Research Brief 358: Passive Samplers Track PFAS, Show Contamination Reduction in Cape Fear River

Common low-cost samplers may be an effective technology for tracking PFAS levels in aquatic environments, according to a study funded by the NIEHS Superfund Research Program – or SRP. The research team found that frequently used passive sampling devices, which collect samples over time, can monitor how PFAS mitigation strategies affect PFAS levels along a stretch of the Cape Fear River in North Carolina. Dr. Erin Baker, a project leader at the Texas A&M SRP Center and part of the analytical core at the North Carolina State University SRP Center, led the team.

PFAS are a class of persistent compounds used to manufacture many industrial and household products, including nonstick cookware and firefighting foams. Bodies of water near PFAS manufacturers sometimes become contaminated due to accidental chemical spills.

Before hitting upon the idea of using passive sampling devices to track PFAS, the scientists previously used solid phase adsorption toxin tracking – also called SPATT – to monitor potential algal blooms on the Cape Fear River. SPATT are a type of passive sampler composed of sticky resin sandwiched between two pieces of mesh. Certain chemicals can bind to the resin in the SPATT and researchers can extract and measure the chemicals. In this study, the research team investigated if PFAS would also bind to the resin in SPATTs, and if the devices could reveal PFAS trends in the river over time.

To verify that the resin in SPATTs could collect PFAS, the researchers placed a sampling device into a container of PFAS-laden water and stirred the water to mimic river flow. After 24 hours, the team dried the resin, then combined it with a solvent. The researchers analyzed the mixture using mass spectrometry – a technique used to measure the types of molecules in a sample – and confirmed PFAS stuck to the SPATT.

The researchers initially deployed SPATTs along the Cape Fear River in 2016 and 2017 at sites upstream and downstream from a chemical manufacturer. After the 2017 tests concluded, the manufacturer began implementing PFAS mitigation techniques. The research team deployed additional SPATTs in 2022, upstream and downstream from the manufacturer. All devices were retrieved after two weeks and frozen until analysis.

Using the same method as their initial verification, the researchers measured PFAS bound by each device retrieved from the field. This data was analyzed using software that clustered the SPATTs on a graph based on their PFAS levels and types.

The scientists found that the types and levels of PFAS collected depended on where along the river the SPATT was deployed and in which year. Upstream samples during all sampling periods showed consistently low PFAS levels over time. Downstream samples from 2016 showed the highest levels of all PFAS but decreased to levels close to upstream samples after remediation efforts.

In total, 78 different legacy and emerging PFAS were detected in the samples. “Legacy” PFAS – a class of PFAS that have been replaced with newer, less persistent “emerging” PFAS – were consistently observed throughout all sampling periods in both upstream and downstream samples. According to the researchers, this may be because, although legacy PFAS are no longer produced, they can still enter surface water through contaminated groundwater or runoff from landfills.

Emerging PFAS levels decreased in upstream and downstream samples from 2017 to 2022, with downstream sites showing the most significant drop. According to the scientists, this indicates that methods used by the chemical manufacturer to prevent PFAS contamination are effective at reducing emerging PFAS levels in the river.

The study results show SPATTs are effective in monitoring PFAS levels in aquatic environments, said the authors. Furthermore, this passive sampling method can provide insight into how PFAS levels change over time.

If you'd like to learn more about this research, visit the Superfund Research Program website at niehs.nih.gov/srp. From there, click on the Research Brief title under the banner, and refer to the additional information listed under the research brief. If you have any questions or comments about this month's podcast, send an email to srpinfo@niehs.nih.gov.

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