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#### **Purpose**

This guide is intended to help technical assistance providers, small communities, and stakeholders to make informed and suitable local decisions on non-treatment and treatment alternatives for (emerging) contaminants, such as PFAS, and when more innovative technologies may be needed. It discusses questions to solve at the start of considering a new treatment technology, gives guidance through the decision process, highlights the role of technical assistance providers, and examines challenges when working with innovative treatment technologies. This guide does not replace a preliminary engineering report. The guide can be read in full or used by chapter of interest. This guide is also found on an abbreviated, interactive version here.

#### **Innovative Drinking Water Treatment Technologies**

Innovative treatment technologies can address drinking water challenges including contamination and emerging contaminants, and aging infrastructure, to water scarcity. Innovative approaches may be required for emerging contaminants and for sustainable and cost-effective treatment solutions.

Innovations in drinking water treatment cover a variety of new and cutting-edge technologies. However, some treatment techniques that are already be considered the best available treatment technologies and are commonly implemented in large water systems may still be new and challenging to deploy in a small water system. Hence, this guide considers treatment technologies that are more complex than the current treatment in use by a specific water system to be "innovative" and aims to provide help through the decision-making process, regardless of the specific technology.

With upcoming regulations for PFAS, innovative treatment technologies will become even more relevant for small water systems. This guide is applicable to various drinking water challenges, but PFAS-related content is highlighted and the appendix provides more information on PFAS-specific resources.

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### **Appendix: PFAS-specific Resources**

## 1. Questions to solve before deciding on a specific treatment technology

A community can be faced with a variety of drinking water quality issues that may require additional or different treatment than the water system currently has. Before starting the decision process for a specific treatment solution, consider the questions discussed below. A water system usually needs to hire a professional engineer for any significant planning, design, treatment technology and facility updates, or construction work.

### Questions to solve

Identify the problem and need

Repeat sampling for confirmation

Understand contaminant source

Interim solutions for safe drinking water supply Assess alternative source options/non-treatment strategies

Choose suitable treatment technology for your system

#### Identify the problem and need

- Problematic source water quality due to emerging contaminants such as PFAS, specific contaminants, or changing source water conditions (e.g., due to pollution).
- Regulatory changes and new MCLs due to new national drinking water standards from EPA or state level rules.
- Concerns from community due to odor, taste, health effects.
- Aging infrastructure may require upgrading or replacement of existing systems

#### Repeat sampling for confirmation

 After the detection of a contaminant, it is often required to immediately confirm with a repeat sample

- Review the sampling results of the detected compound(s) and check whether it is a violation of a state or federal maximum contaminant level (MCL), current lifetime health advisory (LHA), or upcoming regulation.
- The water system's emergency response plan (ERP) (if available) should have steps listed that the system can take if their source is found to be contaminated.

#### **Understand contaminant source**

- Understanding the source, location, and potentially the seasonality of the contamination of the source water is very helpful before planning treatment options. If possible, determining and eliminating the contamination source will prevent further contamination of the source water.
- Depending on the contamination source and whether the party found to cause the contamination problem is being held liable to pay for remediation costs, there may be funding available for treatment.

#### Interim solutions for safe drinking water supply

How can the system provide water that meets all current regulations in the interim before a long-term solution is deployed? An ERP can help with decision making and should be crafted to align with the specifics of the water system. If applicable, the water system needs to comply with the public

notification requirements.

Depending on the severity and type of contamination, some options are:

- Distribution of bottled water
- Short term GAC point-of-use filtration or point-of entry device
- Purchasing and hauling water from a safe drinking water source.

#### Assess alternative source options/non-treatment strategies

Consider all alternatives, including non-treatment, for assessing the most cost-effective way to get the system back to regulatory standards. An alternative source could also be a neighboring system through an emergency interconnection.

New source: interconnection to neighboring system

Interconnecting to a nearby municipal system to purchase water that meets all current regulations can be a good solution and avoids the need to develop special treatment for a local water supply which will eventually be abandoned. This option can be very helpful for small water systems and might be the best option in the long run, if available. The water quality of the potential interconnection needs to be checked before moving forward with this option, as the purchased water may have some chemical characteristics, like Disinfection By-Products, that may need to be accounted for.

New Source: new well

Drilling and developing a new well requires additional hydrogeologic studies in advance (ADEQ, 2024) and permitting processes. Developing a new well can have high upfront costs but can be a useful alternative for systems using groundwater if operating it does not move the contamination plume closer to the well. Assessing sites that are located farther away from the existing source may come with additional expenses for access, building, chemical treatment, and more.

#### Seasonal Use

Changing a source from full-time use to seasonal or peak use which is then blended with other sources might be an option.

If the contamination is a seasonal problem, increased storage during the dry season can help to supply the community with safe water in some cases. However, some regulatory agencies will not accept above the ground water storage as a replacement for well yield and excessive water storage may lead to water quality issues.

#### Blending

Mixing the multiple water sources to lower the contaminant concentration below the MCL is theoretically possible but can be difficult to achieve due to challenges with low MCLs and potentially high detection limits of analytical methods, as for PFAS (ADEQ, 2024). It will also depend on the level of control of the system to maintain consistent flow rates at each of the sources to maintain the target blending rate.

#### Choose a suitable treatment technology for your system

#### Local considerations

If a new treatment is the best or only solution, the system needs to (with the help of a qualified engineer) choose a technology, design, and operational scheme that will reduce the contaminant to safe levels at the lowest possible cost in a robust, reliable, and sustainable way without unintended consequences. The treatment must be suitable for the specific location and situation. It can be helpful to assess if other communities in the area have similar issues and learn from the performance and cost of their solutions. The chosen treatment method must be approved by the system's primacy agency.

#### Point-of-use/entry treatment

A very small water system may be able to manage the issue with point-of-entry (POE) or point-of-use (POU) treatment. Treatment units would be owned by the municipality and the cost would increase by the number of served households. Make sure to check with the primacy agency if POU or POE treatment systems are an option, as some primacy agencies do not allow this option because of potential ownership and maintenance issues.

#### Required treatment capacity

Have a clear understanding of the treatment capacity required. Over- and underestimating the required treatment capacity can cause issues. Different treatment options can require a different footprint for the facility, so consider the available space for the various treatment options as well.

#### Waste stream disposal

Consider the generated waste stream early in the decision process, along with potential waste

For PFAS, there are currently four best available technologies:

- absorption and/or exchange by granular activated carbon (GAC)
- PFAS-selective ion exchange (IX),
- Membrane separation by reverse osmosis (RO) or nanofiltration (NF) (ADEQ 2024). Both GAC and IX decline in efficiency as PFAS molecule length gets smaller. IX has a shorter empty bed contact time than GAC, requiring less media volume and hence, IX has a smaller footprint (ADEQ, 2024). See the appendix for more information on these technologies.

