. His epidemiological research has addressed a wide range of public health issues including environmental hazards in the workplace and community, reproductive health outcomes, and environmental influences on cancer. He has done extensive work on health effects of nonionizing radiation, pesticides, drinking water treatment by-products, and perfluorinated compounds. He is the author of nearly 350 papers in professional journals and editor or author of three books. He was president of the Society for Epidemiologic Research and the Society for Pediatric and Perinatal Epidemiologic Research, and North American regional councilor for the International Epidemiological Association. Dr. Savitz is a member of the National Academy of Sciences Institute of Medicine. From 2013-2017 he served as vice president for research at Brown University. He was a member of the C8 Science Panel that conducted some of the first epidemiologic research on PFAS in the mid-Ohio Valley and has published a number of reports related to potential health effects of PFAS. He recently chaired the Science Panel to advise MPART on the current research related to toxicology, epidemiology, exposure pathways, and remediation of PFAS.



Mr. Kevin Cox

Kevin Cox is a Managing Toxicologist at NSF International. Prior to his current role, Mr. Cox was a Supervising Toxicologist supporting NSF's drinking water additives and dietary supplement certification programs. As an expert in human health risk assessment, Mr. Cox has authored numerous chemical risk assessments evaluating exposure from unregulated drinking water contaminants, dietary supplement ingredients, toy product materials, and pool and spa treatment chemicals. Specific to PFAS, Mr. Cox has conducted a state-of-the-science analysis of published PFAS risk assessments in support of NSF International drinking water programs. This analysis was recently presented to Michigan water management professionals. Mr. Cox received his B.S. in biochemistry and history from the University of Michigan and his MPH in Environmental Health Sciences - Toxicology from the University of Michigan School of Public Health. He is currently an Associate Member of the Society of Toxicology. Mr. Cox also holds a J.D. from the University of Michigan Law School and is a member of the Michigan Bar Association.

Dr. Jamie DeWitt

Dr. Jamie DeWitt is an associate professor in the Department of Pharmacology and Toxicology of the Brody School of Medicine at East Carolina University. Her laboratory's research program explores relationships between biological organisms and their responses after exposure to environmental contaminants, with a specific focus on the immune system and its interactions with the nervous system during development and adulthood. The research program particularly focuses on emerging aquatic contaminants, especially PFAS. With respect to PFAS, DeWitt has published 13 primary research articles, six review articles, two book chapters, and edited a book on PFAS toxicity. She has served as an external reviewer for the United States Environmental Protection Agency (USEPA) health effects assessment of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), the United States National Toxicology Program's immune effects assessment of PFOA and

PFOS, the United States Agency for Toxic Substances and Disease Registry toxicological profile for PFASs, and was a member of the International Agency for Research on Cancer working group for the assessment of the carcinogenicity of PFOA. Her laboratory currently assesses the immunotoxicity of emerging PFAS that have been designed to replace those that have been phased out of production and that are of concern in North Carolina. She double-majored in environmental science and biology for her bachelor's degree from Michigan State University and has doctoral degrees in environmental science and neural science from Indiana University-Bloomington. She completed postdoctoral training in ecotoxicology at Indiana University-Bloomington and in immunotoxicology at the USEPA in partnership with the University of North Carolina at Chapel Hill.

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Executive Summary

Background: The Michigan PFAS Action Response Team (MPART), is a unique, multi-agency proactive approach for coordinating state resources to address per- and polyfluoroalkyl substances (PFAS) contamination. Agencies responsible for environmental protection, public health, natural resources, agriculture, military installations, commercial airports, and fire departments work together to ensure the most efficient and effective response. The work done by MPART on drinking water supports the development of standards now that we have key information, including:

- PFAS have been discovered in drinking water during investigations of contaminated sites and a survey of all of Michigan's public water supplies. Public health responses, such as the provision of alternate water (e.g., point of use filters) have been necessary for thousands of Michiganders based on the strength of the source, location, and the concentrations found.

- The MPART Science Advisory Panel report issued in December 2018 indicated that observational epidemiology literature supports the need for drinking water values below the United States Environmental Protection Agency (USEPA) Lifetime Health Advisory (LHA) level of 70 ppt PFOS and PFOA, individually or in combination, and included a recommendation for establishing state drinking water standards for PFAS.

- The Michigan Department of Health and Human Services (MDHHS)-led MPART Human Health Workgroup developed public health drinking water screening levels for five individual PFAS in February 2019. Those screening levels will prompt further evaluation and public health consultations at numerous public water supplies and residences across the state including where detectable levels of PFOS and/or PFOA are below the USEPA LHA.

On March 26, 2019, Governor Gretchen Whitmer announced that Michigan was establishing enforceable state drinking water standards for PFAS. These standards, otherwise known as Maximum Contaminant Levels (MCLs), under the federal Safe Drinking Water Act have traditionally been established first by the USEPA and then adopted by the states. At this time, however, the USEPA has not initiated its process for establishing PFAS MCLs, and its process could take five or more years to complete. Michigan chose not to wait any longer for federal action.

Governor Whitmer called on MPART to form a Science Advisory Workgroup (Workgroup) to review the existing and proposed PFAS standards from across the country and develop health-based values (HBVs) to inform the initial phase of the rulemaking process for establishing state drinking water standards. The workgroup was given until July 1, 2019 to develop the HBVs. On April 4, 2019, MPART approved a motion to create the Workgroup. The Charge from MPART to the Workgroup is included in Appendix B. The members of the Workgroup were announced on April 11, 2019. The Workgroup was supported by MPART staff.

The Workgroup members are experts in the fields of epidemiology, toxicology, and risk assessment. The composition of the Workgroup matches the typical fields of evaluation for HBV developments. Dr. Jamie DeWitt provided the strong toxicological expertise and up-to-date knowledge on PFAS toxicology as HBVs typically use laboratory animal toxicity studies. Epidemiological information supports the laboratory animal data, and Dr. David Savitz provided his epidemiological expertise in selection of health endpoints and relevance to humans. Tying both toxicology and epidemiology together are risk assessment practices, and Mr. Kevin Cox provided the expertise in that field. Taken together, this Workgroup was able to knowledgably speak on the current state of PFAS health research and provide the scientific expertise needed to efficiently develop HBVs on the requested timeline.

The evaluation and deliberations of the Workgroup occurred over a very limited timeframe (Appendix D), which required frequent interaction. Much of that interaction occurred during 7 web conferences between April 19 and May 29, 2019, culminating in an in-person meeting the weekend of June 1-2, 2019. The Workgroup's final conclusions were presented to MPART on June 27, 2019.

Conclusions: The Workgroup undertook a methodical approach to evaluate existing and proposed standards from across the country for the 18 PFAS analytes considered under USEPA Method 537.1 (Appendix C). They focused on those PFAS that they determined had enough peer reviewed studies on which to base their conclusions. What they considered, and the logic behind their approach, has been carefully documented in individual chemical summaries for each compound that has a derived HBV in the following table:

Summary Table of Drinking Water Health-Based Values

Specific PFAS	Drinking Water Health-based Value	Chemical Abstract Services Registry Number (CASRN)
PFNA	6 ng/L (ppt)	375-95-1
PFOA	8 ng/L (ppt)	335-67-1
PFHxA	400,000 ng/L (ppt)	307-24-4
PFOS	16 ng/L (ppt)	1763-23-1
PFHxS	51 ng/L (ppt)	355-46-4
PFBS	420 ng/L (ppt)	375-73-5
GenX	370 ng/L (ppt)	13252-13-6

The Workgroup also recommended MPART and water supply operators screen analytical results for other long-chain PFAS (eight carbons and above for carboxylates and six carbons and above for sulfonates) included in USEPA Method 537.1 at the lowest concentration proposed for any of the compounds, which is 6 ppt. Based on the similarity in toxicity for the long-chain PFAS, the Workgroup recommends use of the HBV for PFNA (6 ng/L [ppt]) as a screening level for all other long-chain PFAS included on the USEPA Method 537.1 analyte list for which the Workgroup did not develop an individual HBV. Those other long-chain PFAS included in USEPA Method 537.1 are: NEtFOSAA (CASRN: 2991-50-6); NMeFOSAA (CASRN: 2355-31-9); PFDA (CASRN: 335-76-2); PFDoA (CASRN: 307-55-1); PFTA (CASRN: 376-06-7); PFTrDA (CASRN: 72629-94-8); and PFUnA (CASRN: 2058-94-8). While there is not enough information available at this time to support HBVs and drinking water standards for them, these compounds are expected to produce similar health effects. Additional monitoring, research for potential sources, notification of the public, and efforts to reduce exposure are warranted.

The Workgroup recognizes that their conclusions in some cases deviate modestly from those of other organizations. Evolving science and professional judgement can account for the variation. The variation is not substantial, however, and the values are trending lower nationally over time.

Approach

Workgroup Interpretation of the Charge

The Workgroup was conscience of the importance and responsibility placed upon its efforts to identify public health toxicity values for certain PFAS as described within the Charge. Prior to initiating its efforts, the Workgroup sought and received clarification on the scope of the Charge. Given the relatively short timeframe for which to accomplish the tasks set forth within Charge, the Workgroup confirmed that the focus of the effort was to utilize the existing and proposed national- and state-derived PFAS assessments to inform its decision-making process as opposed to conducting a full systematic review of the available scientific literature on PFAS.

Additionally, as one of the outputs of the Charge is to inform State of Michigan on drinking water health-based values for PFAS, it was important to understand if the State of Michigan had any paradigms in place that the Workgroup must follow when deriving drinking water health-based values. The response received from the State of Michigan indicated that the Workgroup was only limited to applying a scientifically defensible approach as described within the Charge. With these issues clarified, the Workgroup approached the tasks set forth in the charge in the following manner:

1) Initially, PFAS analytes were identified within USEPA Method 537.1 for which published or externally peer reviewed PFAS drinking water criteria or reference doses (RfDs) existed and the derivation of such values was done in a scientifically defensible manner. This approach resulted in the selection of PFOA, PFOS, PFHxS, PFHxA, PFBS, PFNA and GenX as PFAS analytes for which the Workgroup would then develop individual public health toxicity values. The remaining PFAS values within USEPA Method 537.1 were later considered as to whether a class-based or group-based public health toxicity value could be applied.

2) For each of the selected PFAS analytes, the Workgroup evaluated the identified points of departure (defined as the point on a toxicological dose-response curve corresponding to an estimated low effect level or no effect level) and rationale from published risk assessments and assessed the underlying key studies that served as the basis for the published values. From this review, the merits of each available point of departure was discussed among the Workgroup and critical studies and points of departures for each of the seven identified PFAS analytes were identified to form the basis of public health toxicity values described further herein.

3) With critical studies and points of departure identified for each individual PFAS, the Workgroup then identified appropriate uncertainty factors to derive public health toxicity values. From these public health toxicity values, the Workgroup recommended specific drinking water exposure paradigms, accounting for sensitive sub-populations, and applied selected relative source contribution factors to derive the drinking water health-based values described further herein.

