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Office of Research and Development
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The Superfund Innovative Technology Evaluation Program

Annual Report to Congress
FY 1999

SITE
SUPERFUND INNOVATIVE
TECHNOLOGY EVALUATION

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Notice

The U.S. Environmental Protection Agency through its Office of Research and Development partially funded and collaborated in the research described here under contract 68-C5-0037 to Tetra Tech EMI and 68-C5-0036 to Science Applications International Corporation. It has been subjected to the Agency's peer and administrative review and has been approved for publication as an EPA document. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Foreword

The U.S. Environmental Protection Agency is charged by Congress with protecting the Nation's land, air, and water resources.iii Under a mandate of national environmental laws, the Agency strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. To meet this mandate, EPA's research program is providing data and technical support for solving environmental problems today and building a science knowledge base necessary to manage our ecological resources wisely, understand how pollutants affect our health, and prevent or reduce environmental risks in the future.

The National Risk Management Research Laboratory is the Agency's center for investigation of technological and management approaches for reducing risks from threats to human health and the environment. The focus of the Laboratory's research program is on methods for the prevention and control of pollution to air, land, water and subsurface resources; protection of water quality in public water systems; remediation of contaminated sites and ground water; and prevention and control of indoor air pollution. The goal of this research effort is to catalyze development and implementation of innovative, cost-effective environmental technologies; develop scientific and engineering information needed by EPA to support regulatory and policy decisions; and provide technical support and information transfer to ensure effective implementation of environmental regulations and strategies.

This publication has been produced as part of the Laboratory's strategic long-term research plan. It is published and made available by EPA's Office of Research and Development to assist the user community and to link researchers with their clients.

E. Timothy Oppelt, Director
National Risk Management Research Laboratory

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Executive Summary

The Superfund Innovative Technology Evaluation (SITE) Program has successfully promoted the development, commercialization and implementation of innovative hazardous waste treatment technologies for more than 14 years. SITE offers a mechanism for conducting joint technology demonstration and evaluation projects at hazardous waste sites involving the private sector, EPA, and other federal and state agencies. The program provides environmental decision-makers with relevant data on new, viable remediation technologies that may have performance or cost advantages compared to conventional treatment technologies. Since the initiation of the SITE Program in 1986, cleanup of contaminated sites through the use of innovative technologies has resulted in a total inflated cost savings of over 2.1 billion dollars.

During fiscal year (FY) 96, the SITE Program reviewed its approach to doing business and determined that operational shifts in the program were necessary to identify and assist in the development of the most sought-after technology types and treatment methods. Building on the strengths of the existing program, such as demonstration design, quality assurance, and technology transfer, the SITE Program has established a remediation problem focus that is driven by the needs of the hazardous waste remediation community. The SITE Program has the following four operating functions: (1) program planning, (2) matching priority sites with innovative cleanup solutions, (3) technology field demonstrations, and (4) information dissemination. The SITE Program's vision is to remain the premiere organization in enhancing the credibility and implementation of effective innovative remediation options.

The SITE Program continues to earn increased recognition as a leader in advancing innovative technology development and commercialization. The program is participating with 128 remediation technology vendors. Through FY 99, the SITE Program has successfully demonstrated 108 technologies, seven of which were demonstrated during FY 99. Emphasis formerly placed on technologies requiring the removal of soil or groundwater (ex situ) is gravitating to in situ technologies that treat contamination in place. The SITE Program recognized this change and has emphasized the development of in situ technologies. Of the 22 ongoing or planned demonstrations, 13 are in situ, while 9 are ex situ. SITE's Monitoring and Measurement Technologies (MMT) Program has completed 38 projects to date, with 9 more in the planning stages.

To ensure that the program continues to meet the needs of the remediation community, the SITE Program established a remediation stakeholder group. This group, which is composed of such agencies as the Department of Defense and the Department of Energy, reviews innovative technology applications and develops an environmental emphasis area list, which ensures that the most pressing issues are prioritized and addressed. An example of multi-agency cooperation is the Cape Canaveral Demonstration Project. This project will evaluate the effectiveness of three in situ remediation technologies for remediation of non-aqueous phase liquids (NAPL) in the subsurface. SITE's MMT Program is also addressing issues in the remediation community, and has identified a need for more effective methods to

evaluate sediment and soil contamination. In response to this need, the MMT Program conducted demonstrations of two innovative sediment sampling technologies in FY 99. The MMT Program is now addressing a similarly difficult problem in evaluating the performance of field total petroleum hydrocarbon (TPH) analysis technologies. Through such relationships with other interested parties, the SITE Program continually pursues opportunities to conduct cooperative technology demonstrations, thereby reducing expenditures and further promoting innovative technologies. These factors assist the SITE Program in attaining its primary goal – the expedited cleanup of the nation's most contaminated sites.

