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Solid Waste and
Emergency Response
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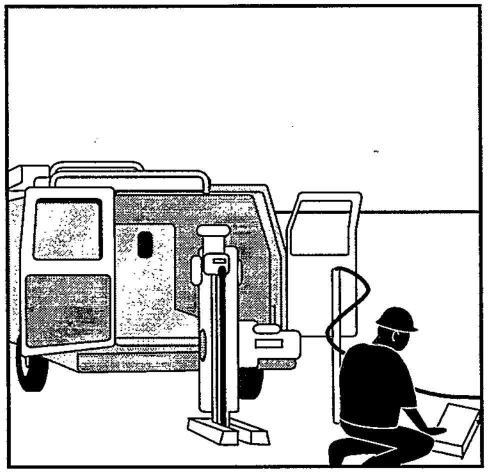
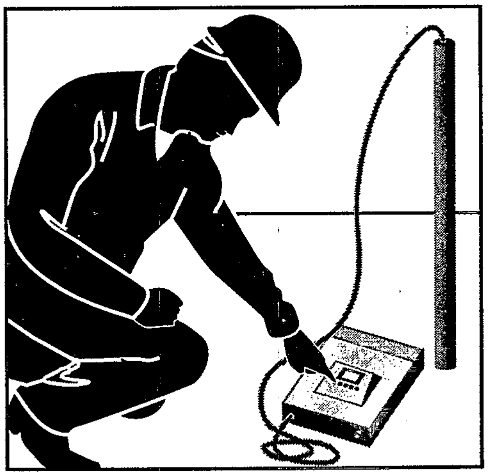
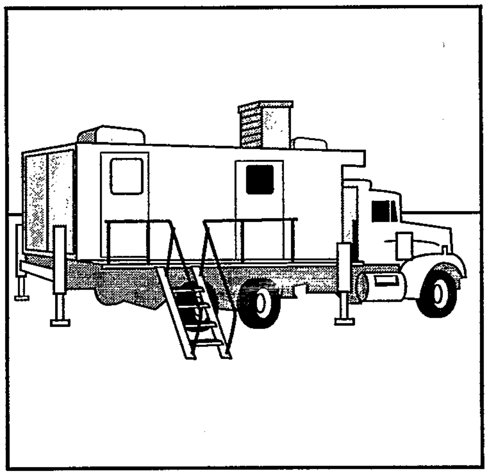
Field Analytical and Site Characterization Technologies

Summary of Applications







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Field Analytical and Site Characterization Technologies Summary of Applications

U.S. Environmental Protection Agency
Office of Solid Waste and Emergency Response
Technology Innovation Office
Washington, D.C. 20460

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Comments or questions about this report may be directed to the United States Environmental Protection Agency, Technology Innovation Office (5102G), 401 M Street, SW, Washington, DC 20460; telephone (703) 603-9910.

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Special acknowledgment also is given to the federal and state staff and other remediation professionals listed as contacts for individual sites and projects. Those individuals provided the detailed information presented in this document. Their willingness to share their expertise will help to further the application of field analytical and site characterization technologies at other sites.

ABSTRACT

This report provides information about experiences in the use of field analytical and site characterization technologies at contaminated sites drawn from 204 applications of the technologies listed below. For each technology, information is presented on the reported uses of the technology; including the types of pollutants and media for which the technology was used; reported advantages and limitations of the technology; and cost data for the technology, when available. Information was obtained from federal and state site managers and from the Vendor Field Analytical and Characterization Technologies System (Vendor FACTS) database. This report is intended to provide information that will facilitate the broader use of various field analytical and site characterization technologies at hazardous waste sites by encouraging information exchange among federal, state, and private-sector site managers. However, it is not intended to provide a comprehensive review of all field analytical and site characterization technologies or of all potential uses of the technologies it does list. More detailed information about them may be obtained from other sources, including those listed in Section 1.2.

This report documents uses of the following field analytical and site characterization technologies at contaminated sites:

Chemical Technologies

- Biosensor
- Colorimetric test strip
- Cone penetrometer mounted sensor
- Fiber-optic chemical sensor
- Fourier-transformed infrared (FTIR) spectrometry
- Gas chromatography
- Immunoassay
- Mercury vapor analyzer
- X-ray fluorescence

Geophysical Technologies

- Bore-hole geophysical
- Direct-push electrical conductivity
- Electromagnetic induction
- Ground penetrating radar
- Magnetometry
- Seismic profiling

Radionuclide Technologies

- Gamma radiation detector
- Passive alpha detector

Sampling and Sampler Emplacement Technologies

- Closed-piston soil sampling
- Direct-push prepacked well screen
- Low-flow ground-water pumping
- Soil gas sampling
- Vertical ground-water profiling
- Vibrating well installation

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Tables

1.0 INTRODUCTION

Newer field analytical and site characterization technologies offer potential savings in time and cost compared with traditional technologies. The United States Environmental Protection Agency (EPA) is interested in increasing awareness of these technologies by encouraging information exchange among federal, state, and private-sector site managers, remediation professionals, and other interested parties. Various field analytical and site characterization technologies have been used at Superfund and Resource Conservation and Recovery Act (RCRA) sites and at sites with leaking underground storage tanks. In addition, as a result of EPA's Brownfields Initiative to encourage the productive reuse of abandoned properties that are or are perceived to be contaminated, there is increasing interest in the use of these technologies at such sites.

EPA believes that providing information about actual applications of new technologies can be very useful in increasing awareness and promoting information exchange. EPA has collected information about the uses of field analytical and site characterization technologies at 204 sites and has summarized the experiences of those involved in applying the technologies at contaminated sites.

This report has two sections. Section 1.0 discusses the purpose and background of the report. Section 2.0 provides a summary of the information obtained about the uses of field analytical and site characterization technologies, including a detailed tabular presentation of the data collected about sites at which field analytical and site characterization technologies have been used. Limitations of the data, including factors that affect the applicability and cost of field analytical and site characterization technologies is also provided. Appendix A provides a list of relevant acronyms, and Appendix B describes the methodology used in collecting the data. Appendix C provides information about the Vendor Field Analytical and Characterization Technologies System (Vendor FACTS) database.

1.1 PURPOSE

This report is a summary of information about uses of 23 field analytical and site characterization technologies, as reported by federal and state site managers. The purpose of this report is to: (1) provide information that will facilitate the broader use of various field analytical and site characterization technologies at hazardous waste sites by encouraging information exchange among federal, state, and private-sector site managers and (2) provide a selected inventory of sites at which various types of field analytical and site characterization technologies have been used. It is important to note that this report presents a summary of the information obtained from federal and state site managers and is not intended to be a comprehensive review of field analytical and site characterization technologies or of all potential uses.

Table 1-1 presents a summary, by number of sites, of the field analytical and site characterization technologies included in this report. As Table 1-1 shows, information was collected from 204 sites. Appendix B presents a description of the methods used to collect the information for this report.

It is important to note that many factors can affect the technical feasibility and cost of field analytical and site characterization technologies. Such factors include physical constraints, site layout, data quality requirements, time constraints, matrix interferences, expected levels of contamination, and other considerations particular to a given site. Such factors should be considered in determining whether specific field analytical and site characterization technologies are appropriate for a particular site.

Table 1-1
Number of Sites by Technology

Technology	Number of Sites Included in this Report
Chemical Technologies	
Immunoassay	43
X-ray fluorescence	39
Cone penetrometer mounted sensor	34
Gas chromatography	24
Fourier-transformed infrared spectrometry	3
Colorimetric test strip	3
Fiber-optic chemical sensor	3
Mercury vapor analyzer	2
Biosensor	1
Geophysical Technologies	
Seismic profiling	8
Ground penetrating radar	4
Bore-hole geophysical	4
Electromagnetic induction	3
Magnetometry	2
Direct-push electrical conductivity	1
Radionuclide Technologies	
Gamma radiation detector	3
Passive alpha detector	1
Sample and Sampler Emplacement Technologies	
Low-flow ground-water pumping	9
Vibrating well installation	6
Soil gas sampling	5
Vertical ground-water profiling	4
Closed-piston soil sampling	1
Direct-push prepacked well screen	1
Total	**204**

With respect to cost information for applications of these technologies at specific sites, provided in Section 2.0 of this report, it is important to note that the costs are presented exactly as reported by site contacts and that the ways in which site contacts reported costs varied. For example, site contacts reported cost information as cost per sample, foot, time, or item. This report did not attempt to recalculate the costs on a consistent basis (normalize the costs) by technology, medium, or other parameter. Cost information provided by site contacts usually was based on their comparison of the cost of using the technology with the cost of off-site laboratory analysis. **Therefore, cost information should be considered qualitatively.**

1.2 BACKGROUND

To better understand the factors that affect field analytical and site characterization technologies and for more detailed information about those technologies, the reader should consult:

- *Expedited Site Assessment Tools for Underground Storage Tank Sites: A Guide for Regulators*, EPA-510-B-97-001, 1997

- *Field Sampling and Analysis Matrix and Reference Guide* (under preparation by the EPA and U.S. Navy, with publication expected in November 1997)

- *Site Characterization and Monitoring Bibliography of EPA Information Resources*, EPA-542-B-96-001, February 1996

- *Superfund Innovative Technology Evaluation Program, Technology Profiles*, EPA-540-R-97-502, December 1996

In addition, EPA's Environmental Technology Verification Site Characterization Pilot Project (also known as the Consortium for Site Characterization Technology) verifies field analytical and site characterization technologies. The program has completed verification reports for the site characterization and analysis penetrometer system and laser-induced fluorescence (SCAPS-LIF) technology and the rapid optical survey tool (ROST™), also a LIF-based technology. The EPA document numbers for those reports are EPA 600-R97-019 and EPA 600-R97-020, respectively. Verification reports are pending for seven field-portable x-ray fluorescence technologies and two field-portable gas chromatography/mass spectroscopy (GC/MS) technologies. Currently, there are 20 field analytical and site characterization technologies in EPA's verification program. Information about the program is available on the World Wide Web at *http://www.epa.gov/etv/.* In addition, EPA is developing an encyclopedia of field analytical and site characterization technologies. This encyclopedia will be available in 1998 through EPA's Clean-Up Information (CLU-IN) World Wide Web site at *http://www.clu-in.com/char1.htm.*

2.0 SURVEY OF APPLICATIONS OF FIELD ANALYTICAL AND SITE CHARACTERIZATION TECHNOLOGIES

2.1 SUMMARY OF RESULTS

This section provides a summary of the information obtained from 204 sites about uses of selected field analytical and site characterization technologies. Tables 2-1, 2-2, and 2-3, respectively, summarize the general uses of the technology (such as site screening, site characterization, compliance monitoring, and cleanup monitoring), the medium monitored, target analytes, and detailed reported data. Table 2-1 presents information about the general uses of data generated through the use of the field analytical and site characterization technologies summarized in this report. Table 2-2 presents information about the technologies by type of medium and analyte. Seven categories of analytes were reported: volatile organic compounds (VOC), semivolatile organic compounds (SVOC), fuels, inorganic compounds, pesticides, explosives, and radionuclides. An additional category, geophysical, was included among the analytes to allow reporting of applications in which the technologies were used to analyze the physical environment. Sections 2.1.1 through 2.1.4 provide a brief description of the technologies and a discussion of the reported advantages and limitations of each technology, when compared with traditional sampling and analysis techniques. The sections are organized by technology type.

Federal and state site managers identified several common concerns related to the use of field analytical and site characterization technologies. Many users reported that the innovative technologies required experienced operators. Users also noted that several technologies yielded false negative results because of insufficient lower detection limits and other causes. Several users reported difficulty in extracting the contaminants from the soil sample and other matrix interferences. Several comments were associated with EPA's role in the use of the technologies. One user reported that his EPA region had no established sample collection procedures for a particular innovative technology. Users reported that little information was available about official verification procedures for the use of the technologies. In addition, one user noted that quality assurance and quality control (QA/QC) procedures for a certain field analytical technology were not well developed.

Table 2-1
Reported Uses of Data Generated by Field Analytical and Site Characterization Technologies

Technology	Site Screening	Site Characterization	Cleanup Monitoring	Compliance Monitoring	Confirmation Sampling	Enforcement	Health and Safety Monitoring	Waste Characterization	Risk Assessment
Chemical Technologies									
Biosensor	✔		✔	✔					
Colorimetric test strip	✔	✔	✔	✔					
Cone penetrometer mounted sensor	✔	✔							
Fiber-optic chemical sensor	✔	✔							
Fourier-transformed infrared spectrometry		✔	✔	✔			✔		
Gas chromatography	✔	✔	✔		✔				
Immunoassay	✔	✔	✔	✔	✔			✔	
Mercury vapor analyzer		✔					✔		
X-ray fluorescence	✔	✔	✔	✔	✔	✔			✔
Geophysical Technologies									
Bore-hole geophysical		✔							
Direct-push electrical conductivity	✔								
Electromagnetic induction		✔							
Ground penetrating radar	✔	✔							
Magnetometry		✔							
Seismic profiling	✔	✔							
Radionuclide Technologies									
Gamma radiation detector	✔	✔							
Passive alpha detector	✔	✔					✔		

Table 2-1
Reported Uses of Data Generated by Field Analytical and Site Characterization Technologies (continued)

Technology	Site Screening	Site Characterization	Cleanup Monitoring	Compliance Monitoring	Confirmation Sampling	Enforcement	Health and Safety Monitoring	Waste Characterization	Risk Assessment
Sampling and Sampler Emplacement Technologies									
Closed-piston soil sampling		✔							
Direct-push prepacked well screen		✔		✔					
Low-flow ground-water pumping	✔	✔		✔					
Soil gas sampling		✔							✔
Vertical ground-water profiling		✔		✔					
Vibrating well installation	✔	✔							

Table 2-2
Reported Uses of Technologies by Medium and Analyte

Analyte → / Technology ↓ Medium →	Volatile Organic Compounds					Semivolatile Organic Compounds					Fuels				
	Soil	Sediment	Ground Water	Soil Gas	Air	Soil	Ground Water	Surface Water	Soil Gas	Air	Soil	Sediment	Ground Water	Surface Water	Soil Gas
Biosensor															
Colorimetric test strip															
Cone penetrometer mounted sensor	✔		✔			✔	✔				✔		✔		
Fiber-optic chemical sensor			✔	✔			✔						✔		
Fourier-transformed infrared (FTIR) spectrometry					✔					✔					
Gas chromatography	✔	✔	✔	✔	✔	✔	✔				✔		✔		✔
Immunoassay	✔	✔	✔			✔	✔	✔			✔	✔	✔	✔	
Mercury vapor analyzer															
X-ray fluorescence															
Bore-hole geophysical															
Direct-push electrical conductivity															
Electromagnetic induction															
Ground penetrating radar															
Magnetometry															
Seismic profiling															
Gamma radiation detector															
Passive alpha detector															
Closed-piston soil sampling															
Direct-push prepacked well screen			✔												
Low-flow ground-water pumping			✔												
Soil gas sampling				✔					✔						
Vertical ground-water profiling			✔												
Vibrating well installation			✔				✔						✔		

Table 2-2
Reported Uses of Technologies by Medium and Analyte (continued)

Technology \ Analyte / Medium	Inorganics			Explosives		Radio-nuclides		Pesticides		Geophysical							
	Ground Water	Soil	Air	Soil	Ground Water	Soil	Sediment	Ground Water	Soil	Depth to Ground Water	Soil Type	Bedrock Stratigraphy	Conductivity	Buried Ferrous Metals	Temperature	Redox Potential	pH
Biosensor				✔	✔												
Colorimetric test strip	✔	✔		✔	✔												
Cone penetrometer mounted sensor										✔	✔		✔		✔	✔	✔
Fiber-optic chemical sensor																	
Fourier-transformed infrared (FTIR) spectrometry																	
Gas chromotography								✔	✔								
Immunoassay	✔	✔						✔	✔								
Mercury vapor analyzer			✔														
X-ray fluorescence	✔	✔															
Bore-hole geophysical										✔		✔	✔				
Direct-push electrical conductivity											✔	✔	✔				
Electromagnetic induction													✔				
Ground penetrating radar										✔		✔		✔			
Magnetometry														✔			
Seismic profiling										✔	✔	✔					
Gamma radiation detector						✔	✔										
Passive alpha detector						✔	✔										
Closed-piston soil sampling											✔						
Direct-push prepacked well screen										✔							
Low-flow ground-water pumping	✔																
Soil gas sampling																	
Vertical ground-water profiling																	
Vibrating well installation																	

2.1.1 Chemical Technologies

Biosensor (Number of Sites: 1)

Biosensors are analytical tools in which the sensing element is an enzyme, antibody, deoxyribonucleic acid, or microorganism and the transducer is an electrochemical, acoustic, or optical device. The technology was used to detect explosives (trinitrotoluene [TNT]; cyclo-1,3,5-trimethylene-2,4,6-trinitramine [RDX]; and cyclotetramethylenetetranitramine [HMX]) in soil, ground water, and composite residues.