## 2. Main steps for a water system and community in the process of deciding on a treatment technology

### Main steps in the decision process

#### Sampling and repeat sampling

- Review current regulations
- Define treatment goal

#### Public notice and community outreach

- · Have clear message, build trust, gather input
- Templates may be available, work with state/health agencies

#### Work with primacy agency

Community needs to engage with the State

#### Preliminary engineering work (hire engineer)

- PER should review several alternatives (retrofit, interconnect)
- PER required for most funding agencies

#### Secure funding

Planning grants may be available, engineers and TAPs can help

#### Final design and construction

- Final design, bidding, and construction
- · Include the State and funding agency's requirements

#### Sampling and repeat sampling

- Test and review the sampling results considering current state and federal regulations.
- Regulations may lay out the next steps for testing, depending on the contaminant and level. In some states, the initial detection of a potential contaminant must be followed up with continued testing over four consecutive quarters. If the potential contaminant remains above the MCL over these four consecutive quarters, the need for treatment is triggered.

Have a clear treatment goal, whether to get below the MCL or going further, the community may
want to achieve non-detect levels.

#### Public notice and community outreach

#### Public notice

- Public involvement helps build trust with and gather input from the community
- Critical to involve the water system's board (or other decision-makers) and the community.
- Helpful to have a committee or contact person in the community.
- May be required, and is a critical part of the regulatory compliance process.
- Public outreach and education must have a clear message.
- Many state and other agencies have developed templates for various types of public notices and require specific public health language for various contaminants.
- Work closely with the State in developing the public notification documents for a community's particular situation, as the requirements are very specific.

#### Community outreach

- Can take place through lunches at public meetings, door to door outreach, partnerships with local organizations, and more.
- If the situation requires, can be accomplished by handing out bottled water with additional information on accessible language proficiency levels/appropriate languages for the community.
- Some communities start a social media page or email chain.

Community meetings about water contamination can be initially challenging -> clear and transparent communication is critical and helps the public accept the steps the water systems are taking to ensure safe drinking water.

#### Bottled water

 If bottled water is supplied to the community or bought from residents themselves, storage space for this needs to be addressed; engagement with the community and for example business leaders or faith groups can help find solutions. Consider how the water will be distributed fairly and equitably among the system's customers. For PFAS contamination, it can be helpful to communicate that bottled water has, as of June 2025, no enforceable PFAS regulations. PFAS has also been found in 39% of tested bottled water products (Chow et al., 2021).

Technical assistance providers can help with these steps and serve communities in many other ways, read more in section 4.



#### Work with primacy agency

The system needs to work with their primacy agency, which may require conducting follow-up testing to confirm that the laboratory results are consistent and will say whether action needs to be taken. In some situations, the State may issue an Administrative Order (AO), or the community and State may jointly execute an Administrative Consent Order (ACO) with mutually agreed timelines to put in the treatment system and come into compliance with regulations.

It is critical for a community to engage with the State, maintain good communication with the regulatory agency, and to hire a consulting engineer to assess their best treatment options.

#### Preliminary engineering work (hire engineer)

- The engineer's preliminary engineering report (PER) is usually critical to secure funding and should review several possible alternatives to ensure that the water system can provide safe water at the most reasonable cost including capital and operation and maintenance (O&M) costs. Often it may be ideal to retrofit the existing treatment system.
- For the preliminary work, the engineer helps to define scope of the project, treatment needs, cost estimates, and develop a PER which is required by most funding agencies.
- Have a good consulting engineer and good support system, such as technical assistance, from the very beginning of a project all the way through to ensure success.
- A community engineering corps brings underserved communities and pro-bono engineers together to work on local infrastructure solutions, and can also help with a PER.

#### Secure funding

- Apply (possibly with help from a technical assistance provider) for federal/state grants or loans.
- Engineers may help prepare the technical part of the application.
- Some agencies (e.g. USDA or state SRF programs) offer planning grants to help pay for the
  engineer's initial work. If the community wants to pursue this option, apply for planning funding
  first, then hire an engineer.

#### Final design and construction

- After funding is secured, continue with final design, bidding, and construction.
- Review and follow the State and funding agency's requirements on the procurement of engineering services before announcing a request for proposals (RFP).

#### **Cost savings:**

The least costly phase of the project development in which to make changes is during the planning stage. Consider adding experienced operations staff to help with the design in areas of ergonomics, parking, environmental factors (like snow), and more. Changes will become more expensive after selecting, bidding, and building. Plan for potential future community growth, if appropriate, when considering treatment options.

## 3. Factors and considerations for treatment technology evaluation and decision-making

Making a decision about a specific water treatment technology can be quite complex. Considerations range from the regulatory framework to measuring progress and compliance (ITRC, 2022), to future resilience (Jones et al., 2019) and many federal and state regulations. Select a technology that can remove all occurring contaminants at the most affordable cost.

#### Contaminant characteristics and source water quality

Co-contaminants impact treatment efficiency Gather data for filter replacement

#### Primacy agency and regulatory requirements

Must approve treatment technology Close collaboration

#### Planning and technology performance

Demonstrate that the technology removes the specific contaminant(s)

Redundant and robust, suitably sized for community

Understand community's water demands

PER needs to consider all feasible alternatives and costs

Asset management plan for new setup

Consider warranty and resources for help

## Factors and considerations for treatment technology evaluation and decision-making

#### Cost and funding

Consider full treatment cost through entire life cycle

Consider operational costs, usually not included in loans/grants

#### **Operators**

Solution must be feasible for operator Consider required operator certifications

#### Waste stream and spent media

Consider waste (stream) removal and costs

#### Contaminant characteristics and source water quality

- Source water type: different treatment needs depending on the source type.
- The characteristics of the contaminants and their concentration levels are critical.
- Some treatment technologies can address co-occurring contaminants simultaneously.
- Co-contaminants, total organic carbon, organic matter, minerals, etc. can have a significant impact on the efficiency of the treatment and may require pretreatment (ITRC, 2022), which can extend the lifetime of the filter material. Example: pre-treatment for higher manganese levels can increase the lifespan of GAC filter material.

Example: for PFAS, the specific type of compound(s) and strength of the carbon-fluorine bond, the chain length the ionic groups, and the total detected concentration all impact the treatment effectiveness.

Variability: Are seasons or weather events driving changes in source water quality or quantity?

#### Primacy agency and regulatory requirements

- Compliance requirements: treatment must meet the required standards. Consider pending and upcoming regulations.
- State primacy agency approves specific treatment technologies and treatment technology plan, provides guidelines on the acceptable treatment methods for specific contaminants. Ensure close collaboration and verify requirements.

