

**PFAS Treatment Technologies Subgroup**  
Virginia Department of Health Office of Drinking Water  
DRAFT Meeting Minutes  
March 25, 2021  
(Scheduled for 10:00 a.m. – 11:30 a.m.)

## **Meeting Opening**

ODW Southeast Virginia Field Office (SEVFO) Director, Dan Horne called the meeting to order at 10:03 am. He reminded everyone attending the meeting that it would be conducted as a public meeting under FOIA guidance, and would be recorded. Minutes and meeting materials will be posted on Town Hall.

Dan Horne welcomed all Subgroup members and members of the public to the Treatment Technologies meeting and called roll. Members attending the meeting who answered the roll call were:

1. Henry Bryndza (Dupont)
2. Wendy Eikenberry (Augusta County Service Authority)
3. Mark Estes (Halifax County Service Authority)
4. Jamie Bain Hedges (Fairfax Water)
5. Mike Hotaling (Newport News Water Works)
6. Mike McEvoy (Western Virginia Water Authority)
7. Russ Navratil (VA AWWA)
8. Kelly Ryan (Virginia American Water)

Others noted as being present:  
Ellen Egen

VDH:  
Nelson Daniel (ODW)  
Christine Latino (ODW)

## **Review Meeting Agenda**

Dan reviewed the agenda proposed for the meeting.

1. Call to order – Member roll-call – Review Agenda – Review draft summary from last meeting
2. Report on assignments from last meeting
3. Update on resources
4. Upcoming Meeting and webinars
5. Preparing for next meeting, assignments
6. Public Comments
7. Next Meeting

Dan asked if there were any additions to the proposed agenda. There were no adjustments proposed, and the proposed agenda was accepted.

### **Review of the Draft Summary from Last Meeting.**

Dan noted that the minutes had been distributed by email on March 22. He asked if there were any edits or corrections needed. There were none identified. Dan proposed that the minutes be accepted as final. Henry noted that the full Workgroup had voted to accept their minutes via votes cast in the “Chat” function. Dan said that would be a great way to move forward. Henry moved to accept the minutes as final, and Mark seconded. The group then voted to accept the minutes from February as final.

### **Assignments from last meeting:**

General assignment for all members:

Review the three most common technologies used for PFAS treatment/removal: Granular Activated Carbon (GAC), Ion Exchange (IX), and Reverse Osmosis (RO). Members should have general familiarity with the processes.

Specific assignments

**Mike Hotaling:** will prepare a review of reverse osmosis, based on the NNWW plant, and info on the Cape Fear NC Plant. He advised that he uploaded two documents to the SharePoint page: a one-page document entitled “Reverse Osmosis (RO) Treatment for PFAS” and a copy of an article from the October 2020 issue of the Journal AWWA about the Cape Fear (Wilmington NC) plant.

The RO document provides a basic summary of RO performance for PFAS removal, as well as cost and concentrate disposal issues. The costs are based on treating a brackish groundwater (similar to the NNWW facility).

The Cape Fear facility pulls water from the Cape Fear River, inland from the ocean. After considerable desk-top and pilot studies, they have started construction on GAC treatment facilities. The target PFAS chemical is Gen X (a short-chain replacement for PFOA).

Mark Estes asked if the Cape Fear facility looked at multiple treatment processes in sequence (series). Mike believes they were evaluated independently. He said that it might make sense to use multiple technologies, depending on the individual circumstances. Mark also questioned if the design was based on lifetime exposure levels or acute exposure levels. Mike wasn’t sure.

**Henry Bryndza:** will review the GAC, RO, and IX processes.

Henry submitted a document summarizing these three technologies, and Dan will post it to the SharePoint page. Henry discussed several points about each technology, including some advantages, disadvantages, and unintended environmental consequences:

IX: Generally good for most PFAS removal (both long-chain and short-chain species), depending on the resin design. The units may be regenerated in place, but this will yield a concentrated stream of PFAS-containing liquid that can be difficult to dispose of. If the resin isn't regenerated in place, the resins will need to be disposed of in special landfills or incinerated. Incineration can result in significant greenhouse gas emissions.

GAC: This is a well-established technology for removing many dissolved organics, including PFAS, primarily for long-chain species, but perhaps not for short-chain species (particularly at low feed concentrations). Need to regenerate in high-temperature furnaces, but if carbon is regenerated, it needs to go back to the same site that it came from. Regeneration yields significant greenhouse gases and high energy costs.

RO: Another well-established technology for removing dissolved organics, including PFAS – effective at removing both long-chain and short-chain species. Very energy intensive, and generates a waste stream that has high concentrations of PFAS (and potentially other contaminants) that may be difficult to dispose of.

Jamie had a questions regarding GAC regeneration process – what happens to the PFAS? Henry cited a study from Karlsruhe Institute of Technology (Germany) which indicates that even the most recalcitrant PFAS is fully destroyed.