4) Lastly, consideration was given to the remaining PFAS analytes from USEPA Method 537.1 that were not selected for the development of individual criteria as to whether a class-based or grouping-based evaluation approach would be appropriate. As described

below, the Workgroup concluded that a screening level approach was valid to assess longer-chain PFAS based on the lowest derived drinking water health-based values.

Based on guidance from the Director of EGLE's Drinking Water and Environmental Health Division, PFAS chemical summary sheets were used to capture the necessary information for the MCL rulemaking process. The Workgroup and MPART staff used this format to provide maximum transparency on the decisions and rationale for drinking water health-based value development for each PFAS.

The chemical summary sheets describe:

- The critical study or studies, point of departure from each study, and conversion to a human equivalent dose;
- Uncertainty factors and a calculated toxicity value;
- Exposure parameters, and methodology for calculation of a drinking water health-based value.

Challenges and Limitations

The premises for the Workgroup's efforts to provide evidence-based conclusions for informing the regulation of PFAS in drinking water are compelling. Policy needs to provide clarity on what levels of specific chemicals are believed to be protective of public health and develop a mechanism to monitor and mitigate pollutants such as PFAS where needed. The Workgroup identified and made optimal use of the scientific evidence that is available to provide guidance, drawing on its knowledge of research methods and quantitative risk assessment. Furthermore, the Workgroup approached the issue free of bias, and as a panel, has a wide range of expertise and familiarity with the research on PFAS. However, the nature of this process is inherently subject to uncertainty and other equally qualified experts presented with the same scientific data the Workgroup drew upon might well make somewhat different conclusions. A number of other organizations have been through a similar exercise in providing guidance on acceptable drinking water contaminant levels, and while there are not extreme differences, there is not complete convergence either. As described in some detail below, a series of inputs were needed to derive the Workgroup's estimates and make that sequence of decisions as transparent as possible for those who wish to compare these conclusions to those made by other agencies. Like all the others, they are based exclusively on toxicology studies given the ability to quantify exposure-response relationships with great precision, but there is a loss of certainty in applying these estimates to free-living human populations. In most cases, there is epidemiologic evidence pertaining to the same health endpoints used in toxicology, and where there is such convergent evidence (e.g., immune function, development), confidence in the applicability of the experimental studies to human populations is enhanced. Finally, it should be noted that the scientific evidence on PFAS is expanding rapidly and that with new studies, the guidelines may well need to be revised. While it would be inefficient to do so frequently, on some periodic basis of several years, it would be useful to repeat the process that generated this report to determine where changes may be needed.

Process

Selection of Toxicity Values

Adverse health effects reported following exposure to PFAS in laboratory animal models and epidemiological studies have been summarized in myriad peer-reviewed and publicly available documents, including those generated by other state agencies. Most recently, the Agency for Toxic Substances and Disease Registry (ATSDR), compiled a toxicological profile for 14 PFAS that comprehensively summarizes evidence from publicly available published studies (ATSDR, 2018). This, and other summary documents, as well as the published studies themselves, were relied on to determine points of departure, as well as the toxicity values that protect the most sensitive populations and reflect a level that is unlikely to lead to adverse health effects if those sensitive populations are exposed over a lifetime or during a sensitive period (i.e., during development). The toxicity values are therefore designed to be protective of all exposed populations. For all of the PFAS examined, points of departure were selected from studies with laboratory animal models. This approach does not negate findings associated with epidemiological studies, but reflects that humans experience uncontrolled and imperfectly documented rather than controlled, precisely measured exposures. Additionally, these points of departure reflect adverse health effects that occur at low doses and that are supported by the weight-of-evidence across endpoints and between findings in humans and laboratory animal models. Therefore, the process to select points of departure used the available scientific evidence to identify an adverse health effect that occurred at a low dose, was supported by findings in other studies, was relevant to humans, and would be protective of sensitive populations.

Uncertainty Factors

In deriving the toxicity values for PFAS, the selected points of departure are divided by uncertainty factors. Uncertainty factors are applied in order to account for:

1. Variation in susceptibility among the human population (intraspecies uncertainty);

2. Uncertainty in extrapolating animal data to humans (interspecies uncertainty);

3. Uncertainty in extrapolating from data obtained from a study with a less-than-lifetime exposure (subchronic to chronic uncertainty);

4. Uncertainty in extrapolating from a lowest observed adverse effect level (LOAEL) as opposed to a no observed adverse effect level (NOAEL); and

5. Uncertainty associated with an incomplete toxicity database. Uncertainty factors assigned for each of these five categories are typically 1x, 3x ($10^{0.5}$x), or 10x with the default value being 10x, which represents greater uncertainty.

For both interspecies and intraspecies uncertainty factors, the variability in response to a toxicant may result from differences in toxicokinetics and/or toxicodynamics. Toxicokinetics refers to the absorption, distribution, biotransformation and excretion of the toxicant following exposure. Toxicodynamics refers to the molecular, biochemical and physiological effects of the toxicant or its metabolites leading to the toxic response. Therefore, the interspecies and intraspecies uncertainty factors are divided into subparts representing the toxicokinetic factor and the toxicodynamic factor. In evaluating the interspecies uncertainty for the selected PFAS, in each

case the toxicokinetic subfactor was able to be reduced to 1x on account of adjustments based on serum half-lives or allometric scaling. Due to lack of data to depart from the default the toxicodynamic subfactor 3x ($10^{0.5}$x), the resulting interspecies uncertainty factor is 3x ($10^{0.5}$x).

When considering the subchronic to chronic uncertainty, the relevant consideration is whether the selected point of departure may differ if the duration of exposure were to be increased. For PFAS, a weight of evidence approach was used to assess the subchronic to chronic uncertainty factor, including, but not limited to, duration of the key study, potential impact of duration on the selected point of departure, as well as availability of chronic repeat-dose toxicity data.

For the NOAEL to LOAEL uncertainty factor, use of a NOAEL (or lower confidence limit on the benchmark dose [BMDL]) allows for an uncertainty factor of 1x. If the point of departure is based on a LOAEL, the uncertainty factor is either 3x ($10^{0.5}$x) or 10x depending on the severity and/or reversibility of the critical effect.

The database uncertainty factor is based on the ability of the existing data to support a scientific judgment of the likely critical effect from exposure to the compound. In assessing the database completeness, the types of toxicity data (e.g., human, animal, mode of action) as well as data gaps that may have improved the derived risk values should be emphasized. This approach should take into consideration issues such as the types of endpoints evaluated, life-stages evaluated, duration, timing, route of exposure, and the potential for latent effects and/or reversibility of effects (USEPA, 2002). For the selected PFAS, each database was unique; however, common concerns were lack of appropriate characterization of immune, endocrine or neurodevelopmental effects.

Relative Source Contribution

Relative source contribution (RSC) is the percentage of a person's exposure to a chemical that comes from drinking water. For example, an RSC of 20 percent assumes that the other 80 percent of a person's exposure to a chemical comes from non-drinking water sources. The USEPA (2000) provides guidance on the selection of an RSC value using an exposure decision tree that takes into account specific populations of concern, whether these populations are experiencing exposure from multiple sources, and whether levels of exposure or other circumstances make apportionment of the toxicity value or POD/UF desirable. The most conservative RSC is established at 20 percent, and the RSC can reach a ceiling of 80 percent as more information is available about exposure pathways and the source of exposure.

Drinking Water Health-Based Value Derivation

The traditional risk assessment approach using simple equations based on body weight, water intake rate and RSC to calculate drinking water HBVs is not adequate to address the bioaccumulative nature and known or presumed developmental toxicity of PFAS. These traditional equations do not consider the PFAS body-burden at birth or any transfer of maternal PFAS through breastmilk. To better address these concerns, and to also account for higher early-life intake rates, the Goeden et al. (2019) simple one-compartment toxicokinetic model was used where the data were available for the individual PFAS. The resulting drinking water HBVs are considered protective for an infant exclusively breast-fed for 12 months, followed by drinking contaminated water through life. Additionally, these drinking water HBVs also protective for formula-fed infants. Where data were not available to derive drinking water HBVs using the model, traditional equations were used.

Confidence Statement

Following USEPA guidance (2002), risk assessments may contain a narrative description of the overall confidence in the derived health-effects based values. Confidence in the risk assessment would be low if there is a high degree of scientific uncertainty and would be high if there is a low degree of scientific uncertainty. Major elements of scientific uncertainty may be considered to include, but not limited to, the following; database completeness, quality of key study(ies), severity and relevance of the critical effect, quality of the dose-response analysis and consideration of sensitive subpopulations. (NRC, 2009; Beck et al., 2016).

For the selected PFAS for which quantitative values were derived there remains significant scientific uncertainty. Health outcomes due to PFAS exposure that warrant additional study include, but are not limited to, endocrine disruption, immunological and neurodevelopmental effects as well as cancer. Further information is needed on the mode of action as well as the cumulative risk of exposure to multiple PFAS. Overall, the present evaluation of the selected PFAS is based on sound science and current practices in risk assessment; however, the Workgroup recognizes that the science of PFAS is constantly evolving and new information may come to light that requires a re-evaluation of the drinking water HBVs established herein.

PFAS Chemical Summary Sheets

Chemical Summary for PFNA

	Decision Point	Rationale/justification
Critical study	Das KP, Grey BE, Rosen MB, et al. 2015. Developmental toxicity of perfluorononanoic acid in mice. *Reproductive Toxicology* 51:133-144.	The Workgroup reviewed the available evaluations and focused on the assessments by ATSDR and New Jersey. Das et al. (2015) was selected by both ATSDR (2018) and NJDEP (2015).
Description of the critical study	Timed-pregnant CD-1 mice were administered 0, 1, 3, 5 or 10 mg/kg PFNA by daily oral gavage from gestational day (GD) 1 to 17. Maternal toxicity and reproductive outcomes were investigated. Postnatal toxicity, liver gene expression and developmental effects were evaluated in mouse offspring. *Body weight endpoints* – Decreased body weight gain in mouse pups *Developmental endpoints* – Delayed eye opening, preputial separation, and vaginal opening in mouse pups	The Workgroup reviewed the health endpoints investigated in Das et al. (2015) and identified the developmental endpoints as more relevant than liver endpoints.
Point of Departure (POD)	A NOAEL of 1 mg/kg/day was identified for developmental effects. The average serum concentration for NOAEL (1 mg/kg/day) was estimated (6.8 mg/L) in dams using an empirical clearance model (Wambaugh et al., 2013). The estimated time-weighted average serum concentration corresponding to the NOAEL was 6.8 mg/L.	The Workgroup decided that serum-based points of departure were appropriate for PFAS.
Human equivalent dose (HED)	The time-weighted average serum concentration of 6.8 mg/L was converted to the HED using the below equation. $NOAEL_{HED}$ = (TWA serum x k_e x V_d) = 0.000665 mg/kg/day Ke = 0.000489165 (4.8×10^{-4}) based on a human serum half-life of 1417 days (calculated from Zhang et al. [2013] as described above) Vd = 0.2 L/kg (ATSDR [2018]; Ohmori et al. [2003])	The Workgroup discussed the human serum half-lives available from Zhang et al. (2013), which were an arithmetic mean of 2.5 years (913 days) for 50 year old or younger females and 4.3 years (1570 days) for females older than 50 years old and all males. An average of 3.9 years (1417 days) was calculated based on those averages. The Workgroup selected the calculated average as it would better represent the entire population.
Uncertainty factors	A total uncertainty factor of 300: • 1 for LOAEL to NOAEL • 10 for human variability • 3 ($10^{0.5}$) for animal to human variability • 1 for subchronic to chronic • 10 for database deficiencies was used.	The Workgroup discussed the uncertainty factors selected by ATSDR (2018) and agreed that those selected were appropriate.

