



Homeowner Guidance for Removing PFAS from Private Drinking Water Wells

What is PFAS and why should I be concerned about it?

PFAS stands for *per-and polyfluoroalkyl substances*, sometimes referred to as *per- and poly-fluorinated substances*. PFAS is not one thing, but rather a large family of chemical compounds used since the 1950s to manufacture stain-resistant, water-resistant, and non-stick products, among other uses. Various types of PFAS compounds may be present in food packaging, outdoor clothing, carpets, floor waxes, firefighting foams, and a wide variety of other items. PFAS compounds are often referred to as “forever chemicals” because they do not completely break down in the environment. Although much is still unknown, there is evidence that exposures to PFAS may cause a variety of adverse health effects, including increases in cholesterol levels, impacts to the thyroid, liver, and/or kidneys, developmental effects, and certain cancers.

How did PFAS end up in my drinking water well?

Some PFAS chemical compounds spilled or discharged to the environment can contaminate groundwater, and move long distances underground, particularly in cracks that are present in bedrock. In Massachusetts, most private drinking water wells are deep and get their water from these bedrock cracks.

What are the allowable levels of PFAS in drinking water?

There are federal and state laws and regulations that limit the amount of PFAS and other contaminants that can be present in public drinking water supplies (e.g., municipal water systems). In Massachusetts, the current drinking water standard for these public water supplies is 20 ng/L (total) of 6 specific PFAS compounds, referred to by their acronyms: PFOS, PFOA, PFNA, PFHxS, PFDA and PFHpA. Collectively, these chemicals are known as “PFAS6”. Note that ng/L stands for *nano-grams per liter*, which is approximately *parts per trillion* or *ppt*. 20 ng/L is an extremely small amount—but large enough to be of concern. In fact, the US EPA has recently introduced lower nation-wide standards for PFAS in drinking water, and MassDEP will adjust its standards accordingly in the coming years.

However, the federal and state drinking water standards do not (directly) apply to private drinking water wells. In Massachusetts, private drinking water wells are regulated by local Boards of Health, though MassDEP gets involved if contamination from spills of oils or chemicals is detected in a well—including PFAS. In these situations, state regulations (the *Massachusetts Contingency Plan*, 310 CMR 40.0000) mandate reducing levels in private wells to, at a minimum, the state drinking water standard (i.e., currently 20 ng/L). And, if feasible, even lower.

Who is responsible for treating my well water?

If the party responsible for a spill of PFAS (or other contaminants) is known, they have a legal responsibility to address the contamination, including within private wells (under Massachusetts General Law [MGL] Chapter 21E). Unfortunately, it is often very difficult to determine the source or sources of PFAS discharges that contaminated drinking water wells, especially bedrock wells. And because the party that caused the spill is sometimes unknown, the law also holds property owners responsible for contamination on their property, *with the exception of owner-occupied one-to-four family homes, as long as they did not cause or contribute to the chemical spill*. In these situations, it's generally up to the homeowner to decide if they want to install a treatment system at their expense—except in cases where the levels of contaminants are high enough to constitute an “Imminent Hazard,” which MassDEP has an obligation to address. Currently, the Imminent Hazard level for PFAS6 in drinking water wells is 90 ng/L.

What will MassDEP do if the level of PFAS6 in my drinking water well is more than 90 ng/L?

If the responsible parties cannot be identified and/or refuse to take action, and if the property owner allows it, MassDEP will install, at state expense, a Point of Entry Treatment system to remove the PFAS.

What if the level of PFAS6 in my drinking water well is less than 90 ng/L?

If the responsible parties are identified, MassDEP will work to compel them to install a treatment system on impacted wells, if allowed by property owners. If a responsible party cannot be identified, it will generally be up to the individual homeowner to address contamination in their well,

What are the options to address PFAS contamination in my well?