SITE Program Description

Introduction

The Environmental Protection Agency's (EPA) Superfund Innovative Technology Evaluation (SITE) Program has successfully promoted the development, commercialization, and implementation of innovative hazardous waste site remediation and characterization technologies for more than 14 years. The SITE Program is currently composed of a Demonstration Program, a Monitoring and Measurement Technology (MMT) Program, and information transfer. Figure 1 below shows the locations of completed SITE projects for both the Demonstration and MMT Programs. The SITE Program formerly supported an Emerging Technologies (ET) Program, but this role has been taken over by other government programs such as the Small Business Innovation Research (SBIR) Program. SITE offers a mechanism for conducting joint technology demonstration and evaluation projects at hazardous waste sites through the involvement of the private sector, EPA, and other federal and state agencies. Commercialization of innovative technologies is assisted by providing potential users with high quality, unbiased, defendable performance and cost data. SITE promotes commercial application of innovative technologies through an extensive technology transfer program. This section will describe each component of SITE, and the overall program principles used for planning and guidance of the Program.

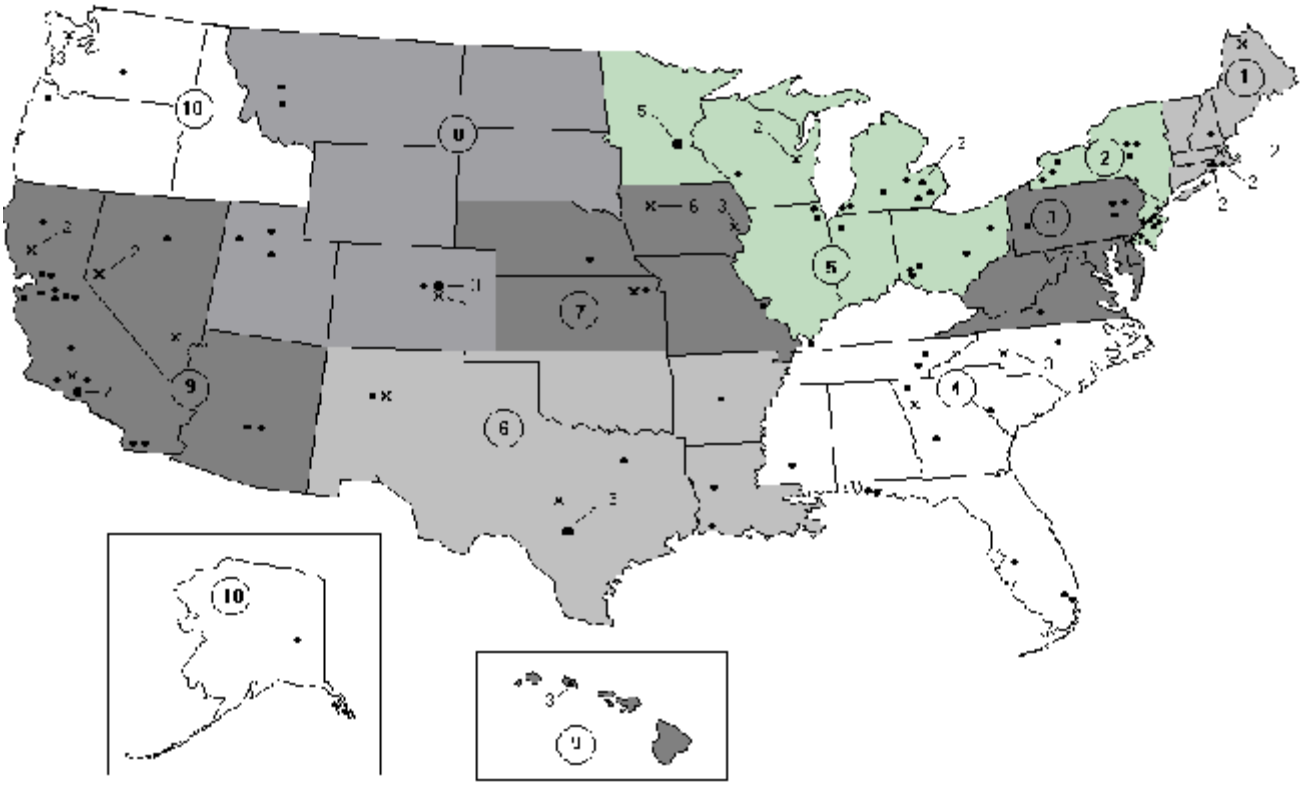


Figure 1 Location of all completed SITE Demonstration (•) and MMT (**V**) Projects (EPA Regions shown in circles).

Program Design

The SITE Program is currently comprised of the following key elements:

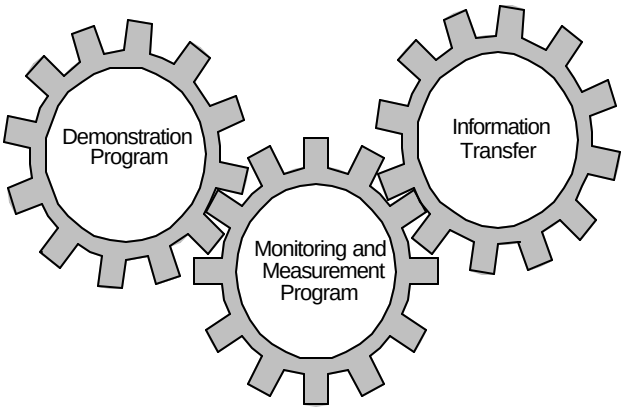
- ***Demonstration Program***
  Evaluates and verifies cost and performance of promising innovative technologies at selected hazardous waste sites to provide reliable performance, cost, and applicability information for site cleanup decision-making

- ***Monitoring and Measurement Technology Program***
  Evaluates technologies that detect, monitor, and measure hazardous and toxic substances to provide more cost-effective and accurate methods for producing real-time data during site characterization and remediation

- ***Information Transfer Activities***
  Disseminates technical information, including engineering, performance, and cost data, to assist in removing barriers for use of innovative and alternative technologies

Program Implementation

