PROJECT FACT SHEET

PROJECT – AN AUTONOMOUS SYSTEM THAT MEASURES AND REPORTS THE CONCENTRATION OF FUNCTIONALIZED PERFLUOROCARBONS IN GROUNDWATER.

Objective

Fluorochemicals have been a significant factor in industrial chemistry for roughly a century. As one of their usages, poly- and perfluoroalkyl substances (PFAS) were used in aqueous film forming foam (AFFF). The DoD is working aggressively to address the national PFAS issue in a cohesive, consistent manner while coordinating and communicating with external stakeholders. We are making substantial progress toward understanding the Department's use of AFFF and researching fluorine-free alternatives to AFFF; monitoring and communicating information on the health effects of human exposure to PFAS; establishing policies and collecting data to track PFAS cleanup progress and costs; and supporting research and development efforts for all of these activities. This project on rapid groundwater detection of PFAS works to further those goals in research and development. The specific objective of this project is to develop and demonstrate an automated analytical method and associated field-portable instrumentation for measuring and reporting concentrations in water of the full suite of functionalized perfluorocarbons. The project was funded through the Small Business Innovation Research (SBIR) program.

Technology Description

Purge-and-trap methods coupled with gas chromatography (GC) and flame- or photo-ionization detection have been standard technology to measure volatile organic compounds (VOCs) in water for decades. More recently, the analytical process has been relocated to the field and integrated with autonomous sample collection and data processing technologies to create self-reporting monitors that have achieved regulatory acceptance. The same concept is applicable in principle to fluorocarbon derivatives (FCs). However, application to FCs is complicated by regulatory levels that are at least 2 orders of magnitude lower than for VOCs, negligible volatility, and much weaker ionization responses than many VOCs. During Phase I, the feasibility of an autonomous system for field measurement and reporting of functionalized perfluorocarbons concentrations was demonstrated to 1) measure perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) concentrations in water samples under two hours with a Method Detection Limit of 10 parts-per-trillion, and 2) perform automated sample loading, concentration, and measurement. The analytical method concentrates FCs from water, derivatizes the acids, adsorbs and feeds the sample to a portable gas chromatograph–mass spectrometer (GC/MS), calculates the original concentration from an automated measurement, performs any other tasks needed to label and package the data for reporting, and transmits it securely to designated recipients.

The goal of proposed Phase II work by HJ Science & Technology is to deliver a fully integrated, working prototype system, ready for production. The overall instrument will be compact, lightweight, rugged, portable, inexpensive, and easy to use. It will be designed to measure concentrations of the full suite of functionalized perfluorocarbons, including PFOA and PFOS, in water with sensitivity and selectivity currently achievable only by laboratory-based instruments.

Benefits

The benefit of a portable platform includes reduction in time and cost, and real-time data for better and more-timely decision making.