#### **Technology performance and planning**

- The treatment technology must reliably and effectively remove the specific contaminant(s) to the required level to be in compliance with state and federal regulations and protect public health and handle changes in water quality or flow rate.
- Technology needs to be redundant and robust and be proven to work and suitable for the system demand. It should be neither overbuilt, which would increase costs unnecessarily, nor underbuilt, as that may not allow the system to comply with regulations.
- Consider the capacity of the system to purchase, run, maintain, and operate the treatment technology.
- Have a clear understanding of current and future water demands for the community.
- PER should review all feasible alternatives to provide safe water at the most reasonable cost. Include potential interim solutions and consideration of agreements with neighboring systems and emphasize the cost of the different options.
- Asset management is critical for effective long-term management, financial planning and understanding the useful life and replacement needs of infrastructure components, media, and filter duration.
- Data gathering at different places in the treatment system can help indicate when to replace the filter media.
- In a new treatment plant, there may be trial and error at the operational start. Consider these challenges with a new treatment technology to ensure that the community is not left on their own with such issues after the engineers and builders are finished. A pilot project for new treatment technologies before fully investing in it may also be a good option to confirm reliability and effectiveness of the chosen system. Apart from a vendor's warranty for specific equipment parts, typically, the contractor has a 1-year warranty on the construction work to repair any defects.

#### **Cost and funding**

- Consider full treatment cost by using life cycle costs (meaning the total cost of an asset over its life cycle including initial capital costs, maintenance costs, operating and maintenance costs) to evaluate the affordability outside of the initial capital investment (Jones et al., 2019), including the useful life span.
- Operational cost is important but usually not included in grants and loans, and sometimes O&M
  costs over time can be lower with a larger investment up front.
- Design considerations should include the delivery of filtration chemicals and other equipment to the system, including access and parking as well as land use considerations.
- The treatment technology design and plan should not be prohibitive to the customer base from a financial perspective and ensure that any costs to the community are distributed in an equitable manner.
- Sampling costs should also be planned in, e.g. the cost of a single PFAS sample can range from \$350 to \$500.
- Are there grants, loans, or cost-sharing opportunities?
- Cost and funding availability is a critical factor in the decision on a specific treatment technology for a community. For small systems without economies of scale, physical interconnection and/or collaboration with other systems can be a great option.

#### Community, operators, and site-specific factors

- The treatment solution must be feasible for plant operators, operator training, and maintenance (Jones et al., 2019).
- Important community and site-specific factors:
  - o System size,
  - o Pre-existing treatment facilities,
  - o Quality of the source water,
  - o Presence of specific contaminant compounds and their detection levels,
  - o Technical and financial situation of the specific water system,
  - o Cost and availability of suitable treatment technologies as well as the capacity of the system to run and maintain this system are critical (ASDWA, 2021),
  - o Geographic location and potential transportation options, for example for spent material.
  - o Land availability: Project costs increase when purchasing land to develop a new water source.
- More complex treatment solutions may require a change in the certification level of operators, demands on operator skill and expertise increase, and more training will be needed.
- Operators may be able to review engineering plans with their knowledge and can save the systems time and money by reducing potentially overbuilt parts and keeping the process in scope.
- Consider operator safety and have appropriate safety equipment. When considering changes to the current operational method, plan for operator safety.
- Operators need a resource they can call for questions and get trained by, which could be a technical assistance organization.

#### Waste stream and spent media

- Spent media replacement or regeneration: budget and a potential technician for maintenance, possible compliance testing, how will media be changed and properly disposed of?
- Can a waste stream or media regeneration be avoided or simplified? For example, spent media
  from GAC may be easier to deal with than the continuous waste stream from nanofiltration or
  reverse osmosis. Each PFAS treatment option leads to some waste stream with concentrated
  PFAS, and proper disposal of this waste is important to consider and may be a critical factor to
  the treatment selection (AWWA, 2020a).

The detection of a regulated contaminant, or emerging contaminant such as PFAS, often means increased cost and effort for a water system. It can also be an opportunity to treat another water issue at the same time, conduct needed upgrades to the system, or collaborate with another community nearby that may experience similar issues.

Treatment technologies can provide higher quality water than required by regulations and often remove other contaminants at the same time. This can give a system increased flexibility to adapt to surface water quality changes and contaminant spikes and increase a system's capacity to minimize health risks (Jones et al., 2019).

## 4. The role of TAPs when helping a community consider solutions and make a decision on a specific treatment system



#### Why technical assistance?

Technical assistance helps communities overcome challenges beyond their capacity and builds long-term sustainability and capacity. RCAPs Technical assistance providers (TAPs) work especially with small, rural, or underserved communities to understand their needs, ensure decisions are informed, sustainable, and practical and develop plans for the future. The main reasons for technical assistance are regulatory compliance, addressing challenges like aging infrastructure, capacity building, support with funding applications, improving resilience and emergency preparedness, and community engagement.

The over 300 TAPs from the Rural Community Assistance Partnership Incorporated (RCAP) serve as trusted advisors, offering specialized training and technical support for small, rural, and tribal communities. These professionals are locally based, and with longstanding relationships and deep community trust, collaborate closely with communities to co-develop tailored solutions to address the most pressing challenges.

#### Trust and relationships are the foundation for technical assistance

Trust between TAPs, the water system, and the community is critical. TAPs build relationships on a case-by-case basis and often have a long-lasting positive relationship with the local community. Technical assistance comes from a non-profit like RCAP at no cost to the community, and TAPs are

advocating on the side of the community and for a suitable and affordable solution.

Respect is another key for relationships between TAPs and the community. TAPs meet people where they are, and don't come into a community with a prescription on how to tackle their water issues.

No-cost technical assistance can be crucial for communities that face water quality problems and need to decide on a new treatment solution. The sooner TAPs get involved in a community, the sooner they can help with the planning process and help with resources, design, and funding. They are also a sounding board for operators and managers, with listening skills and invaluable advice and experience.



#### **Assessment and prioritization**

- TAPs help communities understand their specific issues and identify underlying issues like asset management challenges.
- Violations are often connected to several problems in a water system. TAPs can help with triaging problems to start working on the most pressing issues first and bring a fresh set of eyes.
- Communities may focus on one issue at a time, and with multiple issues, it can be hard to see how to tackle everything. Every system has a different situation and challenges; hence every system will prioritize differently.
- Reviewing the technical, managerial, and financial aspects of a system and how they work together is very helpful for assessing resources within a community, forward thinking, and acting proactively rather than reactively. Building capacity in all three aspects helps the system become more self-sufficient.

#### Technology evaluation and guidance

- Provide information on various treatment options tailored to the community's water challenges and size.
- Compare options based on effectiveness, capital and O&M costs, effectiveness, and lifespan.
- Guidance about relevant rules and regulations, also regarding new rules such as for emerging contaminants.
- Help with data gathering to answer questions, e.g., when the media in primary filters will need to be changed.
- TAPs work with multiple communities and contractors over time, so they can connect people
  and parties that may not have thought of contacting each other or connect a system/community
  to another one facing a similar situation.

#### **Funding assistance**

- Assist with identifying and applying for suitable funding options for a system's specific situation, ranging from federal, state, local, to non-profit funding.
- Help with grant writing, loan and grant application processes, and documentation.
- Develop financial plans with the community to ensure financial sustainability over time and a sustainable solution for the community.
- TAPs can serve as a liaison between a community and a funding agency and build a bridge to assist communities and advocate for them.
- This assistance can also include income surveys for funding eligibility and for principal forgiveness.
- Conduct radius studies to review communities within that radius of similar size and sample their
  city ordinances. Learning what other communities charge for water and wastewater can help a
  community with setting their rates. Aside from the median household income value,
  demographic factors such as people living below the poverty line need to be accounted for.