Reported Advantages:
- Potentially cost-effective
- Real-time data

Reported Limitations:
- None identified

Colorimetric Test Strip (Number of Sites: 3)

Colorimetric test strips are a single measurement, portable technology that uses a wet chemistry non-immunoassay test to detect analytes in soil or water. The intensity of the color formation can be determined visually or with a spectrophotometer. Colorimetric test strips were used to detect nitrates, TNT, RDX, and HMX in soil and ground water.

Reported Advantages:
- Potentially cost-effective
- Easy to use
- Real-time data

Reported Limitations:
- Possible interference caused by nitrite
- Creation of soil slurry necessary to use test strips

Cone Penetrometer Mounted Sensor (Number of Sites: 34)

Cone penetrometer mounted sensors are real-time, in situ, field screening methods for petroleum hydrocarbons and other contaminants, as well as lithologic parameters. Table 2-3 includes several uses of the Site Characterization and Analysis Penetrometer System Laser-Induced Fluorescence (SCAPS-LIF) cone penetrometer mounted sensor technology. The SCAPS-LIF technology was developed through a collaborative effort of the Army, Navy, and Air Force, under the auspices of the Tri-Service SCAPS Program. The method uses a fiber optic-based laser-induced fluorescence sensor system, deployed with a standard 20-ton cone penetrometer. Cone penetrometer mounted sensors were used to perform field screening and site characterization for PAHs and total petroleum hydrocarbons (TPH) such as diesel and jet fuel, gasoline, waste oil, heating fuel, and kerosene, in soil and ground water, as well as the lithologic parameters (pH, redox potential, conductivity, soil type, and other factors).

Reported Advantages:
- Potentially cost-effective
- Continuous, real-time data
- Accurate measurements
- Three-dimensional mapping possible
- Contaminant fingerprinting capability
- Enhanced delineation of contaminant (2-inch vertical resolution)
- No soil cuttings
- Quick decontamination
- Data allowed selection of optimal confirmation soil boring locations

Reported Limitations:
- Expensive for a limited number of sample locations
- Naturally occurring fluorescent material can lead to false positives
- Limited by rough terrain
- Difficult to maneuver in tight spaces
- Subsurface cobbles cause probe refusal

Fiber-Optic Chemical Sensor (Number of Sites: 3)

Fiber-optic chemical sensors are coating-based sensors on fiber optics that detect contaminants by monitoring the change in the refractive index on the coating of the fiber optics that alters the amount of light transmitted to a detector. The technology was used to measure concentrations of TPH; benzene, toluene, ethylbenzene, and xylene (BTEX); and halogenated VOCs, such as trichlorethylene (TCE), in ground water and soil gas.

Reported Advantages:
- Potentially cost-effective
- Can be used in situ
- Easy to use
- Portable
- Quick turnaround time

Reported Limitations:
- Possible interference from other chlorinated VOCs
- Results affected by bailing method and amount of water bailed
- Concentration of contaminants affects response time

Fourier-Transformed Infrared Spectrometry (FTIR) (Number of Sites: 3)

This method is an air monitoring technique that identifies compounds by fingerprinting spectra. A sample's molecular constituents are revealed through their characteristic frequency-dependent absorption bands. The technology was used to measure the concentration of VOCs in air for health and safety, compliance, and cleanup monitoring.

Reported Advantages
- Adequate detection levels
- Portable
- Real-time data

Reported Limitations
- Interference caused by water vapor
- QA/QC methods not fully developed
- Not appropriate when a high degree of spatial resolution is required

Gas Chromatography (Number of Sites: 24)

Gas chromatography (GC) is an analytical technique used to separate and analyze environmental matrices for contaminants. Gas chromatography has been accepted widely as a primary analytical tool for site characterization because of its capability to separate, detect, identify, and quantify target analytes in a complex mixture. The technique is suitable for the analysis of thermally stable organic compounds only. Gas chromatography, with the use of various detectors (photoionization, flame ionization, electron capture, electrolytic conductivity, nitrogen-phosphorus, mass spectrometer, and others), and with various sample extraction and introduction methods (headspace, purge and trap, solvent extraction, solid phase extraction, thermal desorption, and others), was used to measure concentrations of halogenated and nonhalogenated VOCs, SVOCs (including polychlorinated biphenyls [PCB], polynuclear aromatic hydrocarbons [PAH], and pentachlorophenol [PCP]), TPH, pesticides, and dioxins in soil, soil gas, sediment, ground water, and air.

Reported Advantages:
- Potentially cost-effective
- Low detection limits (able to measure maximum contaminant level [MCL] concentrations)
- Quick turnaround time
- High-quality data generated
- Portable
- High sample throughput
- Good correlation with EPA's Contract Laboratory Program (CLP) laboratory data
- Ability to perform simultaneous analysis for BTEX and other hydrocarbon compounds

Reported Limitations:
- Experienced operator required
- Learning curve associated with use of equipment
- Library of components limited for mass spectrometer
- Petroleum carrier solvent caused interference with analysis for PCP
- Modification of extraction time required to improve consistency of results
- Poor extraction of diesel fuels from soils with high organic matter
- Co-elution of three types of contaminants hindered ability to meet detection limits

Immunoassay (Number of Sites: 43)

Immunoassay is a technique for detecting and measuring a target compound through the use of an antibody that binds only to that substance. Quantitation is performed by monitoring color change, either visually or with a spectrophotometer. The technology was used to detect or to measure the concentrations of halogenated VOCs, PAHs, TPH, BTEX, PCBs, organic pesticides, mercury, and bacteria in soil, sludge, sediment, surface water, ground water, and composite residues.

Reported Advantages:

- Potentially cost-effective
- Near real-time data
- Reproducible results
- Reasonable correlation with laboratory results
- Low rate of false negative results, except when fuel compounds were highly degraded
- Portability
- Detection limits capable of meeting action levels
- Capable of defining boundaries of contamination

Reported Limitations:

- High rate of false positives found in results from PCB and organic pesticide kits
- Incapable of identifying individual PAHs
- Poor extraction efficiency in peat or bog samples

Mercury Vapor Analyzer (Number of Sites: 2)

This technology monitors mercury vapors emitted from soil. These analyzers were used for health and safety monitoring and to determine soil sampling locations.

Reported Advantages

- Allowed for real-time understanding of exposure
- Quick turnaround time for data

Reported Limitation:

- Learning curve associated with equipment

X-ray Fluorescence (Number of Sites: 39)

X-ray fluorescence (XRF) analyzers operate on the principle of energy dispersive XRF spectrometry. Energy dispersive XRF spectrometry is a nondestructive analytical technique used to determine the metals composition of environmental samples. Field-portable and transportable XRF units were used to detect or measure concentrations of heavy metals (mercury, chromium, lead, cadmium, copper, nickel, and arsenic) in both in situ and ex situ soils, sludge, sediment, and ground water.

Reported Advantages:
- Potentially cost-effective
- No investigation-derived waste (IDW)
- Good correlation with analytical laboratory results
- Real-time data
- Quick turnaround time
- Capability to determine multiple analytes simultaneously
- Nondestructive method
- Little sample preparation
- Consistent quality of data

Reported Limitations:
- Limit on penetration depth
- Some field-portable units require liquid nitrogen
- One field-portable unit weighs 50 pounds
- Preparation of quality control sample required
- Difficulty in obtaining sufficiently low detection limits because of matrix interference
- Detection limits sometimes not low enough to respond to ecological concerns

2.1.2 Geophysical Technologies

Bore-hole Geophysical (Number of Sites: 4)

Bore-hole geophysical technologies include ground penetrating radar (GPR), electromagnetic induction, and acoustic methods. These technologies were used to map fractures in bedrock, and to determine ground-water flow and depth of the water table. The technologies were used to generate data for use both in site characterization and in placement of monitoring wells.

Reported Advantages:
- Accurate results
- Sensitivity
- Facilitation of better understanding of ground-water flow

Reported Limitations:
- Well diameter must be greater than two inches
- Well casing must be nonmetallic

Direct-push Electrical Conductivity (Number of Sites: 1)

The direct-push sensing of electrical conductivity is a geophysical technique based on the physical principles of inducing and detecting the flow of electrical current within geologic strata. Measurements of soil conductivity and logs of soil conductivity combine to supply information about the lithologic features of a site. This technology was used for site characterization and mapping to support placement of monitoring wells, and to define subsurface geologic and hydrogeologic conditions.

Reported Advantages:
- Potentially cost-effective
- Easy to use
- Portable
- Quick turnaround time
- Capability to identify thin stratigraphic layers that conventional methods miss
- No soil cuttings

Reported Limitations:
- Large metal objects can cause interference
- Susceptible to operator error
- Experienced operator needed to calibrate and interpret logs

Electromagnetic Induction (Number of Sites: 3)

Electromagnetic induction units use a transmitter coil to establish an alternating magnetic field which induces electrical current flow in the earth. The induced currents generate a secondary magnetic field which is sensed by a receiver coil. This technology was used during site characterization to locate disposal trenches at a landfill.

Reported Advantages:
- Easy to use
- Portable
- Quick results

Reported Limitations:
- Large metal objects such as fences can cause interference

Ground Penetrating Radar (Number of Sites: 4)

Ground penetrating radar (GPR) provides a rapid, real-time display of information about the subsurface, ranging from geological features to hydrologic features. The GPR method uses a transmitter that emits pulses of high-frequency electromagnetic waves into the subsurface. The electromagnetic energy that is scattered back to the receiving antenna on the surface is recorded as a function of time. This technology was used during site characterization to identify abandoned waste pits and other subsurface disturbances, bedrock stratigraphy, and the depth to water table. The technology was also used to develop profiles of a river bottom.

Reported Advantages:
- Data useful in identifying subsurface disturbances without soil borings
- Data allowed the selection of optimal soil boring locations
- Focused mapping of sample location
- Information compared favorably with that obtained through other methods

Reported Limitations:
- Surface vegetation can inhibit transmission of signals
- Soils with high electrical conductivity can inhibit transmission of signals
- Interpretation of data is complex; experienced data analyst required

Magnetometry (Number of Sites: 2)

Magnetometers detect the presence of ferrous objects in the subsurface by measuring the earth's magnetic field or how the field changes spatially. Hand-held and vehicle-towed magnetometry units were used during characterization and mapping to identify buried ferrous metals.

Reported Advantages:
- Ability to detect large ferrous metal objects 12 to 20 feet below ground surface
- Ability to discriminate among subsurface anomialies

Reported Limitations:
- Vehicle-based magnetometers limited by terrain and field conditions
- Vehicle-based magnetometers tend to underestimate the number of targets, compared with hand-held devices
- Signals from extraneous metals must be filtered out

Seismic Profiling (Number of Sites: 8)

Seismic profiling technology is based upon the principle that, if an acoustic signal is introduced into the ground, a wave will echo to the surface whenever a change in the medium is encountered. Sensors at the surface receive the signal, which is recorded by a seismograph and processed by software developed by the oil industry. Two- and three-dimensional seismic profiling technologies were used during site screening and characterization to determine bedrock stratigraphy, soil type, and depth to water table.

Reported Advantages:
- Potentially cost-effective
- Very detailed image of soil stratigraphy
- Bedrock fractures defined to within one foot
- Easy to use
- Drilling costs minimized

Reported Limitations:
- Large surface objects cause interference
- Data return is very specific
- Trained technician required to interpret data
- Vegetation must be removed
- Equipment requires direct contact with the ground, presenting a problem for use in buildings

2.1.3 Radionuclide Technologies

Gamma Radiation Detector (Number of Sites: 3)

Gamma radiation detectors are portable instruments that often use sodium iodide or cesium iodide scintillation counter detectors to detect gamma emissions. The technology was used to detect radionuclides in soil, sediment, and liquid waste.

Reported Advantages:
- Easy to use
- Portable
- Lower cost than conventional methods
- Data compared favorably with laboratory data
- Real-time data

Reported Limitations:
- Sensitive to power fluctuations
- Liquid nitrogen required
- Protection from weather required

Passive Alpha Detector (Number of Sites: 1)

Two types of commercially available passive radon detectors, electric ionization chambers and alpha track detectors, have been modified for use in screening of soil in situ for alpha contamination. The detectors were used to measure alpha contamination in soil.

Reported Advantages:
- Potentially cost-effective
- Easy to use
- Fast

Reported Limitations:
- None identified

2.1.4 Sampling and Sampler Emplacement Technologies

Closed-piston Soil Sampling (Number of Sites: 1)

This technology is a discrete-depth sampling technology that uses a locking piston. The locking piston enables the user to collect samples from a previously sampled boring without allowing unwanted material from the overlying borehole to be included in the sample. This sampling technology was used in conjunction with direct-push technology during site characterization to obtain continuous soil cores from below the water table.

Reported Advantages:
- No soil cuttings
- Less expensive than conventional drill rigs
- Faster than conventional methods

Reported Limitations:
- Sampler is designed for use only in soils and unconsolidated sediments
- Generally used at depths of less than 50 feet
- If used for sampling discrete subsurface intervals, the hole must be preprobed

Direct-push Prepacked Well Screen (Number of Sites: 1)

This technology uses a direct-push method to install prepacked stainless steel screens. The technology was used during site characterization and compliance monitoring to install small-diameter monitoring wells.

Reported Advantages:
- Less expensive and faster than installing a conventional well
- No soil cuttings

Reported Limitations:
- Cannot be used in bedrock
- Limit on depth
- Small diameter of well may limit sampling options

Low-flow Ground-water Pumping (Number of Sites: 9)

Low-flow ground-water sampling involves the use of any number of ground-water sampling pumps that purge a monitoring well slowly so as not to cause turbulent flow into the well. The method decreases the turbidity of the water sample and allows collection of a more representative ground-water sample than is possible with conventional technologies. The technology was used to obtain ground-water samples for analysis of VOCs and heavy metals.

Reported Advantages:
- Production of low-turbidity samples possible
- Less purge water generated
- More effective in low recharge wells

Reported Limitations:
- None identified

Soil Gas Sampling (Number of Sites: 5)

A number of passive and active sampling devices can be used to obtain soil gas samples. Passive soil gas absorption devices, in-well monitoring equipment, and canister devices were used to obtain soil gas samples for on- and off-site analysis of VOCs.

Reported Advantages:
- Potentially cost-effective
- Quick turnaround time
- Easy to use
- Large amounts of data generated
- Passive soil gas sampling technology can absorb low-volatility compounds
- Good correlation with monitoring well data

Reported Limitations:
- Active soil gas sampling is not effective in impermeable soils
- Passive soil gas sampling results may not correlate well with results of active soil gas sampling

Vertical Ground-water Profiling (Number of Sites: 4)

Vertical ground-water profiling technology collects point samples rather than samples over a screened interval, as is the case with conventional monitoring wells. The technology uses a probe that is advanced by a pneumatic piercing tool (air hammer) driven by a gasoline-powered air compressor. Ground water is extracted from the profiler by means of a peristaltic pump. This technology was used to vertically delineate contaminants in ground-water.

Reported Advantages:
- Potentially cost-effective
- Enables vertical profiling
- Enables tracking the boundaries of the contaminant plume

Reported Limitations:
- Problem with data comparability
- Difficulty in modeling the migration of TCE

Vibrating Well Installation (Number of Sites: 6)

This technology uses a specially designed all-terrain vehicle that uses a vibrating push mechanism to install small-diameter wells. This vibrating well installation technology was used to install ground-water wells and monitoring wells to depths up to 200 feet.

Reported Advantages:
- No soil cuttings
- Can be installed to 100 feet without pilot hole
- Equipment fits into tight spaces

Reported Limitations:
- Well screens clog easily
- Equipment overheats frequently
- Casing requires welding

2.2 SUMMARY OF DATA ON SPECIFIC TECHNOLOGIES

The information collected using the data collection form in Appendix B has been organized and presented in tabular format to more clearly display data from individual sites. Table 2-3 is organized by technology, with site information listed sequentially by EPA region for each of the technology types.

