Researchers demonstrate the effectiveness of a plasma reactor for the treatment of water

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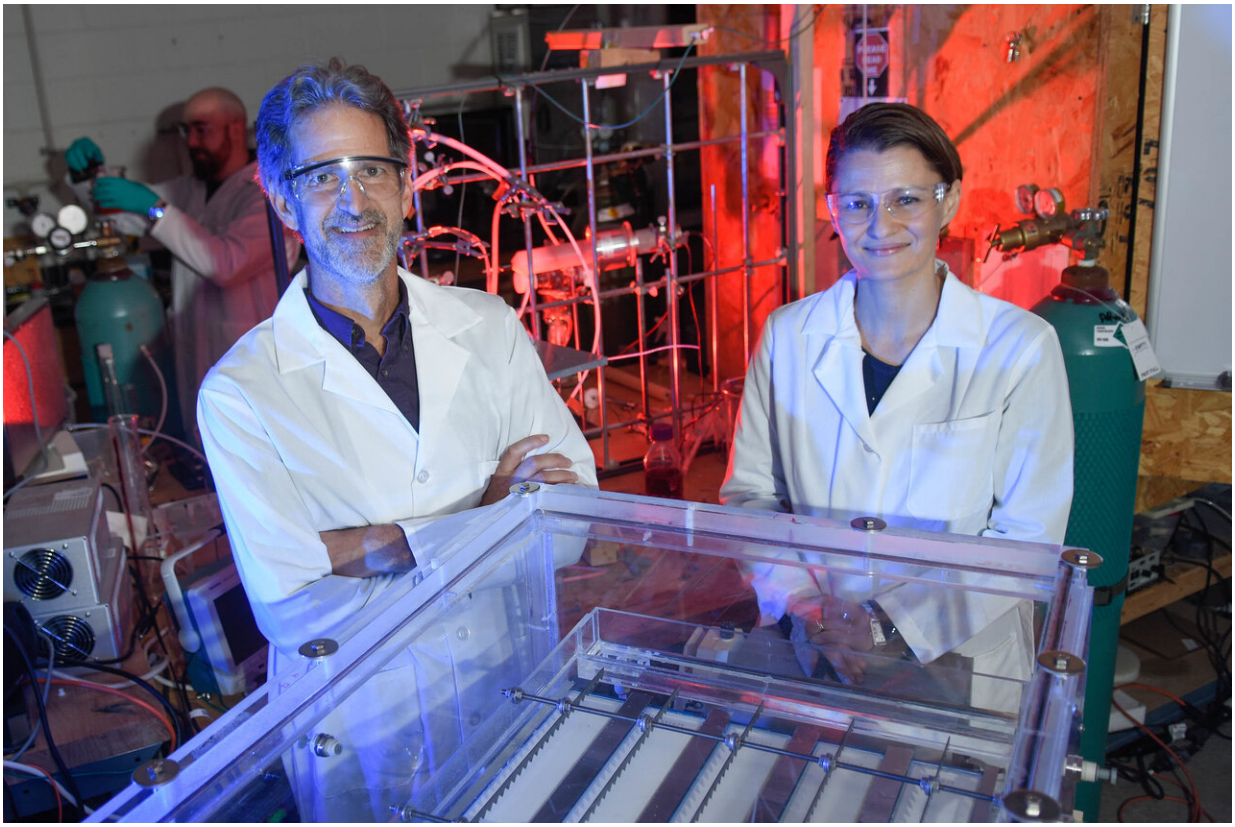

Professor Tom Holson and Professor Selma Mededovic. Credit: Clarkson University

Civilian researchers completed a two-week field demonstration here Sept. 25 using an innovative plasma technology to degrade and destroy

perfluorooctane sulfonate and perfluorooctanoic acid, known as PFOS and PFOA, in groundwater.

This was the first field demonstration of the Enhanced Contact Plasma Reactor, conducted under an Air Force Civil Engineer Center contract with primary contractor Clarkson University and teaming partner GSI Environmental.

Clarkson and GSI were awarded this research project to demonstrate the effectiveness of a plasma reactor for the treatment of water containing PFOS and PFOA. Wright-Patterson AFB was the installation chosen for the field demonstration.

