Researchers test Rhode Island water systems for chemicals known as PFASs

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Credit: Brown University

Researchers from Brown University's Superfund Research Program are partnering with the Rhode Island Department of Heath (RIDOH) to test selected water systems around the state for a group of chemicals known as PFASs.

The human-made chemicals are currently unregulated in drinking water, but the Environmental Protection Agency (EPA) recently lowered the health advisory level for two types of PFAS—Perfluorooctanoate (PFOA) and perfluorooctane sulfonate (PFOS)—to 70 parts per trillion because of new findings on health effects. Research has linked PFOA and PFOS to developmental effects on fetuses during pregnancy and on breastfed infants; to cancer; and to effects to the liver, immune system and thyroid. The EPA advisory level is designed to be protective of these potential health impacts.

The new testing program follows up on previous tests that RIDOH performed in between 2013 and 2015.

Jennifer Guelfo, a postdoctoral researcher in Brown's School of Engineering and a member of the Superfund Research Program, has spent eight years researching PFASs and will lead the water system sampling effort. She discussed the project in an interview.

Q: Can you explain the nature of the chemicals for which you're testing?

In general, PFASs are a class of human-made compounds that do not occur naturally in the environment. They have been used in a variety of products and applications such as stain resistant coatings, non-stick coatings, food paper packaging products, textiles, chrome electroplating and certain types of firefighting foams. PFASs are difficult to clean up when they are released into the environment because they do not break down, or degrade, in the way that many organic contaminants do. Routes of environmental release include use of consumer products, industrial and manufacturing practices, use of firefighting foams, disposal in landfills, and release from wastewater treatment plants. Because of widespread use, release and resistance to degradation, PFASs occur globally in the environment and humans.

Q: What are the drinking water standards currently in place for these chemicals and what health effects are these standards based on?

Nationally there are no drinking water quality standards for PFASs. In May 2016, the EPA issued what are known as lifetime health advisories (LHAs) for two PFASs: PFOS and PFOA. The LHAs are non-enforceable recommendations for the maximum levels of PFOA and PFOS that are safe in drinking water. The LHA is 70 ng/L for the sum of PFOA and PFOS—to put that in perspective, that is approximately equivalent to three and a half drops in the average, Olympic-sized swimming pool.

Currently, it is up to the individual states to decide if they want to implement an enforceable state-level drinking water quality standard, and some have done that. Generally speaking, health-based standards seek to protect the most sensitive populations such as young children and pregnant or lactating mothers.

Q: Can you describe some of the prior testing that has been done PFAS?

From 2013 to 2015, the EPA conducted a nationwide screening of drinking water systems called the Unregulated Contaminant Monitoring Rule effort, or UCMR3. The project looked for multiple contaminants that do not currently have federal drinking water quality standards, including six PFASs. UCMR3 helps the EPA understand the occurrence of PFASs in drinking water and informs decisions about development of federal regulations.

The testing included 17 systems in Rhode Island. Of those, 15 did not have measureable levels of any of the six PFASs. Two systems had measureable levels of PFOA. One system measured 20 ng/L of PFOA, which is below the LHA. The second measured 81 ng/L of PFOA (above the LHA) during initial sampling, but that level decreased to 24 ng/L (below the LHA) during a follow-up sampling event.

Sampling of other locations in Rhode Island will screen drinking water that was not sampled as part of the USEPA UCMR3 effort.

Q: What can be done if the tests reveal elevated levels?

I am not aware of what strategies Rhode Island would implement in the event that elevated PFAS levels were discovered, but I can speak generally to strategies that have been implemented in other regions. When PFASs that exceed standards are discovered, the initial step is to eliminate exposure. In some regions, bottled water has been a short-term solution, while long-term strategies were evaluated and implemented. In order to provide drinking water that meets applicable PFAS levels, utilities may consider new sources of drinking water, such as installation of a new groundwater well in an non-impacted area. When impacts are in private drinking water wells, officials may consider extending the public drinking water distribution system to those homes or businesses.

Another strategy is to use water treatment techniques to reduce PFAS concentrations. Water treatment of PFASs is the focus of a lot of the current PFAS research because it is so challenging. As mentioned, PFASs do not degrade the way some other organic contaminants do, and many conventional treatment techniques rely on degradation to break down contaminants in drinking water. Since some conventional techniques are not effective on PFASs, researchers are currently investigating novel techniques that will destroy the compounds. In the meantime, those who treat PFAS-impacted drinking water rely primarily on filtration techniques. They allow water to pass through the filter while PFASs stay behind, "stuck" to the filter media. These techniques yield drinking water that meets regulatory standards, but it leaves behind filter materials impacted with PFASs that must be disposed of or treated following use. The future of PFAS treatment is likely to include more sustainable techniques that achieve PFAS destruction.

Q: What strategy have you and your colleagues developed for groundwater sampling and identification of potential sources of PFAS releases?

One challenge related to PFAS drinking water impacts lies in understanding the source or sources of the release. Multiple PFAS-containing products have applications that can result in releases. Records identifying which facilities may be associated with use, synthesis or disposal of PFASs are often unconsolidated or missing. So when impacts are discovered, it is challenging to identify and address the source of that release. In addition, the lack of knowledge about potential PFAS sources makes it challenging for regions to know where to sample when they want to assess if PFAS drinking water impacts are present. A group of researchers in the Brown Superfund Research Program, including myself, Scott Frickel and Thomas Marlow, have joined together to try and develop an approach to this challenge.

The approach involves compiling publicly available information that can inform where PFAS releases may have occurred. These kinds of data are often available for download as geospatial coverages. Examples include locations of landfills or facilities such as airports that may have used PFAS firefighting foams. Next, the approach ranks the various facilities on a scale of low to high likelihood of release. This accounts for the fact that our database compiles potential and not known sites of PFAS release. Even when releases do occur, they do not always lead to impacts that effect drinking water, so the next step is to compare the potential sources to locations of drinking water aquifers.

The end result is a risk map. Areas of high risk result when facilities with a high likelihood of PFAS release are proximal to areas where drinking water exposure is likely to occur. High-risk zones may also occur if multiple facilities with a low likelihood of release occur in a small area. This is because the presence of multiple facilities multiplies the overall likelihood of release. Resulting risk maps might be used to prioritize areas that should be targeted for PFAS drinking water screening.

Provided by Brown University