

Researchers step toward understanding how toxic PFAS chemicals spread from release sites

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A study led by Brown University researchers sheds new light on how pollutants found in firefighting foams are distributed in water and surface soil at release sites. The findings could help researchers to better predict how pollutants in these foams spread from the spill or release sites—fire training areas or airplane crash sites, for example—into

drinking water supplies.

Firefighting foams, also known as aqueous film forming foams (AFFF), are often used to combat fires involving highly flammable liquids like jet fuel. The foams contain a wide range of per- and polyfluoroalkyl substances (PFAS) including PFOA, PFOS and FOSA. Many of these [compounds](#) have been linked to cancer, developmental problems and other conditions in adults and children. PFAS are sometimes referred to as 'forever chemicals' because they are difficult to break down in the environment and can lead to long-term contamination of soil and [water supplies](#).

"We're interested in what's referred to as the fate and transport of these chemicals," said Kurt Pennell, a professor in Brown's School of Engineering and co-author of the research. "When these foams get into the soil, we want to be able to predict how long it's going to take to reach a water body or a drinking water well, and how long the water will need to be treated to remove the contaminants."

It had been shown previously that PFAS compounds tend to accumulate at interfaces between water and other substances. Near the surface, for example, PFAS tend to collect at the [air-water interface](#)—the moist but unsaturated soil at the top of an aquifer. However, prior experiments showing this interface activity were conducted only with individual PFAS compounds, not with complex mixtures of compounds like firefighting foams.

"You can't assume that PFOS or PFOA alone are going to act the same way as a mixture with other compounds," said Pennell, who is also a fellow at the Institute at Brown for Environment and Society. "So this was an effort to try to tease out the differences between the individual compounds, and to see how they behave in these more complex mixtures like [firefighting foams](#)."

Using a series of laboratory experiments described in the journal *Environmental Science and Technology*, Pennell and his colleagues showed that the firefighting [foam](#) mixture does indeed behave much differently than individual compounds. The research showed that the foams had a far greater affinity for the air-[water](#) interface than individual compounds. The foams had more than twice the interface activity of PFOS alone, for example.

Pennell says that insights like these can help researchers to model how PFAS compounds migrate from contaminated sites.

"We want to come up with the basic equations that describe the behavior of these compounds in the lab, then incorporate those equations into models that can be applied in field," Pennell said. "This work is the beginning of that process, and we'll scale it up from here."

Ultimately, the hope is that a better understanding of the fate and transport of these compounds could help to identify wells and waterways at risk for contamination, and aid in cleaning those sites up.

More information: jed costanza et al, Aqueous film-forming foams exhibit greater interfacial activity than PFOA, PFOS, or FOSA, *Environmental Science & Technology* (2020). [DOI: 10.1021/acs.est.0c03117](#)

Provided by Brown University

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