Toxicity value	2.2 ng/kg/day (2.2 x 10^{-6} mg/kg/day) which corresponds to a serum concentration of 0.023 mg/L Serum levels used in development of these toxicity levels are not meant to indicate a level where health effects are likely. These serum levels are calculated to be at a point where no or minimal risk exists for people drinking water with a certain PFAS.	Human equivalent dose or serum level divided by the total uncertainty factors = toxicity value
Exposure parameters for drinking water screening HBVs	Breast-fed infant, which is also protective of a formula-fed infant Placental transfer of 69% (MDHHS 2019) Breastmilk transfer of 3.2% (MDHHS 2019) Half-life = 1417 days (3.9 years) (calculated from Zhang et al. [2013] as described above) Volume of distribution = 0.2 L/kg (ATSDR [2018]; Ohmori et al. [2003]) 95th percentile drinking water intake, consumers only, from birth to more than 21 years old (Goeden et al. [2019]) Upper percentile (mean plus two standard deviations) breast milk intake rate (Goeden et al. [2019]) Time-weighted average water ingestion rate from birth to 30-35 years of age (to calculate maternal serum concentration at delivery) (Goeden et al. [2019]) Relative Source Contribution of 50% (0.5) Based on NHANES 95th percentiles for 3-11 (2013-2014) and over 12 years old (2015-2016) participants (CDC 2019)	The Workgroup discussed the Goeden et al. (2019) model which considered full life stage exposure, from fetal exposure, to infant exposure through breastfeeding, and into adulthood. While the model was also developed for a formula-fed infant, the breastfed infant scenario is protective of a formula-fed infant. The Workgroup selected this model for developing drinking water HBVs when the needed inputs were available.
Drinking water HBV	6 ng/L (ppt)	Numeric HBV derived and justified using the above information

Chemical Summary for PFOA

	Decision point	Rationale/justification
Critical study	Onishchenko N, Fischer C, Wan Ibrahim WN, Negri S, Spulber S, Cottica D, Ceccatelli S. 2011. Prenatal exposure to PFOS or PFOA alters motor function in mice in a sex-related manner. Neurotox. Res. 19(3):452-61. Koskela A, Finnilä MA, Korkalainen M, Spulber S, Koponen J, Håkanss on H, Tuukkanen J, Viluksela M. 2016. Effects of developmental exposure to perfluorooctanoic acid (PFOA) on long bone morphology and bone cell differentiation. Toxicol. Appl. Pharmacol. 301:14-21.	The Workgroup reviewed the available evaluation and selected the ATSDR (2018) critical studies. The Workgroup concluded that the ATSDR position was defensible with respect to range and sensitivity of health endpoints identified and considered in ATSDR (2018).
Description of the critical study	Onishchenko et al.: Pregnant C57BL/6 mice were exposed to 0 or 0.3 mg PFOA/kg/day throughout pregnancy. The critical effects considered were Neurobehavioral effects (decreased number of inactive periods, altered novelty induced activity) at 5-8 weeks of age. Koskela et al.: Pregnant C57BL/6 mice were exposed to PFOA mixed with food at the dose of 0 or 0.3 mg PFOA/kg/day throughout pregnancy. Group of five offspring (female) were sacrificed at either 13 or 17 months of age. The critical effects considered were skeletal alteration such as bone morphology and bone cell differentiation in the femurs and tibias.	The Workgroup selected these developmental delays as most appropriate health endpoint as the mammary gland effects may represent a delay that may not be considered adverse. However, the mammary gland effects may be representative of endocrine effects at doses below the selected POD.
Point of Departure	The average serum concentration was estimated in the mice (8.29 mg/L) using a three-compartment pharmacokinetic model (Wambaugh et al. 2013) using animal species-, strain-, sex-specific parameters.	The Workgroup decided that serum-based points of departure were appropriate for PFAS.
Human equivalent dose	The time-weighted average serum concentration of 8.29 mg/L was converted to the HED using the below equation. $LOAEL_{HED}$ = (TWA serum x k_e x V_d) = 0.001163 mg/kg/day Ke = 0.000825175 (8.2×10^{-4}) based on a human serum half-life of 840 days (Bartell et al. 2010) Vd = 0.17 L/kg (Thompson et al. 2010)	The Workgroup selected the PFOA serum half-life of 840 days (2.3 years) as more relevant for exposure to the general population as this half-life corresponds to data from Bartell et al. (2010) in which 200 individuals (100 men, 100 women) were exposed by drinking PFOA-contaminated water. The Workgroup selected the volume of distribution based on human data, when available.

Uncertainty factors	A total uncertainty factor of 300: • 3 ($10^{0.5}$) for LOAEL to NOAEL • 10 for human variability • 3 ($10^{0.5}$) for animal to human variability • 1 for subchronic to chronic • 3 ($10^{0.5}$) for database deficiencies (endocrine effects)	The Workgroup discussed the use of an uncertainty factor of 3 for use of a LOAEL. They noted that a NOAEL for immune effects was similar to the LOAEL selected and that the selected LOAEL represented less severe effects. The Workgroup concluded that use of the 3 ($10^{0.5}$) would be sufficiently protective. The Workgroup added a database uncertainty factor of 3 ($10^{0.5}$) for deficiencies the database regarding endocrine effects. The Workgroup noted that the mammary gland effects may signal a concern for other low dose endocrine effects.
Toxicity value	3.9 ng/kg/day (3.9 x 10^{-6} mg/kg/day) which corresponds to a serum concentration of 0.028 mg/L Serum levels used in development of these toxicity levels are not meant to indicate a level where health effects are likely. These serum levels are calculated to be at a point where no or minimal risk exists for people drinking water with a certain PFAS.	Human equivalent dose or serum level divided by the total uncertainty factors = toxicity value
Exposure parameters for drinking water HBVs	Breast-fed infant, which is also protective of a formula-fed infant Placental transfer of 87% (MDH 2017) Breastmilk transfer of 5.2% (MDH 2017) Human Serum half-life of 840 days (Bartell et al. 2010) Volume of distribution of 0.17 L/kg (Thompson et al. [2010]) 95th percentile drinking water intake, consumers only, from birth to more than 21 years old (Goeden et al. [2019]) Upper percentile (mean plus two standard deviations) breast milk intake rate (Goeden et al. [2019]) Time-weighted average water ingestion rate from birth to 30-35 years of age (to calculate maternal serum concentration at delivery) (Goeden et al. [2019]) Relative Source Contribution of 50% (0.5) Based on NHANES 95th percentiles for 3-11 (2013-2014) and over 12 years old (2015-2016) participants (CDC 2019)	The Workgroup discussed the Goeden et al. (2019) model which considered full life stage exposure, from fetal exposure, to infant exposure through breastfeeding, and into adulthood. While the model was also developed for a formula-fed infant, the breastfed infant scenario is protective of a formula-fed infant. The Workgroup selected this model for developing drinking water HBVs when the needed inputs were available.
Drinking water HBV	8 ng/L (ppt)	Numeric HBV derived and justified using the above information

Chemical Summary for PFHxA

	Decision point	Rationale/justification
Critical study	Klaunig, J.E., Shinohara, M., Iwai, H., Chengelis, C.P., Kirkpatrick, J.B., Wang, Z., Bruner, R.H., 2015. Evaluation of the chronic toxicity and carcinogenicity of perfluorohexanoic acid (PFHxA) in Sprague-Dawley rats. Toxicol. Pathol. 43 (2), 209–220.	The Workgroup reviewed the Luz et al. (2019) compiled information and development of a toxicity value. The Workgroup was in agreement with Luz et al. (2019) on selection of the chronic study (Klaunig et al. 2015) for toxicity value development.
Description of the critical study	PFHxA was administered to male and female Crl:CD rats (n=60-70/sex/dose) via daily oral gavage for up to 104 weeks. Males: 0, 2.5, 15, and 100 mg/kg/day. Females: 0, 5, 30, and 200 mg/kg/day. Functional observational battery, locomotor activity, ophthalmic, hematology, serum chemistry, and tissue and organ histopathology endpoints were evaluated.	The Workgroup also considered the developmental effects observed in Loveless et al. (2009) one generation reproductive assay. Pup body weight was significantly reduced in the 500 mg/kg/day, resulting in NOAEL of 100 mg/kg/day. Data were not available for Benchmark Dose Modeling for further evaluation.
Point of Departure	Critical effect renal tubular degeneration and renal papillary necrosis in female rats – $BMDL_{10}$ 90.4 mg/kg/day (Luz et al., 2019).	The Workgroup noted that the Benchmark Dose approach is preferred over the use of a NOAEL/LOAEL.
Human equivalent dose	Therefore, the BMD was adjusted by $(80kg/0.45\ kg)^{¼}$ = 3.65. The resulting POD_{HED} (90.4 mg/kg/day divided by 3.65) = 24.8 mg/kg/day. (Luz et al., 2019).	The Workgroup discussed the description of the Benchmark Dose modeling conducted by Luz et al. (2019) and concluded the modeling was adequate for use. The Workgroup did not conduct their own Benchmark Dose modeling. The Workgroup took into consideration the available serum half-life data presented in Russell et al. (2013) and concluded that, unlike most PFAS, allometric scaling could be supported.
Uncertainty factors	Total uncertainty factor of 300: • 1 for LOAEL to NOAEL • 10 for human variability • 3 ($10^{0.5}$) for animal to human variability • 1 for subchronic to chronic • 10 for database deficiencies – lack of additional chronic toxicity studies and no additional developmental data in a second species, and immune and thyroid endpoints	The Workgroup discussed the uncertainty factors and selected an uncertainty factor of 10 for database deficiencies. Several items noted were that the available studies were largely in one species, with no mouse or non-human primate data, and that there was insufficient information addressing immune or thyroid endpoints.
Toxicity value	83,000 ng/kg/day (8.3 mg/kg/day)	Human equivalent dose divided by the total uncertainty factor = toxicity value

