

Water, soil analysis technology may help improve cleanup and monitoring at contaminated Superfund sites

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At least 53 million Americans, including about 18 percent of the nation's children, live less than three miles from a Superfund site, according to the Environmental Protection Agency.

Congress created the Superfund program in 1980 to pay for the cleanup of sites identified by the EPA as polluted by highly dangerous wastes.

There are currently more than 1,300 such waste sites across the U.S. The Strategic Environmental Research and Development Program (SERDP) reports that more than 80 percent of these sites and more than 3,000 similarly hazardous Department of Defense sites contain chlorinated solvents. Those solvents are chemicals that were used widely in the past in industrial cleaning and manufacturing operations and pose a significant contamination threat to groundwater supplies.

A Purdue University team, led by Joe Sinfield, an associate professor in Purdue's Lyles School of Civil Engineering, and involving former Purdue researcher Chike Monwuba, has developed a new [method](#) to detect the presence of these hazardous solvents in water and soil. The method offers the potential to enhance monitoring operations and improve the efficiency of remediation efforts.

"Our method is accurate, quick and can detect very low concentrations of the target contaminants," said Sinfield, who also serves as the director of Purdue's College of Engineering Innovation and Leadership Studies Program.

The Purdue team had initially focused on using Raman spectroscopy to directly detect chlorinated solvents. In this approach, a laser is used to examine a sample and the scattered [light](#) is observed to determine its [chemical](#) makeup.

"Traditionally, one would look for specific frequencies of scattered light that are indicative of the presence of the chemical of interest," Sinfield said. "However, after conducting several broad spectral studies of the target compounds in simulated field samples, our team noticed that the light scattered by the water itself was affected by the presence of the

chlorinated solvents—in fact more so than the light scattered by the molecules of the target chemical."

This observation led to the development of a sensing mechanism that is nearly 10 times more sensitive than conventional approaches involving direct observation of the solvents themselves.

Sinfield said the Purdue method also shows promise for detecting chlorine based compounds in other contexts, as well as chemicals such as fluorine, bromine or iodine in an array of application spaces.

Provided by Purdue University

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