2. Contaminants of Concern - PFAS

2.1 Contaminants of Concern - PFAS

Notes:

If you are in the water sector, and even if you are not, you have likely heard about per- and poly-fluoroalkyl substances or PFAS (pronounced pee-fass). PFAS are a class of synthetic chemicals found in water systems that are increasingly a topic of public concern, particularly when they are found in community drinking water supplies.

A couple of things to note as you go thru this eLearning course:

You will need to use the arrows to navigate thru the course.

There are supplemental resources which you can access in the upper right-hand corner of the window

Finally, there will be a couple of knowledge checks that we would like you to answer as you go thru the course

Alright, let's get started!

2.2 Acknowledgments

Notes:

This eLearning course would not be possible without the tireless efforts of volunteers and AWWA staff. Thanks go to these individuals for their time and expertise to develop and peer-review this course.

2.3 Course Overview

Notes:

PFAS are well-known for their use in a variety of applications including non-stick coatings, waterproof fabrics, protective coatings, and firefighting foams. These chemicals are receiving attention as a contaminant of concern in the environment.

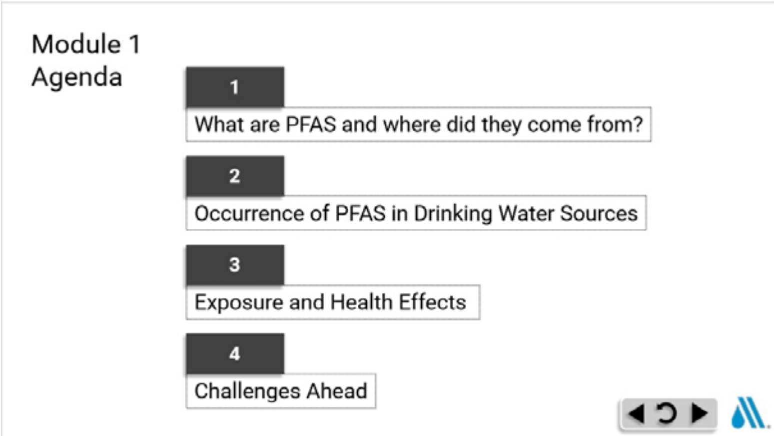
This course is for all water professionals wanting more information on the occurrence and use of PFAS, the presence of PFAS in drinking water supplies, EPA and State actions to address PFAS, and what removal and disposal approaches are available to address PFAS. This course will also address and provide resources for communication as stakeholders ask questions about the safety of their drinking water.

2.4 PFAS Occurrence and Health Effects

Notes:

Teflon made cooking so much easier. No more food sticking to pans, just smooth sailing with the help of nonstick chemicals, generally known as PFAS. Fast forward 75 years, and we are starting to understand what is meant by a forever chemical and its impacts on the environment and human health.

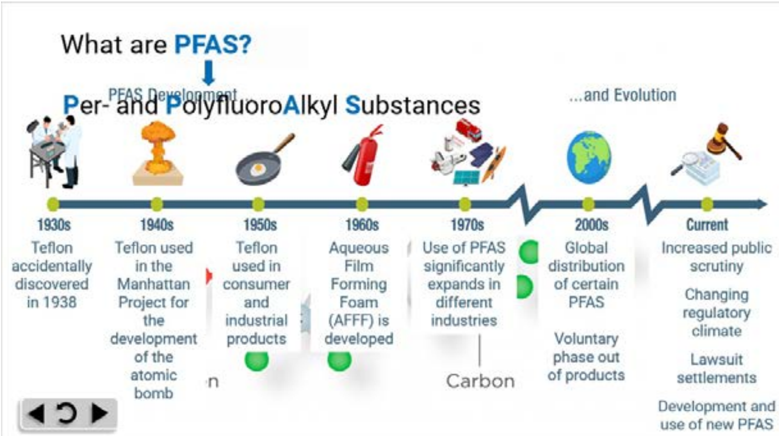
2.5 Module Agenda



Notes:

You will be surprised at the number of everyday products that contain one form or another of a PFAS chemical. In this module we will generally define perfluorinated compounds including the sources and challenges associated with PFAS; then investigate how humans and the environment are knowingly or unknowingly exposed to PFAS and the documented health effects; and finally show how PFAS have migrated into a vast number of drinking water sources. GenX and other chemicals have been introduced as possible replacements for PFAS substances. See how the new chemicals stack up.

2.6 What are PFAS?



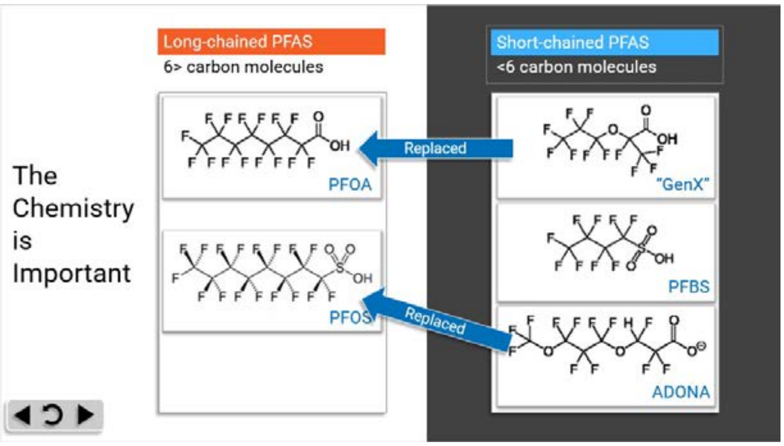
Notes:

You have most likely heard about perfluorinated compounds or PFAS, yet you may not fully understand what they are or why they seem to be a focus of the water sector.

PFAS is an acronym for per- and polyfluoroalkyl substances. They are a class of thousands of synthetic chemicals that have been synthesized for use in a variety of commercial products since the 1940s such as lubricants, surfactants, cellphones, non-stick cookware and firefighting foams. Products that are part of our daily lives.

A closer look at the chemistry and we find that these perfluoroalkyl acids are *organic* compounds in which almost all carbon – hydrogen bonds are replaced with carbon-fluorine bonds. Because the carbon-fluorine bond is one of the strongest, these chemicals do not degrade easily in the environment and is the primary reason why PFAS are often referred to as the forever chemicals.

2.7 The Chemistry is Important



Notes:

These compounds can be clustered into two groups – “long-chain” and “short-chain” compounds. Long-chained PFAS, which include PFOA (pee-fo-a) and PFOS (pee –fos), contain 6 or more carbons and short-chained PFAs have fewer than 6 carbon molecules.

Long-chained PFAs are of particular concern because they are more difficult to degrade and more likely to persist in the environment. Differences associated with chain length and chemical structure have important implications for fate and degradation within the environment as well as toxicity in humans, plants and animals.

As long-chained PFAS were phased out of production, replacement compounds with similar chemistries were developed. GenX was created to replace PFOA, which was voluntarily phased out 10 years ago. ADONA was developed as a replacement for PFOS. Little is known about GenX and ADONA chemicals and health experts are concerned. Emerging evidence suggests that these replacements may be more toxic than the long-chained PFOA and PFOS they were designed to replace.

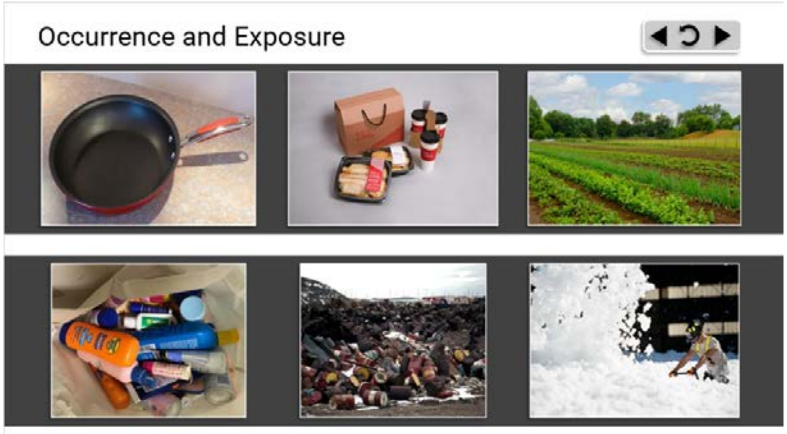
2.8 Everyday Products

Notes:

PFAS are chemically and thermally stable and demonstrate resistances to heat, water, and oil. These are highly desirable chemical properties that enhance everyday consumer goods.

PFAS can be found in almost every home and business and are widely used in commercial products such as firefighting foams, fast food packaging and even dental floss!

2.9 Occurrence and Exposure



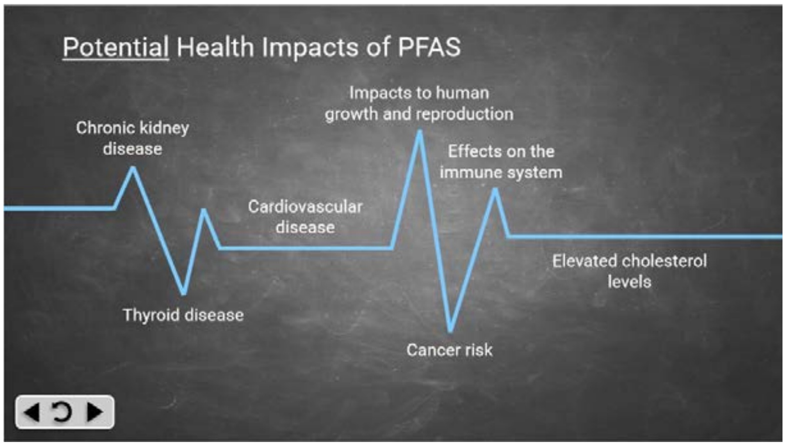
Notes:

PFAS exposure in the general population occurs primarily through consumption of food that has been stored or cooked in materials containing PFAS; eating contaminated food grown in or collected from contaminated soil or water or drinking water that has been contaminated with PFAS. Direct exposure happens from living with products containing PFAS or employment in a profession that produces or uses PFAS.