Funding access is a critical factor for many communities, and access to technical assistance is a key role in overcoming financial barriers.

#### Help with technology and option analysis

TAPs can help ensure that communities select appropriate and right-sized technologies for their treatment challenges. While TAPs are not engineering consultants who design treatment strategies, they can assist systems in working with engineers. TAPs also do usually not have professional legal expertise, so most small systems will need help from engineering firms and legal professionals to draft documents. It is often important to explain the community that the role of this technical assistance is not a substitute for a professional engineering consultant and that they cannot provide these services directly. TAPs can help with the following:

- Facilitate communication between engineers and the community.
- Help understand and explain the overall project schedule.
- Sit down with the community, go over potential costs, and discuss the options with them. The potential assistance of TAPs ranges from sampling, public notice, and funding paperwork to

selecting an engineer and considering the site placement, reviewing bids, budgets, and reports, depending on the specific community needs.

- Help with procuring contractor services, project oversight, and assist with any required reporting to funders and primacy agencies.
- Have conversations with engineers about the engineering report and discuss treatment options and potential modifications, for example, water blending.
- Review the engineering plans with the system and at board meetings, assist with proposals, requests for quotes (RFQs) and requests for proposals (RFPs), and depending on the TAP's experience and background, may help to evaluate whether a bid is realistic.
- Make suggestions to modify plans that could save the system costs, and ensure that the treatment system will be robust, effective, and affordable.
- After the project is completed, TAPs can compare the result back to the bid and help the community confirm that everything is done as agreed upon.
- Ensure that infrastructure upgrades address or are consistent with other community concerns to address long-term sustainability.
- Many TAPs can assist with all steps throughout the process other than approving the engineering plan.

#### Help with regulatory compliance

- Assist with reporting, approvals, and compliance as well as the annual consumer confidence reports (CCRs).
- Provide information on compliance regulations and acquire information about specific state requirements. Many TAPs have a good relationship with regulatory agencies and can act as an unbiased third-party mediator between the community and state.
- Help with monitoring recommendations, developing standard operating protocols/procedures (SOPs), and development of sampling plans to stay in compliance.

#### **Training**

- Appropriate training and support are an important part of operating a new treatment technology successfully.
- TAPs offer training on various topics, ranging from source water protection to PFAS and other emerging contaminants, as they can have a steep learning curve and be highly technical in terms of chemistry and treatment technology.
- Help with SOP development for field staff, create resource guides, and offer management training.
- TAPs can also offer training to board or councils and other stakeholders on the issue, as well as information on regulatory requirements, sampling and treatment options.

With new treatment technologies and emerging contaminants such as PFAS, TAPs may often need training themselves on these complex topics before being able to assist systems and operators with training. These topics may include deciding on a specific EPA sampling method, finding a suitable lab, shipping logistics to comply with the allowed sample extraction time, and the intricate sampling requirements for gathering a non-contaminated PFAS sample. It is also important to understand and contextualize the results. These are evolving technical and scientific issues and will therefore need continued technical expertise training, such as in-person training and webinars on these new developments, to be on par with developments and new solutions.

#### Innovative approaches

As innovative treatment solutions may call for innovative approaches, new ideas are being developed to address these challenges.

#### Regional assistance

Instead of approaching a single community for assistance, it could be offered on a regional scale, such as one valley with similar water issues. TAPs can review the regulatory requirements of several systems as a larger assessment, followed by meeting communities for individual workplans on their specific situation and potential deficiencies to address their issues. This approach can cover communities in a region in a more holistic way. Councils of Governments, or CoGs, as regional governing and/or coordinating bodies, often have an existing infrastructure to serve small communities, and may be a helpful resource or partner.

#### Include ongoing support as part of the agreement

The technical abilities of the system to operate a new treatment technology alone can be a challenge. Even with video calling experts and remote monitoring, on-site visual inspection and assistance is hard to substitute. One way to ensure that the system is not left alone with problems is to include this support as part of the initial funding package. For example, the initial agreement could include that a consultant will come to the system for one week twice a year during a five-year period to train the local staff on site and fix any small things that may need to be addressed. After that, local staff would be well equipped to run the new and more complex system, and the cost for this kind of training would be small compared to the initial capital investment for the treatment plant.

#### Accessible and clear SOPs

It is helpful to ensure that workflows are straightforward and clear for the local staff, especially as there may be long timeframes between some tasks. Accessible SOPs are very helpful. For example for correct valve sequencing, which can be critical for operating GAC filters, valves can be painted in different colors and listed in a laminated, easy-to-access SOP sheet to avoid any cross-connections or inadvertent backflow.



## 5. Challenges and issues when working with innovative technologies

### Challenges and issues when working with innovative technologies

#### Regulatory uncertainty

Primacy approval of the treatment technology is critical, but permitting processes may be still lacking

Pilot studies or additional data may be required, slowing approval and implementation

#### **Higher Capital Cost**

Often capital intensive (infrastructure, installation, O&M)

Correctly estimate replacement material cost and frequency and waste disposal costs

Funding programs may prefer established technologies.

#### Lack of real-world data and performance

Performance between bench or pilot testing and local treatment may vary, potential scaling issues

Maybe no long-term studies for durability and reliability

#### Design and engineering

Potential issues with integration of new technology into existing infrastructure, supply interruption

May depend on proprietary materials and vendors Supply chain issues can delay installation timelines

#### Media disposal and replacement

Filters and sludge may require specialized disposal Replacement may be more frequent than planned

#### Operational complexity and workforce

Operators need training for innovative technologies and may required higher operator license

Nationwide operator shortage

#### Community

Potentially skeptical and concerned, trust is critical

Risk communication and messaging can be challenging, some existing resources available

New and innovative technologies have the potential to improve public health and operational efficiency, allow compliance under increasingly strict regulatory standards, may save money and energy, and may even increase the water supply for a community as lower quality source water can be treated. These technologies can tackle emerging contaminants like PFAS that traditional treatment methods may not successfully remove. But they also come with several challenges regarding cost, regulations, and technical and operational difficulties.

#### Regulatory uncertainty

- Primacy approval of the treatment technology is critical, but regulatory permitting processes or standards may not be established yet.
- New treatment technologies may not be fully covered under state or federal regulations.
   Regulatory agencies may request pilot studies or additional data before approving a novel treatment, potentially slowing approvals and implementation.
- Evolving water quality standards can make the treatment technology decision more challenging or require updates to current treatment processes.

#### **Higher Capital Cost**

- Innovative technologies are often capital and maintenance intensive due to equipment, installation, and operation needs.
- Cost includes capital costs, initial costs including materials for infrastructure, and the continuous costs required for operation, ranging from energy to chemicals, material replacement and maintenance.