SITE is a partnership between the public and private sectors, where the costs and responsibilities are shared by EPA, hazardous waste site owners, and technology developers. EPA enters into cooperative arrangements with site owners and technology developers, under which innovative technologies are demonstrated at selected hazardous waste sites. EPA evaluates the new technologies based on the demonstration results, and compiles and publishes rigorous engineering, performance, and cost data intended to aid in decisions regarding the use of the technologies at other hazardous waste sites. The program generates credible and unbiased technology cost and performance data needed by remedial project managers, consultants, and other environmental decision makers. EPA promotes



SITE PROGRAM

easy and rapid access to this information, allowing project managers to make timely decisions in selecting cleanup remedies.

Historically, one of the greatest factors inhibiting the development and use of innovative cleanup technologies has been the lack of credible cost and performance data during technology development at the commercial scale. Understandably, many site owners are unwilling to risk the use of innovative technologies without assurance of success. By addressing this need, SITE has aided in the first-time field use of many technologies, contributing to wider acceptance of a particular technology. Providing this credible, unbiased cost and performance data remains the foundation of SITE.

The foundation of the SITE Program is providing credible cost and performance data.

Program Principles

To reduce expenditures and to remain at the forefront of innovative technology development, the SITE Program reviewed its approach to doing business in fiscal year (FY) 1996. The review indicated that operational shifts in the program were necessary to more efficiently identify and assist in the development of the most sought after technology types and treatment methods. Building on the strengths of the existing

program, such as demonstration design, quality assurance, and technology transfer, the SITE Program shifted in FY 97 from a technology-driven focus to a remediation problem focus, driven by the needs of the hazardous waste remediation community. EPA's vision of the SITE Program is to remain the premiere program for enhancing the credibility and implementation of effective innovative remediation options.