PFAS can be released into the environment during manufacturing and processing as well as during industrial and commercial use. Products known to contain PFAS are regularly disposed of in landfills and by incineration, which can also lead to the release of PFAS. Many PFAS have unique properties that prevent their complete breakdown in the environment, which means that even removing PFAS from contaminated areas can create PFAS-contaminated waste.

Drinking water contamination is typically localized and associated with a specific source of PFAS which we will explore in more detail in module 3.

2.10 Potential Health Impacts of PFAS



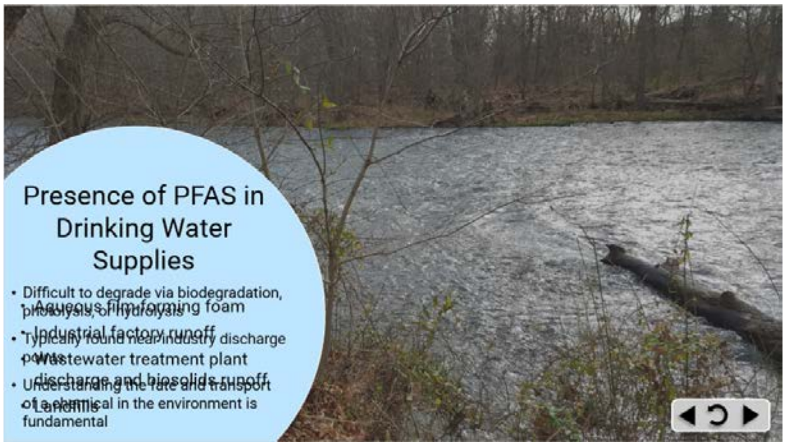
Notes:

Scientists are just beginning to understand the health effects associated with PFAS exposure. The number of PFAS chemicals makes it challenging to study and assess the potential human health and environmental risks. Available human studies have identified *some* potential targets of toxicity; however, cause and effect relationships have not been established for any of the effects, and the effects are not consistently found in all studies.

Peer-reviewed scientific studies have shown that exposure to certain levels of PFAS may have impacts to human growth and reproduction, risk of some cancers, effects on the immune system, and elevated cholesterol levels.

We don't yet fully understand how many people are exposed or how harmful PFAS are to people and the environment long term.

2.11 Presence of PFAS in Drinking Water Supplies



Notes:

PFAS are highly soluble in aquatic environments and can dissolve in surface and ground waters. As shown earlier, PFAS chemical and biological stability make these compounds difficult to degrade via biodegradation, photolysis, or hydrolysis. They are typically found near industry discharge points where PFAS have been used. Understanding the fate and transport of a chemical in the environment is fundamental to the investigation and remediation of any contaminated site and will be important in developing a PFAS monitoring plan.

How did PFAS get into our water supplies?

PFAS can contaminate surface water sources from aqueous film forming foam runoff from firefighting activities, industrial factory runoff, and wastewater treatment plant discharges. Groundwater sources include landfill leachate, plumes from fire fighting foam use, and runoff from land application of wastewater biosolids.

Many PFAS can be persistent in the environment with degradation periods of years, decades, or longer under natural conditions.

2.12 Major Challenges

Notes:

There are over 12000 chemical compounds designated as PFAS and this number is growing. Some we know much about, most we know very little about. They are persistent, by design, and challenging to destroy.

PFAS are found in water, air, soil samples, and humans. As stated earlier, people are most likely exposed to these chemicals by consuming PFAS-contaminated water or food, using products made with PFAS, or breathing air containing PFAS. It is estimated that nearly all Americans have some level of PFAS in their bloodstream.

Widespread contamination from per- and poly fluoroalkyl substances will impose a staggering financial burden on governments and taxpayers.

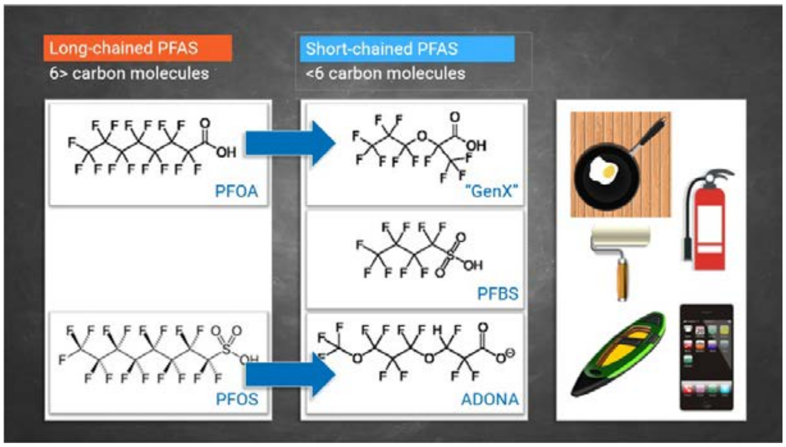
The vast majority of these treatment costs will be borne by communities and ratepayers, who are also facing increased costs to address other needs, such as replacing lead service lines, upgrading cybersecurity, replacing aging infrastructure and assuring sustainable water supplies.

2.13 Knowledge Check – results are not published

2.14 Knowledge Check – results are not published

2.15 Knowledge Check – results are not published

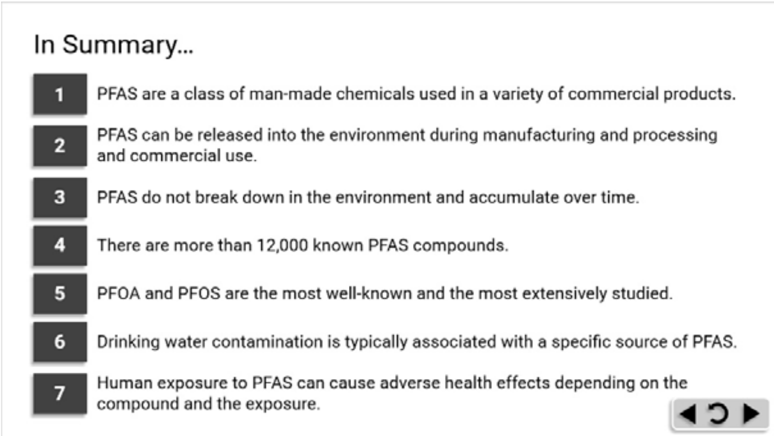
2.16 In Summary...



Notes:

In this first module we have been introduced to the chemical properties of PFAS, how PFAS enters our environment, toxicological impacts to humans and efforts to replace the more well-studied long-chained PFOA and PFOS with short-chained GENX and ADONA compounds.

2.17 In Summary...



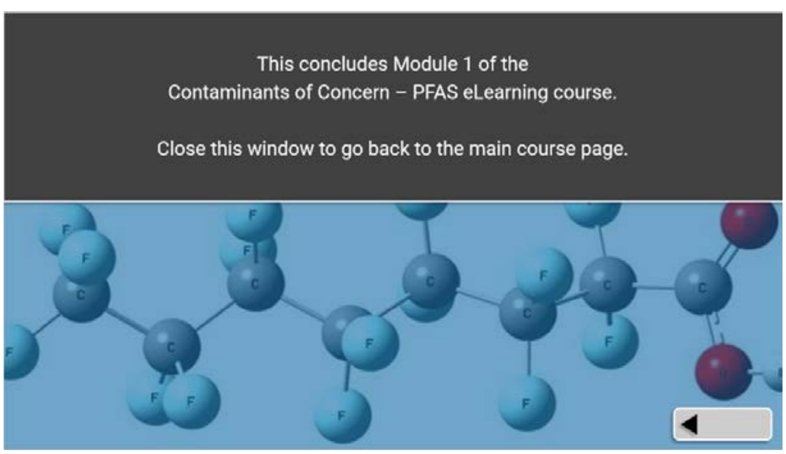
Notes:

In summary:

- PFAS are a class of man-made chemicals used in a variety of commercial products.
- PFAS can be released into the environment during manufacturing and processing and commercial use.
- PFAS do not break down in the environment and accumulate over time.
- There are more than 12,000 known PFAS compounds,
- PFOA and PFOS are the most well-known and the most extensively studied.
- Drinking water contamination is typically associated with a specific source of PFAS.
- Human exposure to PFAS can cause adverse health effects depending on the compound and the exposure

Let's move on to module 2.