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies

Contents

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Chemical Technologies											
Biosensor											
Umatilla Army Depot-Hermiston, OR: explosives washout lagoon, open burn/open detonation (OB/OD) area, small arms incinerator, explosives in ground water	10	Research International, Inc.	Soil, ground water, composite residues (biotreatment monitoring)	Military explosives (TNT, RDX, HMX)	15 months	10-30 samples per day	Site screening, cleanup monitoring, compliance monitoring	Not provided	Real-time data; lower cost compared with analytical laboratory; higher sampling density at same cost	Not provided	Harry Craig (EPA) 503/326-3689
Colorimetric Test Strip											
Agra PWS-Agra, KS: grain fumigation, pesticide and fertilizer production	7	Merck, Ltd. (purchased from Thomas Scientific, Inc.)	Soil (ex situ), ground water	Nitrate	5 days	Soil: 10 minutes per sample Water: 2 minutes per sample	Site screening, site characterization	$10 per sample, including labor	Very fast; easy to use; low cost; used on site to guide investigation	Check for interference caused by nitrite; creation of soil slurry necessary to achieve performance	Darrell Hamilton (Tetra Tech EM Inc. [Tetra Tech]) 913/894-2600 Scott Alberg (KDHE) 913/296-1541
Naval Submarine Base Bangor-Silverdale, WA: open burn and open detonation area	10	Strategic Diagnostics, Inc. (SDI) (RDX soil test kit)	Soil (ex situ)	Explosives (TNT, RDX)	3 months	5 samples per hour	Site characterization	$20 to $25 per sample, plus accessory kit	High sampling density and collection of real-time data; less expensive than laboratory data	Not provided	Harry Craig (EPA) 503/326-3689
Umatilla Army Depot-Hermiston, OR: explosives washout lagoon, OB/OD area, small arms incinerator, explosives in ground water	10	SDI	Soil, ground water, composite residues	Military explosives (TNT, RDX, HMX)	15 months	10-30 samples per day	Site screening, cleanup monitoring, compliance monitoring	Not provided	Real-time data; lower cost compared with analytical laboratory; higher sampling density at same cost; worked exceptionally well with target analyte	Not provided	Harry Craig (EPA) 503/326-3689

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Cone Penetrometer Mounted Sensor											
Site unidentified-Netherlands: landfill and refinery	Not applicable	Delft Geotechnics (Chemoprobe)	Soil, ground water, soil gas	Geophysical data (pH, redox potential, specific conductivity, hydraulic conductivity), LNAPL	Not provided	Measure-ments in 4 minutes; 0.5 hour to 1 hour for a complete sounding	Site characterization	Not provided	Much quicker and more cost-effective than conventional methods; more accurate measurements; allows three-dimensional mapping	Not provided	J.J. Olie (Delft Geotechnics)
Central Landfill 1-RI	1	Not provided	Soil (in situ)	DNAPL	Not provided	Not provided	Cleanup monitoring	Not provided	Rapid sampling; greater accuracy	Subsurface cobbles; not too sensitive	John Courzier (EPA) 617/573-5779
Hanscom Air Force Base (AFB)-MA	1	Not provided	Soil	Not provided	Not provided	Not provided	Site characterization, cleanup monitoring	Not provided	Rapid sampling; greater accuracy	Subsurface cobbles; not too sensitive	Bob Lim (EPA) 617/223-5521
Industriplex 1-MA	1	Not provided	Soil	Not provided	1994	Not provided	Site characterization	Not provided	Rapid sampling; greater accuracy	Subsurface cobbles; not too sensitive	Joe Lemay (EPA) 617/573-9622
Loring AFB-ME	1	Not provided	Soil (in situ)	Not provided	Not provided	Not provided	Cleanup monitoring	Not provided	Rapid sampling; greater accuracy	Subsurface cobbles; not too sensitive	Mike Nalipinski (EPA) 617/223-5503
Silresim 1-MA	1	Not provided	Soil, ground water	VOCs	Not provided	Not provided	Cleanup monitoring	Not provided	Not provided	Not provided	Almerinda Silva (EPA) 617/573-9627
Stamina Mills 1-RI	1	Not provided	Soil (in situ)	TCE	Not provided	Not provided	Cleanup monitoring	Not provided	Technology minimizes vertical migration	Not provided	Neil Handler (EPA) 617/573-9636
Union Chemical 1-ME	1	Not provided	Soil (in situ)	VOCs	Not provided	Not provided	Cleanup monitoring	Not provided	Not provided	Not provided	Terry Connelly (EPA) 617/573-9638

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Cone Penetrometer Mounted Sensor (continued)											
Naval Weapons Station Earle- Colts Neck, NJ	2	U.S. Navy (SCAPS)	Soil (in situ)	BTEX, nonhalogenated VOCs, nonhalogenated SVOCs,	Not provided	4 per hour	Site characterization	Not provided	Quick turnaround of results and fingerprinting capability; good for measuring the extent of free product in soils	Not provided	Jeffrey Gratz (EPA) 212/637-4320 John Mayhew (U.S. Navy) 610/595-0567 x125 & x146
Freedom Textile Chemicals Co.- Charlotte, NC: landfill contaminated with VOCs and SVOCs	4	Not provided	Soil (in situ), sludge	Halogenated and nonhalogenated VOCs and SVOCs	Not provided	Not provided	Site characterization	Not provided	Not provided	Not provided	Joseph Alfand (EPA) 404/562-8496 Phillip Pelp (Freedom Textile Chemicals Co.) 704/393-0089
Naval Air Station New Orleans- New Orleans, LA: fuel farm and piping	6	Navy Research and Development (NRaD) (SCAPS)	Soil (in situ)	PAHs (JP-5 aviation fuel)	1/26/96-1/27/96	41 LIF pushes (296 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation	Not provided	Tom Hampton (NRaD) 619/553-1172 Hal Bolinger (LDEQ) 504/765-0232
Sandia National Laboratory- Albuquerque, NM	6	NRaD (SCAPS)	Soil (in situ)	PAHs (diesel fuel)	8/16/95-8/18/95 and 11/1/95-11/8/95	18 LIF pushes (905 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation	Not provided	Tom Hampton (NRaD) 619/553-1172 John Wesnousky (California Environmental Protection Agency [CalEPA]) 916/322-2543 Steve Billets (USEPA National Environmental Research Laboratory-Las Vegas [NERL-LA]) 702/798-2232

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Cone Penetrometer Mounted Sensor (continued)											
Site unidentified-Location not provided: former manufactured gas plant, coal tar wastes	7	TriServices SCAPS program	Soil (in situ), ground water	PAHs, TPH	10 days	208 feet per day	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Continuous, real-time data; quick decontamination; no soil cuttings	Limited by rough terrain, tight spaces, and subsurface cobbles	Greg Stenback (Iowa State University) Dr. Al Bevolo (Ames Laboratory) 515/294-5414 Kathy Older (USACE)
Site unidentified-Lexington, NE: manufacturing site, use of solvents, cutting oils, motor fuels, hydraulic fluids, and heating oil	7	Unisys Corporation (Rapid Optical Screening Tool [ROST™])	Soil (in situ)	Aromatic petroleum hydrocarbons	3 days	Cone penetro-meter is advanced at 2 centimeters per second or 290 feet per day	Site characterization	$7,000 per day, or $500 per push, or $24 per foot	Faster and less expensive than traditional techniques; continuous and real-time data; no soil cuttings; quicker decontamination than other methods	Difficult to correlate fluorescence intensity with TPH data	Kevin Earley and Keith Rapp (Unisys)
Department of Defense Housing Facility-Novato, CA: exchange gas station	9	NRaD (SCAPS)	Soil (in situ)	PAHs (diesel fuel and gasoline)	5/15/96-5/22/96	15 LIF pushes (178 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation	Not provided	Tom Hampton (NRaD) 619/553-1172 John Pfister (NAVFAC EFA-West) 415/244-2568
Guadelupe Oil Field-CA:	9	NRaD (SCAPS)	Soil (in situ)	PAHs (kerosene)	8/23/94-9/8/94	36 LIF pushes (1,327 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation	Not provided	Tom Hampton (NRaD) 619/553-1172 Richard Aleshire (California Central Coast Regional Water Quality Control Board) 805/542-4631

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Cone Penetrometer Mounted Sensors (continued)											
Marine Corps Air Station, Site 13-Gallarnd, CA: leaking USTs, refinery wastes	9	U.S. Navy (SCAPS)	Soil (in situ)	TPH	2 weeks	4 cone penetrometer testing (CPT) soundings per day (depends on depth)	Site characterization	$3,500 per day	Real-time profile; quick understanding of site; allows focusing of CLP sampling	Expensive; requires a lot of equipment; naturally occurring fluorescence material can lead to false positives	Rachael Simon (EPA) 415/744-2383
Marine Corp Air Station- 29 Palms, CA	9	NRaD (SCAPS)	Soil (in situ)	PAHs (JP-5 [aviation fuel], diesel fuel, waste and heating oil)	8/23/95-8/25/95	8 LIF pushes (220 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation	Not provided	Tom Hampton (NRaD) 619/553-1172
Marine Corps Base-Camp Pendelton, CA: ground control approach facility	9	NRaD (SCAPS)	Soil (in situ)	PAHs (diesel fuel)	6/27/94-7/6/94	25 LIF pushes (335 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation	Not provided	Tom Hampton (NRaD) 619/553-1172 Vickie Church (San Diego County, California) 619/338-2243
Marine Corp Air Station- Yuma, AZ: firefighter training area and fuel bladders	9	NRaD (SCAPS)	Soil (in situ)	PAHs (JP-5 [aviation fuel], diesel and gasoline fuel)	5/17/94-6/9/94	29 LIF pushes (1169 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation	Minor mineral fluorescence, spectrally indistinguishable	Tom Hampton (NRaD) 619/553-1172 Davis Mangold (Navy Facilities Command Southwest Division [NAVFACSW-DIV]) 619/532-2534

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Cone Penetrometer Mounted Sensors (continued)											
Marine Corp Recruit Depot- Yuma, AZ: fire training area, disposal of aircraft cleaning fluids (solvents), landfill, sewage lagoon	9	U.S. Navy (SCAPS)	Soil (in situ)	PAHs (diesel and gasoline fuel)	1/30/95-2/9/95 and 2/21/95-3/1/95	25 LIF pushes (514 feet) 21 LIF pushes (318 feet)	Site characterization	Not provided	Enhanced site delineation	Not provided	Tom Hampton (U.S. Navy) 619/553-1172 Vickie Church (San Diego County) 619/338-2243
Naval Air Station, Site 13- Alameda, CA: former refinery	9	NRaD (SCAPS)	Soil (in situ), ground water	PAHs (refinery waste)	3/17/94-4/6/94	45 LIF pushes (808 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation	Not provided	Tom Hampton (NRaD) 619/553-1172 Lt. Mike Petouhoff (Base Environmental) 510/263-3726
Naval Air Station North Island- CA: leaking UST	9	NRaD (SCAPS)	Soil (in situ)	PAHs (diesel fuel)	7/25/94-8/4/94	25 LIF pushes (701 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation; data was used to support the closure of USTs	Not provided	Tom Hampton (NRaD) 619/553-1172 Richard Mach (NAVFAC SWDIV) 619/556-9934
Naval Complex- Long Beach, CA: multiple UST sites	9	NRaD (SCAPS)	Soil (in situ), ground water	PAHs (diesel fuel, gasoline, and waste oil)	9/16/96-9/27/96, 10/7/96-10/18/96, and 10/28/96-11/8/96	121 LIF pushes (1667 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation; assisted with plume delineation; site closure with minimum sampling; obtained regulatory closure of 16 sites with LIF data and limited confirmation sampling of soil and ground water by a fixed laboratory	Minor mineral fluorescence, spectrally indistinguishable	Tom Hampton (NRaD) 619/553-1172 Hugh Marley (Los Angeles Regional Water Quality Control Board) 213/266-7669 Gary Simon (NAVFAC SWDIV) 619/532-2537

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Cone Penetrometer Mounted Sensors (continued)											
Naval Radio Receiving Facility-Imperial Beach, CA	9	NRaD (SCAPS)	Soil (in situ)	PAHs (fuel oil)	3/6/95-3/22/95	36 LIF pushes (813 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation; obtained regulatory closure of 2 UST sites with only 1 confirmatory soil boring each	Petroleum UST cleanups are moving toward risk-based closure; therefore, the screening-level data from SCAPS is becoming less valuable	Tom Hampton (NRaD) 619/553-1172 Richard Mach (NAVFAC SWDIV) 619/556-9934
Naval In Service Engineering/West-San Diego, CA: hydraulic pump pit	9	NRaD (SCAPS)	Soil (in situ)	PAHs (hydraulic oil)	7/22/96-7/23/96	8 LIF pushes (56 feet)	Site characterization	$2,300 to $4,60 per day for an average push rate of 200 feet per day	Enhanced site delineation; rapid delineation with limited confirmatory soil and water sampling; permitted regulatory approval of site reuse	Not provided	Tom Hampton (NRaD) 619/553-1172
Naval Training Center-San Diego, CA: exchange service station and hobby shop	9	NRaD (SCAPS)	Soil (in situ)	PAHs (gasoline and waste oil)	10/24/94-11/8/94, and 11/15/94-11/16/94	33 LIF pushes (593 feet) 16 LIF pushes (214 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation; provided data to develop and implement site remediation and closure	Not provided	Tom Hampton (NRaD) 619/553-1172 Thomas Macchiarelli (NAVFAC SWDIV) 619/532-3808
Naval Weapons Station-China Lake, CA	9	NRaD (SCAPS)	Soil (in situ)	PAHs (JP-5 [aviation fuel], diesel fuel, gasoline, and waste oil)	8/29/95-8/30/95	12 LIF pushes (224 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation	Not provided	Tom Hampton (NRaD) 619/553-1172

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Cone Penetrometer Mounted Sensors (continued)											
Naval Outlying Landing Field- Imperial Beach, CA: fuel depot	9	NRaD (SCAPS)	Soil (in situ)	PAHs (JP-5 [aviation fuel], diesel fuel and gasoline)	11/30/94-12/15/94	38 LIF pushes (698 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation; data was used to support the closure of 2 USTs	Not provided	Tom Hampton (NRaD) 619/553-1172 Richard Mach (NAVFAC SWDIV) 619/532-1156
Naval Station- San Diego, CA: Bldg. 279	9	NRaD (SCAPS)	Soil (in situ)	PAHs (gasoline)	8/12/96-8/15/96	20 LIF pushes (177 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation	Not provided	Tom Hampton (NRaD) 619/553-1172
Naval Station- San Diego, CA: firefighter training facility	9	NRaD (SCAPS)	Soil (in situ)	PAHs (JP-5 [aviation fuel], gasoline)	1/11/94-2/8/94	22 LIF pushes (313 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation	Not provided	Tom Hampton (NRaD) 619/553-1172 Rick Bassinet (NAVFAC SWDIV) 619/532-1636
Naval Construction Battalion Corps- Port Hueneme, CA: hydrocarbon national test site and exchange gas station	9	NRaD (SCAPS)	Soil (in situ)	PAHs (diesel fuel)	4/4/95-4/11/95, 5/16/95-5/22/95, and 5/28/96-5/30/96	24 LIF pushes (472 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation; vertical resolution of 2 inches; enhanced vertical resolution	Not provided	Tom Hampton (NRaD) 619/553-1172 John Wesnousky (CalEPA) 916/322-2543 Steve Billets (USEPA NERL-LV) 702/798-2232
Naval Air Station North Island- Coronado, CA: fuel tank depot	9	NRaD (SCAPS)	Soil (in situ)	PAHs (JP-5 [aviation fuel], marine diesel fuel)	7/14/93-7/15/93, 8/18/93-8/31/93, and 10/5/93-10/8/93	40 LIF pushes (708 feet)	Site characterization	$2,300 to $4,600 per day for an average push rate of 200 feet per day	Enhanced site delineation; vertical resolution of 2 inches; data used to develop site remediation system	Not provided	Tom Hampton (NRaD) 619/553-1172 Richard Mach (NAVFAC SWDIV) 619/556-9934