Exposure parameters for drinking water HBVs	95th percentile of water intake for consumers only (direct and indirect consumption) for adults (>21 years old) of 3.353 L/day, per Table 3-1, USEPA Exposure Factors Handbook, 2019. An adult body weight of 80 kilograms was used (Table 8-1, USEPA 2011b). A default Relative Source Contribution of 20% was included.	The Workgroup discussed the use of an upper percentile water intake. The 95th percentile for consumers only was selected as it would protect those drinking larger amounts of water. As no human serum data were available to assess the population's exposure to PFHxA from sources other than drinking water, a default Relative Source Contribution of 20% was selected consistent with USEPA (2000) guidance. The Workgroup evaluated the protectiveness of the renal tubular degeneration and renal papillary necrosis in relation to the reduced pup weights observed in Loveless et al. (2009). Available data did not support Benchmark Dose Modeling for further evaluation of Loveless et al. (2009) data.
Drinking water HBV	400,000 ng/L (ppt) (400 micrograms per Liter or parts per billion)	Numeric HBV derived and justified using the above information in the following equation: $$HBV = \frac{RSC \times Toxicity\ value \times Body\ weight}{Water\ intake}$$

Chemical Summary for PFOS

	Decision point	Rationale/justification
Critical study	Dong GH, Zhang YH, Zheng L, Liu W, Jin YH, He QC. (2009). Chronic effects of perfluorooctanesulfonate exposure on immunotoxicity in adult male C57BL/6 mice. Arch Toxicol. 83(9):805-815.	The Workgroup discussed the available evaluations, particularly MDH (2019) and New Jersey Department of Environmental Protection (NJDEP) (2018), and selected a critical study with an immune system functional assay rather than observational data.
Description of the critical study	Adult male C57BL/6 mice were exposed to PFOS daily via oral gavage for 60 days with 0, 0.5, 5, 25, 50 or 125 mg/kg total administered dose, equivalent to 0 or approximately 0.008, 0.08, 0.4, 0.8 or 2.1 mg/kg/day. The NOAEL for suppression of plaque forming cell response and increase in liver mass was 0.5 mg/kg total administered dose which corresponded to a serum concentration of 0.674 mg/L.	The Workgroup acknowledged that immune effects in mice were seen at lower doses in Peden-Adams et al. (2008). Serum concentrations from Peden-Adams et al. (2008) were well below both the NOAEL and LOAEL serum concentrations measured from several other studies as described by Pachkowski et al. (2019) and may be an outlier in the database.
Point of Departure	The NOAEL for suppression of plaque forming cell response and increase in liver mass was 0.5 mg/kg total administered dose which corresponded to a serum concentration of 0.674 mg/L.	The Workgroup decided that serum-based points of departure were appropriate for PFAS.
Human equivalent dose	The serum concentration of 0.674 mg/L was converted to the HED using the below equation (based on ATSDR 2018). $NOAEL_{HED}$ = (TWA serum x k_e x V_d) = 0.0000866 mg/kg/day Ke = 0.000558539 (5.5×10^{-4}) based on a human serum half-life of 1241 days (Li et al. 2018) Vd = 0.23 L/kg (Thompson et al. 2010)	The Workgroup selected the serum half-life from a non-occupationally exposed population as it is closer to the general population's exposure. The Workgroup selected volume of distributions based on human data, when available.
Uncertainty factors	A total uncertainty factor of 30: • 1 for LOAEL to NOAEL • 10 for human variability • 3 ($10^{0.5}$) for animal to human difference (toxicodynamics) • 1 for subchronic to chronic • 1 for database deficiencies	The Workgroup reviewed the uncertainty factors selected by MDH (2019) and adjusted the database uncertainty factor to 1 based on the critical study selection. With consideration of the selected immunotoxicity endpoint, the database uncertainty factor of 1 was supported by the assessments by USEPA (2016), NJDEP (2018), ATSDR (2018) and New Hampshire (2019).

Toxicity value	2.89 ng/kg/day (2.89 x 10^{-6} mg/kg/day) which corresponds to a serum concentration of 0.022 µg/ml Serum levels used in development of these toxicity levels are not meant to indicate a level where health effects are likely. These serum levels are calculated to be at a point where no or minimal risk exists for people drinking water with a certain PFAS.	Human equivalent dose or serum level divided by the total uncertainty and modifying factors = toxicity value
Exposure parameters for drinking water HBV	Breast-fed infant, which is also protective of a formula-fed infant Placental transfer of 43% (MDHHS 2019) Breastmilk transfer of 1.3% (MDHHS 2019) Human serum half-life of 1241 days (3.2 years) (Li et al. 2018) Volume of distribution of 0.23 L/kg (Thompson et al. 2010) 95th percentile drinking water intake, consumers only, from birth to more than 21 years old (Goeden et al. [2019]) Upper percentile (mean plus two standard deviations) breast milk intake rate (Goeden et al. [2019]) Time-weighted average water ingestion rate from birth to 30-35 years of age (to calculate maternal serum concentration at delivery) (Goeden et al. [2019]) Relative Source Contribution of 50% Based on NHANES 95th percentiles for 3-11 (2013-2014) and over 12 years old (2015-2016) participants (CDC 2019)	The Workgroup discussed the Goeden et al. (2019) model which considered full life stage exposure, from fetal exposure, to infant exposure through breastfeeding, and into adulthood. While the model was also developed for a formula-fed infant, the breastfed infant scenario is protective of a formula-fed infant. The Workgroup selected this model for developing drinking water HBVs when the needed inputs were available.
Drinking water HBV	16 ng/L (ppt)	Numeric HBV derived and justified using the above information

Chemical Summary for PFHxS

	Decision point	Rationale/justification
Critical study	NTP 2018 TOX-96: Toxicity Report Tables and Curves for Short-term Studies: Perfluorinated Compounds: Sulfonates and personal communication between MDH and NTP project manager Dr. Chad Blystone (as cited in the HRA Toxicology Review Worksheet for PFHxS, last revised 3/8/2019)	The Workgroup reviewed available evaluations and focused on the ones from Minnesota Department of Health (2019) and ATSDR (2018). In both evaluations, thyroid endpoints were selected. The Workgroup discussed Chang et al. (2018) and concluded that the health outcome (reduction in litter size) was a marginal effect.
Description of the critical study	28-day oral toxicity study in Sprague Dawley rats (NTP, 2018). PFHxS was administered via daily gavage at the following doses for 28 continuous days: Male rats: 0, 0.625, 1.25, 2.5, 5 or 10 mg/kg/day Male rats mean measured plasma levels: 0.102, 66.76, 92.08, 129.0, 161.7, and 198.3 µg/ml Female rats: 0, 3.12, 6.25, 12.5, 25, 50 mg/kg/day Female rats mean measured plasma levels: 0.1754, 37.03, 50.41, 63.82, 83.82, and 95.51 µg/ml n=10/sex/dose Critical effect: decreased serum free thyroxin (T_4) levels was observed in adult male rats at the lowest PFHxS dose administered (0.625 mg/kg/day) Co-critical effects: decreased free and total T_4, triiodothyronine (T_3), and changes in cholesterol levels and increased hepatic focal necrosis	The Workgroup selected this thyroid endpoint as it was a measure of a clinical or functional effect rather than observational.
Point of Departure	POD of 32.4 mg/L serum concentration for male rats based on $BMDL_{20}$. A BMR of 20% was used in the BMD modeling based on clinical and toxicological knowledge regarding adverse outcomes associated with decreases in circulating thyroid hormones. MDH stated that 20% provided a more statistically reliable and biologically significant BMR. (MDH conducted Benchmark Dose modeling and provided modeling run data in the HRA Toxicology Review Worksheet for PFHxS, last revised 3/8/2019.	The Workgroup decided that serum-based points of departure were appropriate for PFAS. Although the Workgroup concluded that the Chang et al. (2018) health outcome was marginal, they did note that the serum concentration at the NOAEL for Chang et al. (2018) was equivalent to the serum concentration at the selected POD.
Human equivalent dose	The POD (32.4 mg/L) was multiplied by a toxicokinetic adjustment based on the chemical's specific clearance rate of 0.000090 L/kg-d (Vd = 0.25 L/kg [Sundstrom et al. [2012], half-life = 1935 days [Li et al. 2018]) for a human equivalent dose of 0.00292 mg/kg/day.	The Workgroup selected the human serum half-life from Li et al. (2018) as it was a non-occupational population drinking water with elevated PFAS.

Uncertainty factors	Total Uncertainty Factor of 300 • 1 for LOAEL to NOAEL • 10 for human variability • 3 ($10^{0.5}$) for animal to human variability (toxicodynamic differences) • 1 for subchronic to chronic • 10 for database deficiencies - to address concerns for early life sensitivity and lack of 2-generation or immunotoxicity studies	The Workgroup reviewed the uncertainty factors used by MDH (2019) and concluded that the database uncertainty factor of 10 was very defensible in this situation, especially for the lack of information on early-life sensitivity.
Toxicity value	9.7 ng/kg/day (9.7 x 10^{-6} mg/kg/day) which corresponds to a serum concentration of 0.11 µg/ml Serum levels used in development of these toxicity levels are not meant to indicate a level where health effects are likely. These serum levels are calculated to be at a point where no or minimal risk exists for people drinking water with a certain PFAS.	Human equivalent dose or serum level divided by the total uncertainty factors = toxicity value
Exposure parameters for drinking water HBV	Breast-fed infant, which is also protective of a formula-fed infant Placental transfer of 80% (MDHHS 2019) Breastmilk transfer of 1.2% (MDHHS 2019) Human serum half-life of 1935 days (Li et al. [2018]) Volume of distribution of 0.25 L/kg (MDH [2019] based on Sundstrom et al. [2012]) 95th percentile drinking water intake, consumers only, from birth to more than 21 years old (Goeden et al. [2019]) Upper percentile (mean plus two standard deviations) breast milk intake rate (Goeden et al. [2019]) Time-weighted average water ingestion rate from birth to 30-35 years of age (to calculate maternal serum concentration at delivery) (Goeden et al. [2019]) Relative Source Contribution of 50% (0.5) Based on NHANES 95th percentiles for 3-11 (2013-2014) and over 12 years old (2015-2016) participants (CDC 2019)	The Workgroup discussed the Goeden et al. (2019) model which considered full life stage exposure, from fetal exposure, to infant exposure through breastfeeding, and into adulthood. While the model was also developed for a formula-fed infant, the breastfed infant scenario is protective of a formula-fed infant. The Workgroup selected this model for developing drinking water HBVs when the needed inputs were available.
Drinking water HBV	51 ng/L (ppt)	Numeric HBV derived and justified using the above information