2.18 Closing



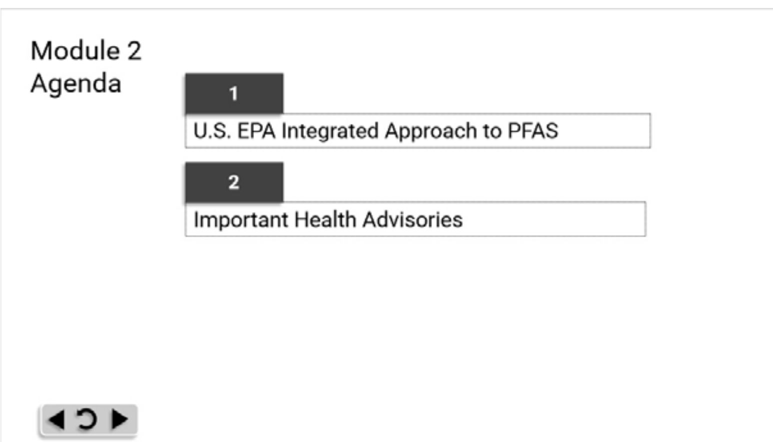
1. Module 2

1.1 U.S. EPA Actions to Address PFAS

Notes:

EPA is active in addressing PFAS. In this module you will see the integrated, multi-agency approach EPA has employed to tackle the issues of PFAS. Until PFAS regulations are issued, health advisories are in place to safeguard the public from PFAS exposure

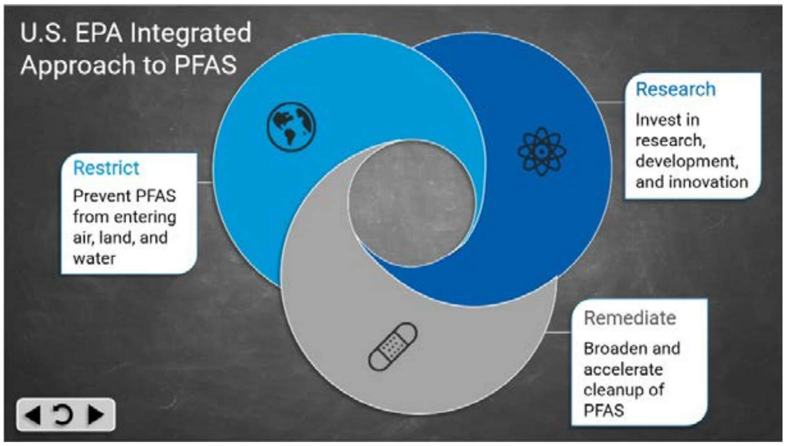
1.2 Module 2 Agenda



Notes:

In this module we will cover the US EPA Integrated Approach to PFAS. We will also discuss the important health advisories. Let's get started with module 2.

__1.3 U.S. EPA Integrated Approach to PFAS__



Notes:

EPA's PFAS Strategic Roadmap builds on and accelerates implementation of policies to safeguard public health, protect the environment, and hold polluters accountable. EPA's integrated approach to PFAS is focused on three central directives

Investing in research, development, and innovation to increase understanding of PFAS exposures and toxicities, human health and ecological effects, and effective interventions that incorporate the best available science;

Pursuing a comprehensive approach to proactively prevent or restrict PFAS from entering air, land, and water at levels that can adversely impact human health and the environment and

Remediation by broadening and accelerating the cleanup of PFAS contamination to protect human health and ecological systems.

1.4 U.S. EPA Agencies Involved with PFAS Issues

Notes:

EPA's approach is shaped by the unique challenges to addressing PFAS contamination. EPA cannot solve the problem of "forever chemicals" by tackling one route of exposure or one use at a time. The risks posed by PFAS demand that the Agency attack the problem on multiple fronts simultaneously. EPA must leverage the full range of statutory authorities to confront the human health and ecological risks of PFAS. The Agency proposes 31 objectives and will use enforcement tools under multiple environmental authorities to conduct their work.

Visit this link for the latest EPA information on PFAS initiatives.

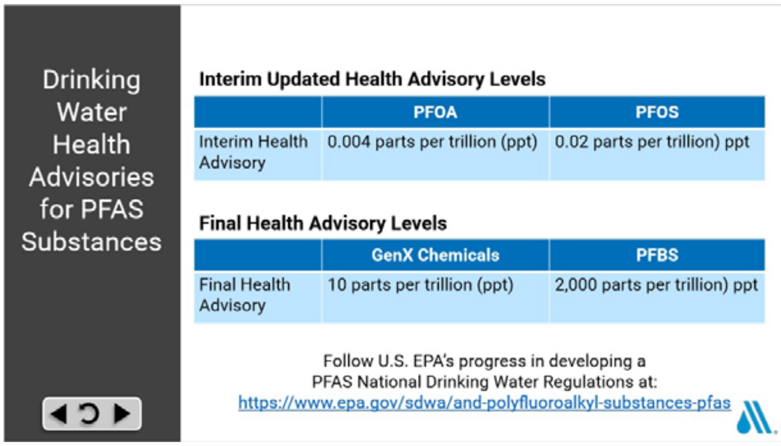
1.5 What is a Health Advisory?

Notes:

The purpose of a health advisory is to provide information on contaminants that can cause human health effects and are known or anticipated to occur in drinking water. EPA's health advisories are non-enforceable and non-regulatory and provide technical information to states agencies and other public health officials on health effects, analytical methods, and treatment technologies associated with drinking water contamination.

EPA’s lifetime health advisories also account for other potential sources of exposure such as food, air, consumer products, which provides an additional layer of protection.

1.6 Drinking Water Health Advisories for PFAS Substances



	PFOA	PFOS
Interim Health Advisory	0.004 parts per trillion (ppt)	0.02 parts per trillion) ppt

	GenX Chemicals	PFBS
Final Health Advisory	10 parts per trillion (ppt)	2,000 parts per trillion) ppt

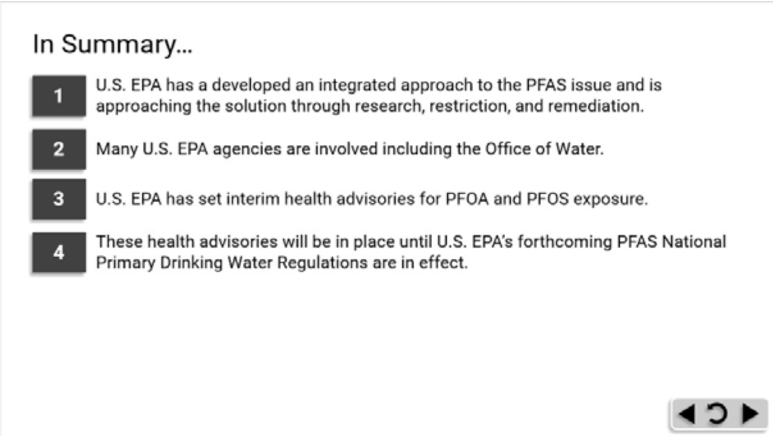
Notes:

Consistent with EPA's mission and responsibility to safeguard public health and keep communities informed when new science becomes available, EPA issued interim updated health advisories for PFOA and PFOS shown in this table.

These health advisories will be in place until EPA's forthcoming PFAS National Primary Drinking Water Regulations are in effect. Visit the link on this page for the latest information on PFAS National Drinking Water regulations.

1.7 Knowledge Check – results are not published

1.8 Summary

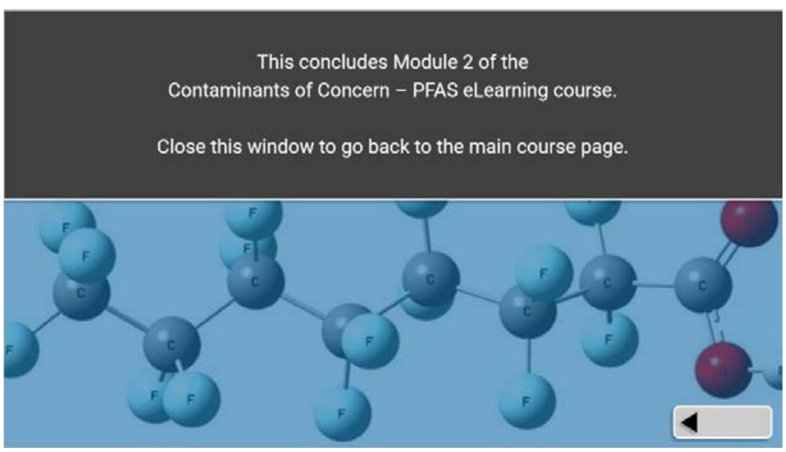


Notes:

This module on federal protection to safeguard public health outlines EPA's integrated approach to the PFAS issue and their approach to the solution through research, restriction, and remediation. Many EPA agencies are involved including the Office of Water. EPA has set interim health advisories for PFOA and PFOS exposure and these health advisories will be in place until EPA's forthcoming PFAS National Primary Drinking Water Regulations are in effect.

With that, we're on to module 3.

1.9 Closing



1. Module 3

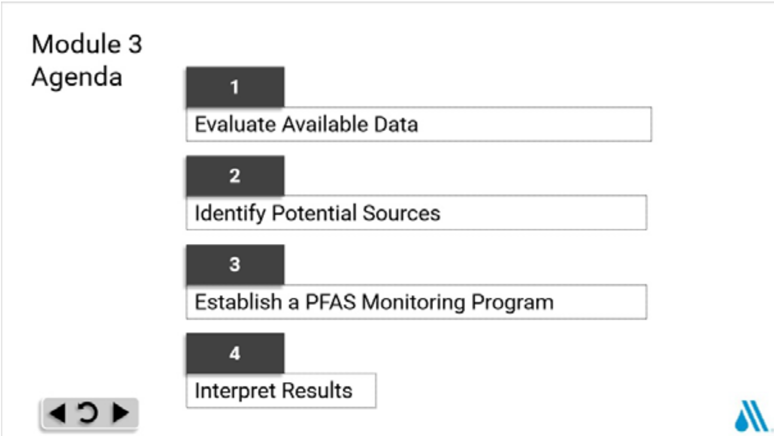
1.1 Source Water Evaluation for PFAS

Notes:

The presence of per-and polyfluoroalkyl substances or PFAS in drinking water sources is a potential health concern and water system managers, customers, and local community decision-makers want to know if PFAS are a potential challenge for their community.