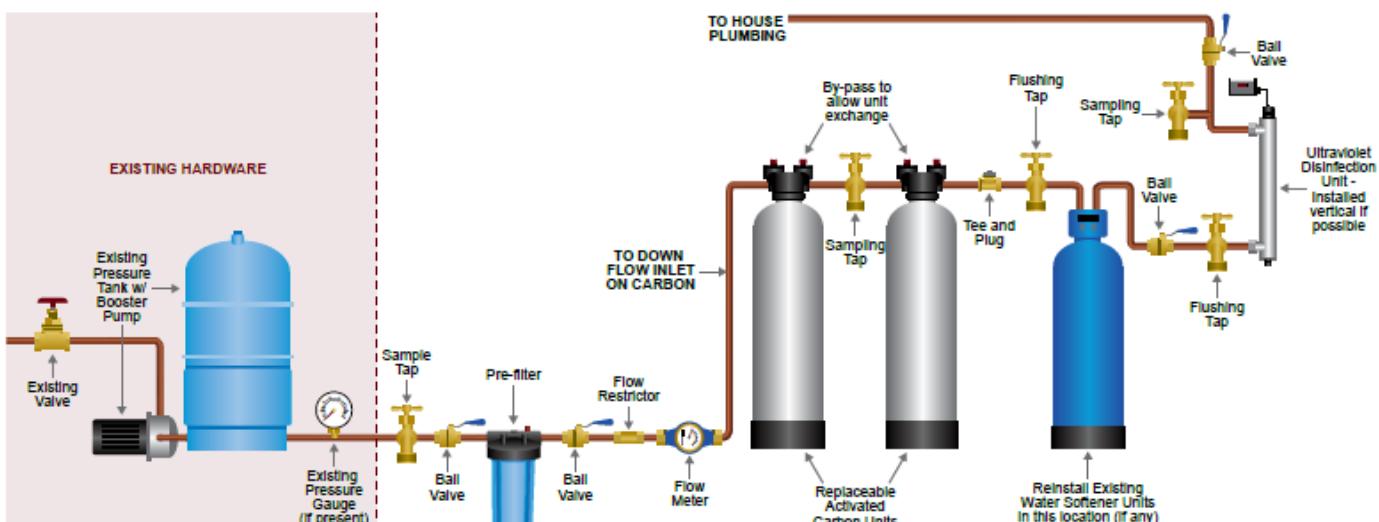
Assuming you do not have the ability to connect to a public water supply, there are essentially 3 options: purchase and use bottled water, install a *Point of Use Treatment (POUT)* system, or install a *Point of Entry Treatment (POET)* system. A POET system is the best and most protective choice but is also the most expensive. For relatively low levels of PFAS contamination, where the primary concern is the risk from drinking the water, the use of (PFAS-free) bottled water could be a reasonable (at least short term) solution. And a POUT system is certainly better than no treatment at all. However, POUT systems do not treat water used for bathing, other household uses, or outside irrigation. The non-treated water from the well then re-enters the environment via septic systems and irrigation infiltration, continuing the cycle of pollution.

What are Point of Use Treatment (POUT) systems?

PFAS POUT systems are basically filters used to treat a small volume of drinking water, including counter-top “pour through” pitchers, attachments to faucets, refrigerator filters, and under-sink units. Most filters contain granular activated carbon (“charcoal filter”). When considering filter options, look for adherence to independent testing/certification standards, for example, the National Sanitation Foundation standard NSF/ANSI 53 – but be aware that many such certified devices have not been tested to prove they can meet the most current drinking water standards (e.g., 20 ng/L PFAS6 in Massachusetts), and may not be effective for all types of PFAS contaminants. Studies have shown a wide variation in the efficacy of these filters, with percent removal efficiencies in the range of 40 to 95+. It’s generally a case of *you get what you pay for* – cheaper/smaller filters are generally less effective and need frequent filter replacements. Studies have suggested that “two stage” or “dual stage” under sink activated carbon installations may be the best POUT option (\$100 to \$500), but make sure to change out the filters as recommended. *One POUT option to avoid is Reverse Osmosis installations, particularly if you are on a septic system*, since they do not remove or destroy the PFAS contaminants, but rather backwash them into the environment - and perhaps back into your well!