- Estimate expected costs and duration for replacement material clearly and conservatively to calculate if the system can cover all costs. If spent media is considered hazardous waste, disposal costs increase.
- Estimating maintenance costs for changing and disposing spent material like GAC filters is challenging as it is based on source water quality, treatment rate, and the effectiveness of contaminant removal.
- Some treatment technologies consume significant energy, raising costs.
- Grant and loan providers may prefer proven, established treatment technologies.

The Bipartisan Infrastructure Law (BIL) provides \$9 billion to protect public health and invest in water systems that are specifically impacted by PFAS and other emerging contaminants though FY2026. \$4 billion is allocated through the Drinking Water State Revolving Fund (DWSRF) and \$5 billion is allocated through EPA's Emerging Contaminants in Small or Disadvantaged Communities Grant Program. Note that many private water systems like mobile home parks or condo associations have a hard time securing funding for innovative treatment technologies, as they often may not meet the requirements for state SRF funding and other opportunities, and even BIL funding may not be available for them.

Some systems may consider joining an ongoing class action lawsuit when affected by certain contaminant sources, such as PFAS. Major PFAS settlements water systems can join are 3M, DuPont, Chemours & Corteva, Tyco, and BASF, although the baseline PFAS testing deadlines have already passed (https://www.pfaswatersettlement.com/). However, this process can take a long time, and there is no guarantee that a system will be reimbursed for some or any costs.

#### Lack of real-world data and performance

- Bench testing for a specific site helps to develop targeted and efficient treatment. For guidance about bench testing or pilot testing for PFAS, consult the PFAS Treatment Evaluation framework from AWWA.
- Performance between bench or pilot conditions and real-world treatment with complex water chemistry and seasonal fluctuations may vary.
- Ensure the technology does not have scaling issues between a potential bench or pilot study and the treatment facility size, and works with local conditions (e.g. seasonal changes, water chemistry).
- Potential lack of long-term studies and limited data on durability, reliability, and successful treatment under varying conditions.

#### Design and engineering

- Potential issues with integration of new technologies into existing infrastructure, extensive planning may be required for older treatment plants.
- Changing to a new system or integrating new treatment components can temporarily interrupt the water supply for the community. Consider a backup system for e.g. media change or failure.
- Removing unnecessary parts of an engineering plan can save costs, avoid both over- and underbuilding the treatment system.
- Potential dependency on proprietary systems, media material, and specific third-party contractors.

- Supply chain issues and shortages may affect the availability of media and the timelines to install the treatment systems.
- Innovative solutions may have proprietary pieces of equipment that can be challenging to get serviced. Option: build a timeframe into the contract for which the community still has a resource for help available, including assistance for the equipment operations.
- A company offering proprietary treatment systems may go out of business or stop supporting the water system.
- Source water quality can have a strong influence on treatment effectiveness.

#### Media disposal and replacement

- Some innovative technologies produce filters, sludge, or by-products that require specialized disposal, e.g. when containing PFAS. Handling these waste streams can be expensive or lead to regulatory concerns.
- Media replacement intervals may be projected incorrectly. Monitor treated water to detect potential breakthrough of the contaminant through the filter.
- Some communities have experienced their filter media being exhausted much more quickly than
  anticipated and needed to adjust to this unexpected expense by borrowing funds, accessing
  savings, or raising rates.
- It can be challenging to upkeep and find media filters, as there are not as many companies
  working on these technologies. Media costs can increase substantially in the initial stages of
  regulatory implementation of treatment technologies.

#### Operational complexity and workforce

- Local operators may need training to manage complex treatment systems; advanced systems
  demand more technical skills to operate and large amounts of real-time data must be interpreted
  correctly.
- With a nationwide workforce shortage and aging operators that are retiring, there is an urgent need for more operators.
- In some states, the license classification for water treatment is based on the technologies used.
   Treating for PFAS may require a different license classification than what an operator currently holds. This requires new training and certification testing, potentially leading to an additional cost burden on them or their utility.

#### Community

- The community may be skeptical about new or unfamiliar treatment technologies and be concerned about public health or costs for the community. Public trust is very important.
- Risk communication and explaining the new treatment processes and their benefits and safety is critical for the community, board members, and regulators.
- Messaging and risk communication can be challenging, especially as information on emerging contaminants and their health impacts is frequently changing and getting updated. Consider local, state, and federal communication resources for assistance.
- Depending on the technology, the new treatment plant may be intrusive for the community (Jones et al., 2019).

## 6. Challenges when using innovative technologies for (very) small water systems

Challenges when using innovative treatment technologies for (very) small water systems

#### Cost

Challenging to distribute the increasing capital and operational costs over a smaller customer base and limited staff

Treatment solutions that are deemed to be affordable for systems may not be affordable for very small systems

#### **Planning**

Use comprehensive planning to address larger challenges

View a treatment challenge with holistic view of the water system and community

Remote communities may have extra challenges for sampling/testing

#### Community

Critical to consider the cost for the community before deciding on a technology

Get community buy-in and communicate why changes or updates of the treatment facility are necessary

#### Engineering

Can be challenging to find an engineer and get a selection of bids

Engineering firm with expertise in preparing funding applications may be more likely to help secure funding

#### Workforce and training

Many systems have one or no full-time employees

Workforce shortage is exacerbated in rural areas

More complex treatment often requires operator to get a different license classification

Small and very small water systems, e.g. in rural areas or mobile home parks, have unique challenges regarding innovative treatment technologies (such as reverse osmosis or UV disinfection). The limited resources in small systems combined with the frequent lack of resources to make informed and sustainable decisions with environmental, social, and economic considerations is a challenge (Jones et al., 2019). Technical assistance can help mitigate these challenges and help with securing the necessary funding.

#### High costs with limited financial resources

- Small systems need to distribute capital and operational costs over a smaller customer base and limited staff.
- With a lack of financial resources, costs may be too high for purchase, installation, and maintenance of innovative technology.
- Difficulty receiving competitive grants or loans.
- Systems may already struggle to pay for basic things like fire hydrant replacements or chlorination of their wells. Raising rates may not be a suitable option for the community.
- Treatment solutions that are deemed to be affordable for systems may not be affordable for very small systems.

For treatment of PFOA and PFOS, EPA has determined that reverse osmosis/nanofiltration is considered affordable for systems serving a population of 3,301-10,000, but not for very small systems serving under 3,300 people (EPA, 2023).

Table 1. Proposed small system compliance technologies (SSCTs) for PFAS removal (EPA, 2023).

System size	GAC	IX	RO/NF	Point of use
(population served)				(POU) RO/NF <sup>1</sup>
25-500	Yes	Yes	No	Yes
501-3,300	Yes	Yes	No	Yes
3,301-10,000	Yes	Yes	Yes	not applicable.2

#### Notes:

¹ POU RO is not currently listed as a compliance option because the regulatory options under consideration require treatment to concentrations below the current NSF International/American National Standards Institute (NSF/ANSI) certification standard for POU device removal of PFAS. However, POU treatment is reasonably anticipated to become a compliance option for small systems in the future if NSF/ANSI or other independent third-party certification organizations develop a new certification standard that mirrors EPA's proposed regulatory standard. The affordability conclusions presented here reflect the costs of devices certified under the current standard, not a future standard, which may change dependent on future device design.