This module will help local water systems evaluate their **drinking water supply** for PFAS contamination and provide tools to identify the potential sources of that contamination.

1.2 Module 3 Agenda



Notes:

Determining presence, abundance, and source characterization of PFAS in a drinking water supply can be summarized in the four-step process shown. The first step is to gather and evaluate the available data, followed by identifying potential sources of PFAS in your watersheds. Using this information, a utility can effectively establish a monitoring program identifying sampling locations, frequency and analytical procedures for determining PFAS and PFAS compounds presence. The final step is to interpret the results from known and suspected activity, the sampling results, and data gathered from available sources.

1.3 Evaluate Available Data

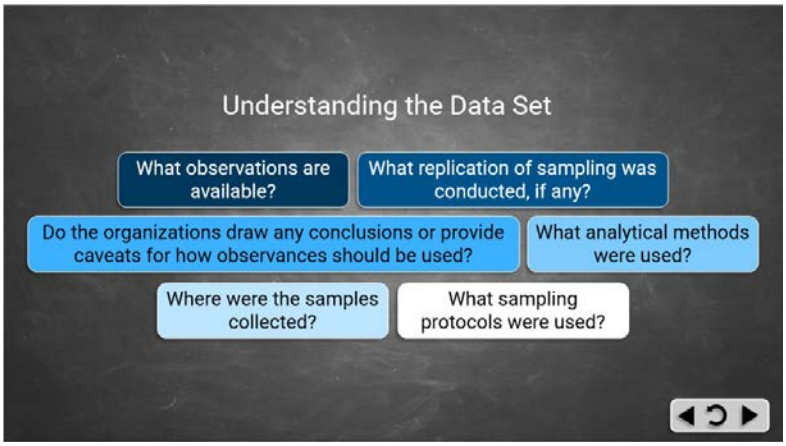
Notes:

If there is existing PFAS occurrence data, a water system can draw on that information to guide its monitoring effort. Aside from monitoring raw or finished water, additional data may be available to characterize the following PFAS sampling locations such as

- Raw water concentrations near a system’s well or upstream from its surface water intake location
- Point source discharges into an aquifer or surface water supply
- Local land discharges, such as aqueous fire-fighting foam runoff, that are typically associated with PFAS releases

The system itself may have information from federal or state-required monitoring. There may also be data that have been collected by other water systems, state environmental agency sampling campaigns, wastewater water utilities, stormwater utilities, and Department of Defense facility sampling. If data are available, it is important to understand the datasets.

1.4 Understanding the Data Set



Notes:

Finding and collecting data is the initial step. Understanding these datasets is crucial. **Ask questions**.

Under what conditions were samples taken and analyzed?

Do the organizations responsible for collecting the data draw any conclusions or express any caveats on how the observations should be used?

Data quality is an important consideration when determining PFAS mitigation strategies. Use the most robust data available.

1.5 Using Existing Data Can Be Complicated

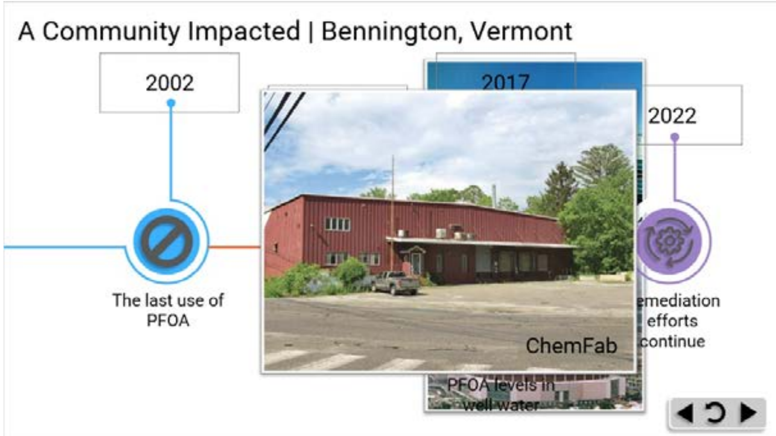
Notes:

Drawing inferences from existing data can be complicated. Sampling location such as the finished water as opposed to the potential source of PFAS will alter the information gathered. Analytical methods are changing as we learn new techniques and “non-detects” are based on what are now considered measurable levels.

Passing time can alter discharge patterns or the use of replacement PFAS has occurred since the samples were taken. Little may be known about sampling protocols and weather conditions at the time of collection. Inconsistent sampling procedures such as water depth in a surface water source or groundwater well purge time, may not be documented. As you can see, using existing data can be complicated. Keep asking questions.

1.6 Activity – results are not published

1.7 A Community Impacted | Bennington, Vermont



Notes:

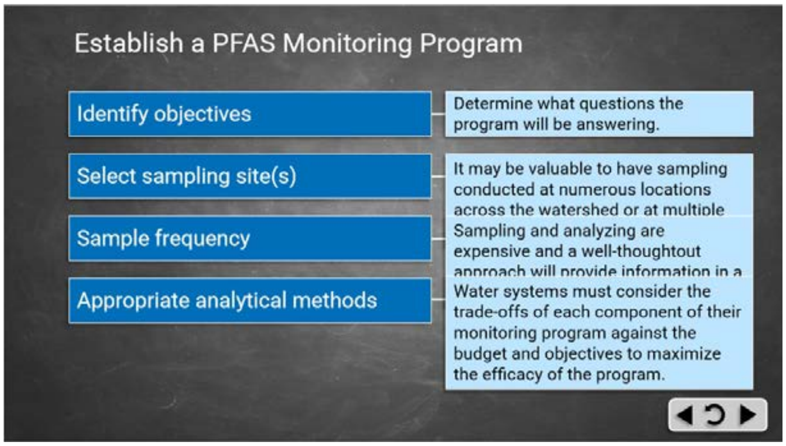
Bennington Vermont is the 6th most populated city in the state of Vermont with a population of over 15,000 people. ChemFab facilities operated in this town for forty years. In 2016 it was found that over half of these residents have PFAS-contaminated drinking water sources and ChemFab was identified as the single contributor of PFAS.

ChemFab once had factories and distribution all over the world, and made specialized materials used on the International Space Station, as well as roofing fabric used on iconic structures such as the Denver International Airport and the Georgia Dome in Atlanta. The facility primarily applied Teflon coatings to fiberglass fabrics by dip-coating the fabrics in a liquid bath of micron size Teflon particles and various additives likely including PFOA and followed by heating these fabrics in ovens to dry and melt the Teflon onto the fabric.

Companies such as ChemFab grew at a time when thousands of new chemicals were introduced into the marketplace. PFOA was legal at the time this plant was operated.

Vermont has partnered with effected communities, the state and the Centers for Disease Control and Prevention to address public health. The Vermont PFOA Contamination Response is taking corrective action with well replacements, well testing plans, bottled water plans, and robust monitoring. Clean up costs are estimated to exceed $50 million.

1.8 Establish a PFAS Monitoring Program



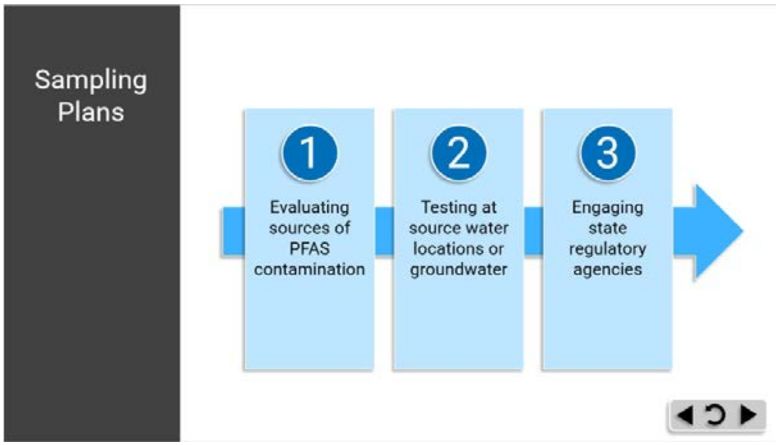
Notes:

Identifying sources of PFAS may indicate the need for a water system monitoring program. Before starting, setting clear objectives for this monitoring program are essential to guide the effort. Determine what questions the program will be answering.

Additional components of a successful monitoring program include selecting sampling locations, sample frequency, and appropriate analytical methods. In developing a monitoring program, each of these components should be balanced while keeping in mind budgets and expectations of stakeholders. Sampling and analyzing are expensive and a well-thoughtout approach will provide information in a cost-effective manner.

For instance, it may be valuable to have sampling conducted at numerous locations across the watershed or at multiple groundwater wells even if the sampling is only conducted annually or for one compound. Water systems must consider the trade-offs of each component of their monitoring program against the budget and objectives to maximize the efficacy of the program.