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Cone Penetrometer Mounted Sensors (continued)											
Naval Amphibious Base-Coronado, CA: abandoned fuel farm	9	NRaD (SCAPS)	Soil (in situ)	PAHs (gasoline and diesel fuel)	2/15/94-3/1/94	22 LIF pushes (274 feet)	Site characterization	Not provided	Enhanced site delineation	Not provided	Tom Hampton (NRaD) 619/553-1172 Kevin Heaton (San Diego County, California) 619/338-2243
Fiber-optic Chemical Sensor											
Site unidentified-Northeast United States (specific location not provided): two leaking UST sites	1	ORS Environmental Systems (ChemSensor)	Ground water	VOCs (TCE), SVOCs, BTEX, TPH	Not provided	10 minutes per measure-ment	Site screening, site characterization	Not provided	Easy to use; rapid, inexpensive data; very portable	Concentration of contaminants affects response time	John Hanshaw (ORS Environmental Systems) 800/228-2310
Savannah River Site-Aiken, SC: TCE used as degreasing solvent	4	Lawrence Livermore National Laboratory (TCE sensor)	Soil gas, ground water	VOC (TCE)	Not provided	Continuous measure-ment	Site screening, site characterization	Not provided	Capable of in situ measurements; less expensive than off-site analysis; rapid measurements	Possible interference from other chlorinated VOCs	Joe Rossabi (Westinghouse Savannah River Company) 803/725-5220
Site unidentified-Las Vegas, NV: leaking UST site	9	FCI Environmental, Inc. (PetroSense® PHA-100)	Ground water	TPH	Not provided	Not provided	Site characterization	Not provided	Can be used in situ; real-time data; easy to use; less expensive than off-site analysis	Results affected by bailing method and amount of water bailed	Devinder P.Salini (FCI Environmental, Inc.) 702/361-7921
Fourier-transformed Infrared (FTIR) Spectrometry											
French Limited Superfund Site-Crosby, TX	6	Not provided	Air	BTEX, PAHs, methane, carbon monoxide	4 days	Continuous measure-ment	Cleanup monitoring (to evaluate bioremediation), health and safety monitoring	Not provided	Not provided	Water vapor presents a potential interference for the absorption features of toluene, benzene, and naphthalene	Jim Sealy (ManTech Environmental Technology) 405/436-8658

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Fourier-transformed Infrared (FTIR) Spectrometry (continued)											
Bliss Ellisville-Wild Wood, MO: dioxin-contaminated oil sprayed on site, buried drums of industrial waste, and uncontained waste	7	Not provided	Air	VOCs	4 months	40-50 measure-ments over a 4-month period	Health and safety monitoring	Not provided	Real-time data; portable system; compound-specific	QA/QC methods not well developed	Wood Ramsey (EPA) 913/551-7382 Mark Thomas (EPA) 913/551-7937 Randy Scheidermann (E&E) 913/432-9961
Site unidentified-Location not provided	7	None - developed by universities	Air	VOCs	1 day	Measure-ments every 12 minutes	Compliance monitoring (for air emissions)	Not provided	Precision and accuracy similar to accepted Method TO-14; adequate detection levels; fast, on-site data	Not appropriate for a high degree of spatial resolution in ambient air monitoring	Jody Hudson (EPA) 913/551-5064
Gas Chromatography											
Site unidentified-Jard, VT	1	Not provided	Not provided	Not provided	12/31/91-11/11/92	Not provided	Cleanup monitoring	Not provided	Avoided downtime; data quality effective for determining final sampling locations	Not provided	Mary Ellen Stanton (EPA) 617/573-9670
Beede Waste Oil-NH	1	PE Photovac, Inc., Thermo Instrument Systems, Inc.	Soil	VOCs, PCBs	11/93-12/93	Not provided	Site characterization	Not provided	Avoided downtime; data quality effective for determining final sampling locations	Not provided	Dorrie Paar (EPA) 617/573-5768
Connecticut Building Wrecking-CT	1	PE Photovac, Inc.	Air	VOCs	12/23/91	Not provided	Site characterization	Not provided	Avoided downtime; data quality effective for determining final sampling locations	Not provided	Dorrie Paar (EPA) 617/573-5768
Indian Line Farm-MA	1	PE Photovac, Inc., Thermo Instrument Systems, Inc.	Soil	VOCs, PCBs	2/27/92-5/28/93	Not provided	Site characterization, cleanup monitoring	Not provided	Avoided downtime; data quality effective for determining final sampling locations	Not provided	Gary Lipson (EPA) 617/223-5584

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Gas Chromatography (continued)											
Site unidentified-Leicester, MA: landfill	1	PE Photovac, Inc., Thermo Instrument Systems, Inc.	Air	VOCs	1/22/92	Not provided	Site characterization	Not provided	Avoided downtime; data quality effective for determining final sampling locations	Not provided	Dorrie Paar (EPA) 617/573-5768
Pichillo Farm Superfund Site-Coventry, RI	1	TMA	Soil (ex situ), soil gas	VOCs, SVOCs	6/96-12/96	2 soil samples per hour	Site characterization	Not provided	On-site real-time results	Not provided	Anna Kraskow (EPA) 617/573-5749 Richard Willy (EPA) 617/573-9639 Alan Peterson (EPA) 617/860-4607
Resolve 1-MA	1	PE Photovac, Inc.	Air	VOCs	6/93-7/94	Not provided	Compliance monitoring	Not provided	Avoided downtime; data quality effective for determining final sampling locations	Instrument calibration requires a significant amount of time	Joe Lemay (EPA) 617/573-9622
Site unidentified-Stratford, CT	1	Thermo Instrument Systems, Inc.	Soil	PCBs	6/17/93	Not provided	Cleanup monitoring	Not provided	Avoided downtime; data quality effective for determining final sampling locations	Not provided	Mike Jagingici (EPA) 617/573-5786
Three C-MA	1	Thermo Instrument Systems, Inc.	Soil	PCBs	8/8/95-8/26/95	Not provided	Site characterization, cleanup monitoring	Not provided	Avoided downtime; data quality effective for determining final sampling locations	Not provided	Dorrie Paar (EPA) 617/573-5768
Toka-Renbe Farm-MA	1	PE Photovac, Inc., Thermo Instrument Systems, Inc.	Soil	VOCs, PCBs	7/7/94	Not provided	Site characterization, cleanup monitoring	Not provided	Avoided downtime; data quality effective for determining final sampling locations	Not provided	Lisa Danek (EPA) 617/573-5707

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Gas Chromatography (continued)											
Site unidentified-Location not provided: active manufacturing facility	3	PE Photovac, Inc. (10S70GC with photoionization detector)	Soil (ex situ)	Halogenated and nonhalogenated VOCs	Not provided	120 samples per day with 3 GCs	Cleanup monitoring	$35 per sample	On-site data used to guide investigation; less costly than off-site analysis; high sample throughput; saved costs for the removal action	Not provided	David Catherman (Environmental Resources Management, Inc.) 610/524-3500
Site unidentified-Illinois: contamination from old compressors that used PCB-containing oils	4	Hewlett Packard (5890 Series II GC)	Soil (ex situ), sediment (ex situ)	PCBs	Not provided	20 minutes per sample	Cleanup monitoring	Not provided	Good correlation between on-site and off-site data; reduced cost; quick data	Modified extraction time required to obtain consistent results	Brad Anderer (TRC Environmental Corporation)
Koppers-Morrisville-Morrisville, NC: wood treatment operations	4	Shimadzu (14AGC)	Soil (ex situ), ground water, air	SVOCs (PCP), dioxin	3 weeks	2 samples per hour	Cleanup monitoring, health and safety monitoring	$13.50 per sample for expendables; $23,214 to purchase GC system; $1,500 per month to rent GC system	On-site data used to verify performance of remediation technology; quick-turnaround data; less expensive than formal analysis	Petroleum carrier solvent for PCP caused interference problems, resulting in poor recovery for some soil samples	Darrell Hamilton (Tetra Tech) 913/894-2600
Florida Department of Transportation - Fairbanks, FL: contaminated landfill	4	Not provided	Soil (ex situ)	PAHs	1 year	Not provided	Site screening, site characterization, cleanup monitoring, confirmation sampling	Not provided	Allows for quick separation of soil into clean or dirty groups when removing large volumes of soil	Operator must be familiar with equipment	Wesley S. Hardegree (EPA) 404/562-8486 Steve Spurlin (EPA) 404/562-8743

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Gas Chromatography (continued)											
Pig's Eye Landfill-St. Paul, MN: municipal solid waste landfill (also contains industrial wastes)	5	Tekmar-Dohrmann, Inc. (HSA) Shimadzu (14AGC)	Soil (ex situ), ground water, soil gas	Halogenated and nonhalogenated VOCs, solvents, BTEX	3 weeks	20 samples per day	Site screening (to determine extent of contamination), site characterization	$50 per sample	Technology was less expensive than off-site laboratory analysis; achieved low detection limits, especially for chlorinated VOCs; data used to guide investigation; only one mobilization	Not provided	Patrick Splichal (Tetra Tech) 913/894-2600
Hastings Superfund Site-NB: landfill, contaminated ground water	7	Not provided (GC used with electron capture detector)	Soil (ex situ), ground water	Halogenated VOCs	6/97	Not provided	Site characterization, cleanup monitoring	Not provided	Real-time data; CLP equivalent; no purge and trap required	Technology requires mobile laboratory	Diane Easley (EPA) 915/551-7797
Kinsley Airport-Kinsley, KS: pesticide formulation, spraying, and tank and applicator cleaning	7	Hewlett Packard	Soil (ex situ), ground water	Pesticides, herbicides (containing chlorinated and nitrogen compounds)	1 week	Not provided	Site screening, site characterization	Approximately $100 per sample	Ability to detect compounds at MCL concentrations; technology produced quick results at about one-third the cost of off-site analysis	Simultaneous elution of 3 target pesticides hinders ability to meet detection limits	Darrell Hamilton (Tetra Tech) 913/894-2600
Site unidentified-Location not provided: drum recycling site	8	Viking Instruments Inc. (GC/MS)	Soil gas, air	VOCs	Not provided	Not provided	Cleanup monitoring, health and safety monitoring	Not provided	Data correlated well with off-site data; data could be used to guide the removal action; portable system; data could be used to monitor public safety	Not provided	Alan Humphrey (EPA) 732/321-6748 Steven Hawthorn (EPA) 303/312-6061

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Gas Chromatography (continued)											
Mount Olivet Cemetery-Salt Lake City, UT	8	PE Photovac, Inc.	Soil (ex situ)	VOCs (Pentachloro-ethane [PCE])	Ongoing	Not provided	Site screening (plume tracing)	Not provided	Time savings; cost savings	Not provided	Luke Chaved (EPA) 303/312-6512 Barry Hayhurst (URS Greiner, Inc.) 303/291-8270
China Lake NAWS-Ridgecrest, CA: laboratory wastes and petroleum wastes from refueling operations and leaking USTs	9	Hewlett-Packard (5890 GC)	Soil (ex situ), ground water	TPH-extractable, PAHs, PCBs, phthalates, light nonaqueous phase liquids (LNAPL)	6 weeks	20 samples per day	Site screening, site characterization	Rental cost of $3,000 per month; $5,000 for expendable supplies for 450 samples	Quick turnaround data; reduced number of samples sent off-site for analysis; reduced costs	Lack of positive identification because there was no mass spectroscopy or second column confirmation; requires operator experience; TPH interference	Darrell Hamilton (Tetra Tech) 913/894-2600
Moffett Field-Mountain-View, CA: leaking USTs and pipelines at fuel farm	9	Shimadzu (14A GC) Tekmar-Dohrmann, Inc. (headspace analyzer)	Soil (ex situ), ground water	TPH-purgeable, BTEX	2 weeks	25 to 30 samples per day	Site screening, site characterization	Equipment can be rented for about $2,500 per month	Simultaneous analysis for BTEX, as well as several fuels; inexpensive; no solvent waste	Poor extraction of diesel fuel from soils with high organic matter	Patrick Splichal (Tetra Tech) 913/894-2600 Jean Barranco (Tetra Tech) 303/295-1101
Piper Aircraft Corporation-Vero Beach, CA	9	Sentex Systems, Inc. (portable GC - Sentograph™)	Soil (ex situ), sediment (ex situ), ground water	VOCs (TCE)	8/23-8/26/92	25 samples per 4 days	Site characterization	Not provided	Real-time data	Library of components limited	Roger E. Carlton (EPA) 706/355-8609 Bill Bokey and Arthur Lee (Piper Aircraft Corporation) 706/355-8604
Garden City Ground Water-Garden City, ID: ground water contamination	10	Not provided (sample extracted using mobile laboratory equipment and analyzed with field GC)	Soil (ex situ), ground water, soil gas	VOCs, solvents	5 weeks	2 samples per hour	Site screening, site characterization, enforcement	Not provided	Quick turnaround time; allowed sampling of a large area for a low cost	Not provided	David Bennett (EPA) 206/553-2103

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Gas Chromatography (continued)											
Preston Ground Water-Preston, ID: gas station with a leaking UST, causing ground-water contamination	10	Hewlett Packard (HP 5890)	Soil (ex situ), ground water	VOCs, BTEX	1 month	3 samples per hour	Site screening, site characterization	50 percent of the cost of CLP data	Real-time data to help direct the field program; tracking of the plume; cost-effective; high quality results	Not provided	Chris Field (EPA) 206/553-1674
Immunoassay											
Industrial Buildings-Location not provided	Not specified	ImmunoSystems, SDI (EnviroGard)	Wipe samples from solid surfaces	PCBs	Not provided	20 samples per 2 hours	Cleanup monitoring, health and safety monitoring	Not provided	Reduced cost per sample; rapid analysis; on-site data	Better control needed for heterogeneity of PCB distribution; possible interference from PCB cleansers	Craig Kostyshyn (SDI) 215/860-5115 (contact obtained from Vendor FACTS database)
Site unidentified-Location not provided	Not specified	BioNebraska (BiMelyze Mercury Assay)	Soil (ex situ), sediment (ex situ), ground water	Mercury	Not provided	Not provided	Site characterization	Not provided	Convenient; cost-effective; real-time data; highly selective for mercury; data correlates well with those obtained by other methods	Not provided	Craig Schweitzer (BioNebraska) 800/786-2580 (contact obtained from Vendor FACTS database)
CYRO Industries-Location not provided	1	SDI	Soil	PAHs	10/95-11/95	Not provided	Site characterization	Not provided	Low cost; 90% accuracy	10% false positives	Ernest Waterman (EPA) 617/223-5511
Site unidentified-Norwood, MA	1	SDI	Not provided	PCBs, PAHs	12/94-8/95	Not provided	Cleanup monitoring, health and safety monitoring	Not provided	Low cost; rapid	Not provided	John LeMay (EPA) 617/573-9622

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Immunoassay (continued)											
Nyanza Chemical Waste Superfund Site- Ashland, MA: dye manufacturing facility, mercury contamination in soils and sediments	1	BioNebraska, Inc. (BiMelyze Mercury Assay)	Sediment, soil (ex situ)	Mercury	9/94-10/94	70 split samples per day	Site screening	$35 per sample	Results showed acceptable correlation with laboratory results; mercury concentrations ranged from less than 0.5 parts per million (ppm) to greater than 100 ppm	Not provided	Greg Morin (U.S. Army Corps of Engineers [USACE]) 617/647-8232 Pam Shields (EPA) 617/573-9632
Pine Street 1- VT	1	Not provided	Soil	PAHs	Not provided	Not provided	Cleanup monitoring	Not provided	Rapid, low cost	Extraction problem caused by soil moisture content	Ross Gilleland (EPA) 617/573-5766
Pinette's- ME	1	Not provided	Soil	PCBs	Not provided	Not provided	Cleanup monitoring	Not provided	Rapid, low cost	Not provided	Ross Gilleland (EPA) 617/573-5766
Raymark 3- CT	1	Not provided	Soil	PCBs	9/93-9/97	Not provided	Cleanup monitoring	Not provided	Rapid, low cost	Not provided	Mike Jasinski (EPA) 617/573-5786
Resolve 1- MA	1	SDI	Soil	PCBs	Not provided	Not provided	Cleanup monitoring	Not provided	Low cost; 90% accuracy	10% false positives	Joe Lemay (EPA) 617/573-9622
Resolve 2- MA	1	SDI	Soil	PCBs	Not provided	Not provided	Cleanup monitoring	Not provided	Low cost	False positives	Joe Lemay (EPA) 617/573-9622
Resolve 1 & 2- MA: PCB-contaminated sites	1	SDI	Soil (ex situ)	PCBs	2 months	3 per hour	Cleanup monitoring	$10 per sample	Results more conservative than laboratory (confirmation sampling)	No major problems encountered	Joe Lemay (EPA) 617/573-9622

