Cleaning up ‘forever’ chemicals is no easy task

Engineers working to develop methods for breaking down these chemicals.

By Byrnelle Turner Jr.
Staff Writer

As researchers learn more about so-called ‘forever chemicals’ in drinking water across the country and the Dayton region, engineers and scientists are scrambling to develop methods of combating the man-made substances.

The U.S. Department of Defense and the U.S. Environmental Protection Agency are paying for various research projects, including one titled at Wright-Patterson Air Force Base. The Air Force alone is expected to spend more than $2.2 billion to clean up PFAS-contaminated sites nationwide, according to the U.S. EPA.

The Dayton Daily News spoke with experts about the ongoing effort to find ways to remediate PFAS for remediation, and how effective experts say they are.

There’s been progress in finding treatments for some types of PFAS, but there are ongoing challenges and, while scientists say colloidal activated carbon has proven to be effective, local experts say there is still more to learn.

Still, there’s a lot more to learn about PFAS, said Abhna Agrawal, a groundwater and soil remediation expert at Wright State University. As scientists become more aware of new chemicals, they will continue to develop better methods of breaking down the chemicals, she said.

It’s kind of a joy to do for us old-timers,” said Agrawal, who has been studying ground water for more than 25 years. “We want through this discovery process in the 1990s when you started finding chlorinated solvents, and it took us at least 25 years before we had a good group of what’s going on. So we are in that process with PFAS at the moment.”

Most common treatment methods

PFAS-related substances or PFAS include substances known as PFAS, PFOA and GenX. It can be found in firefighting foam, water-repellent fabrics, nonstick products, waxes, polishes, and some food packaging, according to the U.S. EPA.

Studies suggest that exposure to these chemicals might affect pregnancy, increase childhood leukemia and cause some forms of cancer, according to the centers for Disease Control and Prevention.

PFAS is perhaps the biggest threat to the region’s drinking water sources, said Oike Hilton, water resource and monitoring manager at the Miami Conservancy District, has said.

Firefighters treated for decades with foam in at least two cities in this region: Wright-Patt and the Dayton Fire Training Center. Both locations sit above the Burnsville Aquifer that has about 3.5 million gallons of water. It is the source of water to Hamilton County, providing most communities in the region with drinking water.

The U.S. EPA has set a health advisory for the chemical, but ongoing drinking water tests are not still PFAS above 70 parts per

But for the first time in January 2021, the EPA began regulating PFAS in drinking water. In addition, the Ohio EPA has started testing the state’s 1,290 public water systems for PFAS. Finally, there are often no chemicals that are PFAS at the moment.”

We could be to reduce the concentration of PFAS to no detection limits within minute,” she said.

The Air Force Civil Engineer Center has provided nearly $3 million to help develop the technology. Mark Cordelli, deputy assistant secretary of the Air Force for Installations, Energy and the Environment, expressed support for the technology shortly after a two-week field study at Wright- Patt in September.

“PFOS/PFOA is a national concern, and research like this could lead to the breakthroughs we need to address potential contamination,” he said. “This demonstration is another example of the Air Force’s commitment to our nation, our commu- nities and our service members. The tests conducted at Wright- Patt were successful, Modesto Thalgard said.

A prototypical of the Enhanced Contact Plasma Reactor – plasma technology – shows the device shooting high energy voltage into a container that destroys PFAS contaminants. (CONTRIBUTED)

Successful field test

The process of destroying PFAS starts when contaminated water enters the 16-foot trailer at one end. On top of the reactor are a series of discharge plates where high voltage electrical energy enter the system. That energy is catalytic for breaking apart the PFAS compound in the water, Thalgard said. The reactor also causes gas in the water to form bubbles, which the PFAS sticks to. The bubbles float to the wa- ter surface and the high voltage electrical energy pushes them like lightning bolts, destroying the chemicals.

Hundreds of gallons of toxic water are treated under a variety of operating conditions during the trial at Wright-Patt. The result was that PFAS in the water was below the detection level of 10 parts per million, Modesto Thalgard said.

The reactor is capa- ble of treating 2 gallons of water per minute using an EDP and other funding. The team is working to scale up the product so it’s capable of treating a minimum of 50 gallons per minute, Modesto Thalgard said.

“We tested our granular carbon meth- odology, the plasma technology reveals that the water is pumped from the ground. But the reactor is only able to process 2 gallons of water at a time, it doesn’t use chemicals or re- quire disposal of a residue product, which can be costly, said Modesto Thalgard and Stephen D. Rich- ardson, principal engineer with G2 Environmental Inc. in Texas. Richardson was a former employee of Richardson and his company is designing to a 10-foot trailer that should require the operation to make more progress.