1.9 Sampling Plans



Notes:

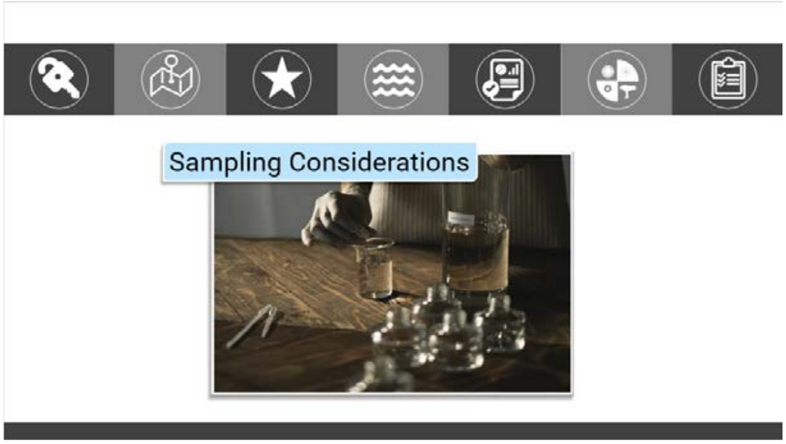
Although PFAS contamination is usually caused by a point source, a few studies have reported migration of contaminants to remote areas several miles away from the point of release. In some instances, determining the exact origin of PFAS contamination may be challenging, especially when PFAS is present at low concentrations.

A good sampling plan should include multiple locations of contaminated soil and/or water at the point of discharge as well as downstream locations. Sampling may be conducted up to several miles upstream of a point source to confirm whether PFAS contamination could be coming from elsewhere.

Testing at source water intake locations or groundwater wells is also recommended. This can involve testing at several points upstream of the intake point, such as varying reservoir locations or nearby wells.

And last, the sampling plan should engage state regulatory agencies. Once point sources are identified, regulatory agencies should be apprised of observations. Regulatory agencies can also be helpful for understanding and communicating to stakeholders

1.10 Sampling Considerations



Notes:

1.11 Cross-Contamination Awareness Special Precautions

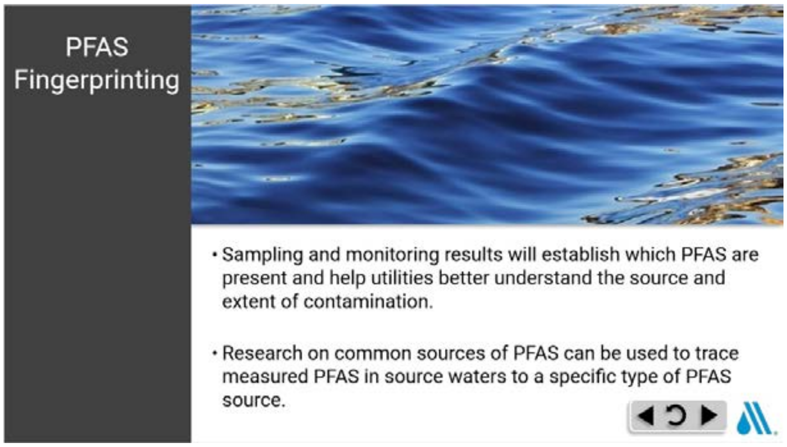
Notes:

While no special equipment is required for sampling stable PFAS compounds in water, special care should be taken during the sampling and transport process to avoid contamination from PFAS coated clothing, sampling materials and storage containers. Since PFAS are measured in such small quantities – parts-per-trillion - even the smallest cross-contamination could contribute to a false positive sample. Grab samples are collected in polypropylene bottles and shipped in coolers with ice packs to the selected laboratory for PFAS measurement.

1.12 Activity - Part 1 – results are not published

1.13 Activity - Part 2 – results are not published

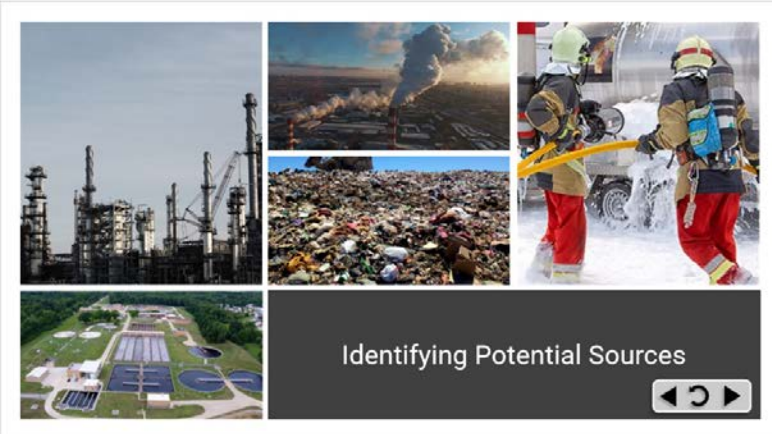
1.14 PFAS Fingerprinting



Notes:

For water systems that conduct monitoring programs, it can be difficult to interpret the results to determine the likely source of PFAS contamination and to determine appropriate follow-up action. Let's investigate approaches to interpret PFAS results in a way that helps determine the sources of the contamination in the system's watershed.

1.15 Identifying Potential Sources



Notes:

If the evaluation's purpose is to move beyond the initial evaluation of influent PFAS levels, **identification of potential sources is the next step**. Existing occurrence data can suggest whether a water body or aquifer is contaminated; however, beyond that data, land uses exist where there are known examples of PFAS contamination.

There is no exhaustive list of the types of industrial facilities that contribute to PFAS contamination in the environment. For the purposes of a source water evaluation, and in the absence of comprehensive data, PFAS contamination have been previously reported to be linked with facilities involved in the manufacturer of leather and leather products, coated or laminated packaging paper and plastics film, carpets and rugs, electroplated metal products, and semiconductors or other electronic equipment.

Landfills have the potential to be sources of PFAS due to their acceptance of waste, both consumer and industrial, that may contain PFAS. PFAS from solid waste can enter landfill leachate, which may be collected and treated through landfill leachate management systems. Legacy dumps and waste disposal sites that were in use prior to regulatory requirements, may also leach PFAS-containing leachate into groundwater if no liner is present.

Measurable levels of PFAS have been found in wastewater treatment plant biosolids. Types of PFAS in groundwater due to biosolids application would be dependent on the source of contamination to the original wastewater treatment plant.

Importantly, PFAS manufacturing and use began in the 1940s, so identifying relevant land uses may entail identifying sites that are no longer in active use and no longer engage in practices that release PFAS such as industrial sites.

1.16 PFAS Compounds and Associated Sources

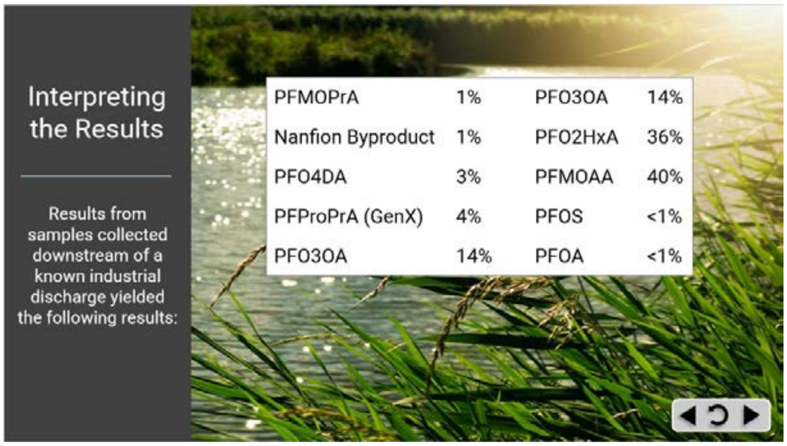
PFAS		Associated Sources
Perfluoro-2-methoxyacetic acid	PFMOAA	Industrial discharge
Perfluoro(3,5-dioxahexanoic) acid	PFO2HxA	Industrial discharge
Perfluoro-3-methoxypropanoic acid		Industrial discharge
Perfluorobutane-sulfonate	PFBA	AFFF discharge, industrial discharge, landfills
Perfluoropentanoic acid	PFPeA	AFFF discharge, landfills
Perfluorohexanoic acid	PFHxA	AFFF discharge, landfills
Perfluoroheptanoic acid	PFHpA	AFFF discharge, industrial discharge, landfills
2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)-propanoic acid	GenX / PFProPrA	Industrial discharge
Fluorotelomer sulfonate 6:2		AFFF discharge
Nafion Byproduct 1		Industrial discharge
Nafion Byproduct 1		Industrial discharge

Notes:

This table presents a sampling of PFAS and possible PFAS contamination sources in drinking water. It was generated using occurrence data with known PFAS contamination sources. This list is not intended to be complete but represents many of the PFAS identified in drinking water to date and is a useful tool for tracing PFAS sources.

For example, according to this table, high concentrations of a PFBA could indicate contamination from aqueous fire fighting foam or AFFF, industrial facilities, or landfills. The water system or regulatory agency will need to determine if one or more of these sources is located within the area to better understand the source of contamination. If none of these contamination sources is a possibility, a wastewater treatment plant that receives PFBA or more broadly PFOS from one of these sources and discharges effluent upstream of the water treatment plant could be the cause of PFAS contamination.