#### Regulatory approvals and infrastructure planning

- If a technology is not pre-approved by regulatory authorities, pilot studies and other data collection may be required, increasing time and cost.
- Changing regulations about new technologies can be difficult to understand and comply with.
- For very small communities, point-of-use or point-of-entry filters which are owned by the municipality can be a lower cost, simpler technology solution. However, this solution may not be approved in all states for all contaminants and may create potential liability for the system.
- New technologies may require more space than available and may not work with existing infrastructure.
- Delivering equipment, in-person support, and shipping/submitting samples for water testing may be more challenging in remote locations.
- New technologies may require special parts and special service support, and longer delivery times can lead to longer downtimes when a technology needs to be repaired.
- Comprehensive regional planning can address larger challenges. A PER is specific to a community's need but is not necessarily looking at comprehensive planning for the region.
- Consider a treatment challenge with a holistic view on the water system and community to avoid other challenges down the road.
- Regional partnerships could facilitate working together on new technologies and sharing expertise and resources.

<sup>&</sup>lt;sup>2</sup> EPA's work breakdown structure (WBS) model for POU treatment does not cover systems larger than 3,300 people (greater than 1 million gallons per day [MGD] design flow), because implementing and maintaining a large-scale POU program is likely to be impractical.

#### **Engineering**

- Some technologies are optimized for large treatment facilities and may not scale down efficiently for very small systems. Performance information in small systems is helpful.
- Small systems may have only one or few sources, leading to larger variability in water quality and potentially affecting treatment efficiency.
- Smaller projects are usually less lucrative for engineers, making it challenging to find an engineer and get a selection of bids.
- Engineering firm quotes can be quite different. Aim for multiple bids to get the best quotes.
- Consider an engineering firm with expertise in preparing funding applications as this may help the community secure the funding.
- Innovative technologies can require more monitoring and calibration systems, but data in the cloud may require fewer on-site staff, too.
- Troubleshooting advanced treatment systems can be difficult for small systems and on-site or technical support may be needed.

#### Community

- Buy-in from a community for a newer and more expensive treatment technology is critical but can be challenging due to unfamiliarity, cost, and potentially previous negative experiences.
- Keeping the community involved can be challenging for small systems which are very busy and may lack the resources or expertise to explain the new technology.
- Consider the cost for the community before deciding on a technology and evaluate how to distribute cost in an equitable way in case a rate increase is necessary.
- Explain the need and path for treatment to the board and other stakeholders.

#### Staffing limitations and lack of technical expertise

A survey from 2020 shows that 43% of systems RCAP serves had no or only one full-time employee and supplement their operations with part-time staff or volunteers (Bostic et al., 2020). The required knowledge, skillset, and workforce costs increase with a more complex treatment system. The current workforce shortage is exacerbated in rural areas where systems often cannot afford to offer salaries that are competitive with larger systems, making it hard to attract and retain qualified operators. Many small systems have frequent turnover as certified operators often move on to systems that can compensate them better for their extensive experience. Creating a positive work culture with meaningful relationships is critical for retaining employees.

Operators often need to get different license classification for new treatment technologies. For this, the operator may need to undergo training and certification testing which could result in an additional cost burden on them or their utility. Training may also not be readily available in rural or isolated areas. Workforce training is a critical part of solving this challenge.

#### 1) PFAS Regulations

In April 2024, EPA finalized National Primary Drinking Water Regulations (NPDWR) for six PFAS compounds under the Safe Drinking Water Act. These are the first legally enforceable federal standards for PFAS in drinking water.

Note that 11 states have already own enforceable PFAS standards and states can adopt stricter regulations than the federal rule.

Compound	Final MCLG	Final MCL (enforceable levels)
PFOA	7ero	4.0 parts per trillion (ppt) (also expressed as ng/L)
PFOS	Zero	4.0 ppt
PFHxS	10 ppt	10 ppt
PFNA	10 ppt	10 ppt
HFPO-DA (commonly known as GenX Chemicals)	10 ppt	10 ppt
Mixtures containing two or more of PFHxS, PFNA, HFPO-DA, and PFBS	1 (unitless) Hazard Index	1 (unitless) Hazard Index

- MCL (Maximum Contaminant Levels): Legally enforceable limit.
- MCLG (Maximum Contaminant Level Goals): Health-based, nonenforceable goal.

#### **Compliance timelines:**

**Monitoring timeline:** Public water systems must monitor for these PFAS and complete initial monitoring by 2027, followed by ongoing compliance monitoring. Water systems are required provide their customers with sampling results for these six PFAS in 2027.

**Treatment timeline:** Public water systems must implement treatment solutions to reduce the PFAS levels if they exceed these MCLs by 2029. Public notification timeline: Public water systems must notify the public if PFAS levels exceed one or more of these MCLs starting 2029.

#### **Updates:**

EPA announced on May 14, 2025, that they will keep these current standards for PFOA and PFOS, but plans to extend the compliance date to 2031. EPA also announced its intent to rescind the regulations and reconsider the regulatory determinations for PFHxS, PFNA, HFPO-DA

(GenX), and the Hazard Index mixture of these three PFAS and PFBS. At time of publication, these changes have not been finalized.

#### 2) PFAS Treatment Technologies

PFAS compounds are very stable due to their carbon-fluorine bond, so many conventional treatment technologies are ineffective. This calls for new treatment technologies and/or innovative combinations of existing technologies. The treatment technologies that are currently available for use at full-scale in water treatment plants can remove PFAS, but not destroy them, although research is ongoing (ITRC, 2023). The following table contains an overview of the most commonly used and proven treatment technologies.

PFAS Treatment Technology Overview table (modified from AWWA, 2020a).

Treatment Technology	Relative cost	Short-chain PFAS removal	Long-chain PFAS removal	Waste streams and PFAS endpoints	Additional notes
Powdered activated carbon (PAC) absorption	moderate	<40%	>80%  Note: EPA  TDB* states up to 95% removal for PFOA and up to 99% for PFOS, as well as PFNA.	PAC residuals removed via settling or filtration	Useful for intermittent use, quick and easy implementation with relatively low capital costs.  PFAS removal depends on PAC type and dose.  Increases residuals loading and decreases residual dewatering.  Not as effective for PFAS removal compared to other technologies.
Granular Activated Carbon (GAC) absorption	moderate to high (lower than membrane systems)	Note: EPA TDB* states up to >99% removal for PFHxS and PFBS, up to 93% removal of GenX. Shorter chain PFAS have lower GAC loading capacities faster breakthrough but could be effectively treated if media is changed more frequently (ITRC).	40% to 96%  Note: EPA TDB* states up to >99% removal for PFOA and PFOS, as well as PFNA.	Backwash stream or GAC media	Currently the most studied treatment method for PFAS removal (EPA, 2018), but site-specific effectiveness.     Removes additional constituents, such as taste and odor compounds, TOC (and associated DBP reduction), and CECs → suitable for many applications.     Requires less energy than RO/NF.     Requires media disposal.     PFAS removal decreases as adsorption sites become exhausted, no removal once breakthrough is reached.     PFAS will compete for sites with other organic compounds.     Less economically feasible at higher concentrations (mg/L) due to relatively quick PFAS breakthrough.