The team has not determined how the reactors will cost. Each reactive unit would cost $100,000 to $750,000, with the reactor and the cheaper cost being made up of 40% to 50% less than the granular carbon method.

The team is now working to make the system more efficient. They also will conduct more tests before beginning commercial use, the reactor in 2023, they said.

Dayton leaders said they are aware of the plasma technology and will continue to monitor it along with other treatment meth- ods. The plasma technology has shown promise with small quanti- ties of water, Dayton Water Director Rich- ard M. Powell said.

We are actively tracking cur- rent and emerging treatment technology related to PFAS, particularly those which are scalable for application in high capacity treatment operations,” Powell said.

Dayton supplies drinking wa- ter to more than 400,000 people, including Montgomery County, Greene County and a handful of washour water plants in the city.

Chemicals continued on A2
How PlumeStop treats water contaminated with PFAS
Holes are drilled into the ground and a filtering plume is injected into the aquifer. The plume purifies the water by eliminating PFAS in that area of the aquifer for 40-60 years.

Source: REGENESIS

A groundwater remediation team drills into a contaminated site at a Michigan Army National Guard base to prepare to inject Calci-Activated Carbon. On PlumeStop it fall 2016. H. BRINE/REGENESIS

Underground treatment approach
Agarwal said he prefers underground treatment methods such as calci- activated carbon, also known as PlumeStop, a superior approach for PFAS remediation in aquifers because it’s cost-effective, less disruptive, fast acting and has proven to be effective, he said. PlumeStop was first test- ed on a contaminated site in Canada about five years ago, said Scott Wilson, president and CEO of REGENESIS, a California-based company that has been treating a wide range of contaminants worldwide for the past 25 years. In addition to PFAS, the product can treat multiple other contaminants, he said.

To create PlumeStop, they mill carbon fiber activated carbon that is then wrapped in a substance that keeps it from reforming into larger particles. Several holes are drilled into the ground and the substance is pumped into the aquifer. Gravity then moves the plume through the aquifer, picking up the surface and forming a permeable treatment zone. It appears as if the aquifer surface has been painted black, Wilson said. “When it does that, being actively treated, it’s rendering the polluted aquifer into a purifying filter,” he said. “The carbon still pull all of the PFAS out and make it stick to the soil because the soil basically has been painted with this black carbon. So you’ve purified the water moving through this area and it becomes super clean.”

One application of the PlumeStop can last decades. Said Wilson, Canadian groundwater remediation experts Grant R. Casey estimate it can last between 40 to 60 years. The product starts to take effect immedi- ately while reducing PFAS to undetectable levels.

The cost of the proce- dure will depend on the size of the contaminated area, Wilson said. One ap- plication to a small site, for example, could cost about $57,000, he said.

“Only a matter of time!”
PlumeStop was injected to a contaminated site at a Michigan Army National Guard base in the fall of 2018. Since then, REGENESIS has conducted quarterly sampling at the site, and the PFAS has remained below detectable levels. Applica- tions are planned for other DOS sites in Pennsylvania and Colorado, and at princi- pal sites on the East Coast, said Wilson.

It’s also being used on a U.S. EPA Superfund site in Connecticut. The Superfund law passed in the 1980s allows the EPA to clean up contaminated sites and forces the parties re- sponsible for the contamin- ation to either perform cleanups or reimburse the government. There are sev- eral U.S. EPA Superfund sites in the Dayton area. The city of Dayton has used PlumeStop on a lim- ited basis, said Poolow, the water director.

“We have employed this technology to deal with a different type of concern, but we are not an area of potential risks for PFAS migration in groundwater,” he said. “Our concern is assessing the chemical and biological conditions of our own aquifer to see if this technology has the potential to have sustained effectiveness.”

Given the fact that the PlumeStop seems to be ef- fective at combating PFAS, why isn’t it widely used? There’s no problem right now is that we do not have a standard to clean up to,” Wilson said. “The U.S. EPA has not established a regu- latory standard to clean up to.”

Agarwal believes that there’s a lack of knowledge about PlumeStop because it’s relatively new. Federal and local officials are hesitant to take a chance on products they aren’t famil- iar with, he said. Still, he optimizes, saying it’s only a matter of time before the underground method is more widely used. The U.S. EPA has found a variety of ways to remove PFAS from drinking water, a spokesman said. But it recommends that munici- palities do what’s best for their communities.

“There are things to con- sider with each of these technologies, including costs and operational fea- sibility, which can vary. Therefore, what we would recommend would be the needs of the community,” the spokesman said via email. "We recommend that municipalities consult with their respective state environmental program to understand the costs and obtain approvals before installing any treatment technologies."