Chemical Summary for PFBS

	Decision point	Rationale/justification
Critical study	Feng, X; Cao, X; Zhao, S; Wang, X; Hua, X; Chen, L; Chen, L. (2017). Exposure of pregnant mice to perfluorobutanesulfonate causes hypothyroxinemia and developmental abnormalities in female offspring. Toxicol Sci 155: 409-419.	The Workgroup evaluated available agency decision documents and selected the study associated with the draft USEPA (2018) PFBS toxicity value based on thyroid effects. The kidney effects identified in the draft USEPA (2018) toxicity assessment were identified as a potentially compensatory response. The thyroid effects were identified as having greater functional significance.
Description of the critical study	PFBS was orally administered to pregnant ICR mice (n=30/dose) at doses of 0, 50, 200, and 500 mg/kg/day from gestational day (GD) 1 to GD20. Dams (F0) and female offspring (F1) from each dose group were subsequently evaluated for 1) growth and development, 2) hormone levels, and 3) serum PFBS levels. The critical effect is decreased serum total thyroxine (T_4) in newborn (PND 1) mice. Selection of total T_4 as the critical effect is based on a several key considerations that account for cross-species correlations in thyroid physiology and hormone dynamics particularly within the context of a developmental life stage.	
Point of Departure	A POD of 28.19 mg/kg/day ($BMDL_{20}$) for decreased serum total T_4 in newborn (PND 1) mice was selected	The Workgroup noted that a Benchmark Dose approach is preferable to a NOAEL/LOAEL. The Workgroup noted that the thyroid point of departure would be protective of the kidney effects as well. The draft USEPA (2018) toxicity assessment contained administered doses from the individual studies converted to HED doses using study-specific Dosimetric Adjustment Factors (DAF; not reported for each dosing group) derived using allometric scaling ($BW^{3/4}$) prior to BMD model analysis. An example DAF calculation was provided in Table 8 of the draft USEPA (2018) toxicity assessment: dose x DAF = 200 x 0.149 = 29.9 mg/kg/day, where DAF equals $(BW_{animal}^{1/4})/(BW_{human}^{1/4}) = 0.0399^{1/4} \div 80^{1/4} = 0.149$ The POD_{HED} = 4.2 mg/kg/day for decreased serum total T_4 in newborn (PND 1) mice (USEPA 2018). The USEPA POD_{HED} of 4.2 was divided by 0.149 (USEPA example DAF) to obtain a $BMDL_{20}$ of 28.19 mg/kg/day.

Human equivalent dose	The $BMDL_{20}$-HED is 0.0892 mg/kg/day. The $BMDL_{20}$ of 28.19 mg/kg/day was divided by the Dose Adjustment Factor of 316 (human serum half-life/female mouse serum half-life = 665 hours/2.1 hours = 316) (MDH, 2017).	The Workgroup evaluated the half-life based Dose Adjustment Factor used by the Minnesota Department of Health (MDH) (2017). As that allowed conversion of the point of departure to a human equivalent dose using chemical-specific information, the Workgroup selected this approach over the allometric scaling used in the draft USEPA (2018) PFBS toxicity assessment.
Uncertainty factors	The total uncertainty factor is 300. • 1 for LOAEL to NOAEL • 10 for human variability • 3 ($10^{0.5}$) for animal to human variability • 1 for subchronic to chronic • 10 for database deficiencies, for the lack of neurodevelopmental, immunotoxicological, and chronic studies	The Workgroup discussed the uncertainty factors selected in the draft USEPA (2018) toxicity assessment and supported their use.
Toxicity value	300 ng/kg/day (0.0003 mg/kg/day)	Human equivalent dose or serum level divided by the total uncertainty factors = toxicity value
Exposure parameters for drinking water HBV	95th percentile of water intake for consumers only (direct and indirect consumption) for infants (birth to <1 year old) of 1.106 L/day, per Table 3-1, USEPA Exposure Factors Handbook, 2019. An infant body weight of 7.8 kilograms was used and represents a time-weighted average for birth to 1 year old (Table 8-1, USEPA 2011). A default Relative Source Contribution of 20% was included.	The Workgroup discussed the use of an upper percentile water intake. The 95th percentile for consumers only was selected as it would protect those drinking larger amounts of water. As insufficient human serum data was available to assess the population's exposure to PFBS from sources other than drinking water, a default Relative Source Contribution of 20% was selected consistent with USEPA (2000) guidance.
Drinking water HBV	420 ng/L (ppt)	Numeric HBV derived and justified using the above information in the following equation: $$HBV = \frac{RSC \times Toxicity\ value \times Body\ weight}{Water\ intake}$$

Chemical Summary for GenX

	Decision point	Rationale/justification
Critical study	Oral (Gavage) Reproduction/ Developmental Toxicity Study in Mice (OECD TG 421; modified according to the Consent Order) DuPont-18405-1037 (2010) (also contains 90-day toxicity study information and outcomes - that information is not described here)	The Workgroup evaluated the North Carolina Department of Health and Human Services (2017) and draft USEPA (2018) information. The draft USEPA (2018) evaluation was identified as providing a more in-depth and robust analysis and approach.
Description of the critical study	In a combined oral gavage reproductive/developmental toxicity study in mice with HFPO dimer acid ammonium salt, the test compound was administered by oral gavage to Crl:CD1(ICR) mice (25/sex/group) at doses of 0, 0.1, 0.5, or 5 mg/kg/day, according to a modified OECD TG 421. Parental F0 males were dosed 70 days prior to mating and throughout mating through 1 day prior to scheduled termination. Parental F0 females were dosed for 2 weeks prior to pairing and were dosed through LD 20. F1 animals (offspring) were dosed daily beginning on PND 21 through PND 40. At 0.5 mg/kg/day, liver effects (increased absolute and relative weight and histopathologic findings) were reported in both males and females. At 5 mg/kg/day, male and female F1 pups exhibited lower mean BWs at PNDs 4, 7, 14, 21, and 28. Male F1 pups continued to exhibit lower mean BWs at PNDs 35 and 40. The USEPA (2018) identified additional developmental effects (delays in balanopreputial separation and vaginal patency) that occurred at the same dose level, but the biological significance of these effects are equivocal as described. NOAEL (F0) = 0.1; LOAEL (F0) = 0.5 for liver effects (single-cell necrosis in males, and increased relative liver weight in both sexes). NOAEL (F1) = 0.5 for developmental effects (decreased pup weights).	The Workgroup noted that while primarily industry-funded studies are the only ones available, they followed recognized testing guidelines and/or were published following external peer-review. These studies appear to be sufficient for developing values.

Point of Departure	$BMDL_{10}$ = 0.15 mg/kg/day for liver single cell necrosis in parental males (DuPont-18405-1037, 2010).	The Workgroup noted that the Benchmark Dose approach is preferred over the use of a NOAEL/LOAEL. USEPA (2018) evaluated the relevance of this endpoint in humans and noted that, per the Hall criteria (Hall et al., 2012) liver effects accompanied by effects such as necrosis or inflammation, among others, are indicative of liver tissue damage (USEPA, 2018). While some liver effects in rodents are mediated through PPARα and may be less relevant to humans, available information indicates that liver single cell necrosis may be mediated by a number of processes and pathways. In PPARα-mediated rodent hepatocarcinogenesis, liver necrosis is not a key event. (DeWitt and Belcher, 2018)
Human equivalent dose	A candidate POD_{HED} was derived from the $BMDL_{10}$ for liver effects using a $BW^{3/4}$ allometric scaling approach. A BW_a of 0.0372 kg was identified as the mean BW of the F0 male mouse controls. A BW_h of 80 kg for humans was selected. The resulting DAF for the allometric scaling of doses from mice to humans is 0.15. Using the $BMDL_{10}$ of 0.15 mg/kg/day to complete the calculation results in a POD_{HED} for single-cell necrosis of the liver from DuPont-18405-1037 (2010) of 0.023 mg/kg/day (USEPA 2018).	The Workgroup noted that a toxicokinetic adjustment from the point of departure to human equivalent dose would provide a chemical-specific conversion. However, no chemical-specific data on human serum half-life was available that would allow this conversion. Allometric scaling, per USEPA (2011a) guidance, was used.
Uncertainty factors	Total Uncertainty Factor of 300 • 1 for use of a LOAEL to NOAEL • 10 for human variability • 3 ($10^{0.5}$) for animal to human variability • 3 ($10^{0.5}$) for subchronic-to-chronic • 3 ($10^{0.5}$) for database deficiencies, including lack of epidemiological, and developmental and immunotoxicological studies in laboratory animals	The Workgroup evaluated the uncertainty factors selected by USEPA (2018). Given the deficiencies in the database, including a lack of epidemiological studies and developmental and immunotoxicological in laboratory animals, a database uncertainty factor of 3 was retained. In conjunction with the deficiencies covered by the database uncertainty factor, the subchronic to chronic uncertainty factor of 3 was identified as sufficient.
Toxicity value	77 ng/kg/day (7.7 x10-5 mg/kg/day)	Human equivalent dose or serum level divided by the total uncertainty = toxicity value

Exposure parameters for drinking water HBV	95th percentile of water intake for consumers only (direct and indirect consumption) for adults (>21 years old) of 3.353 L/day, per Table 3-1, USEPA Exposure Factors Handbook, 2019. An adult body weight of 80 kilograms was used (Table 8-1, USEPA 2011b). A default Relative Source Contribution (RSC) of 20% was included.	The Workgroup discussed the use of an upper percentile water intake. The 95th percentile for consumers only was selected as it would protect those drinking larger amounts of water. As no human serum data was available to assess the population's exposure to GenX from sources other than drinking water, a default Relative Source Contribution of 20% was selected consistent with USEPA (2000) guidance. The Workgroup evaluated the protectiveness of adult exposure in combination with the point of departure. The NOAEL for developmental effects described above was at a dose five times higher than the NOAEL for liver necrosis effects. As a drinking water value based on the developmental NOAEL would be higher than the level presented below, the Workgroup decided that the drinking water HBV below based on liver effects would be sufficiently conservative to be protective of infant exposure.
Drinking water HBV	370 ng/L (ppt)	Numeric HBV derived and justified using the above information in the following equation: $$HBV = \frac{RSC \times Toxicity\ value \times Body\ weight}{Water\ intake}$$

Rationale for Individual HBVs

While there are on-going discussions regarding the grouping of multiple PFAS into one drinking water value, there is no consensus from the scientific community on which PFAS should be grouped or the basis of that grouping. Grouping methods that have been applied include combining multiple PFAS into one number based on known or assumed toxicity, carbon chain length, and/or biological half-life (simple addition) as well as the use of relative ability of the grouped PFAS to lead to a comparable health endpoint (toxic equivalency); the latter approach being similar to those used for dioxins, furans, and coplanar polychlorinated biphenyls.

There is, however, scientific agreement that the long-chain PFAS (eight carbons and above for carboxylates and six carbons and above for sulfonates) have similar toxicity. Based on the similarity in toxicity for the long-chain PFAS, the Workgroup recommends use of the HBV for PFNA (6 ng/L [ppt]) as a screening level for all other long-chain PFAS included on the USEPA Method 537.1 analyte list for which the Workgroup did not develop an individual HBV. This screening level should not be used to evaluate the risk of developing health effects, but as a screening tool for EGLE/public water supplies to use for decision making.

