United States Environmental Protection Agency
Solid Waste and Emergency Response (5102G)
EPA 542-N-99-007
October 1999
Issue No. 35

TECH TRENDS

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The Applied Technologies Newsletter for Superfund Removals & Remedial Actions & RCRA Corrective Action

ABOUT THIS ISSUE

This issue highlights recent demonstration results and new technical resources on several innovative technologies for site characterization and process monitoring.

Soil Sampling Technology Verification

by Eric Koglin and Steve Billets, U.S. EPA National Exposure Research Laboratory

Four soil sampling technologies for collecting volatile organic compounds (VOCs) were among those tested over the past four years under the Monitoring and Measurement Technology portion of the U.S. EPA's Superfund Innovative Technology Evaluation (SITE) Program and the Site Characterization and Monitoring Technologies (SCMT) Pilot of the Environmental Technology Verification (ETV) Program. The SCMT Pilot is one of 12 ETV pilots designed to verify the performance of commercial-ready environmental technologies. The purpose of these verification programs is to accelerate the development and commercialization of improved environmental technology through third party verification and reporting of performance. The goal of the ETV Program is to verify the performance characteristics of commercial-ready environmental technologies through the evaluation of objective and quality-assured data so that potential purchasers and permitters are provided with an independent and credible assessment of the technology that they are buying or permitting. The purpose of the SITE Program is to conduct research and performance verification studies of alternative or innovative technologies that may be used to achieve long-term protection of human health and the environment.

The soil sampling technology demonstration, which was conducted at the SBA Site in Albert City, IA, and the CSC Site in Denver, CO, was designed to generate performance information for each participating technology. The demonstration design required collection of soil samples by both the tested technology and the reference sampling method (split spoon sampler). Samples were sent to a commercial laboratory for analysis, and the analytical results were used to compare the performance of the tested samplers with that of the reference sampler. Comparisons between technologies, however, were not made.

A pre-demonstration sampling exercise was used to delineate sampling locations at the two sites. A 10.5- by 10.5-foot area was identified at each site and divided into seven rows and seven columns, producing 49 18- by 18-inch sampling cells. Twelve grid-depth combinations exhibiting consistent soil texture, acceptable VOC concentrations, and acceptable variability in VOC concentrations were selected for the demonstration. A sample cell in each column was selected randomly.

Four soil sampling technologies were tested:

- Simulprobe Technologies, Inc.'s *Core Barrel Sampler*

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Figure 1. Highlights of Soil Sampling Technology Demonstration

Technology	Sample Recoveries (percent)		Investigation-Derived Waste		Sample Throughput (minutes per sample)	
	CSC Site	SBA Site	Soil (gallons)	Waste Water (gallons)	CSC Site	SBA Site
Core Barrel Sampler	68	95	18	50	11.8	21.4
AMS Dual Tube Liner Sampler	70	91	20	25	10.9	16.4
Large-Bore Soil Sampler	78	98	18	35	15.3	27.5
JMC Environmentalist's Subsoil Probe	95	96	<6	<6	13.4	22.5
Reference Sampler	87	88	990	150	8.4	26

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- Art's Manufacturing and Supply's *AMS Dual Tube Liner Sampler*
- Geoprobe Systems, Inc.'s *Large-Bore Soil Sampler*
- Clements Associates, Inc.'s *JMC Environmentalist's Subsoil Probe*

Each soil sampling technology was compared to the reference sampling method in terms of the following parameters: (1) sample recovery, (2) VOC concentration in recovered samples, (3) sample integrity, (4) reliability and throughput, and (5) cost. These parameters were assessed in two different soil textures and in high- and low-concentration areas at each site. In addition, integrity tests were conducted by advancing a sampler filled with uncontaminated potting soil into a zone of grossly contaminated soil.

Selected highlights of the performance results are provided in Figure 1. Final verification reports on these technologies are available for downloading through the ETV Web site at www.epa.gov/etv.

Under the SCMT Pilot, a total of 29 innovative technologies have been tested and verified, including 2 cone penetrometer-deployed sensors, 2 field-portable gas chromatograph/mass spectrometers, 2 soil gas samplers, 7 field-portable X-ray fluorescence analyzers, 7 field analytical technologies for polychlorinated biphenyls, and 5 wellhead monitoring technologies. For more information, contact Steve Billets or Eric Koglin (EPA/National Exposure Research Laboratory) at 702-798-2232 or 702-798-2432, or e-mail billets.stephen@epa.gov or koglin.eric@epa.gov; Dan Powell (EPA/Technology Innovation Office) at 703-603-7196 or e-mail powell.dan@epa.gov; or visit the ETV Web site at www.epa.gov/etv.

Horizontal Drilling Used to Sample Soil

by Michael Fracasso, State of Connecticut/Department of Environmental Protection, and Katherine Sequino, Directional Technologies, Inc.

Horizontal directional drilling (HDD) can be used to obtain soil samples without disrupting the operations of active industrial facilities and without violating the structural integrity of building floor slabs. HDD technology was employed at an electronics circuit manufacturing site in Danbury, CT, to determine if historical operations had impacted sub-slab soils located beneath areas of environmental concern (AECs), including a number of solid waste management units (SWMUs), inside the plant building. The State of Connecticut's Department of Environmental Protection (DEP), which reviewed environmental monitoring and sampling strategies at this site under the State's RCRA Voluntary Corrective Action Program, found that the use of HDD provided significant benefits over conventional vertical drilling methods. Conventional drilling would have required temporary shut-down of the facility while sampling activities occurred, and possibly created new contaminant pathways by drilling through an epoxy-coated, layered concrete floor slab that had been designed to be impervious.

