UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Research and Development
Washington, D.C. 20460

ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM

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VERIFICATION STATEMENT

TECHNOLOGY TYPE:	**FIELD PORTABLE GAS CHROMATOGRAPH/MASS SPECTROMETER**
APPLICATION:	**MEASUREMENT OF VOLATILE ORGANICS IN SOIL, WATER, AND SOIL GAS**
TECHNOLOGY NAME:	**SpectraTrak™ 672**
COMPANY:	**VIKING INSTRUMENTS CORPORATION**
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The U.S. Environmental Protection Agency (EPA) has created a program to facilitate the deployment of innovative environmental technologies through performance verification and information dissemination. The goal of the Environmental Technology Verification (ETV) Program is to further environmental protection by substantially accelerating the acceptance and use of improved and more cost effective technologies. The ETV is intended to assist and inform those involved in the design, distribution, permitting, and purchase of environmental technologies. This verification statement provides a summary of the demonstration and results for the Viking SpectraTrak™ 672 field portable gas chromatograph/mass spectrometer (GC/MS) system.

PROGRAM OPERATION

The EPA, in partnership with recognized testing organizations, objectively and systematically evaluates the performance of innovative technologies. Together, with the full participation of the technology developer, they develop plans, conduct tests, collect and analyze data, and report findings. The evaluations are conducted according to a rigorous demonstration plan and established protocols for quality assurance. The EPA's National Exposure Research Laboratory, which conducts demonstrations of site characterization and monitoring technologies, selected Sandia National Laboratories, Albuquerque, New Mexico as the testing organization for field portable GC/MS systems.

DEMONSTRATION DESCRIPTION

In July and September 1995, the performance of two field transportable GC/MS systems was determined under field conditions. Each system was independently evaluated by comparing field analysis results to those obtained using approved reference methods. Performance evaluation (PE), spiked, and environmental samples were used to independently assess the accuracy, precision, and comparability of each instrument.

The demonstration was designed to detect and measure a series of primary target analytes in soil gas, water, and soil. The primary target analytes at the U.S. Department of Energy's Savannah River Site, near Aiken, South Carolina, were trichloroethene and tetrachloroethene. The primary analytes at Wurtsmith Air Force Base, in Oscoda, Michigan, were benzene, toluene, and xylenes. Secondary analytes at the Michigan site included a variety of chlorinated organic solvents. The sites were chosen because they exhibit a wide range of concentrations for most of the analytes and provided different climatic and geological conditions. The conditions at each of these sites represent typical, but not all inclusive, conditions under which the technology would be expected to operate. Details of the demonstration, including a data summary and discussion of results may be found in the report entitled "Environmental Technology Verification Report, Field Portable Gas Chromatograph/Mass Spectrometer, Viking Instruments Corporation SpectraTrak™ 672." The EPA document number for this report is EPA/600/R-97/148.

TECHNOLOGY DESCRIPTION

GC/MS is a proven laboratory analytical technology that has been used in environmental laboratories for many years. The combination of gas chromatography and mass spectrometry enables the rapid separation and identification of individual compounds in complex mixtures. The gas chromatograph separates the sample extract into individual components. The mass spectrometer then ionizes each component which provides the energy to fragment molecules into characteristic ions. These ion fragments are then separated by mass and detected as charged particles, which constitutes a mass spectrum. Quantitation is achieved by comparing the abundance of those ions which are characteristic of a specific compound to the response received from the mass spectrum obtained from a reference standard. This spectrum can be used in the identification and quantitation of each component in the sample extract. For nontarget or unknown analytes the mass spectrum is compared to a computerized library of compounds to provide identification of the unknown. Field transportable GC/MS is a versatile technique that can be used to provide rapid screening data or laboratory quality confirmatory analyses. In most systems, the instrument configuration can also be quickly changed to accommodate different inlets for media such as soil, soil gas, and water. As with all field analytical studies, it may be necessary to send a portion of the samples to an independent laboratory for confirmatory analyses.

The Viking SpectraTrak™ 672 is a commercially available GC/MS system that provides laboratory-grade performance in a field transportable package. The instrument, including the on-board computer, is ruggedized and encapsulated in a shock-mounted transport case. It weighs about 145 lbs. and can be transported and operated in a small van. The instrument used in the demonstration used a purge and trap device for water and soil analysis and direct injection for soil gas samples. The minimum detection limit is 5 ppb for soil gas, 5 μg/kg for soil, and 5μg/L for water. The instrument requires a skilled operator. Recommended training is one week for a chemist with GC/MS experience. At the time of the demonstration, the baseline cost of the SpectraTrak™ 672 was $145,000.

VERIFICATION OF PERFORMANCE

The observed performance characteristics of the SpectraTrak™ 672 include the following:

- **Throughput:** Sample throughput was approximately 30 minutes for soil extracts and water samples using purge and trap. The direct injection soil gas samples required 15 minutes each for analysis.

- **Completeness:** The SpectraTrak™ 672 detected 99 percent of the target compounds reported by the reference laboratory.

- **Precision:** Precision was calculated from the analysis of a series of duplicate samples from each media. The results are reported in terms of relative percent difference (RPD). The values compiled from both sites generally fell within the range of 0 to 30 percent RPD for soil and 0 to 15 percent RPD for the water and soil gas samples.

- **Accuracy:** Accuracy was evaluated by comparing the Viking GC/MS analysis results with performance evaluation and spiked samples of known contaminant concentrations. Absolute percent accuracy values from both sites were calculated for five target analytes. For soil, most of the values fall in the 0 to 20 percent range with a median of 13 percent. For water, most of the values fall in the 0 to 20 percent range with a median of 14 percent. The soil gas accuracy data generally fall in the 0 to 60 percent range with a median of 28 percent.

- **Comparability:** The SpectraTrak™ 672 produced water and soil data that were comparable to the reference laboratory data (median absolute percent difference was less than 50 percent). The soil gas data were not comparable. This was due in part to difficulties experienced by the reference laboratory in analyzing soil gas samples and other problems associated with sample handling and transport.

- **Deployment:** The system was ready to analyze samples within 30 minutes of arrival at the site. At the Savannah River Site the instrument was transported in and operated from a hatchback passenger car; a van was used at the Wurtsmith Air Force Base site.

The results of the demonstration show that the Viking SpectraTrak™ 672 field portable gas chromatograph/mass spectrometer can provide useful, cost-effective data for environmental problem-solving and decision making. The deviation between the Viking GC/MS and reference laboratory results for the soil gas samples, while statistically significant, is not so great as to preclude the effective use of the Viking GC/MS system in many field screening applications. We were unable to determine whether the Viking soil gas data or that of the reference laboratory or both were problematic. Undoubtedly, this instrument will be employed in a variety of applications, ranging from serving as a complement to data generated in a fixed analytical laboratory to generating data that will stand alone in the decision-making process. As with any technology selection, the user must determine what is appropriate for the application and the project data quality objectives.

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NOTICE: EPA verifications are based on an evaluation of technology performance under specific, predetermined criteria and the appropriate quality assurance procedures. EPA makes no expressed or implied warranties as to the performance of the technology and does not certify that a technology will always, under circumstances other than those tested, operate at the levels verified. The end user is solely responsible for complying with any and all applicable Federal, State and Local requirements.