The contract was the latest result of a 2011 Broad Agency Announcement issued by AFCEC. It is part of ongoing Air Force efforts to identify potential cost-effective and sustainable environmental solutions for cleaning groundwater containing PFOS and PFOA concentrations, for the Air Force, and the nation.

PFOS and PFOA are synthetic chemical compounds used for decades in many industrial and consumer products such as nonstick cookware, stain-resistant fabric and carpet and some food packaging. Both chemicals are very persistent in the environment and in the human body—meaning they don't break down over time. According to the Environmental Protection Agency, there is evidence that exposure to PFOS and PFOA can lead to adverse human health effects.

PFOS and PFOA are also part of a larger group of synthetic chemical compounds, collectively called per and polyfluoroalkyl substances and referred to as PFAS. The family of PFAS compounds are what the Clarkson-GSI team is focusing their research on. While the acronyms are sometimes mistakenly used interchangeably in conversation and online, PFOS and PFOA are the most researched compounds of the

PFAS group, and are the ones that Air Force is focusing on. PFOS and PFOA were components of a legacy firefighting foam the Air Force and others began using in the 1970s to extinguish petroleum-based fires. That firefighting foam has since been phased out by the Air Force.

Water used for the demonstration was drawn from two monitoring wells at the Wright-Patterson fire training area.

"We are trying to destroy or degrade PFAS impacted groundwater using electrical discharge plasma," explained Dr. Selma Mededovic of Clarkson University, principal investigator.

The plasma reactor is a closed system utilizing water, electricity and argon gas to degrade PFOS and PFOA in minutes.

"The argon gas concentrates PFAS at the gas-liquid interface and plasma is generated at that interface, which then destroys PFAS," said Mededovic.

Chemically, the plasma reduces the PFAS molecule chain down into smaller compounds and elements, through several cycles. No additional chemicals or additives are needed.

"This is the only technology that actually destroys PFAS molecules that has been demonstrated at this scale, it doesn't just remove them from water," said Dr. Tom Holsen of Clarkson University and co-principal investigator. "All of the other demonstrations that we're aware of remove it from the water through filtration so there is still a PFAS containing waste. Our method actually destroys PFAS."

During this two week demonstration, hundreds of gallons of groundwater were treated. That time allowed engineers to test different durations and flows to optimize the efficiency of their Environmental Remediation

Mobile Laboratory.

"The overall goal of the project was to transition the technology from the laboratory to the field and optimize operating conditions of the mobile system," said Stephen Richardson of GSI Environmental, Inc., and co-principal investigator.

According to the researchers, the next phase in this project will be a detailed analysis of the treated water, and evaluating further scaling-up of their plasma reactor design.

Samples of groundwater from various Air Force bases, including Wright-Patterson AFB, were used in early studies.

Drinking water at Wright-Patterson is tested regularly and contains PFOS/PFOA well below the EPA lifetime health advisory level. The base is also home to a water treatment facility using Granulated Activated Carbon, online since June 2017, and has filtered more than 225 million gallons of drinking water for PFOS and PFOA, to date.

The Air Force's investigation work and mitigation actions are guided by the Comprehensive Environmental Response, Compensation and Liability Act, or CERCLA, applicable state laws and the EPA's lifetime drinking water health advisory of 70 parts per trillion.

"PFOS/PFOA is a national issue, and research like this could lead to the breakthroughs we need to address potential contamination," said Mark Correll, Deputy Assistant Secretary of the Air Force for Installations, Energy and the Environment. "This demonstration is another example of the Air Force's commitment to our nation, our communities and our environment."

With its main campus located in Potsdam, New York, and additional

graduate program and research facilities in the New York Capital Region, Beacon, New York, and New York City, Clarkson University is a leader in technological education and sustainable economic development through teaching, scholarship, research and innovation.

More information: The Broad Agency Announcement which created the opportunity for the Clarkson University-GSI Environmental plasma reactor research is still active, as AFCEC continues to seek, evaluate and potentially fund future efforts at sustainable environmental solutions for cleaning groundwater containing PFOS and PFOA concentrations. For more information, visit: www.afcec.af.mil/Home/Environm … -Support-Branch/BAA/

Provided by Clarkson University