Treatment	Relative	Short-chain	Long-chain	Waste	Additional notes
Technology	cost	PFAS	PFAS	streams and	
		removal	removal	PFAS	
				endpoints	
Ion Exchange	moderate	< 95%	55% to 97%	Backwash	Potential competitive
(IX)	to high			stream or	exchange with other
		Note: EPA	Note: EPA	IX resin	organics and fewer
		TDB* states	TDB* states		secondary water quality
		up to >99%	up to >99%		benefits compared to other
		removal for	removal for		processes.
		PFHxS and	PFOA and		Resin can be specialized
		PFBS and	PFOS, as		specifically for PFAS, may
		GenX.	well as		allow for a higher
			PFNA.		absorption than activated carbon (site-specific).
					Resin disposal is required.
					Removal decreases as IX
					and adsorption sites
					become exhausted, and
					there will be no removal
					once breakthrough is
					reached.
					Less economically feasible
					at high concentrations
					(mg/L) due to relatively
					quick PFAS breakthrough.
Nanofiltration	high	> 95%	> 95%	Concentration	NF concentrate will
(NF)			Note: EPA	stream	contain high PFAS
		Note: EPA	TDB* states		concentrations and will
		TDB* states	up to		require disposal, which
		up to >99%	>99.9%		can be expensive.
		removal for	removal for		Post-membrane treatment
		PFHxS, up to	PFOA and		is necessary to ensure stable
		99.8% for	>99.3% for		finished water.
		PFBS and up	PFOS, and		High energy requirements but less than RO.
		to >83%	up to 99%		but less than KO.
		removal and	for <u>PFNA</u> .		
		to below limits of			
		quantitation GenX.			
		Genx.			

Treatment Technology	Relative cost	Short-chain PFAS removal	Long-chain PFAS removal	Waste streams and PFAS endpoints	Additional notes
Reverse Osmosis (RO)	high	Note: EPA TDB* states up to >99% removal for PFHxS, up to 99.8% for PFBS and up to >83% removal and to below	> 99%  Note: EPA  TDB* states up to >99.9% removal for PFOA and >99.3% for PFOS, and up to 99% for PFNA.	Concentrate stream	RO concentrate will contain high PFAS concentrations and will require disposal, which can be expensive. Post-membrane treatment is necessary to ensure stable finished water Highest energy requirements. Likely not necessary just
		limits of quantitation GenX.			for treating PFAS.

\*EPA's Treatability Database (TDB) lists PFAS contaminants by specific type and the potential treatment options that were found to be effective.

To estimate treatment costs, <u>EPA's Drinking Water Treatment</u> <u>Technology Unit Cost Models</u> can be used, although this does not substitute a preliminary engineering report.

The selection of a PFAS treatment technology is influenced by the following factors (modified after ITRC, 2023):

- Key factors are site characteristics, availability of tested and proven treatment technologies, and the regulatory framework to measure both progress and compliance.
- A conceptual site model is important for understanding and justifying the selected treatment technology.
- PFAS characteristics impact treatment effectiveness. What is the strength of the specific C-F bond, types of ionic groups (sulfonate or carboxylate), carbon chain length, and total concentration?
- Changes in PFAS properties: are there natural processes or remedial actions for other contaminants that affect the distribution and mobility of PFAS?
- What are co-contaminants, total organic carbon and geochemistry, do they impact the efficiency of the potential treatment?
- Community acceptance: there are often trade-offs regarding cost, cleanup effort, and residual contamination.

#### 3) Risk communication

Addressing PFAS contamination with the community can be challenging. Information on risk communication is limited, inconsistent, and changes as scientific understanding improves. As time passes, more sites are found to be contaminated, and the understanding of the health

impacts from PFAS in drinking water has increased over the last years. All of this makes risk communication with the public a critical part of PFAS management for water systems. An effective communication plan needs to engage the served public and use effective communication strategies (AWWA, 2020b).

#### General (risk) communication resources

- AWWA's Risk Communication Guide for Water Utilities <u>Trending in an Instant</u> is available online (the executive summary is found <u>here</u>). This guide help water systems with communication about various water-related topics, including development of a crisis communication plan. They aim to increase public trust by keeping the customers informed and engaged and contain tools and action steps to help a utility respond during high-profile communication issues.
- The CDC hosts a comprehensive <u>Drinking Water Advisory</u> <u>Communication Toolbox</u> with resources and templates for helping water systems to communicate with the public and partners about water advisories.
- The Massachusetts Water Works Association has also published a <u>Drinking Water Advisory Communication Toolbox</u> with various templates.
- The <u>Six Principles of the CERC (Crisis and Emergency Risk</u> Communication) from the CDC:



#### Be First:

Crises are time-sensitive. Communicating information quickly is crucial. For members of the public, the first source of information often becomes the preferred source.



### Be Right:

Accuracy establishes credibility. Information can include what is known, what is not known, and what is being done to fill in the gaps.



### Be Credible:

Honesty and truthfulness should not be compromised during crises.



#### **Express Empathy:**

Crises create harm, and the suffering should be acknowledged in words. Addressing what people are feeling, and the challenges they face, builds trust and rapport.



#### **Promote Action:**

Giving people meaningful things to do calms anxiety, helps restore order, and promotes some sense of control.  $^{3}$ 



#### **Show Respect:**

Respectful communication is particularly important when people feel vulnerable. Respectful communication promotes cooperation and rapport.

Source: CDC, 2018.

#### PFAS specific risk communication resources

While the scientific research and understanding of PFAS is continuing, water utilities can use specific guidance on risk communication to protect public health and establish trust with their customers and address their concerns in a timely and credible manner. Proactive communication strategies help utilities to respond with empathy and transparency (Henderson et al., 2020).