What are Point of Entry Treatment (POET) systems?

A PFAS POET system is a multi-component, whole-house filtration installation designed to treat all PFAS-contaminated water used within (and outside) of the home, operated in conjunction with any existing treatment systems, such as water softeners. A typical POET system installation includes sediment filters, one or two cylinders containing PFAS-removing media, an ultraviolet (UV) light disinfection unit, flow meters, and flow restrictors. A typical system of this nature is depicted below:



Here are some things to know when considering the installation of a PFAS POET system:

- The cost is generally in the range of \$5000 - \$10,000 depending on the complexity of the system and specific water quality parameters in the water to be treated.
- The heart of the system are the cylinders of PFAS removing media (“vessels”), each usually containing about 1.5 cubic feet (11 gallons) of granular activated carbon, also known as “GAC”. Note that not all GAC filters are equally as effective in removing PFAS, with coal-based GAC perhaps being the best, though coconut shell GAC may be appropriate in some situations. And some vendors use an *Ion-Exchange (IX)* resin instead of GAC, though MassDEP has limited information on these systems.
- The GAC vessels work by “trapping” the PFAS chemical compounds. Eventually, the GAC media gets saturated, and PFAS flows out of the vessel. That is why two vessels (in series) is recommended—the second vessel will trap this breakthrough, preventing exposures to household residents. There are also engineering advantages in having two vessels in series, in order to “load up” the first vessel with the maximum amount of PFAS. Eventually, the first vessel will have to be removed; the second vessel will be re-plumbed as the first vessel, and a new vessel will be installed as the second vessel. While it is possible to save money by installing only one vessel, this is likely to lead to some amount of exposure to household residents, unless a frequent and expensive testing program is implemented.
- Though they may not always necessary, a UV disinfection unit is sometimes installed in POET systems to kill any bacteria or viruses that could grow on the filter media.

Do Point of Entry Treatment (POET) systems require monitoring and maintenance?

Yes. Some items have a predictable replacement schedule, others are based upon testing results.

- Sediment filters should be changed once per year at a minimum, though more frequent replacement of a pre-filter may be needed to maintain water pressure within the home (if a drop in pressure is noted, the filters should be checked). Filters are relatively simple to purchase and replace—see the owner’s manual for specific product details. These can often be purchased at home improvement stores or online and disposed of as household waste; replacement instructions should be available in the POET system user manual. Expect to pay in the range of \$10 to \$20 for each filter.
- The UV purification system consists of a UV bulb and quartz sleeve, both of which must be replaced annually. Over time, the UV light fades and becomes less effective at disinfecting the water. Some systems are equipped with a count-down timer and will audibly alarm when replacement is overdue. Installers usually recommend hiring a qualified water professional to replace the bulb due to multiple hazards presented (electrical, heat, UV light, and they contain mercury). However, the replacement is often quick and simple, requiring no special tools. If a homeowner would like to replace the bulb and sleeve themselves, specific product details and instructions can be found in the UV system owner’s manual. Expect to pay in the range of \$150 to \$250 for the UV bulb and quartz sleeve.
- It’s difficult to predict when GAC vessels will become saturated and require replacement. The only way to know for sure is to test the water coming out of the vessel(s) – which is why a two-vessel system is recommended. However, for low to moderate levels of PFAS in drinking water wells, and typical water usage volumes, the “lead” vessel in a two-vessel system can last two or more years. MassDEP recommends procurement of a new vessel when PFAS starts to be detected in the “midpoint” water sample (i.e., the water exiting the first vessel and entering the second vessel). This action is best left to professionals. Expect to pay in the range of \$1000 to \$2000 for the procurement and installation of a new vessel and removal and recycling of the old (saturated) vessel.