1.17 Interpreting the Results

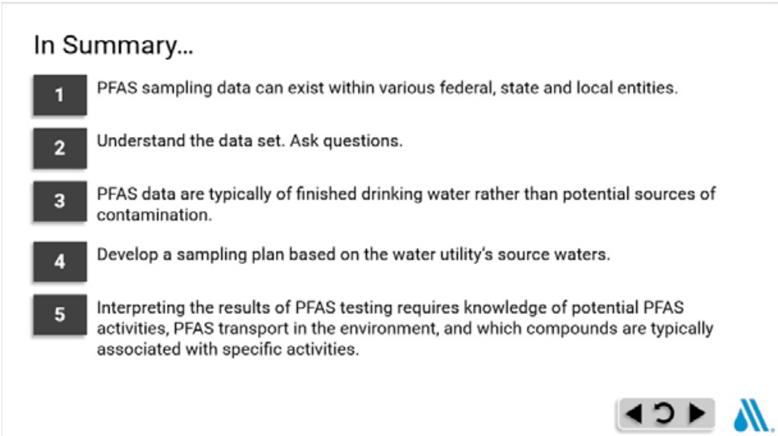


Notes:

These data represent average PFAS results from water samples collected from a river downstream of a known chemical discharge location. PFAS samples collected **upstream** of the chemical discharge location showed minimal PFAS levels. Using these analytical results and information from the previous table, we are able to confirm that the PFAS contamination resulted from the chemical discharge.

1.18 Knowledge Check – results are not published

1.19 Summary

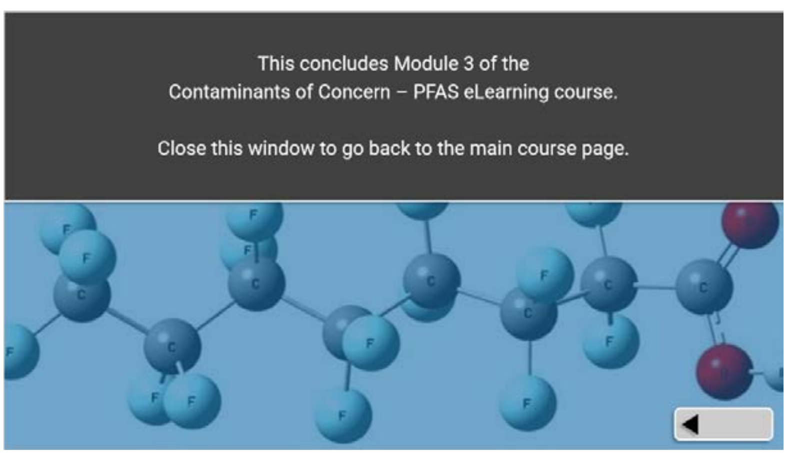


Notes:

This module covered finding and identifying *sources* of PFAS in your watershed. We know that PFAS sampling data can exist within various federal, state and local entities and once you find a dataset, it is critical that you understand the data set. Ask questions. Ask lots of questions. PFAS data are typically of finished drinking water rather than potential *sources* of contamination. A sampling plan based on the water utility's source waters will help narrow PFAS sources.
Interpreting the results of PFAS testing requires knowledge of potential PFAS activities, PFAS transport in the environment, and which compounds are typically associated with specific activities.

PFAS clean up is costly and the more information you can pinpoint through investigation will be invaluable when choosing PFAS remediation approaches.

1.20 Closing



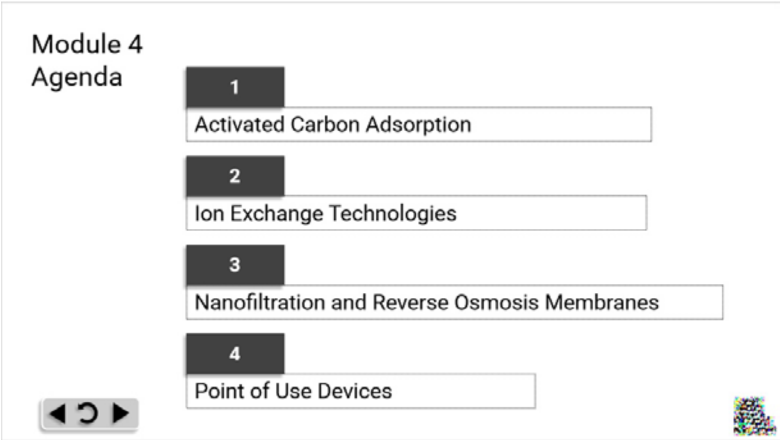
1. Module 4

1.1 PFAS Removal Technologies

Notes:

Municipal utilities, federal and military installations, and industrial facilities face challenges in removing or reducing PFAS in drinking water sources. Separately or together, granular activated carbon, ion exchange and membrane filtration are effective treatment options when trying to minimize PFAS in finished water. Requirements for ultimate disposal or destruction of PFAS and process residuals significantly affect operating costs, which in turn play a critical role in treatment process selection.

1.2 Module Agenda

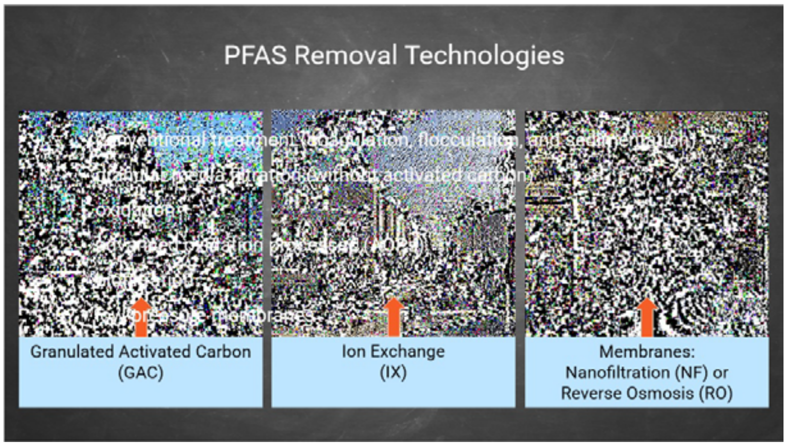


Notes:

Treatment technologies currently available for full-scale use in water treatment plants include activated carbon adsorption, ion exchange, and high-pressure membrane filtration. These are effective for removal but not PFAS destruction. PFAS are generally resistant to chemical, physical, and biological degradation, which limits many potential removal mechanisms.

Point of use devices are often seen as a solution for homeowners or smaller systems but do they meet the standards?

1.3 PFAS Removal Technologies



Notes:

Treatment technologies that provide *little* or no PFAS removal include conventional treatment (coagulation, flocculation, and sedimentation), granular media filtration (without activated carbon), oxidation, advanced oxidation processes (AOPs), biofiltration, and low-pressure membranes.

Advanced treatment processes that can effectively remove PFAS from drinking water include granular activated carbon (GAC), ion exchange (IX), nanofiltration (NF), and reverse osmosis (RO). These treatment processes can be used in conjunction and with different configurations to provide more robust PFAS removal. It is important to note that PFAS removal efficiency using these advanced treatment processes is site-specific and the decision to provide treatment requires considering factors and impacts to the overall process.

This module will focus on effective treatment processes for PFAS removal from drinking water that have been demonstrated and used at full-scale.

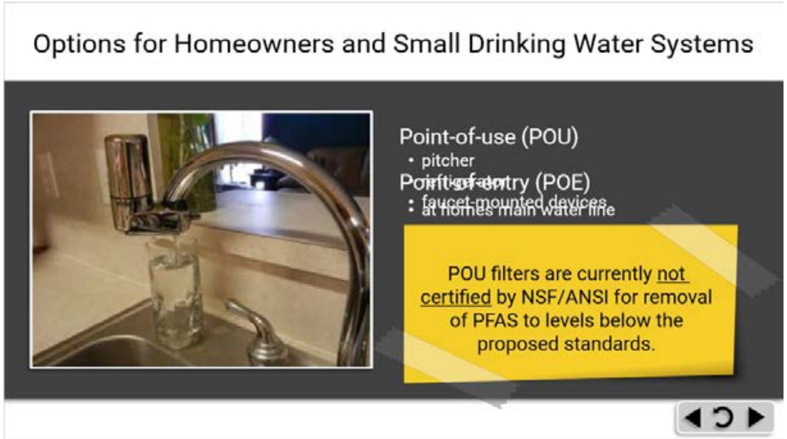
1.4 Nation's Largest Ion Exchange

Notes:

December 2021 Orange County Water District and the Yorba Linda Water District began operating the nation's largest ion exchange treatment facility to remove per and poly fluoralkyl substances from local well water. Orange county provides drinking water for more than 2.3 million people and manages the Orange county Groundwater Basin which serves as the primary drinking water supply for several cities and water agencies. PFAS was detected in many of the groundwater wells within the basin.

Per the California Division of Drinking Water interim drinking water notification and response level criteria for PFOA and PFOS Orange County was required to reports PFOA and or PFOS results above the notification level require the water agency and to remove the source from service or provide treatment. This resulted in the ion exchange facility you see here. As is common with many utilities, taking a supply off-line can have substantial operational and economic impacts.

1.5 Options for Homeowners and Small Drinking Water Systems



Notes:

Point-of-use (POU) devices such as pitcher, refrigerator, and faucet-mounted devices attach where water is dispersed, and point-of-entry (POE) systems are installed at a home's main waterline.

