

## **Biosensor Helps Characterize Contaminants and Health Risks Following Disasters**

A sophisticated biosensor may provide information about contaminant distribution in the aftermath of natural disasters, according to an NIEHS Superfund Research Program (SRP)-funded study. Led by former Texas A&M University SRP Center trainee Krisa Camargo and Michael Unger, Ph.D., from the Virginia Institute of Marine Sciences, the team demonstrated this type of tool is useful for quickly characterizing and prioritizing environmental samples for further analysis, particularly in the context of disaster research response.

Focusing on polycyclic aromatic hydrocarbons, or PAHs, a complex mixture of suspected carcinogenic contaminants found in soil, sediment, and water, the team validated a biosensor previously developed by Unger as an alternative to expensive and time-consuming traditional approaches. This tool uses antibodies from mice to detect and quantify PAHs in real time. It also calculates total free PAHs in porewater, the liquid between sediment or soil particles. This information helps scientists determine how much of the measured PAHs can be taken up by the body and potentially cause harm.

According to the researchers, this study supports the utility of the biosensor as a rapid and cost-effective tool to characterize PAH contamination and potential health risks to prioritize environmental samples for further analysis by more costly and time-consuming traditional methods. Such insight is valuable for future disaster research response efforts where time and resources are limited.

Hurricanes and flooding can redistribute contaminants, such as from overflowing wastewater treatment plants or uncovering and redistributing contaminated soils and sediments. Consequentially, increased potential for exposure to hazardous substances makes it important to understand where contaminants come from and their movement during and after disasters.

Collaborators field tested the biosensor in samples collected from a river in Virginia with known PAH contamination and samples collected before and after Hurricane Harvey hit the Houston area, including samples collected from a residential neighborhood. They looked for differences in PAH levels and composition and identified potential sources of PAHs based on the chemicals detected.

The team found differences in PAH concentrations by sample location, with PAH levels being higher in Virginia compared to Texas, and distinct clustering for associated PAH sources. For example, in Virginia, PAHs were largely attributed to historical wood treatment facilities. The sediment core samples taken in Houston before Hurricane Harvey suggested PAHs originated from a mix of geological processes, crude oil, or combustion. In soil samples taken after the hurricane, PAHs were also attributed to biomass combustion and living organisms, which the researchers suggest may be related to organic matter in floodwaters.

After documenting PAH levels, the team sought to evaluate potential risks to human health and to animals using screening values from the U.S. Environmental Protection Agency. All samples were below risk thresholds for human health. However, concentrations of some PAHs in sediments collected after Hurricane Harvey and from Virginia were above risk thresholds for animals. Follow-up studies are needed to understand the underlying mechanisms by which these chemicals cause harm to animals and how exposure to mixtures of PAHs may alter toxicity, say the team.

Finally, the team assessed the ability of the biosensor to predict PAH concentrations measured by traditional methods and the corresponding health risks to humans and animals. The authors explained

that the strong correlations between porewater PAH levels using the biosensor compared to traditional methods demonstrate the biosensor can effectively screen and predict PAH concentrations as well as potential health risks.

The study was made possible by a 2018 K.C. Donnelly Externship award to Camargo. Mentored by Texas A&M University SRP Center researchers and co-authors Anthony Knap, Ph.D., Jose Sericano, Ph.D., Thomas McDonald, Ph.D., and Weihsueh Chiu, Ph.D., Camargo used her externship to work with Unger in Gloucester Point, Virginia. While there, she used Unger's biosensor to develop a screening method that could be used for rapid needs assessments during public health emergencies and to inform emergency responders in the aftermath of disasters like Hurricane Harvey.

If you'd like to learn more about this research, visit the Superfund Research Program website at [niehs.nih.gov/srp](http://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](mailto:srpinfo@niehs.nih.gov).

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