Adverse health effects of long chain (six-carbon perfluorosulfonic acids or eight-carbon perfluorocarboxylic acids) have been established in epidemiological and laboratory animal model studies. These adverse health effects include kidney and testicular cancer, elevated serum cholesterol, endocrine effects, immune effects, and reproductive effects (ATSDR, 2018). These effects are supported by studies of different human populations exposed to a few or to many PFAS, including those from populations of high PFAS exposure and the general population and demonstrate that many different long-chain PFAS can produce similar adverse health effects in exposed humans. However, while not all long-chain PFAS have robust data available for the development of a HBV, the totality of evidence indicates that long-chain PFAS in drinking water may pose risks of adverse health effects.

While health concerns are based on the total exposure to PFAS across many sources, because drinking water is the predominant source of exposure for many people consuming contaminated water, it remains the focus for health-based regulation based on current knowledge. Therefore, monitoring of drinking water should continue and be based on levels that will be protective for exposure to all PFAS.

At this time, it is recommended that the proposed HBV for PFNA be used as a screening level for the long chain PFAS included in USEPA Method 537.1 that may be found in drinking water that are not covered by an individual PFAS HBVs as presented in the Summary Table of Drinking Water HBVs.

Summary of Conclusions

Summary Table of Drinking Water HBVs

Specific PFAS	Drinking Water Health-based Value	Chemical Abstract Services Registry Number (CASRN)
PFNA	6 ng/L (ppt)	375-95-1
PFOA	8 ng/L (ppt)	335-67-1
PFHxA	400,000 ng/L (ppt)	307-24-4
PFOS	16 ng/L (ppt)	1763-23-1
PFHxS	51 ng/L (ppt)	355-46-4
PFBS	420 ng/L (ppt)	375-73-5
GenX	370 ng/L (ppt)	13252-13-6

For all other PFAS on the USEPA Method 537.1 analyte list, the Workgroup recommendation is to use the lowest long-chain (eight carbons and above for carboxylates and six carbons and above for sulfonates) HBV of 6 ppt, which is the HBV for PFNA. Those other long-chain PFAS included in USEPA Method 537.1 are: NEtFOSAA (CASRN: 2991-50-6); NMeFOSAA (CASRN: 2355-31-9); PFDA (CASRN: 335-76-2); PFDoA (CASRN: 307-55-1); PFTA (CASRN: 376-06-7); PFTrDA (CASRN: 72629-94-8); and PFUnA (CASRN: 2058-94-8).

As shown in Figure 1 (below), the drinking water values for PFOS and PFOA have gone down over time. This is a reflection of the evolving science, both the ever-increasing knowledge gained from published toxicology and epidemiology studies and the risk assessments for development of toxicity values and drinking water values. Information continues to become available on multiple PFAS and as there are thousands of PFAS, new information will likely become available for many years to come. It is quite possible that the same trend demonstrated in Figure 1 will be seen for other PFAS, where drinking water values become lower over time and that new values could be developed within a few years' time. As described in the Challenges and Limitations section, along with use of current scientific data, development of drinking water values includes a certain amount of scientific judgement informed from the scientific knowledgebase. It is that combination of scientific judgement and data that ultimately informs the development of drinking water values. With emerging contaminants like PFAS, rapid availability of data drives public health protective actions and drinking water values.

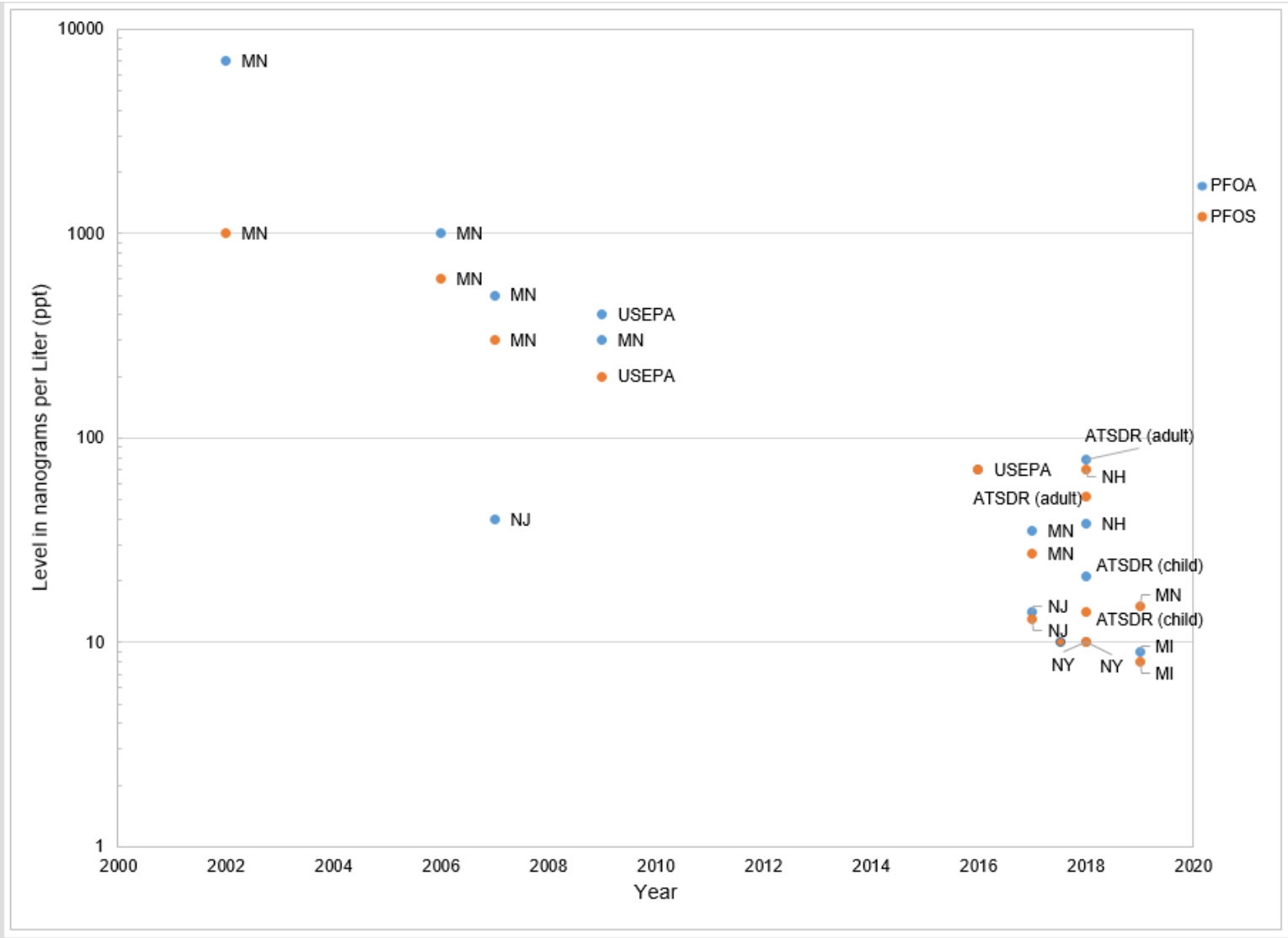

Figure 1: Screening Levels, Health-Based Values, and Regulatory Standards for PFOS and PFOA Over a 20-Year Timeframe.

The numbers in Figure 1 are the various screening levels, HBVs, and regulatory standards developed by various agencies and states over time as of June 2019. It does not include the agencies that include multiple PFAS into a single value. This should not be considered an exhaustive list of all PFAS drinking water values available, and values may be updated, and additional values will likely become available. The Michigan values included in Figure 1 are the MPART Human Health Workgroup public health drinking water screening levels.

Concluding Remarks

The Workgroup would like to commend the State of Michigan for addressing PFAS concerns with unusual rigor, openness, and reliance on independent scientific guidance. From the beginning of the recognition of environmental and public health issues related to PFAS, the State of Michigan has been at the forefront nationally in assessing the scope of the contamination, intervening to mitigate exposure, and monitoring the evidence to guide policy. The statewide survey of drinking

water supplies was highly unusual if not unique relative to other areas, and the process of developing Maximum Contaminant Levels as rigorous as any in the nation. By engaging experts from outside the state agencies to complement the considerable expertise of the staff in the Michigan Departments of Health and Human Services and Environment, Great Lakes, and Energy, they have demonstrated their commitment to following the evidence through to developing sound policy.

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Appendix A: Acronym List

ATSDR	Agency for Toxic Substances and Disease Registry
BMD	benchmark dose
BMDL	lower confidence limit on the benchmark dose
BMR	benchmark response
BW	body weight
BWa	body weight animal
BWh	body weight human
CDC	Centers for Disease Control and Prevention
DAF	dosimetric adjustment factor
EGLE	Environment, Great Lakes, and Energy (Michigan Department of)
GD	gestational day
GenX	perfluoro-2-propoxypropanoic acid
HBV	health-based value
HED	human equivalent dose
HFPO	hexafluoropropylene oxide
HRA	health risk assessment
kg	kilogram
L	liter
LD	lactation day
LHA	lifetime health advisory
LOAEL	lowest observed adverse effect level
MCL	Maximum Contaminant Level
MDH	Minnesota Department of Health
MDHHS	Michigan Department of Health and Human Services
mg	milligram
MI	Michigan
ml	milliliter
MPART	Michigan PFAS Action Response Team
µg	microgram
ng	nanogram
NHANES	National Health and Nutrition Examination Survey
NJDEP	New Jersey Department of Environmental Protection
NOAEL	no observed adverse effect level
OECD	Organization for Economic Co-operation and Development
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutane sulfonic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexane sulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonic acid
PND	postnatal day
POD	point of departure
POD_{HED}	point of departure human equivalent dose
PPAR	peroxisome proliferator-activated receptor
ppt	parts per trillion
RfD	reference dose
RSC	relative source contribution
TWA	time weighted average
UF	uncertainty factor
USEPA	United States Environmental Protection Agency

Appendix B: MPART Motion for Creation of Science Advisory Workgroup, April 4, 2019

Motion

Motion to establish a Science Advisory Workgroup with the Charge described below, comprised of external members with expertise in toxicology, epidemiology, and risk assessment, and further to authorize the chairperson of MPART to finalize the appointments in consultation with MPART members.

Preamble

On March 26, 2019, Governor Whitmer directed the Michigan PFAS Action Response Team (MPART) to further protect public health and the environment, by forming a Science Advisory Workgroup to "review both existing and proposed health-based drinking water standards from around the nation to inform the rule making process for appropriate Maximum Contaminant Levels for Michigan..." Toward this objective, the Science Advisory Workgroup shall make numeric recommendation(s) to MPART for those per- and polyfluoroalkyls substances (PFAS) for which adequate information exists.