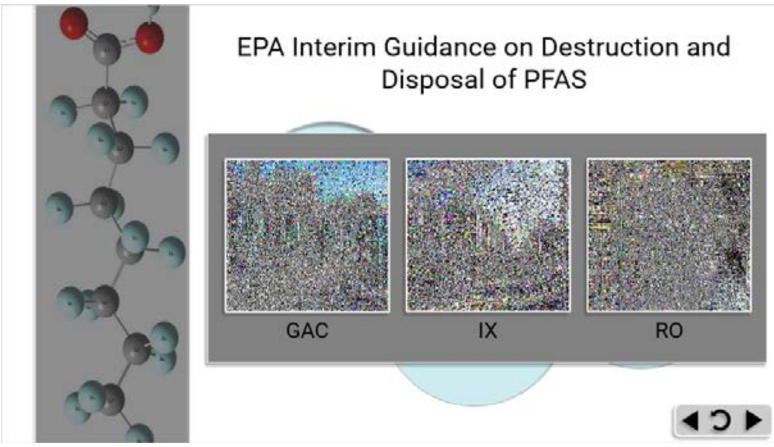
No single treatment device can remove all substances in water including all variations of PFAS. If a point of use or a point of entry device is installed it is important to make sure the devices are certified and/or specially labeled to reduce or remove the contaminant of concern.

For PFAS, certified products are either granular activated carbon filtration or reverse osmosis treatment systems. When purchasing home water treatment to address PFAS, look for products certified to NSF /ANSI 53 for filter devices or NSF/ANSI 58 for devices using reverse osmosis.

There are no point of use filter devices currently certified by NSF/ANSI for removal of PFAS to levels below the proposed standards.

1.6 EPA Interim Guidance on Destruction and

Disposal of PFAS



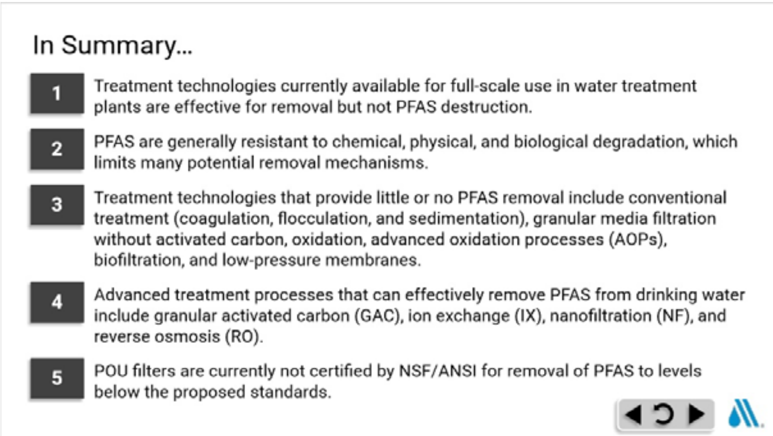
Notes:

How will drinking water utilities dispose of spent filters and other equipment they use to remove the PFAS? The technologies the EPA named and reviewed in this course, namely granular activated carbon, ion exchange and reverse osmosis / nanofiltration, concentrate the PFAS they remove from drinking water, but then move them into other media.

EPA provided interim guidance that generally describes technologies that may be feasible and effective to varying degrees for the destruction or disposal of PFAS and PFAS-containing materials. Thermal treatment, landfills, and underground injection are the disposal technologies offered. In all cases, EPA cautions that there are many variables and further research is essential. Check with your primacy agency for approved disposal methods of PFAS concentrate.

1.7 Knowledge Check – results are not published

1.8 Summary



Notes:

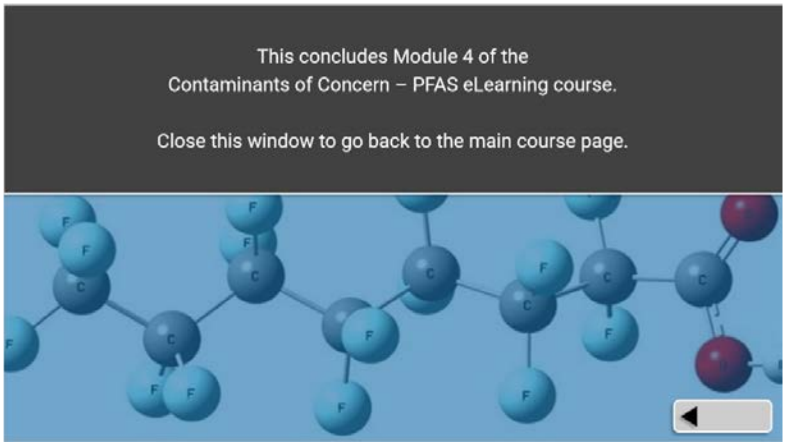
This module covered the technologies available for effective PFAS removal from drinking water sources but not PFAS destruction. The removal choices are limited as PFAS are generally resistant to chemical, physical, and biological degradation.

It is important to note that conventional treatment technologies such as coagulation, flocculation, and sedimentation, granular media filtration without activated carbon, oxidation, advanced oxidation processes, biofiltration, and low-pressure membranes do not remove PFAS.

The only water treatment technologies that can effectively remove PFAS from drinking water include granular activated carbon, ion exchange, nanofiltration, and reverse osmosis.

Point-of-entry and point-of-use devices are often used by homeowners and smaller systems. It is important to note the Point-of-Use filters are currently <u>not certified</u> by NSF/ANSI for removal of PFAS to levels below the proposed standards. Check the label to make sure your device removes the contaminants you need it to remove.

1.9 Closing


This concludes Module 4 of the
Contaminants of Concern – PFAS eLearning course.
Close this window to go back to the main course page.

1. Module 5

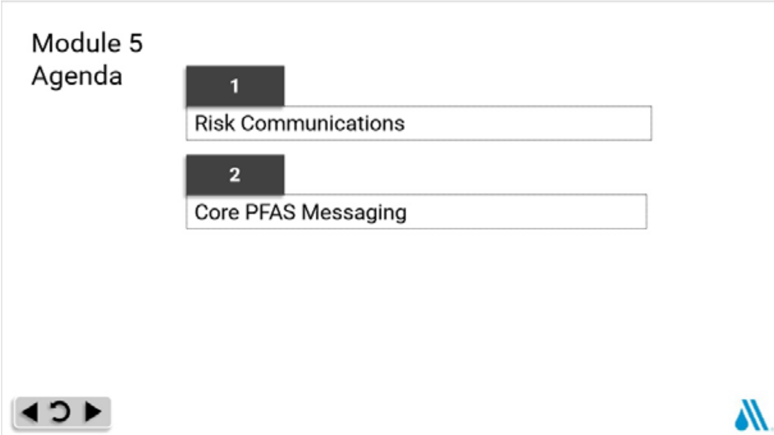
1.1 Communicating about PFAS

Notes:

As a water service provider, your core focus is to protect public health and the environment. Water professionals have traditionally met their public health mission as a silent service.

Historically, your utility's standards, practices and processes may have received little attention from the community you serve. Today, however, sensationalism around drinking water quality incidents, widespread broadcasting through social media and the growth in public distrust of government agencies means your community needs to hear from you.

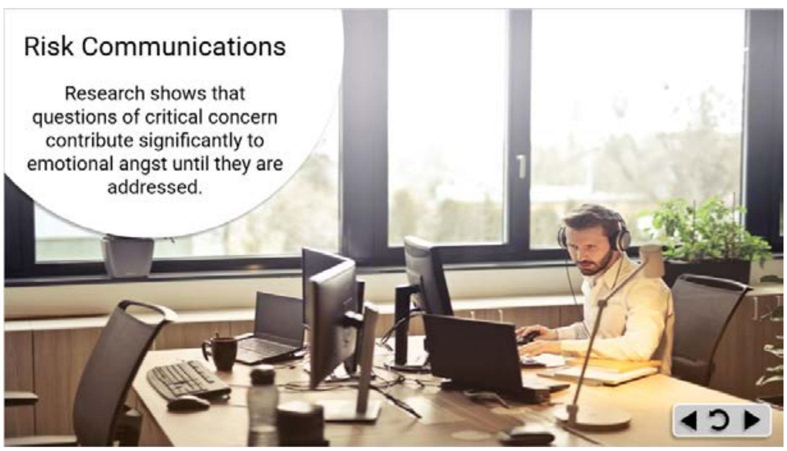
1.2 Module Agenda



Notes:

Water utilities need to create a dialogue with the public about water quality and how they're addressing contaminants of concern. This module looks at basic practices of risk communications and provides examples on how to develop core messaging.

1.3 Risk Communications



Notes:

Risk communication is about conveying the possibilities of both bad and good outcomes and is a critical step in addressing contaminants of, especially high-profile compounds like PFAS. Risk communication techniques are beneficial for communicating in an environment where fear, anxiety and high emotions are present and will help you return the conversation to one of reasoned discourse and enhance your reputation as the trusted source for information.

