# Novel In Situ Extraction Technologies for Contaminants in Groundwater (Task N.0441)

**Government POC**
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**Status**
Complete

## Statement of Need

Government regulators often require extensive, expensive chemical analyses of groundwater by environmental laboratories to characterize contaminants during monitoring and environmental restoration activities. Improved sampling procedures may reduce analytical costs. The National Defense Center for Energy and Environment (NDCEE), operated by Concurrent Technologies Corporation (*CTC*), demonstrated and validated the effectiveness of passive groundwater sampling technologies: (1) The Snap Sampler; (2) The HydraSleeve; and, (3) The HydraSleeve coupled with a novel extraction technology, the In Situ Tubular Extraction Device (InSTED), which was developed by the United States (U.S.) Army Corps of Engineers (ACE), Engineer Research and Development Center (ERDC).

## Technical Approach

The NDCEE evaluated the alternative technologies against the U.S. Environmental Protection Agency (EPA) low-flow purging method to: (1) Determine whether the alternative technologies can provide technically defensible analytical data for chemical contaminants of concern to the Department of Defense (DoD) compared to the baseline technology; and (2) Evaluate the utility, comparability, and cost effectiveness of sampling with these devices in place of the U.S. EPA low-flow purging method. The technologies were evaluated at two different sites, each with different contaminants in the groundwater. Test Site 1 contained explosive constituents (e.g., HMX, RDX, and TNT), and Site 2 contained Polycyclic Aromatic Hydrocarbon (PAH) constituents (e.g., benzo(a)anthracene, benzo(b)fluoranthene, and chrysene).

The data obtained was analyzed independently to determine if the technology evaluated provided data that was statistically different from the other three methods. Data obtained from the U.S. EPA method was compared to data from the alternative methods to determine if the alternative technologies provided technically defensible data relevant to regulatory decision making. In addition, to determine the financial impacts of either starting a new groundwater sampling program or replacing the U.S. EPA low-flow purge method with one of the three alternative sampling methods, the Environmental Cost Analysis Methodology (ECAM®) was applied.

## Results and Benefits

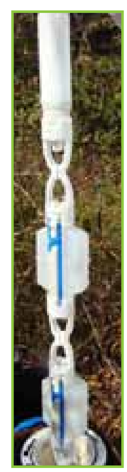
The results for the explosives demonstrated no significant differences in the data obtained from the three alternative methods or between the alternative methods and the U.S. EPA method. In the PAH data set, no significant differences existed in the data obtained from the three alternative methods or between the InSTED and the U.S. EPA method. When compared to the U.S. EPA method, the Snap Sampler produced results that were not statistically different for 12 of the 16 of the target PAHs, and the HydraSleeve produced results that were not statistically different for 11 of the target 16 target PAHs. Three specific PAH constituents, benzo(a) anthracene, benzo(b)fluoranthene, and chrysene, were found to be statistically different when using both the Snap and HydraSleeve.

The results of the ECAM demonstrated that for Scenario A (quarterly sampling of explosives in 100 80-foot deep wells in a new monitoring program), any of the three alternative sampling methods would provide cost benefits compared to the U.S. EPA low-flow purge method. For the Snap Sampler, the payback period was less than one year. For the other two alternatives the payback was considered immediate. The most cost-beneficial technology proved to be HydraSleeve, followed by the InSTED, and finally the Snap. The ECAM was then completed for Scenario A again, but with the assumption that a groundwater monitoring program was already in place. Capital investments were not included for the U.S. EPA method. There were financial benefits to changing to any of the three alternative technologies. For the Snap Sampler, the payback period was just over 2 years. For the HydraSleeve the payback was approximately six months, and the InSTED was just under one year. The most cost-beneficial technology proved to be HydraSleeve, followed by the InSTED, then finally the Snap Sampler. For Scenario B (quarterly sampling of PAHs in 100 30-foot deep wells in a new monitoring program), there were financial benefits in changing to two of the three alternative methods from the U.S. EPA method. The most cost-beneficial technology proved to be HydraSleeve, followed by the Snap Sampler. The payback for the Snap Sampler was less than one year; with the HydraSleeve, the payback was immediate. For Scenario B, considering the replacement of the U.S. EPA method with the alternative technologies in an existing groundwater monitoring program financial benefits were again seen; the payback periods were approximately 2 years for the Snap, less than 1 year for the HydraSleeve, and approximately 3 years for the InSTED. The most cost-beneficial method was the HydraSleeve, followed by the Snap Sampler. The InSTED method does not show a significant cost benefit over time for Scenario B, because implementation of the U.S. EPA method is relatively easy at a site with shallow wells.

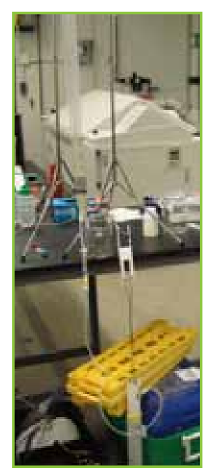
## Technology Transfer and Outreach

This task demonstrated that the alternative technologies may reduce long-term monitoring costs and provide data comparable to the U.S. EPA Low-Flow method for explosives and the majority of PAHs. The NDCEE used information and lessons learned from the two demonstrations to develop User Guides for the InSTED and Snap Sampler and to disseminate project results at conferences.

*Hydrasleeve*



*Snap Sampler™*



*In Situ Tubular Extraction Device (InSTED)*