Incineration is a very effect method of destroying PFAS. She asked about IX. Henry noted that there is still a waste stream that will add to cost of operations, and the owners will need capture the cost. Affordability is something we would need to keep in mind.

Mike McEvoy agreed that the GAC regeneration process will destroy the PFAS compounds, but at those temperatures, you will also lose a significant portion of the carbon itself. The question is, how much carbon are you willing to lose with the process? They're trying to not destroy the entire mass. There is a question about what is the optimum temperature.

**Mike McEvoy** did some research that he will upload to the site regarding Granular Activated Carbon Filtration and the Cost considerations for GAC. He will also provide information from WVWA's consultant.

Mike noted that GAC is effective for long-chain compounds but removal capacity is quickly depleted for short-chain compounds. He also noted that testing costs

(\$275 to \$300 per test) are high for operational control – one might need multiple tests per month to determine breakthrough.

He noted that a project in Alabama is seeing carbon disposal/regeneration costs are higher than expected due to PFAS concerns. He said that the GAC regeneration/replacement costs were coming in about 4 times higher than the PER estimates, for various reasons. He cited the NSF/ANSI 61 standard, and concerns about comingling regenerated carbons from different water plant sources. He also noted greenhouse gas concerns during carbon production and transport.

Mike mentioned some case studies of PFAS removal via GAC.

1. City of Ann Arbor (2019):  
This is a 22 mgd plant. \$1Million capital costs (only due to the fact that existing infrastructure was available). \$300K per year in carbon replacement. Carbon last two years (1/2 replaced each year). Looking at IX for short chain compounds because carbon was deemed impractical.
2. Oakdale, Minnesota (2015):  
This is a 2.9 mgd facility, designed for long-chain treatment only. \$3M capital expenses, and \$192K per year operating expenses. Carbon is replaced every 18 months.
3. He also noted that New Jersey American Water has several GAC plants in operation.

Mike said that he wasn't able to find much on IX treatment.

He then discussed RO, noting that it is very effective at removing PFAS and other emerging contaminants. There can be significant cost considerations for RO. He noted that there can be other options for membrane treatment available besides "standard" RO, including nanofiltration and "low pressure" RO. RO does not destroy these compounds, it just concentrates them, creating a disposal challenge. He noted a study of treatment options by CDM Smith for Brunswick Co, NC. They looked at a chained GAC and IX facility and compared that to an RO facility. They chose a Low Pressure RO, 3- stage system, which would create a 10% concentrate. The plant is under construction, with a design of 41 mgd, at a cost of \$72M (\$59M 25 yr. present worth cost).

Mike said that the cost numbers he's seen so far all appear to be for big plants. He's not seen much for small systems.

A question was posted to the chat, asking how scalable are these plants? The question was asked primarily about small systems. It was noted that many of the manufacturers can easily add additional units in parallel or in series (or both) to meet system demand.

Mike Hotaling noted that both GAC and RO remove TOC and other compounds as well as PFAS. We need to be able to account for these benefits when we calculate the costs for PFAS removal.

Mike also noted that he has some cost curves addressing costs vs. plant size for both GAC and RO. These curves were done as part of the effort to look at the impacts of the DBP rules, but they still should be fairly good. He will share these with the group.

### **Update on Resources**

Dan noted that Mike Hotaling had provided a slide presentation by Hazen & Sawyer, and this had been posted to the SharePoint page.

### **Upcoming Events**

Dan reminded that AWWA will hold a webinar on Wednesday, March 31, 2021, from 1:00 to 2:30 pm., on their new PFAS Treatment Selection Guide. Dan will try to get a copy of the slides and post to SharePoint.

Dan reminded that the full PFAS Workgroup Meeting will be in late April. Tony Singh will be providing a date for this meeting.

### **Preparing for the next meeting:**

Dan noted that we will need to discuss the format for treatment process summaries that will be prepared for presentation to the full Workgroup. Things that we will need to cover include:

- General discussion, capabilities, limitations, operating considerations, ongoing process performance monitoring
- Need to look at case histories of operating facilities (cost, performance, monitoring operations, etc.

We will need to start preparing these summaries to share with other subgroups and the full Workgroup.

### **Assignments**

Dan asked that the members please look at smaller systems, similar to what we might see in Virginia. The large utilities should be able to address the situation. Smaller groundwater systems might need help on what they have and how to address it. Dan said that he will reach out to Michigan EGLE (formerly known as DEQ) to see if he can get some information – he'd recently seen a promo from a vendor talking about a system recently installed at a Michigan school for PFAS removal.

Mark said that he will contact National Rural Water Association and Virginia Rural Water Association to see if they can provide some information on small systems and PFAS removal.

**Public Comments:**

There were no comments from the public.

**General Comments or Questions:**

There were no comments from the group at large.

**Next meeting of Subgroup**

The next meeting will be held April 22, 2021, from 10:00 to 11:30. The group will meet every fourth Thursday of the month at 10:00 a.m.

