



Successes

New Soil Volatile Organic Compound Samplers

ADVANCED RESEARCH

To support coal and power systems development, NETL's Advanced Research Program conducts a range of pre-competitive research focused on breakthroughs in materials and processes, coal utilization science, sensors and controls, computational energy science, and bioprocessing—opening new avenues to gains in power plant efficiency, reliability, and environmental quality. NETL also sponsors cooperative educational initiatives in University Coal Research, Historically Black Colleges and Universities, and Other Minority Institutions.

ACCOMPLISHMENTS

- ✓ Process improvement
- ✓ Cost reduction
- ✓ Greater efficiency
- ✓ Innovative materials



Objectives

The objective of this jointly sponsored research (JSR) task is to complete work on two new soil sampling devices for volatile organic compound (VOC) analysis. This research is directed at achieving national acceptance of the devices both by the regulatory community and by environmental firms that are responsible for evaluating and cleaning up VOC-contaminated sites throughout the United States.

VOCs are emitted as gases from a wide array of industrial and household chemical products numbering in the thousands. Some VOCs may have short- and long-term adverse health effects. Altogether, VOCs are the most significant organic contaminants in soil and groundwater associated with disposal sites across the United States. The U.S. Environmental Protection Agency (EPA) has identified nearly 70,000 affected industrial and residential sites, and the Department of Defense (DoD) has targeted approximately 9,000 military sites for cleanup. A major problem associated with sampling soil for volatile organic chemical analysis is the preservation of sample integrity during collection, storage, and shipment of samples to the laboratory. Soil sampling and storage practices for this type of analysis must be designed to minimize VOC loss due to volatilization and biodegradation. Laboratory data can grossly underestimate the actual VOC concentrations in a soil if close attention is not paid to sampling and handling techniques.

Project Description/Technology

Under this JSR task, the University of Wyoming Research Corporation — also known as Western Research Institute (WRI) — has been working with its co-sponsor over the past decade to: (1) improve and commercialize a volumetric sampler for VOCs originally developed by En Chem, Inc. and called the En Core® Sampler; and (2) develop and validate a method for collecting and storing surface-level soil samples for VOC analysis using the sampler.

PROJECT DURATION

Start Date

04/10/98

End Date

04/09/08

COST

Total Project Value

\$4,067,267

DOE/Non-DOE Share

\$2,033,513 / \$2,033,763

CORPORATE CO-SPONSOR

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As part of this work, an ASTM (American Society for Materials and Testing) International standard practice was developed. This is Practice D 6418, Standard Practice for Using the Disposable En Core® Sampler for Sampling and Storing Soil for Volatile Organic Analysis, which was approved in 1999. A number of studies were conducted and the practice has been updated since then. To minimize VOC loss, the current standard specifies cold storage of the sample in the sampler at 4 ± 2 °C for up to 48 hours; -7 °C to -21 °C for up to 14 days; or 4 ± 2 °C for up to 48 hours followed by storage at -7 °C to -21 °C for up to 5 days.

The En Core technology was transferred to a spinoff company, En Novative Technologies, Inc. With the completion of the En Core® Sampler activities, WRI and its co-sponsor En Novative expanded the scope of the research and began developing a new subsurface soil sampler technology, the Accu Core™ Sampler, which can be used with a penetrometer tool for collecting subsurface soil samples down to 180 feet below the surface. With WRI's participation, En Novative entered into an agreement with Geoprobe® Systems, Salina, Kansas, to develop and test this new downhole VOC sampler technology. WRI is providing input into the design, conducting independent performance tests, and assisting in developing the methodology for using the technology.

Product Features

En Core® Sampler

The En Core® Sampler provides a simple, consistent, accurate means for collecting, holding, and handling a soil surface field sample during shipment to the laboratory for VOC analysis. The device has three components: 1) the coring body/storage chamber, which is designed to collect and store a sample of 5 grams or 25 grams; 2) an O-ring sealed plunger to remove the sample, without disruption, into an appropriate container for analysis or preservation; and 3) a slide-on cap with an O-ring seal and locking arm mechanism. The body, plunger, and cap are composed of an inert composite polymer, making it chemically nonreactive with the soil structure and contaminants. Each sampler is certified clean when received from the manufacturer. It is disposable and not to be reused. It is supplied with a protective, moisture-proof bag for shipment to the laboratory.

The En Core® Sampler has two reusable stainless steel attachments. These are a T-handle, which is used to push the sampler coring body/storage chamber into the soil for sample collection, and an extrusion tool, which attaches to the plunger for removing the sample from the storage chamber for analysis.



The En Core® Sampler, made of high-tech inert composite polymer, is available in 5 gram and 25 gram versions.



Above, an attachable, reusable En Core® T-handle is used to push the sampler into the soil.

Aside from simplicity of use, the disposable En Core® Sampler avoids many of the problems of alternative VOC soil collection techniques, including:

- The Sampler eliminates the need for methanol preservation in the field;
- The Sampler eliminates the need for preservation with sodium bisulfate; and
- Most importantly, the Sampler avoids many sources for lab discrepancies, thus assuring more consistent and accurate analyses.

Accu Core™ Sampler

The Accu Core™ Sampler is designed to be the most accurate and labor saving method available to collect subsurface soil samples in the field. The Accu Core™ Sampler is designed to work with the Geoprobe® dual-tube direct push penetrometer, which is widely used throughout the United States for collection of subsurface soil samples. The focus of the technology is on use of the Accu Core system for screening to identify the portion of the subsurface soil core that should be selected for analysis without disrupting the integrity of the soil sample that will be analyzed, and use of the Accu Core sampler section to obtain a soil sample without significant VOC loss due to sub-sampling.

Status/Accomplishments

Major efforts over the past several years have focused on continued performance validation of the En Core and Accu Core samplers, with a major focus on generation of field data for the Accu Core™ Sampler. Current activities involve field testing the Accu Core sampling technology with the Geoprobe® dual-tube penetrometer to evaluate the performance of the technology for collecting a sample of subsurface soil so the integrity of the soil is not disrupted and the potential for VOC loss is greatly reduced.

“Both the En Core® Sampler and the Accu Core™ Sampler satisfy EPA Method 5035A designed for preparation of samples containing low concentrations of VOCs.”

STATES AND LOCALITIES IMPACTED

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U.S. Department of Energy
Office of Fossil Energy

Printed in the United States on recycled paper 

June 2008

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