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Immunoassay (continued)											
General Electric Corp. (GE) Site No. 5-NY: industrial landfill	2	SDI (EnviroGard)	Soil (ex situ)	PCBs (Aroclor 1260)	Not provided	80 samples per day	Site characterization (technology evaluation performed by GE)	$18 per sample	Low rate of false positives results	Not provided	L.A. Socha (GE)
General Motors, Central Foundary Division Site-Massena, NY	2	SDI (PCB RISC™)	Soil (ex situ), sediment (ex situ)	PCBs	2-3 months on 2 occas-ions	4 samples per hour	Cleanup monitoring, compliance monitoring	Not provided	Large savings in time and analytical costs; savings in labor and equipment costs; real-time data aided in guiding excavation activities	No official report on verification procedures	Lisa Jackson and Anne Kelly (EPA) 212/637-4274 Jim Hartnett (GMC) 315/764-2239
Aberdeen Proving Ground-Aberdeen, MD: military activities	3	New Horizons Diagnostic Corp. (The SMART Test)	Soil, sediment (ex situ)	Bacteria	7/93-7/97	Not provided	Not provided	$6 per sample	Not provided	Not provided	Peter Stopa (U.S. Army)
Delaware Sand and Gravel-New Castle, DE: landfill drum pit	3	OHM	Soil (ex situ)	PCBs	Not provided	Not provided	Site screening	Not provided	Real-time monitoring	Not provided	Eric Newman (EPA) 215/566-3237
Former Coal Gasification Site-Georgetown, DE: coal gasification wastes	3	SDI (RaPID® Assay)	Soil (ex situ), ground water	VOCs, BTEX, PAHs	Not provided	40 samples per day	Site screening, site characterization	BTEX-$20 per sample PAHs-$25 per sample	Not provided	Not provided	Robert M. Schulte (Delaware Department of Natural Resources)
Saunders Supply-VA: wood treating facility	3	Not provided	Ground water	SVOCs (PCP)	2 days	Not provided	Site characterization	Not provided	Fast results	Not provided	Andy Palestini (EPA) 215/566-3223
Woodbridge Research Facility-Woodbridge, VA: former radio transmission facility/research lab	3	Not provided	Soil (ex situ)	PCBs	1994	Not provided	Site characterization	Not provided	Not provided	False positives detected	Jack Porosnak (EPA) 215/566-3362 Jeff Waugh (Earth Tech) 410/671-1615

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Immunoassay (continued)											
Agricultural Cooperative- South-central, WI: herbicide and pesticide manufacturing	4	SDI (RaPID® Assay)	Soil (ex situ)	Pesticides (atrazine)	Not provided	20 samples per day	Not provided	$50 per sample	Not provided	Not provided	Dr. Kirsti Sorsa (RMT, Inc.)
American Creosote Works- Jackson, TN: wood preserving facility	4	SDI (EnviroGard)	Soil (ex situ)	PAHs	Not provided	80 samples per day	Site characterization (technology evaluation)	$18 per sample	Good agreement with results produced by EPA Method 8270	Not provided	Dennis Revell (EPA) 703/355-8807
Transformer and Refurbishing Facility- MI: utility wastes	5	SDI (RaPID® Assay)	Soil (ex situ), ground water	PCBs	Not provided	Not provided	Not provided	$25 per sample	Not provided	Not provided	P. Berlinski (Delta Environmental, Inc.) 916/638-2085
Amesor Timber- Steelville, MO: lumber treatment	7	SDI	Soil (ex situ)	SVOCs (PCP)	3 days	25 samples per day	Site characterizations	$225 per kit	Cost-effective; quick turnaround time for results; helped to direct sampling efforts; reduced the number of samples needed to characterize the site	Sufficient reagent was not provided; only 60 of the 70 samples collected produced valid results	Paul Doherty (EPA) 913/551-7924
Farmland Refinery- Coffeyville, KS: refinery (petroleum waste)	7	SDI (RaPID® Assay)	Soil (ex situ), ground water, surface water	PAHs	5 days	20 samples in 2 hours	Site characterization	$50 per sample exclusive of labor	Easy to use; low detection limits; rapid data	Interference caused by high concentration of petroleum; cannot identify individual PAHs	Patrick Splichal (Tetra Tech) 913/894-2600 Scott Ritchey (EPA) 913/551-7641
Former Manufactured Gas Plant- Marshalltown, IA: coal gasification	7	SDI (D Tech)	Soil (ex situ), sediment (ex situ), ground water	TPH (coal tar and coal gasification wastes), dense nonaqueous phase liquids (DNAPL)	Not provided	50 samples per day	Site characterization	$12,855 to complete project and report	Results of the survey showed the area of DNAPL contamination	Conditions of interference affected the data	Dr. Al Bevolo (Ames Laboratory) 515/294-5414

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Immunoassay (continued)											
Kinsley Airport-Kinsley, KS: washing of pesticide application rigs	7	SDI (Envirogard)	Soil (ex situ)	Toxaphene	3 days	12 soil samples in 3 hours	Site screening, site characterization	$50 per sample exclusive of labor	Cost savings; portable; quick turnaround times; detection limits capable of meeting action levels	High percentage of false negative results when compared with results from confirmation laboratory	Keith Brown (Tetra Tech) 913/894-2600 Susan Stover (KDHE) 913/296-5531
Osage Metal-Kansas City, KS: metal salvage yard, recycling of car batteries and transformers	7	SDI	Soil (ex situ)	PCBs	5 months	50 samples	Cleanup monitoring, confirmation sampling, waste characterization	Not provided	Saved time; produced usable results	Unsure of specific detection limits of the test	Wood Ramsey (EPA) 913/551-7382
Roanoke Apartments-Kansas City, MO: gasoline service station with a leaking UST	7	SDI (D Tech)	Soil (ex situ), sediment (ex situ), ground water	TPH, LNAPL	Not provided	50 samples per day	Site characterization	$13,345 to complete project	Allowed definition of migration pathways	Not provided	Craig Kostyshyn (SDI) 215/860-5115 (contact obtained from Vendor FACTS database)
Whiteman AFB-MO: gasoline service station with a leaking UST	7	SDI (D Tech)	Soil (ex situ), sediment (ex situ), ground water	Fuel oil	Less than 1 month	50 samples per day	Site characterization	$22,981 to complete site characteriza-tion	Allowed straight-forward definition of 2 plumes confirmed by FID readings	Not provided	Craig Kostyshyn (SDI) 215/860-5115 (contact obtained from Vendor FACTS database)
Crows Landing-Patterson, CA: burn pit, landfill area	9	SDI (PETRO RISC™)	Ground water	TPH	2 weeks	10 samples in 2 hours	Site screening, site characterization	$194 for 4 tests; $400 per week for spectrophoto-meter	Cost-effective; easy to use; very portable; quick turnaround times	Test kit gave false negative results because fuel oil was degraded	Todd Bechtel (Tetra Tech) 303/295-1101

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Immunoassay (continued)											
Gila River Indian Reservation- Gila River Indian Community, AZ: storage, mixing, and application of pesticides	9	SDI	Soil (in situ)	Pesticides	3 months	1 sample every 20 minutes	Site screening, site characterization	$20 per sample	Faster method of collecting reliable data; easier to use (can develop a generic sampling plan); cheaper; quick, reliable data; real-time data; flexible for use in the field	Not provided	Carolyn Douglas (EPA) 415/744-2343
Hickam Air Force Base- Honolulu, HI: leaking UST site	9	SDI (EnviroGard)	Soil (ex situ)	TPH (JP-4 aviation fuel)	Less than 1 month	10 samples in 1 day	Site screening, site characterization	$18 per sample	Low rate of false positive results (one false positive result in 10 samples at a screening level of 1,000 ppm)	Not provided	Bryce Hataoka (Hawaii Department of Health)
McCormick and Baxter- Stockton, CA: wood treatment	9	SDI (RaPID® Assay)	Soil (ex situ)	Halogenated SVOCs (PCP), PAHs	10 days	233 samples	Site screening, site characterization	Not provided	Technology saved money by allowing reduction in the number of samples sent to the off-site lab	Not provided	Marie Lacey (EPA) 415/744-2236

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Immunoassay (continued)											
Navajo Nation Dip Vats Project- AZ: toxaphene dip vats	9	SDI (EnviroGard)	Soil (ex situ)	Pesticides (toxaphene)	Ongoing	1 sample every 20 minutes	Site screening, site characterization (technology demonstration)	$20 per sample	Good agreement with EPA Method 8081 (no false positive or negative results at 10-ppm level); faster method of collecting reliable data; easy to use cheaper; flexible for use in the field	Not provided	Carolyn Douglas (EPA) 415/744-2343 Stanley Edison (Navajo Nation) 520/871-6861
Naval Station, Treasure Island- San Francisco, CA: fire training area, fuel farms	9	SDI (PETRO RISC™, D Tech)	Soil (in situ), storm drain sediments	PCBs, BTEX, TPH (gas, diesel)	6 months	4 samples per hour	Site screening	$30 per test	Real-time data; able to delineate and verify contamination in the field	Need better concentration range; operator must be certified to use kit	Gina Kathuria (California Regional Water Quality Board) 510/286-4267
Naval Station Treasure Island- San Francisco, CA: leaking USTs and pipelines	9	SDI (PETRO RISC™ and PCB RISC™)	Soil (ex situ), ground water	BTEX, PCBs, PAHs	5 months	4 samples per hour	Site screening, site characterization	Not provided	Not provided	Degraded fuels, which lacked aromatics, gave 15 to 20% false negative results, compared with results from formal laboratory; PAH test kits not useful	Thorsten Anderson (Tetra Tech) 415/543-4880 Gina Kathuria (California Regional Water Quality Board) 510/286-4267
NCS Stockton-Stockton, CA: pesticide storage, leaking drums containing pesticides	9	SDI (EnviroGard and RISC™)	Soil (ex situ), ground water	Pesticides (Dichlorodi-phenyltrichloro-ethane [DDT])	2-3 weeks	4 samples per hour	Site screening, site characterization	Less than $50 per sample	Field screening data showed good correlation with independent laboratory data	TPH interference required dilution and affected detection limit; peat or bog samples gave poor extraction efficiency	Beth Kelley (Tetra Tech) 916/853-4523
Sanders Aviation- Tempe, AZ: crop duster activities	9	SDI	Soil (ex situ)	Pesticides	2 weeks	10 samples in 1 hour	Site screening, site characterization	Not provided	Real-time data; cost-effective; identification of hot spots	Must be careful about setting up and defining ranges	Tom Dunkelman (EPA) 415/744-2294

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Immunoassay (continued)											
Astoria Plywood-Astoria, OR: plywood mill operations	10	SDI (PETRO RISC™ and PCB RISC™)	Soil (ex situ)	PCBs, TPH	4 days	4 samples per hour	Site screening, site characterization	PCB-$38 per sample; TPH-$29 per sample; accessory kit rented for $550 per week	Data for soil samples screened with PCB test kits showed reasonable correlation with analytical laboratory data	Data for soil samples screened with TPH test kits showed poor correlation with data from analytical laboratory; possible matrix interference from presence of hydraulic oil having higher molecular chains	Joe Mollusky (Tetra Tech) 206/587-4650
Battery Recycling Plant-AK:	10	BioNebraska, Inc. (BiMelyze Mercury Assay)	Soil (ex situ), sludge	Heavy metals (mercury)	Not provided	48 samples per day	Not provided	$24 per sample	Operational mercury range up to 4,400 ppm for analysis of confirmation samples	Not provided	Mike Boykin (Ecology and Environment) 206/624-9537
Environmental Pacific Corp.-Amity, OR: abandoned battery recycling facility	10	BioNebraska, Inc. (BiMelyze(R) Mercury)	Soil (ex situ), ground water, dust, sludge, concrete residue	Heavy metals (mercury)	1 month	1-2 samples per hour	Site screening, compliance monitoring, verification sampling	Not provided	Cost-effective; real-time data; reproducible results	Not provided	Thor Cutler (EPA) 206/553-1673
Pacific Wood Treating-Ridge Field, WA: former wood treating facility	10	SDI (RaPID® Assay)	Soil (ex situ), ground water, surface water	SVOCs, PCBs, PAHs	1 month	1 sample every 2 hours	Site screening, site characterization, cleanup monitoring	Not provided	Quick turnaround, allowed for definition of extent of contamination; reduced analytical costs allowed for effective direction of field efforts	Not provided	Bill Langston (EPA) 206/553-1679 Mark Ader (EPA) 206/553-1808

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Immunoassay (continued)											
Reynolds Metal Co.-Troutdale, OR: aluminum reduction facility	10	SDI (RaPID® Assay)	Soil (ex situ), sediment (ex situ), ground water	PCBs, PAHs	3 months	51 samples per hour (after extraction and analysis in batches)	Site screening, cleanup monitoring, confirmation sampling	$20 per sample	Quick turnaround allowed for definition of extent of contamination; provided oversight of the potentially responsible party's data collection efforts	Cannot distinguish individual PCBs	Chris Field (EPA) 206/553-1674
Umatilla Army Depot-Hermiston, OR: explosives washout lagoon, OB/OD, small arms incinerator, explosives in ground water	10	SDI (RaPID® Assay, D-TECH)	Soil, ground water, composite residues	Military explosives (TNT, RDX, HMX)	15 months	10-30 samples per day	Site screening, cleanup monitoring, compliance monitoring	Not provided	Real-time data; lower cost compared with analytical laboratory; higher sampling density at same cost	Not provided	Harry Craig (EPA) 503/326-3689
Mercury Vapor Analyzer											
Dewey Daggett-MA: landfill	1	Jerome Meter (mercury vapor analyzer)	Air	Heavy metals (mercury)	8/30/95	Not provided	Cleanup monitoring	Not provided	Avoided downtime; data quality effective for determining final sampling locations; fast analysis	Not provided	Not provided
Truman-St. Joseph, MO: mercury spill	7	Jerome Meter (mercury vapor analyzer), Gillian pump™	Air	Heavy metals (mercury)	6/96-7/97	Not provided	Cleanup monitoring, confirmation sampling, health and safety monitoring	$60 per sample	Allowed for a real-time understanding of exposure; quick turnaround time on data	Learning curve associated with the operation of the technology; Gillian pumps™ did not work well if the pumps were not charged fully	Ken Rapplean (EPA) 913/551-7769
X-Ray Fluorescence											
Bristol Sandblasting-RI	1	TN Spectrace (Spectrace 9000)	Soil	Heavy metals (lead)	10/19/94	Not provided	Site characterization, cleanup monitoring	Not provided	Effective in guiding final sampling locations	Not provided	Dorrie Paar (EPA) 617/573-5768

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
X-Ray Fluorescence (continued)											
Brockton Gas-MA	1	Not provided	Soil	Heavy metals (lead)	Not provided	Not provided	Cleanup monitoring	Not provided	Not provided	Not provided	Dorrie Paar (EPA) 617/573-5768
Carroll Products-RI	1	Not provided	Soil, sludge	Heavy metals (lead)	Not provided	Not provided	Site characterization	Not provided	Not provided	Not provided	Bob Brackett (EPA) 617/573-5744
Cohen Property-MA	1	Not provided	Soil	Heavy metals (lead)	8/9/94	Not provided	Cleanup monitoring	Not provided	Not provided	Not provided	Janis Tsang (EPA) 617/573-5732
Finberg Field-MA	1	TN Spectrace (Spectrace 9000)	Soil	Heavy metals (lead)	6/8/95	Not provided	Site characterization	Not provided	Effective in guiding final sampling locations	Not provided	Frank Gardner (EPA) 617/573-5722
Goldfedders-CT	1	TN Spectrace (Spectrace 9000)	Soil	Heavy metals (lead)	3/20/95-8/18/95	Not provided	Cleanup monitoring	Not provided	Not provided	Not provided	Frank Gardner (EPA) 617/573-5722
Hatherway and Patterson-MA	1	Not provided	Soil	Heavy metals (lead)	Not provided	Not provided	Cleanup monitoring	Not provided	Not provided	Not provided	Lisa Danek (EPA) 617/573-5707
Kearsarge-NH	1	Not provided	Soil	Heavy metals (lead)	9/26/90-4/17/91	Not provided	Cleanup monitoring	Not provided	Not provided	Not provided	Dean Taglioferro (EPA) 617/263-5596
Lake Success Business Park, Remington Arms-Bedford, MA	1	Niton XL spectrum analyzer	Soil	Heavy metals (lead)	10/96-present	Not provided	Site characterization, cleanup monitoring	Not provided	Low cost; quick turnaround time for data; ease of use	Not provided	Stephanie Carr 617/573-5593 Niton, Inc. 800/875-1578
New Hampshire Plating Co.-Merrimack, NH: electroplating facility	1	Not provided	Soil (ex situ)	Heavy metals (cadmium)	1993	Not provided	Site characterization	Not provided	Not provided	Not provided	Dick Goehlevet (EPA) (617) 573-5742

