Accelerated Tri-Services SCAPS Sensor Development

Cleanup
CU-729

RESEARCH CATEGORY: 6.2 Applied Research

LEAD AGENCY: U.S. Army

LAB: Waterways Experiment Station - Vicksburg, MS

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FY 1998 FUNDS: $500K

OBJECTIVE: The objective of this project is to accelerate the development, testing, and demonstration of new or enhanced sensor technologies for detecting and delineating subsurface contaminants in-situ. This work will significantly expand the capability of the Site Characterization and Analysis Penetrometer System (SCAPS) to detect chemical contamination in soils and groundwater. Additionally, this project includes development of improved sampling, analysis, and data processing technologies to support the new or enhanced sensor technologies.

BENEFIT: This work will provide the Department of Defense (DoD) and Department of Energy (DOE) with an expanded capability to conduct site characterization and monitoring using SCAPS. Successful development and fielding of advanced SCAPS sensors will significantly accelerate site characterization efforts and will reduce costs. Immediate payoff will be technology for volatile organic compounds (VOCs), explosives, and heavy metal contaminant detection, and improved Petroleum, Oil, Lubricants (POL) detection. Improved SCAPS sampling technology will provide alternative cost-effective methods to obtain site characterization and verification data. Hybrid sampling technologies coupled to sensors and in-situ methods for contaminant extraction will greatly expand the utility of SCAPS technology. The Tri-Service SCAPS will serve as a test platform for all technology development and will accelerate the evaluation of effectiveness and feasibility for subsequent demonstration activities. Rapid development and fielding of sensor technologies for SCAPS will significantly increase its return on investment.

TECHNICAL APPROACH AND RISKS: Initially, identification and evaluation of candidate sensing technologies which address DoD, DOE, and Environmental Protection Agency (EPA) contaminants of interest and which have potential for rapid in-situ SCAPS applications will be conducted. Laboratory instrumentation will be developed to determine limits of detection, define soil matrix effects, and evaluate SCAPS implementation considerations. Associated support technologies, including data acquisition, analysis, and visualization systems will be developed and tested. Prototype SCAPS sensor and sampler probes will be developed and tested in controlled laboratory and field experiments. SCAPS field tests and demonstrations will be conducted to validate SCAPS technologies and to increase acceptance by regulators, users, and the public. These field tests will make maximum use of available DoD National Environmental Technology Test Sites (NETTS) program test sites. Technical risks associated with this project include uncertainties involved in transitioning laboratory methods to field-use technology, and the ability to control the variabilities of sensor performance that result from site-specific conditions such as variations in soil stratigraphy, interference sources, presence of multiple contaminants, and changes in contaminant state.

ACCOMPLISHMENTS: In FY97, SCAPS researchers completed SERDP-funded laboratory and

field evaluations of SCAPS samplers [transitioned to Environmental Security Technology Certification Program (ESTCP) for validation and certification]. Activities included the initial field tests of Laser-induced Fluorescence (LIF) probe that incorporates the Massachusetts Institute of Technology/Lincoln Laboratory microchip laser, as well as the design, development, and fabrication of an improved fiber optic Laser-induced Breakdown Spectroscopy (LIBS) probe (Patent application filed - Navy Case No. 78165). Also completed were improvements to the X-ray fluorescence (XRF) probe, and successful field tests of the XRF and electrochemical sensors at Joliet Army Ammunition Plant, IL. All these probes successfully detected subsurface lead contamination, and these technologies are being transitioned to ESTCP for dem/val testing during FY98. Other activities included completion of: 1) design of SCAPS Surface Enhanced Raman Sensor (SERS) probe; 2) fabrication and laboratory testing of SERS probe; and 3) successful initial field test of "cone sipper" probe for the SERS probe at Naval Air Station North Island, CA. Successful field demonstrations of an electrochemical VOC sensor, a multiport sampler, and a VOC thermal desorption sampler were also conducted.

TRANSITION: Technology developed under this proposed effort will be transitioned to the U.S. Army Environmental Center (AEC) which is the agency responsible for demonstrating and transitioning SCAPS technologies to the U.S. Army Corps of Engineers District Offices, the Naval Facilities Engineering Command, the Air Force System Program Office, and also to DOE-Headquarters. Transition of SCAPS technology to private industry will be pursued by licensing agreements for patented technology and through Cooperative Research and Development Agreements (CRADA).