1.4 Communication Challenges

Notes:

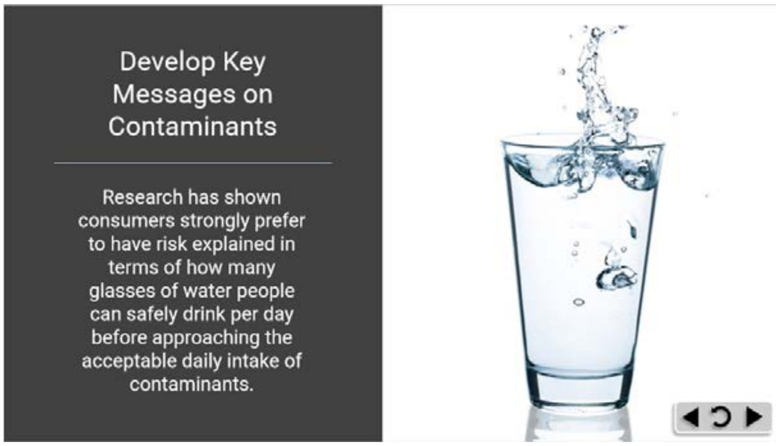
PFAS communication is an evolving situation. There is uncertainty as professionals grapple with the science, regulations and getting ahead of misinformation

In today's media environment, utilities are competing for attention with accomplished advocacy voices that have leveraged social media and used the water utilities' past silence to establish themselves as influencers on water issues. Many of these voices are helpful in raising awareness of important issues and have a genuine interest in improving water quality and protecting the environment. However, some of these influencers have an economic interest in capitalizing on the public's growing concern about water quality to sell various products and services. Others are political advocates aiming to build a policy platform to recruit new supporters or dues-paying members.

Water utilities should strive to be the trusted source for information about water in their communities. Trusted sources lead in times of crisis, are rarely targeted for a negative campaign and quickly and easily recover if they are targeted.

In times of fear, uncertainty and complexity, people turn to trusted sources. Utilities can become this trusted source through proactive, regular communication and engagement, and the messages you share do not have to be slick, expensive or hard to develop to be effective.

1.5 Develop Key Messages on Contaminants

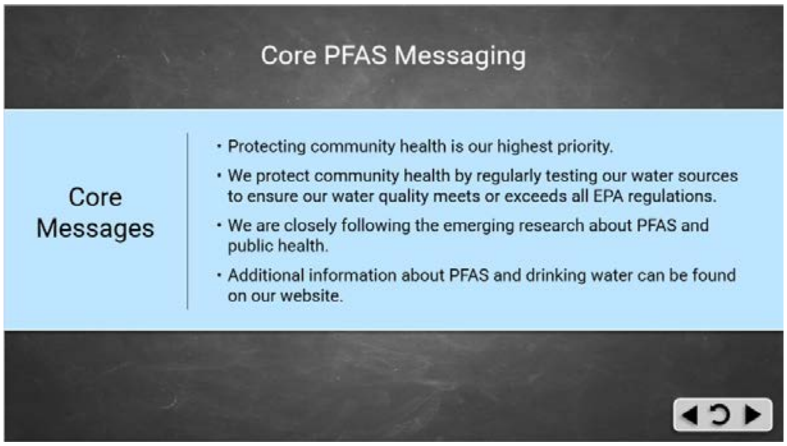


Notes:

Water utilities need to create a dialogue with the public about water quality and how they are addressing contaminants of concern. Several studies of risk communication have highlighted the effect of word choice on public understanding and associations. Public surveys designed and conducted by researchers have indicated that some water utility customers rapidly associate "contaminants or emerging contaminants" with "emergency." A firm understanding of consumer's conceptualizations of safe drinking water and contaminants is imperative.

All water utilities should provide consumers with the same general information on contaminant health effects based on *scientific research*, because inconsistent messages cause confusion and distrust. Key messages will help explain the risks and consider consumer risk perceptions.

1.6 Core PFAS Messaging



Notes:

Prioritize what information you want to share and stick to the messaging. Some core messages might include

Protecting community health is our highest priority.

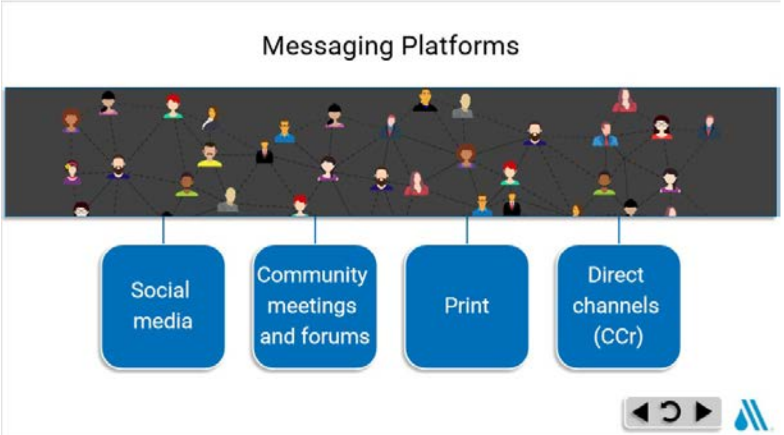
We protect community health by regularly testing our water sources to ensure our water quality meets or exceeds all EPA regulations.

We are closely following the emerging research about PFAS and public health.

Additional information about PFAS and drinking water can be found on our website.

Reinforce the message by letting stakeholders know what you are doing to protect the community

1.7 Messaging Platforms



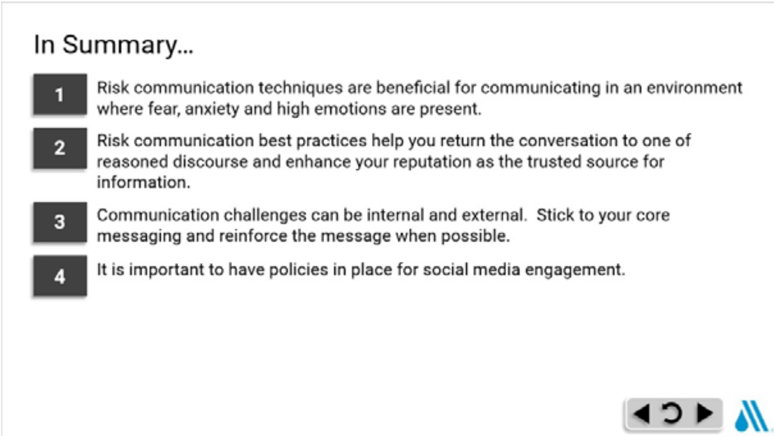
Notes:

Getting people to listen to your message in this information-overloaded world is a challenge, especially when it is complex, uncertain or creates anxiety. To effectively communicate, you must use your own communication channels and those of community influencers to reach people where they are already listening.

Proceed carefully on social media. You are communicating in real-time, you have no idea who is watching you nor what they are doing with the information you are sharing. The best strategy is to be prepared and have policies in place for social media engagement.

Engaging the public in person allows the utility to be in the community they serve and is an opportunity to host informational events.

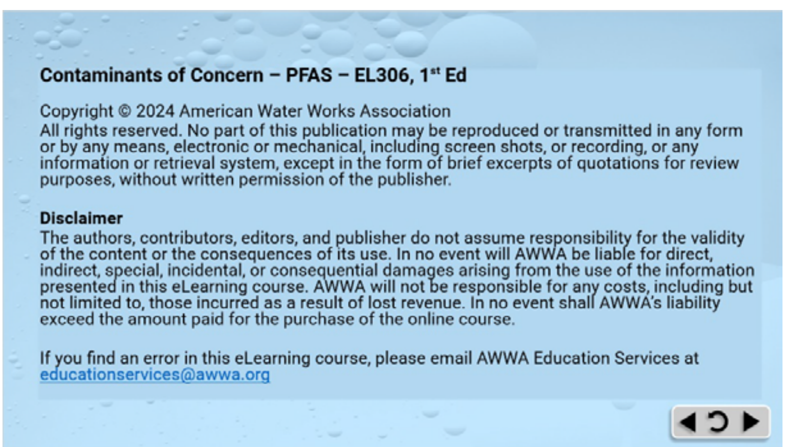
1.8 Summary



Notes:

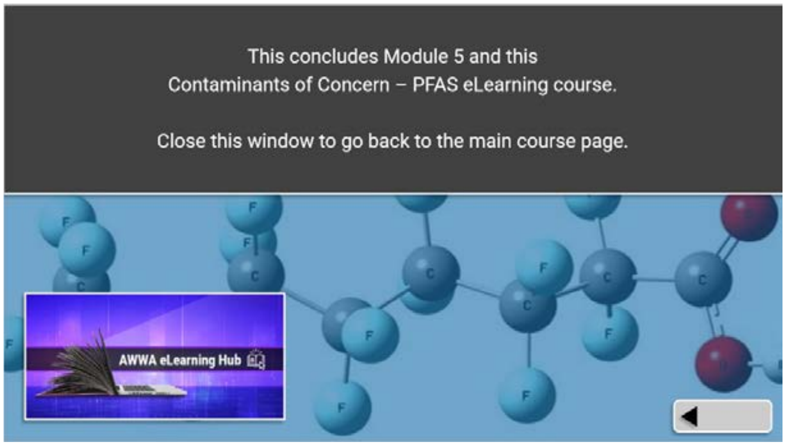
This module looked at basic practices of risk communications and emphasized its importance in alleviating high emotions. With thoughtful risk communication, you will be able to return the conversation to one of reasoned discourse and reinforce that you are a trusted source of information. Communication is a challenge. Experts advise you stick to your messaging and have policies in place for social media engagement. The messaging on social media is does not go away.

1.9 Disclaimer



Notes:

1.10 Closing


This concludes Module 5 and this
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