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
X-Ray Fluorescence (continued)											
New Hampshire Plating Co.- Merrimack, NH: electroplating facility	1	Not provided	Soil	Heavy metals (lead)	6/93-6/94	Not provided	Cleanup monitoring	Not provided	Rapid analyses; low cost	Not provided	Jim DiLorenzo (EPA) 617/223-5510
Precision Chrome Plating Corporation- RI	1	TN Spectrace (Spectrace 9000)	Soil	Heavy metals (lead, chromium)	4/24/95	Not provided	Site characterization	Not provided	Effective in guiding selection of final sampling locations	Not provided	Dorrie Paar (EPA) 617/573-5768
RAE Battery- CT	1	TN Spectrace (Spectrace 9000)	Soil	Heavy metals (lead)	Not provided	Not provided	Cleanup monitoring	Not provided	Speed and less down time	Not provided	Lisa Danek (EPA) 617/573-5707
Raymark- CT	1	Not provided	Soil	Heavy metals (lead)	Not provided	Not provided	Site characterization	Not provided	Not provided	Not provided	Mike Jasinski (EPA) 617/573-5786
Shapiro Site- MA	1	TN Spectrace (Spectrace 9000)	Soil	Heavy metals	6/14/95	Not provided	Site characterization	Not provided	Effective in guiding selection of final sampling locations	Not provided	Dorrie Paar (EPA) 617/573-5768
Sparkling Fiber- NH	1	TN Spectrace (Spectrace 9000)	Soil	Heavy metals (lead)	Not provided	Not provided	Site characterization	Not provided	Effective in guiding selection of final sampling locations	Not provided	Dorrie Paar (EPA) 617/573-5768
Site unidentified- Stratford, CT	1	Not provided	Soil	Heavy metals (lead)	6/17/93	Not provided	Cleanup monitoring	Not provided	Not provided	Not provided	Mike Jasinski (EPA) 617/573-5786
Surrette Battery- NH	1	TN Spectrace (Spectrace 9000)	Soil	Heavy metals (lead)	4/2/95- 8/22/95	Not provided	Cleanup monitoring	Not provided	Effective in guiding selection of final sampling locations	Not provided	Frank Gardner (EPA) 617/573-5722
West Street Property- MA	1	TN Spectrace (Spectrace 9000)	Soil	Heavy metals (lead)	Not provided	Not provided	Site characterization	Not provided	Effective in guiding selection of final sampling locations	Not provided	Dorrie Paar (EPA) 617/573-5768

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
X-Ray Fluorescence (continued)											
Vega Baja Solid Waste Disposal Site-PR	2	TN Spectrace (model number not provided)	Soil (in situ), soil (ex situ)	Heavy metals	7 days	350 samples	Site characterization	$17 per sample	Effective use of time and resources, resulting in further cost savings; identification of hot spots	Research needed to determine how effective an analytical tool technology would be for non-screening purposes	Dennis Munhall (EPA) 212/637-4343 Juan Davila (EPA) 212/637-4341
Hebelka-Location not provided	3	Not provided	Soil (ex situ)	Heavy metals (lead)	2 months in 1992	Not provided	Not provided	Not provided	Not provided	Not provided	Fred MacMillian (EPA) 215/566-3201
Mid-Atlantic Wood Preserves-MD: wood treatment facility	3	Not provided	Soil (in situ)	Heavy metals (copper, chromium, arsenic)	Not provided	200 samples per 3 days	Cleanup monitoring	Not provided	Fast verification during response action; good correlation with lab samples	May want to use concentration range to allow flexibility in decision making	Eric Newman (EPA) 215/566-3237
Palmerton Zinc-Palmerton, PA: wall paint	3	Outokumpu Electronics and Princeton Gamma Tech	Solid walls	Heavy metals	6 months in 1991	200 hours	Site characterization	Not provided	Not provided	Penetration depth was limited	Fred MacMillan (EPA) 215/566-3201
Site unidentified-Location not provided: active manufacturing facility	3	TN Spectrace (Spectrace 6000)	Soil (ex situ)	Heavy metals (chromium, copper, nickel)	4 months	954 samples per 4 months	Cleanup monitoring	$146 per sample	Less expensive than off-site analysis; no waste generated; nondestructive method; real-time data; reduced cost of cleanup	Not provided	David Catherman (Environmental Resources Management, Inc.) 610/524-3500
Lockheed Martin Advanced Recorders-Sarasota, FL: ground-water and soil contamination	4	Not provided	Soil (ex situ)	Heavy metals	5 days	Not provided	Site characterization	Not provided	Not provided	Analysis of metals other than lead may be suspect	Wesley S. Hardegree (EPA) 404/562-0486
Old Citgo Refinery-Bossier City, LA: petroleum refinery operations	6	TN Spectrace (Spectrace 9000)	Soil (ex situ), sludge	Heavy metals (chromium, lead)	1 week	Collected and analyzed 200 to 300 samples	Site screening	Approxi-mately $4,000 per week	Time and cost savings	Not provided	Paul Dubois (Tetra Tech) 214/740-2012

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
X-Ray Fluorescence (continued)											
St. Charles Metal Finishing Company-St. Charles, MO: plating wastes	7	HNU Systems, Inc. (SEFA-P)	Soil (ex situ)	Heavy metals (lead and chromium)	5 days	10 samples per hour	Site characterization	$55,000 to purchase SEFA-P; rental charge of $2,000 for 2 weeks	Less expensive than off-site analysis; quick turnaround time; data used to guide investigation; can handle multiple analytes simultaneously; little sample preparation	Detection limits for chromium at least 200 milligrams per kilogram; instrument weighs 50 lbs and is not very portable; requires liquid nitrogen	Ruben McCullers (EPA) 913/551-7455
Tri-State-Jasper County, MO: airborne emissions deposited from smelter	7	Metorex (X-MET-880)	Soil (in situ), soil (ex situ)	Heavy metals	1 year	10,000 samples	Site screening, site characterization, cleanup monitoring, confirmation sampling	$10 to $20 per sample (exclusive of labor cost)	Real-time data to guide excavation; quick turnaround; portable	Equipment malfunctioned	Dave Williams (EPA) 913/551-7625
Site unidentified-Location not provided: 15 abandoned or inactive smelter sites	8	TN Spectrace (Spectrace 9000)	Soil (ex situ)	Heavy metals	Not provided	Not provided	Site characterization	Not provided	Rapid on-site data; inexpensive; little sample preparation; no solvent waste; can handle multiple analytes simultaneously	Not provided	Lawrence Kaelin (RF Weston) Steve Hawthorn (EPA) 303/312-6061
California Gulch Superfund Site-Leadville, CO: old mining and smelter operations	8	Metorex (X-MET 880)	Soil (ex situ)	Heavy metals (lead)	3 months	10 samples per hour; analyzed 3,700 soil samples	Site characterization	Not provided	Field-portable XRF data correlated well with CLP data; faster and less expensive than off-site analysis; data used to guide investigation; nondestructive method	Need to pulverize the quality control check sample instead of using loose soil	C.A. Kuharic and W.H. Cole (Lockheed Martin)

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
X-Ray Fluorescence (continued)											
China Lake NAWS-Ridgecrest, CA: laboratory wastes discharged to drainage ditches and lagoons	9	TN Spectrace (Spectrace 9000)	Soil (ex situ), soil (in situ), sediment (ex situ), sediment (in situ)	Heavy metals	1 month	12 samples per hour	Site characterization	Leased for $6,000 per month	Easy to use; portable; can perform in situ measurements; no solvent waste; provides rapid data; little sample preparation	High detection limits (200 mg/kg) for chromium; field portable XRF barium data did not compare well with confirmatory data	Bryce Smith or Scott Schulte (Tetra Tech) 913/894-2600
Concord Naval Weapons Station-Concord, CA: storage and distribution of military munitions	9	Not provided	Soil (ex situ)	Heavy metals	Fall 1995	30-50 samples per day (no preparation) 20 samples per day (with preparation)	Site characterization	Not provided	Quick screening of sites; identification of hot spots	Detection limits not low enough to meet ecological concerns; matrix interference; results only indicate surface conditions and therefore may not provide adequate information for remediation purposes	Barbara Smith (EPA) 415/744-2366
Defense Distribution Region West, Sharpe Depot-Lanthrop, CA: storage and distribution of military munitions	9	Not provided	Soil (ex situ)	Heavy metals	2 weeks	3 samples per hour	Site characterization	Not provided	Quick turnaround time; cheaper than use of CLP laboratory; good results	Data not comparable to laboratory data	John Guzman (Defense Logistics Agency) 209/982-2093 Mike Wolfram (EPA) 415/744-2410
Defense Distribution Region West-Location not provided	9	Not provided	Soil (in situ), soil (ex situ)	Heavy metals	Not provided	Not provided	Site characterization	Not provided	Can collect more samples per area because of cost savings; allows for identification of trends in the field; saves time and money	Lack of guidance on data validation procedures	Marlon Mezquita (EPA) 415/744-1527

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
X-Ray Fluorescence (continued)											
Mare Island Naval Shipyard-Vallejo, CA: naval submarine and ship repair, maintenance, and construction facility	9	TN Sprectrace (Spectrace 6000)	Soil (ex situ), sediment (ex situ)	Heavy metals	Ongoing	Not provided	Site characterization	Not provided	Rapid turnaround time; lower cost; flexibility in the field; consistent quality control, instead of inconsistencies that arise when various laboratories are used	Analytical biases for certain metals; difficulties in obtaining sufficiently low detection limits because of matrix interference	Tom Huetteman (EPA) 415/744-2384
Sacramento Army Depot-Sacramento, CA	9	Not provided	Soil (in situ), soil (ex situ)	Heavy metals	9 months	Not provided	Site characterization, cleanup monitoring	Not provided	Can collect more samples per area because of cost savings; allows for identification of trends in the field; saves time and money	Lack of guidance on data validation procedures	Marlon Mezquita (EPA) 415/744-1527
Verdese Carter Park-Oakland, CA: lead acid waste, disposal of batteries	9	Not provided	Soil (in situ), soil (ex situ), (paint and dust)	Heavy metals (lead)	2 years	50 samples per day	Site screening, site characterization, cleanup monitoring	Not provided	Saves time and money; non-destructive (therefore the same sample analyzed in the field can be analyzed in the laboratory)	No EPA Region 9 standard operating procedures	Mike Bellot (EPA) 415/744-2364 Loran Henning (EPA) 415/744-1305
McCarty's Pacific Hide and Fur-Pocatello, ID: metal salvaging yard and lead acid battery storage	10	Outokumpu Electronics	Soil (in situ)	Heavy metals (lead)	10 days	Not provided	Site screening, site characterization, cleanup monitoring, confirmation sampling	Not provided	Transportable; capable of screening 6 elements simultaneously; data correlated well with laboratory data	Not provided	Ann Williamson (EPA) 206/553-2739 Lorraine Edmond (EPA) 206/553-7366 David Frank (EPA) 206/553-4019

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
X-Ray Fluorescence (continued)											
Umatilla Army Depot-Hermiston, OR: explosives washout lagoon, OB/OD area, small arms incinerator, explosives in ground water	10	TN Spectrace (model number not provided)	Soil	Heavy metals (lead)	15 months	10-30 samples per day	Cleanup monitoring, compliance monitoring	Not provided	Real-time data; lower cost, compared with cost of using analytical laboratory; higher sampling density at same cost	Not provided	Harry Craig (EPA) 503/326-3399
Geophysical Technologies											
Bore-hole Geophysical											
Loring AFB-Limestone, Maine: fuel oil release area, blasting conducted to support recovery of fuel oil	1	Mala Geo-Sciences, Inc. (Terra Plus bore-hole GPR)	Soil (bedrock)	Bedrock stratigraphy	6/95-present	Not provided	Site characterization	Bore-hole radar $250,000	Produces "picture" of bedrock planes to 25-50 meter radius of the bore-hole	Not provided	Pete Haeni (United States Geological Survey [USGS] - Connecticut) 860/240-3299 Richard Willy (EPA) 617/573-9639
New Hampshire Plating Co.-Merrimack, NH: electroplating facility	1	Geonics Ltd. (EM-39 bore-hole electromagnetic induction unit used in conjunction with natural gamma log survey)	Soils (in situ), ground water	Electrical conductivity	1994	Continuous readout	Site characterization	$25,000 per unit	Technology delivered good results	Can be used only in open bore-holes/PVC with diameter > 2", (non-metallic wells)	Richard Willy (EPA) 617/573-9639 Thomas Mach (USGS) 603/226-7805
Letterkenny Army Depot-Letterkenny, PA	3	Geophex (bore-hole acoustic equipment)	Ground water	Depth to ground water	5/95-6/97	1 hole per day	Site characterization	$120,000 per unit	Produces superior data; produces picture of bedrock fractures; real-time data	Post-processing of data is expensive	Paul Stone (USACE) 717/261-6863

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Bore-hole Geophysical (continued)											
Limestone Rd.-Cumberland, MD: ground water contamination	3	USGS	Soil (bedrock)	Bedrock fracture identification, temperature	7/93	3 bore-holes per day	Site characterization	Not provided	Better understanding of ground-water flow	Bore-hole size and terrain may limit equipment	Andy Sochanski (EPA) 215/566-3370 Leslie Brunner (EPA) 215/566-3239 Dan Phelan (USGS) 410/828-1535
Direct-push Electrical Conductivity											
Salina North-Salina, KS: industrial area, solvent use and disposal, grain fumigation, chemical manufacturing	7	Geoprobe® Systems (Direct Image® soil conductivity logging system)	Soil (in situ)	Site subsurface lithology (to define subsurface geologic and hydrogeologic, conditions)	3 days	11 logs to 65 feet in 3 days	Site characterization	$14,000 per unit	Capable of identifying stratigraphic layers that conventional methods missed; very fast; less expensive than standard methods; no soil cuttings	Susceptible to operator error; experienced operator needed to calibrate and interpret logs	Curt Enos (Tetra Tech) 913/839-8515 Wes McCall (Geoprobe Systems, Inc.) 913/825-1842 Susan Stover (KDHE) 913/296-5531
Electromagnetic Induction											
Holtrachem-Location not provided	1	VLF Electromagnetic Survey equipment	Bedrock	Not provided	1994	Not provided	Site characterization	Not provided	Not provided	Not provided	Ernest Waterman (EPA) 617/223-5511
Bliss Ellisville-Wild Wood, MO: buried drums containing dioxin	7	Geonics, Limited (EM-31)	Soil (in situ)	Buried ferrous metal	2 months	7 acres	Site characterization	Not provided	Not provided	Overhead power lines caused interference	Wood Ramsey (EPA) 913/551-7382
Letterkenny Army Depot-Letterkenny, PA: landfill	3	Geophex (multifrequency conductivity instrument)	Soil (in situ)	Disposal trenches	6/97	12 acre site per week	Site characterization	$10,000 per acre	Quick turnaround time; ease of use, portable	Large metal objects can introduce noise	Paul Stone (USACE) 717/261-6863 Eric Powers (Geophex) 919/839-8515