Dan adjourned the meeting at 11:05 a.m.

# Establishing Regulatory Limits for PFAS in Virginia Drinking Water

Treatment Technology Subgroup

Dan Horne

Virginia Department of Health

March 25, 2021

# Subgroup Members

Henry Bryndza (DuPont)

Jessica Edwards (Loudoun Water)

Wendy Eikenberry (Augusta County Service Authority)

Mark Estes (Halifax County Service Authority)

Chris Harbin (City of Norfolk)

Jamie Bain Hedges (Fairfax Water)

Jack Hinshelwood (VDH - ODW)

Mike Hotaling (Newport News Water Works)

Mike McEvoy (Western Virginia Water Authority)

Russ Navratil (Virginia Section AWWA)

Kelly Ryan (Virginia American Water)

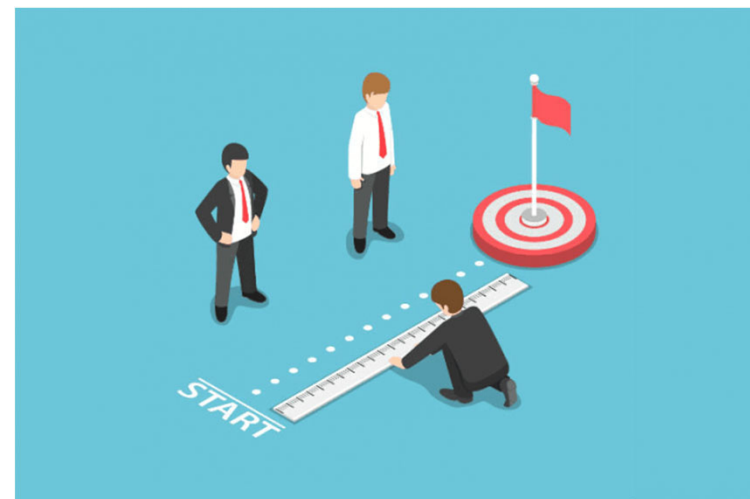
Dan Horne (VDH - ODW) Team lead



# PFAS Subgroup Meeting Agenda

## 25 Mar 2021

1. Call to order - Member roll-call – Review agenda – Review draft summary from last meeting
2. Report on assignments from last meeting
3. Update on resources
4. Upcoming meetings and webinars
5. Preparing for next meeting
6. Public Comments
7. Next Meeting



# Review of Draft Summary from Last Subgroup Meeting

- Distributed to Subgroup members on March 22
- Any comments, suggestions for changes/edits?
- Consensus for accepting summary as final

# Report on Assignments from last meeting

- **General assignment for all members:** Review the three most common technologies used for PFAS treatment/removal (Granular Activated Carbon, Ion Exchange, and Reverse Osmosis) and have general familiarity with the processes
- **Specific assignments:**
  - **Mike Hotaling:** will prepare a review of reverse osmosis, based on the NNWW plant and info on the Cape Fear NC plant
  - **Henry Bryndza:** will review the reverse osmosis and ion exchange processes
  - **Mike McEvoy:** will provide info obtained from WVWA's consultant

# Update on Resources

- Mike Hotaling provided copy of slides from Hazen & Sawyer presentation (posted to Treatment Technologies page on Sharepoint)
- From this meeting - Henry Bryndza's summary of GAC, IX, and RO technologies - posted to Sharepoint
- From this meeting - Mike Hotaling posted (1) copy of an AWWA Journal article about the Cape Fear NC plant, designed to remove PFAS (GenX) (2) short description and summary of the NNWW RO plant, which treats brackish groundwater

# Upcoming meetings and webinars

- Wednesday, 31 Mar: 1:00 - 2:30 p.m.  
AWWA webinar on the Treatment Selection Guide  
<https://www.awwa.org/Events-Education/Events-Calendar/mid/11357/OccuranceId/485?ctl=ViewEvent>  
(note: there is a cost to attend, with a differential for non-members)
- Next meeting of the Full PFAS Workgroup - TBA (late April)

# Preparing for next meeting

- Discussion of format for treatment process summaries
  - General discussion, capabilities, limitations, operating considerations, ongoing process performance monitoring
  - Need to look at case histories of operating facilities (costs, performance, monitoring operations, etc.)
  - What questions do we need to be asking (e.g. - do projects always/some times/never need pilot testing, what operational testing is needed, etc.)
  - Start synthesizing information and preparing summaries to share with other subgroups, full Workgroup
- **Assignment:** Mark Estes - look for information on installed small systems

# Public Comments

## Next Meeting of Subgroup

- Subgroup will meet on fourth Thursday of the month, at 10:00 a.m.
- Target is for meetings to last no more than 90 minutes (end early if possible)

Next meeting: April 22, 2021



# Have any Questions, Comments, or Suggestions? Contact

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