Charge

The Science Advisory Workgroup shall:

1. For the PFAS listed in USEPA Method 537.1, review all existing and proposed national- and state-derived PFAS drinking water standards and identify the most scientifically defensible non-cancer or cancer-based public health toxicity values available for each individual PFAS chemical family member, or combination thereof, for which the Science Advisory Workgroup determines that adequate information exists. Provide written justification that shall include, but not be limited to, the basis for the selection of the primary study, critical effect identification, point of departure determination, evaluation of all uncertainty and/or modification factors applied, and the non-cancer or cancer-based toxicity value derivation.
2. Review all existing and proposed national- and state-derived PFAS drinking water standards and identify the most scientifically defensible exposure assessment and risk evaluation methodology for each individual PFAS chemical family member, or combination thereof, for which the Science Advisory Workgroup determines that adequate information exists. Provide written justification that shall include, but not be limited to, selection of the most appropriate receptor(s) and identification of all appropriate exposure assumptions for the receptor(s).
3. Identify the most appropriate and scientifically defensible combination of each specific PFAS toxicity value and exposure assessment and risk evaluation methodology, including consideration of relative source contribution, from which to derive a health-based drinking water value for each individual PFAS chemical family member, or combination thereof, for which the Science Advisory Workgroup determines that adequate information exists.
4. Provide to MPART no later than July 1, 2019, a report recommending scientifically-defensible numeric health-based values to inform the rulemaking process for Maximum Contaminant Levels for each individual PFAS chemical family member, or combination thereof, with written justification for the calculation methodology and each input into used in the methodology by the Science Advisory Workgroup.

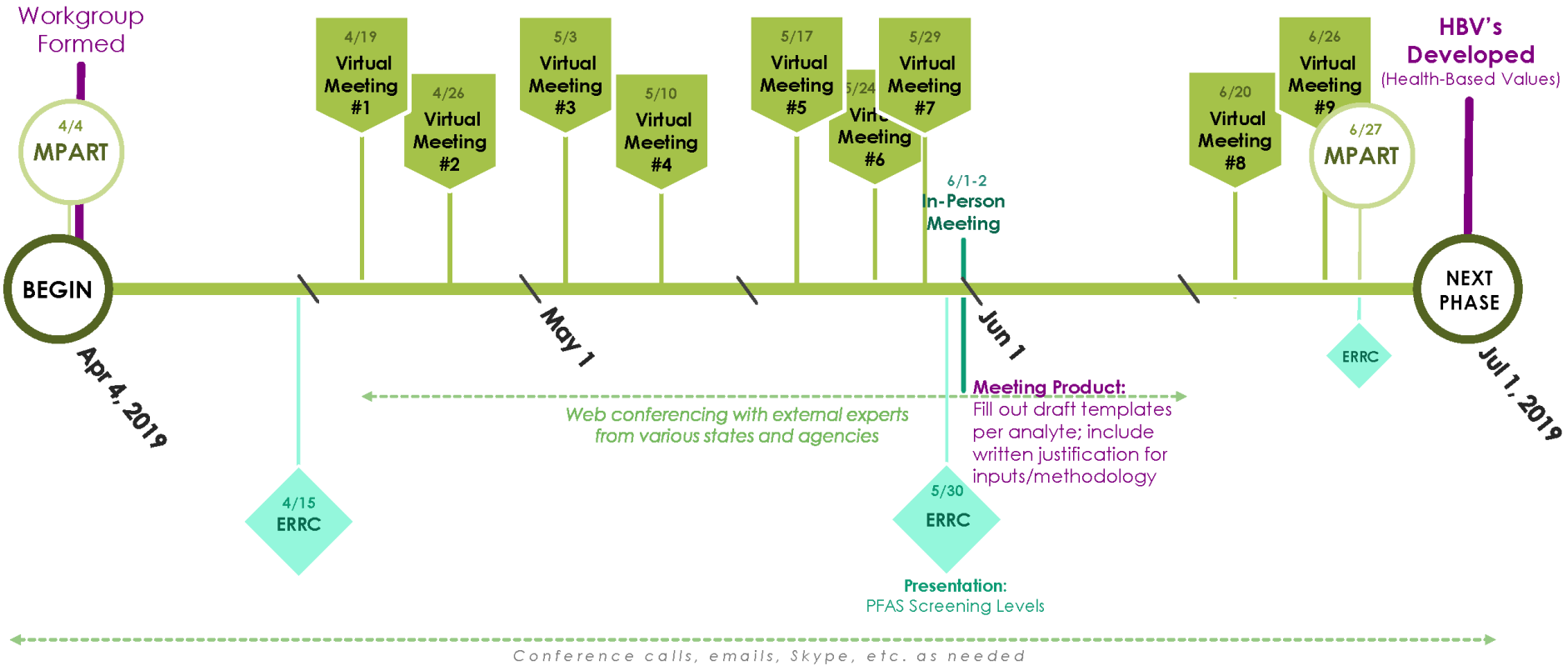
End

Appendix C: USEPA Method 537.1 Analyte List

Analyte Name*	Acronym	Fluorinated Carbon Chain Length	Chemical Abstract Services Registry Number (CASRN)
Perfluorotetradecanoic acid	PFTeA	C_{14}	376-06-7
Perfluorotridecanoic acid	PFTriA	C_{13}	72629-94-8
Perfluorododecanoic acid	PFDoA	C_{12}	307-55-1
Perfluoroundecanoic acid	PFUnA	C_{11}	2058-94-8
Perfluorodecanoic acid	PFDA	C_{10}	335-76-2
Perfluorononanoic acid	PFNA	C_9	375-95-1
Perfluorooctanoic acid	PFOA	C_8	335-67-1
Perfluoroheptanoic acid	PFHpA	C_7	375-85-9
Perfluorohexanoic acid	PFHxA	C_6	307-24-4
Perfluorooctanesulfonic acid	PFOS	C_8	1763-23-1
Perfluorohexanesulfonic acid	PFHxS	C_6	355-46-4
Perfluorobutanesulfonic acid	PFBS	C_4	375-73-5
2-(N-Ethylperfluorooctanesulfonamido) acetic acid	N-EtFOSAA	C_8	2991-50-6
2-(N-Methylperfluorooctanesulfonamido) acetic acid	N-MeFOSAA	C_8	2355-31-9
Hexafluoropropylene oxide dimer acid	HFPO-DA (GenX)	C_6	13252-13-6[a]
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	C_{10}	763051-92-9[b]
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	9Cl-PF3ONS	C_8	756426-58-1[c]
4,8-dioxa-3H-perfluorononanoic acid	ADONA	C_7	919005-14-4[d]

[a] HFPO-DA is one component of the GenX processing aid technology.
[b] 11Cl-PF3OUdS is available in salt form (e.g. CASRN of potassium salt is 83329-89-9).
[c] 9Cl-PF3ONS analyte is available in salt form (e.g. CASRN of potassium salt is 73606-19-6)
[d] ADONA is available as the sodium salt (no CASRN) and the ammonium salt (CASRN is 958445-448).
** Some PFAS are commercially available as ammonium, sodium, and potassium salts. This method measures all forms of the analytes as anions while the counterion is inconsequential. Analytes may be purchased as acids or as any of the corresponding salts.*

Appendix D: Timeline for the Science Advisory Workgroup's Development of Drinking Water HBVs



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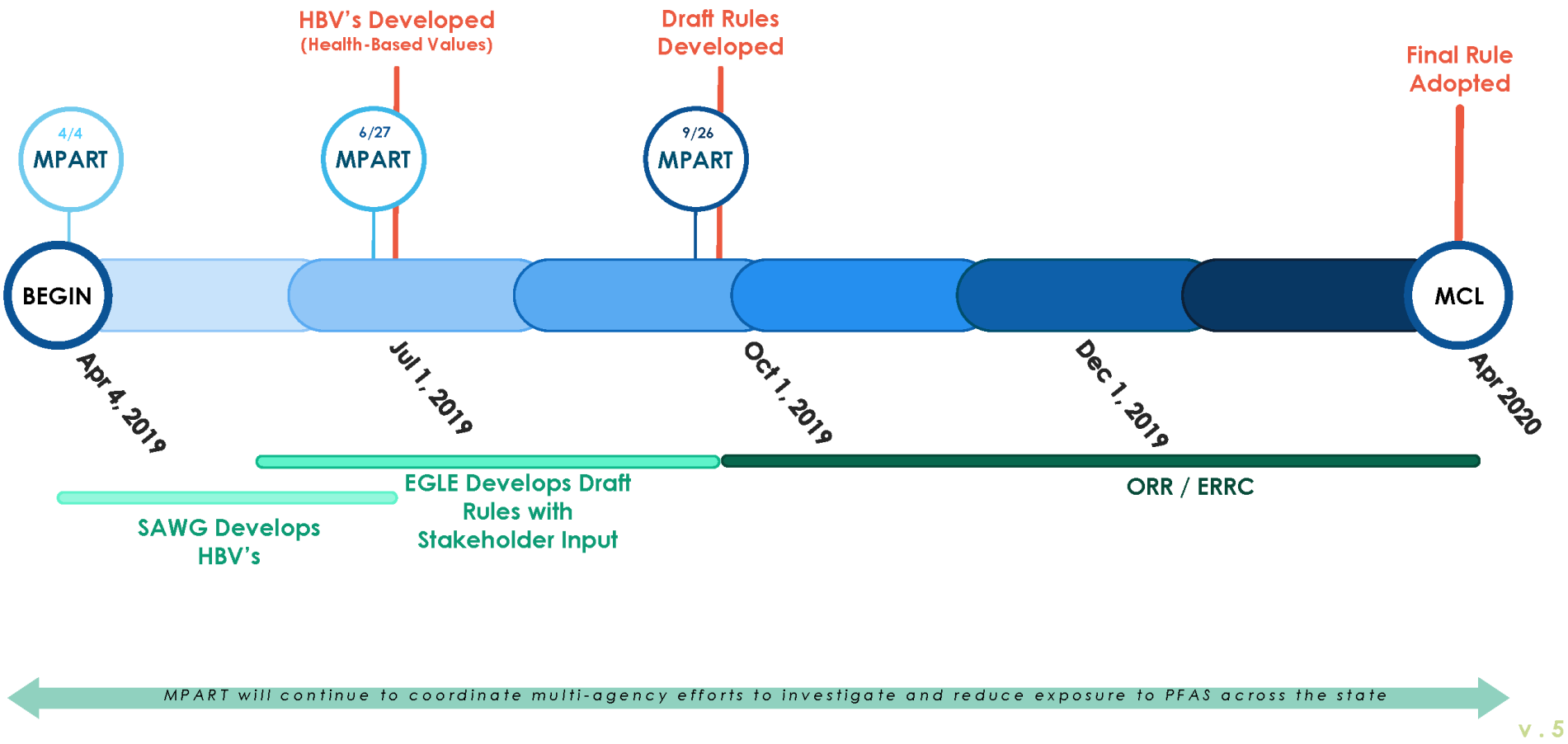
ERRC = Environmental Rules Review Committee

Appendix E: Timeline of the Maximum Contaminant Level Development Process



MPRnews

3M and PFC groundwater contamination in Minnesota

Minnesota tightens rules on 'forever' chemical in drinking water

Kirsti Marohn Collegeville, Minn. April 3, 2019 10:26 PM

State health officials use scientific research to set what are known as health-based advisory values for a variety of chemicals at levels that are likely to pose little or no risk to human health. Judy Griesedieck for MPR News File

Minnesota health officials are adjusting acceptable levels for two troublesome pollutants found in drinking water supplies in the east Twin Cities metro area, based on new scientific data.