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Ground Penetrating Radar											
Ciba-Geigy-Cranston, RI	1	Not provided	Till, bedrock	Structure contours	1991	Not provided	Site characterization	Not provided	Nonintrusive	Poor identification of buried utilities	Frank Battaglia (EPA) 617/573-5747
General Electric-Pittsfield, MA	1	Not provided	Till	Structure contours	1995-present	Not provided	Site characterization	Not provided	Nonintrusive	Not provided	Bryan Olsen (EPA) 617/573-5747
Gilson Road-Nashua, NH: former waste disposal site (1960-70s)	1	Not provided	Subsurface	Water table, bedrock stratigraphy	Not provided	Continuous profile	Site characterization	Not provided	Information pertaining to depth of water table and bedrock compared favorable with GFR data; produced a picture of the bedrock plane	Not provided	Thomas Mack (USGS, New Hampshire) 603/226-7805
Dupont-Newport-Newport, DE: contamination in riverbed	3	OceanSystems, Inc. (GPR with dual frequency sounding and side-scanning sonar)	Soil (in situ) (river bottom)	Sediment layers	Not provided	Continuous profile	Site characterization	Not provided	Focused sample location mapping	Fine grain analysis more expensive	Randy Sturgeon (EPA) 215/566-3227
Magnetometry											
Naval Air Engineering Station-Lakehurst, NJ	2	Geo-Centers, Inc. (Surface-Towed Ordnance Locating System [STOLS])	Soil (in situ)	Buried ferrous metals	Not provided	0.75 acre per hour	Site characterization	$8,600 per acre	Relatively quick survey of terrain	Limited by field conditions (mud, severe weather, foliage, and deeply located anomalies); equipment tends to underestimate number of targets compared with hand-held devices; signals from extraneous metals must be filtered out	Jeffrey Gatz (EPA) 212/637-4320 Greg Bury (Naval Air Engineering Station Lakehurst) 908/323-1014

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Magnetometry (continued)											
Bliss Ellisville-Wild Wood, MO: buried drums containing dioxin	7	Geonics Limited (proton magnetometer, G-856)	Soil (in situ)	Buried ferrous metal	2 months	7 acres	Site characterization	Not provided	Not provided	Overhead power lines caused interference	Wood Ramsey (EPA) 913/551-7382
Seismic Profiling											
Allegany Ballistics Laboratory-Rocket City, WV: TCE disposal pit, drum storage area	3	Resolution Resources, Inc. (three-dimensional seismic reflection technology)	Soil (in situ)	Bedrock stratigraphy	10/95-11/95	Not provided	Site characterization	Not provided	Cost-effective method for determining migration path for DNAPLs	Data return is very specific; trained technicians required	Jeff Kidwell (Navy Sea Systems Command) 757/322-4795
National Aeronautic and Space Administration (NASA) Kennedy Space Center-FL: former components cleaning facility for rocket parts	4	Resolution Resources, Inc. (three-dimensional seismic reflection technology)	Soil (in situ)	Soil type	12 days on site; 45 days for data assessment	2 months to sample and delineate seismic data for a 1,500' x 1,500' area	Site characterization	$150,000 to develop subsurface, high resolution model	Very detailed image of soil stratigraphy that aids in the placement of wells; defines fractures within one foot	Removal of vegetation required	Jacqueline Quinn (NASA) 407/867-4265
Former Vickers Site-Omaha, NE: hydraulic pump facility	7	Resolution Resources, Inc. (three-dimensional seismic reflection technology)	Soil (in situ)	Depth to ground water, bedrock stratigraphy	5/12-5/20/97	62,000 sq ft per day	Site characterization, cleanup monitoring	$100,000 per 500,000 sq ft	Portable unit; identified fractures in bedrock	Not provided	Paul Broomer (Unisys) 612/687-2673 Mike Westerheiw 612/687-2887
Naval Air Station Alameda-Alameda, CA: aircraft support operations	9	Resolution Resources, Inc. (three-dimensional seismic reflection technology)	Soil (in situ) (sediments, bedrock)	Bedrock stratigraphy	11/96-10 days	Not provided	Site screening	Not provided	Noninvasive; real-time; cost-effective; easy to use	Equipment requires direct contact with ground, which presents a problem in buildings; data require interpretation	Ken Speilman (Navy EFA West) 415/244-2539

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Seismic Profiling (continued)											
Lawrence Livermore National Laboratory-Livermore, CA: landfills, disposal pits, spills	9	EG&G, Inc. (Innovative Transducers)	Sediment, ground water	Depth to ground water, soil type, bedrock stratigraphy	1992-present	Not provided	Site characterization, cleanup monitoring	$150,000 per unit	Rapid data collection; provides opportunity to properly design and install remedial system and determine migration pathways for contaminants	Works best where water table is shallow	Robert Bainer (Lawrence Livermore National Laboratory) 510/422-4635
Lawrence Livermore National Laboratory-Livermore, CA	9	Resolution Resources, Inc. (three-dimensional seismic reflection technology)	Sediments, bedrock	Subsurface stratigraphy (structure)	1-2 weeks	Not provided	Site characterization	Not provided	Information can be used to determine likely migration pathways	Not provided	Robert Bainer (Lawrence Livermore National Laboratory) 510/422-4635 Mary-Linda Adams (Resolution Resources) 540/349-9172 or 517/647-1832
Naval Air Station North Island-San Diego, CA: chemical waste dumping site	9	Resolution Resources, Inc. (three-dimensional seismic reflection technology)	Soil (in situ)	Bedrock stratigraphy	2 months	Not provided	Site characterization	$250,000 for 40-acre site	Cost-effective method of obtaining detailed on-site stratigraphy, using minimal preexisting bore-hole data; able to identify fault zones (contaminant migration pathways), saving several months in field exploration	Not provided	Bill Collins (NAVFACSW-DIV) 619/556-8929

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Seismic Profiling (continued)											
Stringfellow hazardous waste site-Riverside, CA: Former hazardous waste landfill (1956-1972)	9	Resolution Resources, Inc. (three-dimensional seismic reflection technology)	Soil (in-situ)	Bedrock stratigraphy, fractures	1/97-6/97	11 acres (7,800 data points) per 30 days	Site characterization	Not provided	Used to locate groundwater extraction wells, minimizing drilling costs	Metal objects on surface (fence) caused interference, but did not prohibit use of equipment	Stewart Black (URS Greiner, Inc.) 916/929-2346
Radionuclide Technologies											
Gamma Radiation Detector											
Site unidentified-Texas City, TX: abandoned tin smelter facility	6	Ludlum, Inc. (Model 19 with a sodium iodide scintillation detector)	Soil (in situ), sediment (in situ)	Radionuclides	Not provided	Not provided	Site characterization	Not provided	Rapid, real-time data; portable system; data compared favorably with laboratory data; less expensive	Not provided	Warren Zehner (EPA) 281/983-2127 Joe Cornelius (E&E)
Ramp Industries Removal Action - Denver, CO: radioactive and mixed waste processor, transfer station, abandoned material at site, spills	8	Canberra (gamma spectrography)	Liquid waste (drummed)	Radionuclides	2.5 months	Not provided	Waste characterization	$900 per wk rental, inspector at $370 per wk	Identifies waste in the field before shipping and disposal	Expensive; requires trained operator; sensitive to power fluctuations; requires liquid nitrogen; needs protection from elements	Dave Christenson (EPA) 303/312-6645 Dave Hall (SEG) 423/376-8246
Naval Air Station Alameda, Hunters Point Annex-Oakland, CA	9	EG&G ORTEC (Micro Nomad)	Soil (in situ)	Radionuclides	9/95-11/95	Not provided	Site characterization	$750 per week (minus laptop)	Ease of use; portability; much cheaper than conventional methods	Not provided	Kevin Taylor (Tetra Tech) 404/225-5505

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Passive Alpha Detector											
Area 11B at the Nevada Test Site-Mercury, NV	9	Rad Electric, Inc. (electric ionization chambers and alpha track detectors made by Landuer, Inc.)	Soil (in situ)	Radionuclides, (uranium)	Not provided	Not provided	Site characterization, health and safety monitoring	$25 per sample	Alpha track detectors have fewer potential interferences than electric ionization chamber; both techniques are fast, easy to use, and inexpensive	Not provided	C.S. Dudney and K.E. Meyer (Oak Ridge National Laboratory)
Sampling and Sampler Emplacement Technologies											
Closed-piston Soil Sampling											
Salina North-Salina, KS: industrial area, solvent use and disposal, grain fumigation, chemical manufacturing	7	Geoprobe Systems, Inc. (Marco-Core® closed piston soil sampler)	Soil (ex situ)	Not provided	2 days	Not provided	Site characterization	$630 per unit	Can retrieve intact soil cores from below the water table (saturated materials); no cuttings; faster and less expensive than conventional drill rig	The sampler is designed for use only in soils and unconsolidated sediments; it generally is used at depths of less than 50 feet; if used for discrete interval sampling at depth, the bore hole must be preprobed to the top of the targeted sampling interval	Wes McCall (Geoprobe Systems Inc.) 913/825-1842 Susan Stover (KDHE) 913/296-5531
Direct-push Prepacked Well Screen											
Salina North-Salina, KS: industrial area, solvent use and disposal, grain fumigation, chemical manufacturing	7	Geoprobe (direct-push prepacked-screen monitoring well)	Ground water	Halogenated and nonhalogenated VOCs	1 week	3 hours to install one prepacked well to 65 feet	Site characterization, compliance monitoring	$45 per 3-foot prepacked screen	Less expensive and faster than installing well by conventional methods; no soil cuttings	Depth limitations; wells cannot be placed in bedrock; small diameter of well creates difficulty in developing, purging, and sampling when large volumes of water are needed	Wes McCall (Geoprobe Systems Inc. 913/825-1842 Susan Stover (KDHE) 913/296-5531

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Low-flow Ground-water Pumping											
Auburn Road- NH: landfill	1	Not provided	Ground water	VOCs, heavy metals	4/95-4/96	Not provided	Cleanup monitoring	Not provided	Samples for inorganic water quality are more representative	Longer sampling time, increasing cost	Darryl Luce (EPA) 617/573-5767
Davis GSR- RI	1	Not provided	Ground water	VOCs, SVOCs, heavy metals	4/93-8/93	Not provided	Cleanup monitoring	Not provided	Samples for inorganic water quality are more representative	Not provided	Joe Lemay (EPA) 617/573-9622
Fort Devens- MA	1	Not provided	Ground water	VOCs, heavy metals	1/96-present	Not provided	Cleanup monitoring	Not provided	Fewer waste by-products; data quality	Not provided	Jim Byrne (EPA) 617/573-5799
Otis AFB- MA	1	Not provided	Ground water	VOCs, heavy metals	1993-present	Not provided	Cleanup monitoring	Not provided	Fewer waste by-products; data quality	Not provided	Carol Keating (EPA) 617/223-5594
Peterson/Puritan- RI	1	Not provided	Ground water	VOCs, heavy metals	5/95-present	Not provided	Cleanup monitoring	Not provided	Fewer waste by-products; data quality	Not provided	Dave Newton (EPA) 617/573-9612
Revere Textile- CT	1	Not provided	Ground water	VOCs, heavy metals	1993-present	Not provided	Cleanup monitoring	Not provided	Fewer waste by-products; data quality	Not provided	Leslie McVickar (EPA) 617/573-9689
Saco Land Fill- ME	1	Not provided	Ground water	Heavy metals	1992-1993	Not provided	Cleanup monitoring	Not provided	Fewer waste by-products; data quality	Not provided	Ron Jennings (EPA) 617/573-5794
Tibbetts- NH	1	Not provided	Ground water	VOCs, heavy metals	6/95-present	Not provided	Cleanup monitoring	Not provided	Fewer waste by-products; data quality	Longer sampling time, increasing costs	Darryl Luce (EPA) 617/573-5767
Ponders Corner (Lakewood)- South of Tacoma, WA: drycleaning and laundry operations	10	Brainard-Kilman	Ground water	Halogenated VOCs	7 days	Not provided	Site screening, site characterization, cleanup monitoring	Not provided	Minimizes sucking of soil and sediments into sampler	Not provided	Ann Williamson (EPA) 206/553-2739

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Soil Gas Sampling											
Site unidentified- eastern United States: former coal gas manufacturing plant	Not specified	W.L. Gore and Associates (GORE-SORBER[SM])	Soil gas (also used to monitor soil and ground water)	PAHs, SVOCs	Exposure time of 3 weeks	Not provided	Site characterization	Not provided	Low-volatility compounds can be absorbed; can be used in situ; cost savings; good correlation with monitoring well data	Not provided	Mark Stutman and Mark Wrigley (W.L. Gore and Associates) 410/996-3406
Davis GSR - Smithfield, RI: landfill	1	Not provided	Soil gas	VOCs	4/92-8/92	Not provided	Site investigation	Not provided	Cost-effective; real-time data	Not provided	Joe Lemay (EPA) 617/573-9622
Sothersworth - NH: landfill	1	Petrex	Soil gas	VOCs	Not provided	Not provided	Cleanup monitoring	Not provided	Not provided	Not provided	Roger Duwart (EPA) 617/573-9628
Site unidentified- Location not provided	7	Not provided (Summa Canister)	Soil gas	VOCs (solvents)	Not provided	Not provided	Site characterization, cleanup monitoring, compliance monitoring, health and safety monitoring	$658 per canister	Easy to collect a sample; portable system	Not provided	Harry Kimball (EPA) 913/551-5171
Sacramento Army Depot- Sacramento, CA	9	SEAMIST (equipment used in conjunction with soil gas monitoring wells)	Soil gas	Halogenated VOCs (TCE, PCE)	9 months	50 samples per well, 6 wells per day	Verification sampling	$30,000 per well	Independent verification; versatility of application (can sample the ports desired); retractable (could move the wells)	Must customize technology to the site's lithology	Marlon Mezquita (EPA) 415/744-1527
Vertical Ground-water Profiling											
Pease AFB 3- NH	1	Waterloo Centre for Groundwater Research	Ground water	DNAPL	1/95-9/95	Not provided	Cleanup monitoring	Not provided	Vertical delineation of contaminants	Not provided	Mire Daly (EPA) 617/573-5783

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Vertical Ground-water Profiling (continued)											
Savage-NH	1	Waterloo Centre for Groundwater Research	Ground water	DNAPL	3/95-5/95	Not provided	Cleanup monitoring	$350, 000	Vertical delineation of contaminants	Not provided	Dick Goehlert (EPA) 617/573-5742
Wells G&H 1-MA	1	Waterloo Centre for Groundwater Research	Ground water	Not provided	8/94	Not provided	Cleanup monitoring	Not provided	Discrete fracture ground water samples	Not provided	Mary Garren (EPA) 617/573-9613
Sacramento Army Depot-Sacramento, CA	9	Not provided (BAT Probe)	Ground water	Halogenated VOCs	6 months	Not provided	Site characterization	Not provided	Cost-effective; enables vertical profiling; can target monitoring well zones; enables tracking of plume boundaries	Problems with data comparability; difficult to model migration of TCE	Marlon Mezquita (EPA) 415/744-1527
Vibrating Well Installation											
Town Garage/Radio Beacon-NH	1	Solinst, Inc. (Ground-water Packer) Mykro Waters, Inc. (Microwells)	Ground water	VOCs	1/91-7/97	Not provided	Cleanup monitoring	Not Provided	Discrete fracture ground water samples	Not provided	Jim Di Lorenzon (EPA) 617/223-5510
Yaworski-CT	1	Mykro Waters, Inc. (Microwells)	Ground water	VOCs (benzene)	9/97-present	Not provided	Cleanup monitoring	Not provided	Lower cost, rapid installation	Not provided	Anni Loughlin (EPA) 617/223-5575
Fletcher's Paint-NH	1	Mykro Waters, Inc. (Microwells)	Ground water	VOCs, inorganics	9/94	Not provided	Cleanup monitoring	$1,000 per well	Lower cost, rapid installation	Not provided	Darryl Luce (EPA) 617/573-5767
Gallops Quarry-CT	1	Mykro Waters, Inc. (Microwells)	Ground water	VOCs, inorganics	9/94	Not provided	Cleanup monitoring	Not provided	Lower cost, rapid installation	Not provided	Leslie McVickar (EPA) 617/573-9689
New Hampshire Plating-NH	1	Mykro Waters, Inc. (Microwells)	Ground water	VOCs, SVOCs, inorganics	6/93-6/94	Not provided	Cleanup monitoring	Not provided	Lower cost, rapid installation	Not provided	Jim Di Lorenzo (EPA) 617/223-5510

Table 2-3
Summary of Field Analytical and Site Characterization Technologies
Reported Data on Specific Technologies (continued)