- EPA has a <u>PFAS communications toolkit</u> to help communicate about PFAS. It contains videos, a social media toolkit, infographics, and a guide for planning the communication.
- The JAWWA article <u>Talking to Customers and Communities about PFAS</u> outlines methods for communication and engagement. Key points are that utilities should be the first ones to communicate about the issue, communicate often and early and use accurate and plain language. Utilities should be careful to use words that convey the appropriate level of risk, to provide context, and to be a credible source of information. Work with partners such as local health departments to ensure the messages around PFAS are consistent.
- The Interstate Technology and Regulatory Council (ITRC) has several resources for risk communication about PFAS with the public. Their four-page summary document on <u>Risk Communication</u> <u>for PFAS</u> summarizes information on the role of risk perception, risk communication challenges for PFAS, has examples for PFAS planning and engagement tools, and describes how to set PFAS risk communication smart goals and key message development:

### Examples of Specific, Measurable, Attainable, Relevant, and Timely PFAS goals: (from the Little Hocking Water Association case study, Section 15.4.1)

- By (date), the community is informed via the municipal website, flyers, and canvassing that bottled water is
  available as an alternate water source and used by 85% of the affected population.
- After (months), the extent of the impacted water supply is known via well testing, possible remediation options are identified and communicated to the community via a public meeting, municipal website, and newsletter.

#### Examples of Key Main Messages for a PFAS Site:

Question: What are PFAS and why is the state concerned about them?

- Main message #1:
  - PFAS are a family of human-made chemicals found in many products used by consumers and industry. (15 words)
- Main message #2:
  - o PFAS are emerging contaminants of concern. (6 words)
- Main message #3:
  - o Some PFAS may adversely impact human health. (6 words)

Source: ITRC, 2020.

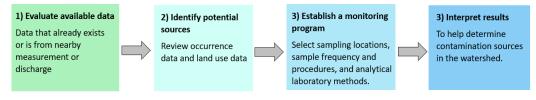
- ITRC has also a very extensive information and training page on <u>PFAS Risk Communication</u> that goes in much more depth and details than the above mentioned four-pager.
- ITRC published a 20-minute video with risk communication tools to be prepared for challenges when discussing PFAS contamination with the public: <a href="https://www.youtube.com/watch?v=H-qOaPip-z5q">https://www.youtube.com/watch?v=H-qOaPip-z5q</a>
- The Environmental Research Institute Of The States (ERIS) hosts a <u>PFAS Risk Communications Hub</u> with a clearing house resources section by state and on drinking water and PFAS- specific communication resources and templates for town hall meetings and media advisories.

#### 4) Source water protection

Evaluating your water supply for PFAS contamination and identifying potential PFAS contamination sources is critical as PFAS in drinking water are a potential health concern that will be or are already regulated on a federal and state level. Evaluating your source water for PFAS can help you understand any ongoing PFAS influx into your water sources, find where PFAS are entering your water supply, and prioritize PFAS contamination sources for mitigation and clean up.

To assess and protect your source water from PFAS, there are several helpful resources available to guide water systems through the process of source water evaluation.

 AWWA developed a comprehensive guide on <u>Source Water</u> <u>Evaluation for PFAS</u> including defining the objective for assessing PFAS in your source water, developing a public communication plan, deciding what time and financial resources to commit to this evaluation, and developing a monitoring plan. To evaluate source water, AWWA suggests the following workflow:



Steps to address PFAS in source water protection. Modified from: AWWA Source Water Evaluation for PFAS, 2020.

 ASDWA developed a <u>PFAS Source Water Protection Toolkit</u> that includes a Decision Support Tool that provides information by state on responses to PFAS contamination and drinking water source protection. The tool is in Excel format and can be downloaded via their <u>website</u>.

- ASDWA published also a <u>PFAS Source Water Assessment Mapping Guide</u> that helps with using GIS data to identify and map source waters that are vulnerable to PFAS contamination. This guide outlines how to assess source water vulnerability to PFAS, how to find possible PFAS source location data e.g. based on industry codes, how to use PFAS monitoring data and include watershed data for better understanding.
- ASDWA released a short <u>factsheet</u> for communication with industry on PFAS contamination and source water.

#### 5) Funding options for PFAS treatment

 EPA's Emerging Contaminants (EC) in Small or Disadvantaged Communities Grant (SDC):

Under the Bipartisan Infrastructure Law (BIL), \$2 billion is available to address emerging contaminants like PFAS in drinking water. This investment is available as a grant program under EPA's Emerging Contaminants in Small or Disadvantaged Communities (EC-SDC) Grant Program and provides grants to public water systems in small or disadvantaged communities to address emerging contaminants, such as PFAS. These grants will be awarded non-competitively to states and territories.

• EPA's Emerging Contaminants in Small or Disadvantaged Communities (EC-SDC) Tribal Grant Program:

Under BIL funding, \$100 million has been designated for the EC-SDC Tribal Grant Program, which funds activities to address emerging contaminants like PFAS in water systems that serve federally recognized tribes. Note that there is no cost-share or match applicable for the funding made available under this program.

• <u>DWSRF for PFAS</u> treatment:

DWSRF funding can be used to pay for equipment and upgrades to treatment technologies, for example a new treatment plant or expansion of an existing facility to add PFAS treatment. DWSRF set-asides can be used for laboratory or testing equipment for research or contamination prevention (EPA, 2019).

- States may have grants and loans for funding PFAS treatment as well.
- Depending on the specific state, there may be resources available to help disadvantaged communities with costs related to the PER.

#### 6) Questions to ask for PFAS treatment planning

Decision trees are very helpful for planning PFAS treatment or non-treatment, and are very helpful for treatment selection, suitability of specific treatment types, and evaluating simultaneous compliance. The Arizona Department of Environmental Quality published <a href="Decision Trees">Decision Trees</a> for PFAS Mitigation Selection in Drinking Water to help professional engineers assisting drinking water utilities with informed decisions for PFAS mitigation. Many parts of the planning process for changes to current drinking water treatment are not unique to PFAS, like characterization of water supply and understanding the water demand of a community. However, some questions are specifically relevant for PFAS treatment and helpful to consider. Note that these questions are only an addition and the civil engineering due diligence for the planning design is still expected. (Questions are taken/modified from <a href="AWWA's Drinking">AWWA's Drinking</a> Water Treatment for PFAS Selection Guide and <a href="ITRC's treatment technology section">ITRC's treatment</a> technology section.)

- 1. Will this treatment method remove PFAS in the water from this source and water treatment facility to comply with the federal and state regulations?
- 2. Will this treatment provide additional relevant water quality benefits?
  - a. Does it reduce taste and odor issues, disinfection byproducts levels, hardness, microbial risk, or Contaminants of Emerging Concern?
- 3. What additional measures will be needed to avoid water quality issues if this treatment process is installed for this water system?
  - a. What will the pH be? Do we need alkalinity adjustment or corrosion control treatment?
  - b. Does it require a change in the primary disinfection strategy?
- 4. What additional treatment is required for preparing the water from this source for this treatment? Do we need to change the peroxidation methods, or do we need additional pretreatment, filtration, or pH adjustment?
- 5. Where in the treatment train would this new treatment be installed? What are the implications on the facility and operations? Do we need additional pumping or change process controls?
- 6. What happens to the waste stream and is this different for each treatment technology considered? Are there viable disposal options for the liquid and/or solid treatment and pretreatment process waste streams

- 6. What other non-PFAS organic constituents are in this water that need treatment?
- 7. Can co-contaminants be treated with the same technology that would treat PFAS? If so, does this negatively affect the PFAS removal efficiency?

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