I already have a treatment system – why do I need another one?

The most common systems on private drinking water wells are sediment filters and water softeners – neither of which will remove PFAS contaminants. Aeration systems for radon treatment and aeration/oxidation systems for iron/manganese/sulfur removal will not effectively treat PFAS. And while some “resin” systems for arsenic removal may remove some PFAS contaminants, their effectiveness and longevity are unclear.

Conversely, Reverse Osmosis (RO) systems (often installed to remove arsenic) are effective in removing PFAS, but their use is discouraged, as they do not remove or destroy contaminants but rather discharge them back into the environment. *If you are on a septic system and have an RO system, you are advised to switch over to a resin-based arsenic removal system, to protect water quality in your drinking water well.*

Sounds like PFAS testing is the key to addressing this problem. What should I know?

The need for treatment, and schedule to replace PFAS filters, are all based upon obtaining and analyzing water samples for PFAS contaminants. There's a lot to know:

- Expect to pay in the range of \$250 to \$500 per sample—and more if you retain a professional to obtain the samples. It normally takes 2 to 4 weeks to obtain the results from the laboratory.
- MassDEP recommends that samples be tested using either **EPA Method 537.1** or **EPA Method 533**, both of which are certified methods for measuring PFAS in drinking water.
- To monitor the effectiveness of a POUT or POET system, a reasonably protective schedule would be to collect water samples every 6 months. In a two-vessel POET system, samples should ideally be collected from the midpoint sampling tap and the sampling tap after the UV disinfection system (“effluent sample”). To save money, sample only the midpoint; if a detection is noted, obtain and analyze a sample of the effluent, and/or change out the first vessel.
- Whether you or a qualified water professional obtains samples, it is highly recommended that testing be done by a laboratory that is certified by MassDEP to perform drinking water analyses for PFAS (the available testing methods require specialized equipment and many labs do not have this capability). The current list of these labs can be found online at <https://www.mass.gov/how-to/find-a-certified-laboratory-for-water-testing> (be sure to select “PFAS” in the analyte window).
- You can save money by obtaining samples yourself and sending them to a laboratory. The first step is to contact the lab and obtain the needed sampling containers. As of the writing of this guide, four laboratories in Massachusetts & New Hampshire are certified to analyze for PFAS in drinking water:

Pace Analytical Mansfield, MA (508) 822-9300	New England ChromaChem Salem, MA (978) 744-6600	Contest (Pace Analytical) East Longmeadow, MA (413) 525-2332	Absolute Resource Portsmouth, NH (603) 436-2001
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Of these four, New England ChromaChem and Absolute Resource offer home testing kits; other labs will direct the homeowner to purchase a testing kit online or work through a smaller laboratory that functions as a liaison. The laboratory will provide directions for collecting, storing, and shipping samples. It is generally recommended to flush the system prior to sampling, for example, by running the kitchen tap for about 15 minutes. For two-vessel POET systems, obtain the effluent sample then the midpoint sample after flushing the sampling ports of about 1 quart of water. NOTE: to save money, it is generally not necessary to obtain and analyze a “trip blank,” if offered by the lab.

Where can I get more information about PFAS treatment systems?

There is a lot more information available on the internet; as always, the key to effective research in this regard is to stick with trusted sources, which include the US EPA and other government agencies, credible commercial and consumer organizations (e.g., National Sanitation Foundation (NSF), American National Standards Institute (ANSI), and Consumers Reports), and credible academic institutions and peer-reviewed scientific journals. Claims made by vendors marketing treatment systems may or may not be accurate; consider asking for proof and/or performance guarantees.

For professional installation/operation/maintenance, conduct an internet search for “home water treatment in Massachusetts.” Note that there are no government certification/licensing requirements for these types of businesses, so make sure to shop around, check references, and ask for documentation or guarantees supporting performance claims. And make sure to test your water about a week after system installation to verify the system is working properly!