The chemicals are part of a family of compounds known as per- and polyfluoroalkyl substances, or PFAS, found in products ranging from nonstick cookware to firefighting foam.

On Wednesday, the Minnesota Department of Health lowered slightly the health-based advisory values for perfluorooctane sulfonate, or PFOS, to 15 parts per trillion, down from the previous level of 27 parts per trillion set two years ago. The levels are used to determine whether water from public systems and private wells is safe to drink.

State health officials use scientific research to set what are known as health-based advisory values for a variety of chemicals at levels that are likely to pose little or no risk to human health. The state Pollution Control Agency uses the values to determine whether cities and other public water suppliers must treat their drinking water to reduce contaminants.

The impact of the change announced Wednesday is minor, but will allow health officials to more accurately evaluate the potential health risks of exposure to the chemicals, said Jim Kelly, manager of environmental surveillance and assessment at the state health department.

"It's a tweak, it's a slight adjustment, in our minds," Kelly said. "That's really a very small difference when you're talking about low, low parts per trillion."

The health department for the first time also set a value for perfluorohexane sulfonic acid, or PFHxS, at 47 parts per trillion. Until now, there hasn't been enough scientific data available to set a value for PFHxS, Kelly said, so the health department was using the PFOS value of 27 parts per trillion as a substitute.

PFAS compounds were manufactured beginning in the 1950s for a variety of industrial and consumer products, including nonstick cookware, stain and water repellents for clothing and furniture, food wrappers and firefighting foam.

About 20 years ago, studies found that PFAS were showing up around the globe: in water, soil, wildlife and even in humans. Scientists are still studying the health effects of the chemicals, but research has linked prolonged exposure to PFAS to health problems including some cancers, thyroid disease and infertility.

States are struggling with how to regulate PFAS chemicals, which are showing up in drinking water supplies across the nation.

The U.S. Environmental Protection Agency has established a non-binding advisory level of 70 parts per trillion for two of the chemicals, PFOA and PFOS. Other states, including Minnesota, have set more stringent levels.

The latest change is a less drastic action than in 2017, when Minnesota health officials cut the health-based values for PFOA and PFOS in half. The cities of Cottage Grove, Oakdale, Woodbury, St. Paul Park and Bemidji had to take action quickly to ensure their drinking water supplies met the new standards.

The new values won't affect any public drinking water systems, Kelly said. But the health department will issue advisories notifying the owners of six private wells in the east metro area that their wells are above the recommended level. Those well owners will be provided with an alternate water supply, Kelly said.

Since 2002, state officials have issued nearly 1,100 private well advisories due to PFAS levels.

Minnesota's 3M Company manufactured PFAS at its plant in Cottage Grove, Minn., for decades beginning in the 1950s.

The company legally disposed of its waste containing PFAS in landfills in the eastern suburbs of the Twin Cities metro area. The chemicals leached into the groundwater in nearby cities like Woodbury, Oakdale, Cottage Grove and Lake Elmo.

In 2010, Minnesota sued 3M for natural resource damages. The high-profile case settled last year when 3M agreed to pay $850 million to provide safe drinking water and clean up contamination in the east metro.

Kelly said he thinks the new values will be helpful as state and local officials try to figure out how to use the 3M settlement money to come up with long-term drinking water solutions for the east metro.

"That depends on a really accurate picture of where the groundwater is impacted to the point where it can't be used in an untreated manner for drinking," he said.

On the federal level, the EPA in February released an action plan aimed at moving toward setting safety limits nationwide for PFAS. Environmentalists and some members of Congress said the strategy wasn't aggressive enough.

- Bemidji settles with 3M over water treatment for 'forever chemicals'
- Minn. agencies roll out plan to tackle 'forever chemicals'
- State offers options to keep St. Paul suburban water free of 3M chemicals

What are the health effects of PFAS?

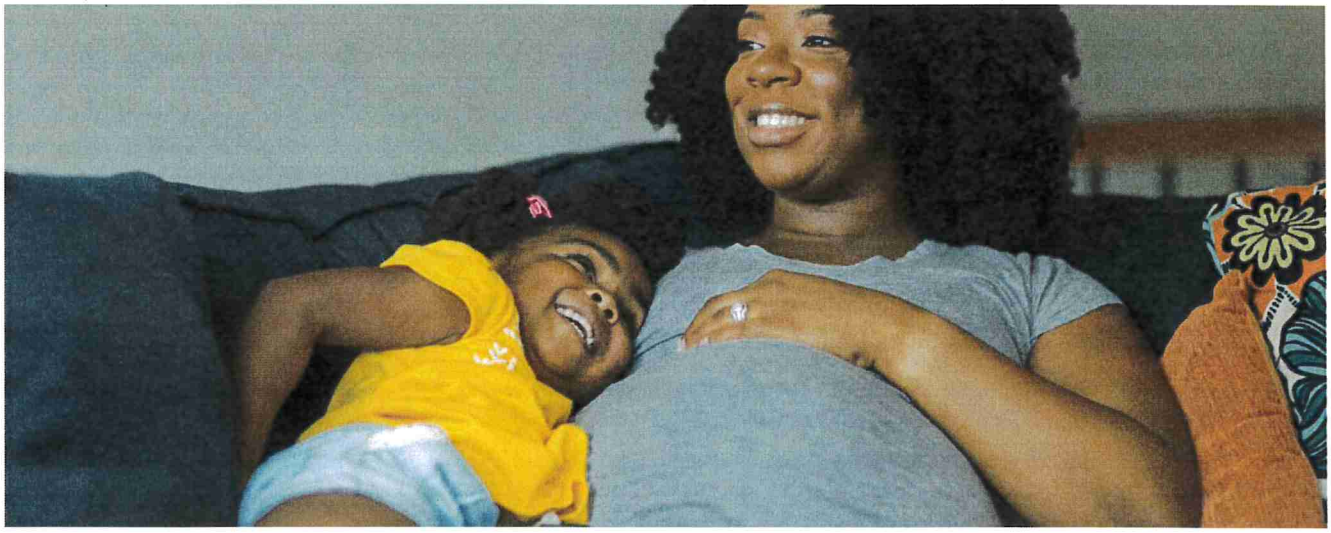
Statement on Potential Intersection between PFAS Exposure and COVID-19:

CDC/ATSDR understands that many of the communities we are engaged with are concerned about how PFAS exposure may affect their risk of COVID-19 infection. We agree that this is an important question.

CDC/ATSDR recognizes that exposure to high levels of PFAS may impact the immune system. There is evidence from human and animal studies that PFAS exposure may reduce antibody responses to vaccines (Grandjean et al., 2017, Looker et al., 2014), and may reduce infectious disease resistance (NTP, 2016). Because COVID-19 is a new public health concern, there is still much we don't know. More research is needed to understand how PFAS exposure may affect illness from COVID-19.

References:

1. Grandjean P, Heilmann C, Weihe P, et al. Estimated exposures to perfluorinated compounds in infancy predict attenuated vaccine antibody concentrations at age 5-years. J Immunotoxicol. 2017;14(1):188-195. doi:10.1080/1547691X.2017.1360968
2. Looker C, Luster MI, Calafat AM, et al. Influenza vaccine response in adults exposed to perfluorooctanoate and perfluorooctanesulfonate. Toxicol Sci. 2014;138(1):76-88. doi:10.1093/toxsci/kft269
3. NTP (National Toxicology Program). 2016. Monograph on Immunotoxicity Associated with Exposure to Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). Research Triangle Park, NC: National Toxicology Program. https://ntp.niehs.nih.gov/ntp/ohat/pfoa_pfos/pfoa_pfosmonograph_508.pdf



A large number of studies have examined possible relationships between levels of per- and polyfluoroalkyl substances (PFAS) in blood and harmful health effects in people. However, not all of these studies involved the same groups of people, the same type of exposure, or the same PFAS. These different studies therefore reported a variety of health outcomes. Research involving humans suggests that high levels of certain PFAS **may** lead to the following:

- Increased cholesterol levels
- Changes in liver enzymes
- Small decreases in infant birth weights
- Decreased vaccine response
- Increased risk of high blood
- Increased risk of kidney or

in children

pressure or pre-eclampsia in pregnant women

testicular cancer

At this time, scientists are still learning about the health effects of exposures to mixtures of different PFAS.

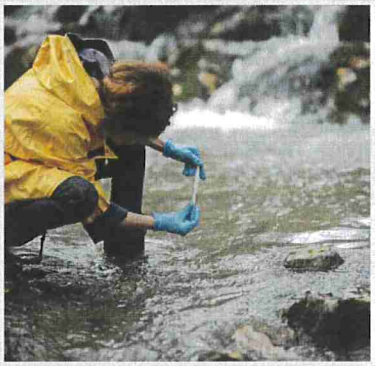
One way to learn about whether PFAS will harm people is to do studies on lab animals.

- Most of these studies have tested doses of PFAS that are higher than levels found in the environment.
- These animal studies have found that PFAS can cause damage to the liver and the immune system.
- PFAS have also caused birth defects, delayed development, and newborn deaths in lab animals.

Humans and animals react differently to PFAS, and not all effects observed in animals may occur in humans. Scientists have ways to estimate how the exposure and effects in animals compare to what they would be in humans.

Additional research may change our understanding of the relationship between exposure to PFAS and human health effects.

What are PFAS?

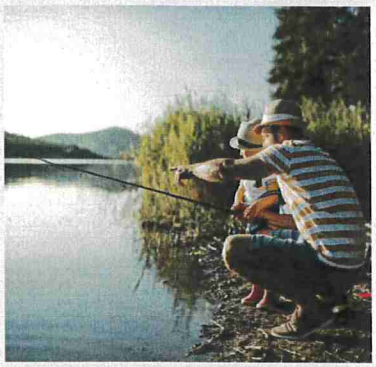


PFAS are man-made chemicals that have been used in industry and consumer products worldwide since the 1950s.

How Can I be Exposed?

There are several ways you can be exposed to PFAS.

PFAS in the US



Most people in the United States have been exposed to PFAS and have PFAS in their blood.

Page last reviewed: June 24, 2020