In FY 99, the program continued to focus on cost-effective solutions to common remediation problems. The success of the program's focus is illustrated in the strong response to solicitations for technologies, and the great interest in resource leveraging with the SITE Program from federal and state agencies, such as the Department of Defense (DOD), Department of Energy (DOE), and State Environmental Protection Agencies.

The SITE Program is defined by the following four operating principles: (1) program planning, (2) matching priority sites with innovative cleanup solutions, (3) technology field demonstrations, and (4) information dissemination.

Demonstration Program

In the Demonstration Program, innovative cleanup technologies are field tested on hazardous waste materials. SITE demonstrations are conducted at hazardous waste sites, such as those on the National Priorities List (NPL); Brownfields at non-NPL sites; or under simulated hazardous waste site conditions at developer or federal test and evaluation facilities. Engineering, performance, and cost data are gathered on innovative technologies. The data are then reviewed by potential users to evaluate applicability to similar waste sites or to compare effectiveness and costs to other alternatives. Data collected during each field demonstration are used to assess the performance of the technology, the potential need for pre- or post-processing of the waste, applicable types of wastes and contaminated media (for example, soil, sludge, water, sediment), potential operating problems, limitations, and approximate capital, operating, and maintenance costs.

The SITE Program annually solicits applications for participation in the Demonstration Program from interested private firms and federal and state agencies with responsibility for cleanup operations at hazardous waste sites. Cooperative arrangements or Memoranda of Understanding form the relationship between the SITE Program and the parties responsible for the host site. No contractual agreement is arranged and no funds are given to the site as part of this arrangement. SITE provides in-kind service in the form of project planning, testing, sampling/analytical services, evaluation data analysis, and report writing.

Host site owners (see Appendix B for sites categorized by state and location) are responsible for providing necessary data related to the hydrogeology and other site conditions, results of feasibility studies, and results of waste analyses. The owner is responsible for all logistical requirements for the demonstration, such as availability of utilities, access to land area at the site large enough for equipment setup, elimination or restriction of geographical or geological hindrances, security provisions, and personnel safety provisions. Technology developers whose systems are demonstrated are responsible for transporting equipment to the selected site, operating their systems, and removing equipment from the site upon completion of the demonstration. EPA is financially and technically responsible for project planning, sampling and analysis, quality assurance and quality control, preparing evaluation reports, and disseminating cost and performance information to environmental managers. EPA also prepares evaluation reports, bulletins, project summaries, and videotapes to document demonstration activities. These reports and videotapes evaluate available information on the technology and analyze its overall applicability to other site characteristics, waste types, and waste matrices. Reports also include rigorous testing procedures and the quality assurance and quality control standards.

As of September 30, 1999, the Demonstration Program included 132 accepted, ongoing, and completed demonstrations. These technologies are presented alphabetically in

Appendix A, according to the state in which the developer's business is located.

Monitoring and Measurement Technology Program

The MMT Program provides developers of innovative hazardous waste measurement and monitoring technologies with an opportunity to demonstrate a technology's performance under actual field conditions. Following the demonstration, EPA compiles the results and prepares a report summarizing the findings. Distribution of technical reports enhances market acceptance and can define new applications for the technology.

The purpose of the MMT Program is to accelerate the acceptance and use of effective innovative measurement and monitoring technologies in the field. These technologies include new or modified technologies that can detect, monitor, and measure hazardous and toxic substances in the subsurface, soil, sediment, waste materials, and surface waters. Technologies tested in the program include chemical sensors for in situ measurements, groundwater sampling devices, soil and core sampling devices, soil gas or fluid samplers, laboratory and field-portable analytical equipment, and other systems that support field sampling or data acquisition and analysis. The primary objectives of this portion of the SITE program are to:

< Test field analytical technologies that enhance monitoring and site characterization capabilities
< Identify performance attributes of new technologies addressing field characterization and monitoring problems more cost-effectively and efficiently
< Prepare protocols, guidelines, and methods that enhance the acceptance of these technologies for routine use

MMT Program technologies can be used to accurately assess the degree of contamination at a site, provide data to evaluate potential effects on human health and the environment, supply data to assist in selecting the most appropriate cleanup action, and monitor the effectiveness of a remediation technology. The selection process places high priority on technologies that provide more cost-effective, faster, and safer methods than conventional technologies for producing real-time or near-real-time data. Innovative technologies are demonstrated under field conditions and results are compiled, evaluated, published, and disseminated by the Office of Research and Development (ORD).