Site Description	EPA Region	Vendor/ Product	Media Monitored	Contaminant/ Parameter	Period of Use	Through-put	Data Use(s)	Cost	Technology Advantages	Technology Limitations	Contact(s)
Vibrating Well Installation (continued)											
Hastings Superfund Site- NE: landfill, contaminated ground water	7	Mykro Waters, Inc. (Microwells)	Ground water, soil	VOCs	6/97	Up to 2000 feet of well per day	Site characterization, cleanup monitoring	Not provided	Wells can be installed to approximately 100' without pilot hole and 200' with pilot hole; generates no drill cuttings; equipment can fit into tight spaces	Equipment overheats frequently; well screens clog easily in clay and other fine materials; requires welding 20' sections	Diane Easley (EPA) 913/551-7797 Randell Ross (ADA) 405/436-8611

APPENDIX A

LIST OF ACRONYMS

LIST OF ACRONYMS

AFB	Air Force Base
BTEX	Benzene, toluene, ethylbenzene, and xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	EPA Contract Laboratory Program
CLU-IN	Clean-Up Information (Internet home page containing clean-up information)
CPT	Cone penetrometer testing
CSCT	Consortium for Site Characterization Technologies
DDT	Dichlorodiphenyltrichloroethane
DNAPL	Dense nonaqueous phase liquids
EPA	U.S. Environmental Protection Agency
FTIR	Fourier-transformed infrared
GC	Gas chromatography
GC/MS	Gas chromatography/mass spectroscopy
GPR	Ground penetrating radar
HMX	Cyclotetramethylenetetranitramine
IDW	Investigation-derived waste
LIF	Laser-induced fluorescence
LNAPL	Light nonaqueous phase liquids
MCL	Maximum contaminant level
mg/kg	Milligrams per kilogram
NERL-LV	EPA National Environmental Research Laboratory-Las Vegas
NPL	National Priorities List (CERCLA)
NRaD	Navy Research and Development
OB/OD	Open burn/open detonation
OSC	On-scene coordinator
OSW	EPA Office of Solid Waste
PAH	Polycyclic aromatic hydrocarbon
PCE	Pentachloroethane
PCP	Pentachlorophenol
PCB	Polychlorinated biphenyl
ppb	Parts per billion
ppm	Parts per million
QA/QC	Quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RDX	Cyclo-1,3,5-trimethylene-2,4,6-trinitramine
RPM	EPA Remedial Project Manager
SCAPS	Site Characterization and Analysis Penetrometer System
SVE	Soil vapor extraction
SVOC	Semivolatile organic compound
TCE	Trichlorethylene
TIO	EPA Technology Innovation Office
TNT	Trinitrotoluene
TPH	Total petroleum hydrocarbons
USACE	U.S. Army Corps of Engineers
UST	Underground storage tank
Vendor FACTS	Vendor Field Analytical and Characterization Technologies System
VOC	Volatile organic compound
XRF	X-ray fluorescence

APPENDIX B

DATA COLLECTION METHODOLOGY

DATA COLLECTION METHODOLOGY

Two methods were used to compile information for this report:

- A network of regional contacts for field analytical and site characterization technologies was used to obtain information from the Environmental Protection Agency remedial project managers (RPM), on-scene coordinators (OSC), site managers, and other project managers who are closely involved in the use of site characterization technologies.

- Available files, reports, and other sources, such as the Vendor Field Analytical and Characterization Technologies System (Vendor FACTS) database, that contain information about field analytical and site characterization technology applications at EPA-lead and non-EPA-lead hazardous waste sites were reviewed.

To expedite that process, EPA developed a form for gathering relevant information about the use of field analytical and characterization technologies at Superfund, Resource Conservation and Recovery Act, and federal facilities sites. The form, included in this appendix, was distributed to all EPA regions.

The data collection form had three parts; generally, 10 to 20 minutes were required for its completion. Part 1 of the collection form requested general information about the individual who completed the form, to provide a reference or contact familiar with the application of the technology at a particular site. Part 2 of the form requested general information about the site. Part 3 of the form requested data about the technology and the application of the technology at the site. Requested specifically in Part 3 were: (1) the type of technology used, (2) the type of data produced and how the data were used at the site, (3) the medium characterized and monitoring targets, and (4) information about costs. In addition, Part 3 of the form inquired about the performance of the technology at the site (advantages and limitations) and the presence of independent verification of performance (such as a comparison of data produced in the field with those obtained by analysis of samples at an off-site laboratory).

Status Report on Field Analytical Technologies Utilization

EPA's Office of Solid Waste and Emergency Response is compiling an inventory of sites where field portable, analytical and site characterization technologies have been used. The purpose of this project is to support a broader use of new monitoring techniques that are capable of streamlining the site assessment and remediation processes. This effort will result in a product which will improve the capability for networking between project managers tasked with site assessment and remediation. The report will be similar to EPA's *Innovative Treatment Technologies: Annual Status Report* that describes applications of new technologies at hazardous waste sites.

In order to compile information for this new report on field analytical and characterization technologies, EPA's Technology Innovation Office (TIO) is interviewing site managers who are closely involved in the use of site characterization technologies at contaminated sites. To expedite this process, TIO has developed a data collection form that is included in this package of information. Regional Project Managers (RPMs) and On-Scene Coordinators (OSCs) should use the form to provide relevant information about the demonstration of field analytical technologies at Superfund projects. In addition, TIO will use the form to collect information from other project managers on technologies used at Resource Conservation and Recovery Act (RCRA), underground storage tanks (UST) and federal facility sites and projects.

The blank data collection form contains three parts and generally requires 10 to 20 minutes to complete. *Part 1* of the collection form requests general information about the individual who is completing the form. Its purpose is to provide a reference or contact concerning the application of the technology at a particular site. *Part 2* of the form requests some general data about the site at which the application of the technology occurred. *Part 3* of the form requests data about the technology and application of the technology at the site. Specifically, *Part 3* of the form identifies: the type of technology used; its vendor; the type of data produced and how it was used at the site; the media characterized and monitoring targets; and cost information. In addition, *Part 3* of the form inquires about the performance of the technology at the site, any interferences noted, and references, such as a removal assessment or remedial investigation report, that may describe an independent verification of the technology's performance (such as the comparison of data produced in the field to that obtained by analysis of samples at an off-site laboratory).

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

FIELD ANALYTICAL AND CHARACTERIZATION TECHNOLOGIES
ANNUAL STATUS REPORT

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DATA COLLECTION FORM

JUNE 1996

FIELD ANALYTICAL & CHARACTERIZATION TECHNOLOGIES DATA COLLECTION FORM

PART 1: GENERAL INFORMATION

1. Name ____________
2. Organization ____________
3. Phone ( ) ______-______ Ext. ______
4. Fax Number ( ) ______-______
5. E-mail Address ____________
6. **Additional Contact(s).** Please list any other individuals who may be familiar with the application of the field analytical or characterization technology at this site.

   Name ____________ Phone ( ) ____-____

   Name ____________ Phone ( ) ____-____

PART 2: SITE INFORMATION

1. Site Name ____________
2. Region ____ State ____________ City ____________
3. **Site Type or Waste Source.** Describe the historic activity and/or source (such as a landfill or surface impoundment) that caused contamination at the site.

____

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4. **Regulatory Status/Statute/Organization of Site.** Please describe the regulatory status of the site. For example, is the site a RCRA treatment, storage, or disposal facility (TSDF) subject to corrective action? *Please check all that may apply.*

- ☐ CERCLA
- ☐ RCRA Corrective Action (RCRA Subtitle C)
- ☐ UST Corrective Action (RCRA Subtitle I)
- ☐ TSCA
- ☐ Safe Drinking Water Act
- ☐ State (specify) ____________
- ☐ DoD
- ☐ DOE
- ☐ Other (specify) ____________
- ☐ Not Applicable

Site Name/Technology ______________________________

PART 3: TECHNOLOGY DESCRIPTION

1. Technology or Trade Name. ______________________________

____

2. **Technology Type.** *Please check all that apply.*

Analytical

- ☐ Air Measurement (Weather Measurement Technologies Excluded)
- ☐ Analytical Detectors (Stand Alone Only)
- ☐ Biosensors
- ☐ Chemical Reaction-Based Indicators (Colormetric)
- ☐ In situ Chemical Sensors
- ☐ Fiber Optic Chemical Sensors and Analyzers
- ☐ Gas Chromatography (GC)
- ☐ Other Chromatography
- ☐ Mass Spectrometry (MS) (May include GC/MS)
- ☐ Ion Mobility Spectroscopy
- ☐ Other Spectroscopy Techniques
- ☐ Immunoassays
- ☐ Soil Gas Analyzers
- ☐ X-Ray Fluorescence Analyzers
- ☐ Electrochemical-based Detectors
- ☐ Thermal Desorption Devices
- ☐ Other: ______________________________

Geophysical

- ☐ In situ Physical Sensors
- ☐ Ground Penetrating Radar
- ☐ Shallow Seismic Reflection/Refraction
- ☐ Subsurface Resistivity Geophysical Instruments (including cone penetrometer)
- ☐ Subsurface Conductivity Geophysical Instruments
- ☐ Subsurface Magnetrometry Geophysical Instruments

Extraction

- ☐ Extraction Technologies (Analytical Traps)
- ☐ Supercritical Fluid Extraction

Other Sampling Technology

- ☐ Air Sampling Technologies
- ☐ Water Sampling Technologies
- ☐ Soil Sampling Technologies

Other: ______________________________

3. **Vendor Name.** Please provide the name of the manufacturer of the technology or equipment used at the site.

____

(**Note:** Questions 4 through 9 may be answered by including a vendor or manufacturer's fact sheet or sales brochure with the completed form)

☛ (For PRC only) Check to see if vendor is listed on Vendor FACTS: ☐ Yes ☐ No

Site Name/Technology ____________________

4. Vendor Address ____

____

City ____________________ State ____________________ Zip Code ____________

5. Vendor Phone Number (   ) ______ - ______

6. **Technology Description.** Provide a brief description of the monitoring/measurement device or technology, including scientific principles on which the technology is based; key steps; unique or innovative features; whether the full-scale system is continuous, on demand, or single measurement; and whether the technology is transportable, portable, or in situ.

____

____

____

7. **Data Type.** What type of data does the technology produce? *Please check all that apply.*

- ☐ Qualitative (yes/no, absence or presence)
- ☐ Quantitative (specific number)
- ☐ Semi-quantitative (measurement within range)

8. **Use of Data Produced By the Technology.** At this site, identify how the data produced by the technology was used?

- ☐ Screening
- ☐ Cleanup monitoring or verification sample analysis
- ☐ Compliance monitoring
- ☐ Risk assessment
- ☐ Enforcement
- ☐ Site characterization
- ☐ Other: ____

9. **Sample Throughput/Measurement Frequency.** Please indicate the sample throughput (that is, how long it takes to generate a useable data point). Throughput is measured by the total time required to obtain the data divided by the total number of data points.

Units

____ per hour ____ per ft^2 ____ per linear ft ____ per acre ____ continuous readout

☐ Other specify ____

10. Time Period Technology Used. Identify how long the technology or equipment was used at the site.

Number of months/days ______________ or From: ________ To: ________

11. Media Monitored or Characterized. Identify all media in which the technology for monitoring or measurement was used.

- ☐ Soil (in situ)
- ☐ Soil (ex situ)
- ☐ Sludge
- ☐ Solid (for example, slag, rock)
- ☐ Sediment (in-situ)
- ☐ Sediment (ex situ)
- ☐ Light Non-aqueous Phase Liquids (NAPLs)
- ☐ Dense Non-aqueous Phase Liquids (DNAPLs)
- ☐ Groundwater
- ☐ Soil gas
- ☐ Surface water
- ☐ Leachate
- ☐ Air particulates
- ☐ Other (specify) ______________

12. Monitoring Targets. *Please check all that apply.* Identify all the contaminants that have been monitored or measured by the technology at the site.

Chemical	Monitoring Target
☐	Halogenated volatiles
☐	Halogenated semivolatiles
☐	Nonhalogenated volatiles
☐	Nonhalogenated semivolatiles
☐	Organic pesticides/herbicides
☐	Dioxins/furans
☐	PCBs
☐	Polynuclear aromatics (PNA)
☐	Solvents
☐	Benzene-toluene-ethyl benzene-xylene (BTEX)
☐	Acetonitrile (organic cyanide)
☐	Organic acids
☐	Heavy metals
☐	Nonmetallic toxic elements
☐	Radioactive metals
☐	Radionuclides
☐	Asbestos
☐	Inorganic cyanides
☐	Inorganic corrosives

Physical	Monitoring Target
☐	Water Table
☐	Soil Types
☐	Bedrock Stratigraphy
☐	Resistivity
☐	Conductivity
☐	Buried Ferrous Materials
☐	Buried Non Ferrous Materials
☐	Soil Moisture
☐	Temperature
☐	Other (specify) ______________

Miscellaneous

☐	Explosives/propellants
☐	Organometallic pesticides/herbicides
☐	Radon
☐	Other (specify) ______________

13. Discussion of the Technology. Describe the benefits, accomplishments, or advantages obtained by using this technology at the site. (For example, cost effectiveness, quick turn-around time in obtaining data, portability, or ease-of-use).

____

____

____

____

14. Cost of Using The Technology.

a. Who operated the equipment/technology?

❒ Vendor ❒ Respondent Other (explain) ______________________

b. Are there any cost data available? (For example, can you explain the cost of using the technology in terms of the purchase of equipment, rental costs, or cost per sample).

____

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____

c. At this site or project, were there any specific factors affecting the cost of using the equipment or technology (such as, labor rates, calibration time, other equipment needed, depth to contamination, interferences, or access to power)?

____

____

____

____

15. Independent Verification of Technology Performance. During this project, was there independent verification of the results produced by this technology?

❒ Yes ❒ No ❒ Unknown

a. If the answer to question 13 is yes, is there a report(s) that documents the verification of the results and how may the report be obtained?

____

____

____

____

____

____

16. **General Comments.** Please provide any other general comments concerning the use or performance of the technology (such as, discussion of any technical limitations, site conditions, contaminants, or other interferences encountered when using the technology at this site, or lessons learned from applying the technology at this site). Please also indicate if you were satisfied or dissatisfied with the performance of the technology and technical support of the vendor.

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____

17. **Additional Information.** The following information will not be included the Annual Status Report summarizing information on field analytical and characterization technologies, but may provide important additional information concerning future efforts to evaluate or assess the use of field analytical and characterization technologies.

Benefit of a More Detailed Case Study. Indicate whether the technology would benefit from additional study or evaluation to verify its performance (such as that which may be provided by a detailed case study).

❐ Yes ❐ No Comments: ____________________

____

Participation in Further Analysis of The Technology. Please indicate if you would be interested in participating or contributing to further evaluation of the technology.

❐ Yes ❐ No

Additional Data on Field Analytical and Characterization Technologies. Identify any additional field analytical and characterization technologies on which you are interested in obtaining useful data.

____

____

____

APPENDIX C

VENDOR FIELD ANALYTICAL AND CHARACTERIZATION TECHNOLOGIES SYSTEM DATABASE

VENDOR FACTS

The Vendor Field Analytical and Characterization Technologies System (Vendor FACTS) is a Windows™-based database of innovative measuring and monitoring technologies for site characterization. It is a searchable database that allows users to: (1) obtain information about innovative measurement and monitoring technologies for use in the field; (2) search the database to identify technologies that measure or monitor specific types of contaminants or specific media; (3) identify technologies that are used for analytical measurement, physical characterization, site mapping, or health and safety monitoring; (4) identify vendors by technology or trade name; (5) view cost and performance data for a technology, reported by project; (6) scroll through a vendor's information record page by page, using menu selections; and (7) print or download to a file the results of custom searches and system reports.

To access Vendor FACTS, the user first must select one of the following search categories:

General Vendor Information	**Project Data**
Vendor Name	Site Name
Technology Type	Site Location
Trade Name	Regulation/Statute
Media	Project Type
Monitoring Targets	Equipment Scale
Waste Source	Contaminant Type
Technology Maturity	
Intended Use	
Data Quality Use	

A menu of vendor information will appear. The user then can select one of the following information options:

- Company Profile
- Technology Profile
- Technical References
- Technology Description
- Operation and Maintenance
- Cost and Licensing
- Monitoring Targets
- Conditions Affecting Performance
- Data Collected
- Representative Projects

To become a registered user, mail or fax your name, organization, address, and telephone number to the address below. Please indicate whether you wish to order the Vendor FACTS software or to register as a Vendor FACTS user.

U.S. EPA/NCEPI
PO Box 42419
Cincinnati, OH 45242-0419
Facsimile: (513) 489-8695