Horizontal soil sampling begins with the drilling of an angled bore hole from the ground surface (Figure 2). The bore's path then is leveled, and sections of drill pipe are added as the bore progresses toward a designated target point. Next, the drill bit is pulled out of the bore path and replaced by the sampling tool. After samples are taken, the sampling tool is pulled out of the bore path and replaced by the drill bit to continue drilling. This process is repeated for each required soil sample location. Soil conditions at the Danbury site allowed for drilling and sampling to be completed without a drilling fluid additive.

At the Danbury site, seven soil samples were collected by advancing three horizontal bore holes through the concrete foundation wall of the manufacturing building. One bore hole was sampled at various distances from the foundation to assess soil conditions

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Figure 2. Installation of a Horizontal Well

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beneath SWMU 10, the present manufacturing area, and AEC 18. The second bore hole was sampled to collect additional information on soil below the present manufacturing area and AEC 18, and on soil associated with overlying SWMUs 9 and 11. The third bore hole was sampled to provide data on soil below a waste management area comprising eight additional SWMUs. When sampling was completed, each boring was backfilled with concrete grout.

If conventional vertical drilling techniques had been used to obtain soil samples at this site, facility operations would have had to cease temporarily during drilling and while equipment was moved between sample locations. Using HDD technology, however, no facility operations were disrupted during the entire period of sampling. For more information, contact Michael Fracasso (State of Connecticut/DEP) at 860-424-3303 or e-mail michael.fracasso@po.state.ct.us; Katherine Sequino (Directional Technologies, Inc.) at 203-248-9599 or e-mail kathy@directionaltech.com; or Mark Franson (Charter Oak Environmental Services, Inc.) at 860-423-2670 or e-mail charter-oak@snet.net.

Tree Core Analysis to Delineate CAH Contamination

by Don Vroblesky, U.S. Geological Survey

The ability of trees to take up chlorinated aliphatic compounds (CAHs) makes the analysis of tree cores a potentially cost-effective and simple approach to examining CAH contamination in soil and shallow ground water. In addition, this technology can assist in optimizing well placement at hazardous waste sites. At the TNX Area of the U.S. Department of Energy's Savannah River Site, SC, the U.S. Geological Survey (USGS) recently studied the cores of six species of trees growing over shallow ground water contaminated with cis-1,2-dichloroethene (cDCE) and trichloroethene (TCE). Analysis indicated that cDCE and TCE concentrations in the trees reflected the configuration of chlorinated-solvent ground-water contamination plumes.

Between January 1997 and February 1998, cores were taken from mature trees growing above and in the vicinity of a forested flood plain with contaminated ground water in the TNX Area. The USGS studied the cores of 97 trees, including 64 bald cypress (*Taxodium distichum [L.] Rich*), 12 loblolly pine (*Pinus taeda L.*) 5 tupelo (*Nyssa aquatica L.*), 7 sweet gums (*Liquidambar stryaciflua L.*), 6 oaks (*Quercus* spp.), and 3 sycamores (*Platanus occidentalis L.*). At selected trees, two cores were collected approximately 25 millimeters from each other to compare replication. The cores then were analyzed using headspace gas chromatography.

Resulting data were used to evaluate differences in TCE and cDCE concentrations among tree species and between sites (control versus contaminated). Core analytical results also were compared to ground water samples taken in May and August 1987. The area where cDCE was found in trees occurred along a path coincident with the ground water flow path from a contaminant source, and coincided with areas where cDCE was found in ground water. The distribution of trees containing TCE was more widespread, however, suggesting that a second plume of TCE exists in the aquifer.

Differences in contaminant uptake among the species also were identified, with the highest demonstrated by bald cypress and loblolly pine. TCE concentrations as high as 2,000-3,000 nmol/L were found in cypress pine and 1,742 nmol/L in loblolly pine. Additionally, TCE concentrations decreased in cores collected from successively higher parts of the trunk.

Contact Don Vroblesky (USGS) at 803-750-6115 or e-mail vroblesk@usgs.gov for more information.

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Measurement & Monitoring Technologies for the 21st Century

The U.S. EPA's Office of Solid Waste and Emergency Response (OSWER) is undertaking an initiative to advance new systems for monitoring hazardous waste sites. Although significant technological advances have occurred over recent years in the areas of chemical constituent identification and quantification, geophysical analysis, and information management, increased efforts are needed to integrate these new tools into ongoing site investigation and cleanup.

The *Measurement & Monitoring Technologies for the 21st Century* initiative, known as *21M^2*, will match existing and emerging technologies with OSWER program and client needs through partnerships to research and evaluate new equipment and processes in the field. It will also aggressively pursue the transfer of information and lessons learned to professionals in the hazardous waste management and site remediation communities. To obtain more information or provide input on technology needs, contact Dan Powell (EPA/OSWER Technology Innovation Office) at 703-603-7196 or e-mail powell.dan@epa.gov, or visit the Hazardous Waste Clean-Up Information (CLU-IN) Web site at http://clu-in.org.

Field-Based Technologies Training Program

The *Field-Based Site Characterization Technologies Training Program* is a five-day, advanced-level training program designed to provide a detailed introduction to on-site technologies that can be used to characterize a site, and an overview of the planning and process issues associated with field analytical and sampling technologies. This course is designed for experienced environmental professionals who are involved in the use of field-based technologies, related data interpretation, or related report preparation.

The training will be offered in various cities over the coming year at no cost to participants. To obtain additional information, contact the CERCLA Education Center at 703-603-9910 or visit EPA's Internet home page on training opportunities at http://www.trainex.org.

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