PROJECT ID:
570

Improve Cost Effectiveness of Groundwater Monitoring with Long Duration Time-Integrated Groundwater Samplers

Preparing time-integrated groundwater sampler in deployment sleeve. (Photo Credit: GSI, Inc.)

Time-integrated groundwater sampler. (Photo Credit: GSI, Inc.)

OBJECTIVE:

This project will demonstrate application of a time-integrated sampler for measurement of volatile organic compound (VOC) concentrations in groundwater.

PROBLEM STATEMENT:

The amount of VOCs in groundwater can vary dramatically from week to week due to weather events and other factors including temperature, pH, dissolved oxygen content and microbial activity. This high variability hinders groundwater monitoring efforts and limits managers' ability to demonstrate remedy effectiveness. Short-term apparent increases in contaminant concentrations can create regulatory concern regarding plume stability or remedy effectiveness and may trigger requirements for unnecessary, more aggressive remedies.

There is a need to transition from traditional grab sampling to long-term time-integrated groundwater sampling and incorporate the latter into the ongoing operation of Navy groundwater management programs.

The availability of laboratory-measured uptake rates will enhance regulatory acceptance of the sampler.

DESCRIPTION:

This project seeks to demonstrate and validate a time-integrated sampling system that will provide more representative and less variable data to enable significant cost savings to the environmental monitoring program and improve understanding of long-term trends in groundwater concentration data.

Deployment of time-integrated groundwater sampler in a monitoring well. (Photo Credit: GSI, Inc.)

The use of passive sorbent samplers to measure VOC concentrations is well validated. (Note: Sorbents are materials used to absorb or adsorb liquids or gases.) However, newly designed passive samplers require the determination of an uptake rate for each target VOC. The uptake rate reflects the rate at which the VOC diffuses from the sample media to the sorbent. While uptake rates can be estimated, the most accurate uptake rates are obtained through direct laboratory measurement.

Although theoretical uptake rates can be used for sampler validation, this project will perform an uptake rate study to determine specific uptake rates in a laboratory setting and in the field, thereby validate the performance of the sampler.

The availability of laboratory-measured uptake rates will enhance regulatory acceptance of the sampler.

An uptake rate study exposes samplers to defined concentrations of VOCs using specialized equipment under highly controlled conditions. For this demonstration, laboratory validated uptake rates for the time-integrated sampler will be measured at the Health and Safety Laboratory (HSL) in Harpur Hill, England. HSL is the world leader for measurement of sampler uptake rates.

The uptake study will include at least two exposure time periods (7 and 14 days) to demonstrate linear uptake over time. The study will include at least 10 petroleum and chlorinated VOCs most commonly found at Navy sites which includes benzene, ethylbenzene, toluene, xylene, tetrachloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE) and vinyl chloride. The basic functionality of the long-duration time-integrated sampler has already been shown through laboratory and field teting for deployment periods of up to three months. This demonstration project will build upon this work by enabling a 6-month deployment, improved data quality due to long term concentration trend analysis, and reduced monitoring costs.

To enable six-month deployment, the sampler solves the problem of biofouling by using a vapor-phase sorbent housed within an air-filled chamber, preventing bacterial degradation of the sorbent.

The field validation program will consist of sampler deployments at Naval Air Station North Island (NASNI) in San Diego, CA at 20 demonstration wells for six consecutive three-month deployments, and 20 demonstration wells for three consecutive six-month deployments. This sampling effort will be conducted in collaboration with another NESDI "new start" project (no. 573: In-Well Headspace Samplers for Long-Term Groundwater Chlorinated Hydrocarbon Monitoring) being led by the Naval Research Laboratory (NRL) to locate both passive samplers at the same location at NASNI. Assuming an average of three VOCs in each well, this would result in a validation dataset of at least 360 individual concentration measurements, which will be further supplemented by NRL's sampler results.

The larger field demonstration of the sampler will promote regulatory acceptance by generating laboratory-measured uptake rates for the most common Department of Defense VOC contaminants.

The larger field demonstration of the sampler will promote regulatory acceptance by generating laboratory-measured uptake rates for the most common Department of Defense VOC contaminants and demonstrating an absence of bias in sampler results compared to conventional groundwater sampling methods. The use of passive sampling will reduce recurring labor costs as well.

TRANSITION DESCRIPTION:

The validation of the time-integrated sampler and NRL's passive sampler from this NESDI project will be presented in peer-reviewed publications and at conferences. Project information for both laboratory and field studies may also be used in NAVFAC technology transfer initiatives such as the Remedial Innovative Technology Seminar and training programs including the Navy's Advanced Environmental Restoration course. The performers will communicate results to regulators through organizations such as the Interstate Technology and Regulatory Council.

In addition, the performers will present and demonstrate the use of the sampler (and its advantages) through short pamphlets and videos suitable for distribution through social media (e.g., LinkedIn).

Both samplers will be made available as a commercial "off the shelf" sampler similar to the currently available SNAP Samplers®, Hydrasleeve®, and passive diffusion bags (PDB) no purge grab samplers. No special training will be needed.

Further, both project teams will disseminate cost and performance data and transition the technology to both federal and targeted non-federal sectors such as manufacturing and other operations-intensive industries through mechanisms such as presentations at appropriate meetings and conferences, and preparation of an electronic planning tool and user guide.

CONTACT:

For more specific information about this project, contact the Principal Investigator at 805-982-1793. Contact the NESDI Program Manager at 805-982-4893 for more general information about the program.

ABOUT THE NESDI PROGRAM

The Navy Environmental Sustainability Development to Integration (NESDI) program is the Navy's environmental research and development demonstration and validation program, sponsored by the Chief of Naval Operations Energy and Environmental Readiness Division and managed by the Naval Facilities Engineering Systems Command from the Engineering and Expeditionary Warfare Center in Port Hueneme, CA. The mission of the program is to provide solutions by demonstrating, validating and integrating innovative technologies, processes and materials and by filling knowledge gaps to minimize operational environmental risks, constraints and costs while ensuring Navy readiness and lethality.

Visit the program's public website at https://www.navfac.navy.mil/NESDI for more information.