Evaluations or demonstrations have now been completed for 38 technologies in the MMT Program. The MMT Program is administered by ORD'S National Exposure Research Laboratory at the Environmental Sciences Division in Las Vegas, Nevada. Technologies demonstrated under the MMT Program are listed in Appendix A.

Emerging Technology Program (ETP)

Support of the ETP ended in FY 98, after completion of all committed projects in the program. The purpose of ETP was to foster research and development of innovative technologies for remediation of Superfund and other hazardous waste sites. Technologies entered the program at the bench- or pilot-scale stage of development. EPA provided developers the opportunity to advance a technology from bench- and pilot-scale testing to demonstration.

Addition of new projects within ETP was discontinued in 1996 due to reductions in funding to the Superfund research and development budget, and recognition of overlap with other initiatives such as the SBIR Program. Upon completion of the ETP, technologies were considered for the SITE Demonstration Program, although many vendors chose to fully commercialize their technologies after participating in the program.

Program Planning

To ensure that the SITE Program continues to focus on validating the most sought- after remediation technologies, overall program direction and strategies are now evaluated each

year based on input from the user community and other private- and public-sector stakeholders. As part of the overall program planning process, the SITE Program is developing and will implement a quality management plan based on American National Standard Institute, Specifications and Guidelines for Quality Assistance for Environmental Data Collection and Environmental Technology Programs (ANSI/ASQC E4). This plan will enable the program to focus more clearly on long-term quality assurance and planning issues that impact overall program performance.

Matching Priority Sites with Innovative Cleanup Solutions

The SITE Program solicits and prioritizes hazardous waste sites, and then seeks appropriate technologies for demonstration at these sites. Priority sites are selected based on feedback from the user community, including federal and state agencies. Matching a site with a technology is a flexible process, and a site owner has the option of evaluating multiple technologies. If no specific technology or vendor is identified by a site, technologies and vendors are matched by the SITE Program and other interested parties, which may include state and federal regulators and other public representatives.

The selection of sites for the program is based on the research needs of EPA, as well as federal and state agencies.

An important aspect of technology selection is that more than one technology may be introduced for review and demonstration. This aspect allows for matching the most appropriate and feasible technology to a particular site. General technology needs of the user community are identified by soliciting input from working groups, forums, personal communication, and hazardous waste publications. With this continuous input, the SITE Program will continue to focus on the needs of the remediation community and the more pressing problems at contaminated sites.

Technology Field Demonstrations

Field demonstrations are conducted to provide quality data to evaluate technology performance. Project planning is an integral part of the demonstration process, and ensures that quality assurance/control and statistical analysis issues have been addressed in advance of initiating a demonstration. The resulting data and reports are intended for use by the site owners and state and federal decision-makers in evaluating remediation options and for adding credibility to technology vendors promoting their processes.

SITE Program technology demonstrations are increasingly conducted in partnership with other EPA offices, other federal agencies, states, private industry, and universities. These partnerships not only reduce the overall costs of demonstrations to EPA, but accelerate remediation of some of the most problematic sites at federal and state facilities. One example of interagency partnerships is the DNAPL Consortium, consisting of DOE, DOD, EPA, the Air Force (USAF), and the National Aeronautics and Space Administration (NASA). This group is currently working on a demonstration evaluating three technologies used to remediate DNAPL at the Cape Canaveral Air Station.

Information Dissemination

As part of its continuing improvement process, the SITE Program recognized the need for expediting the progression of demonstration data from the program to the user community. The expansion of its electronic information sources was identified by the SITE Program as the most effective means for accomplishing this task. As a result, the amount of information on innovative technologies available through electronic sources is growing rapidly, with the World Wide Web as the primary conduit.

Electronic documents are accessible through the World Wide Web at the Environmental Technologies Verification (ETV) Web site (*http://www.epa.gov/ORD/SITE*) and a site supported by the EPA Office of Solid Waste

and Emergency Response Technology Innovation Office (TIO) (*http://clu-in.org*). Several technology databases summarize information about innovative treatment technologies and associated vendors. These databases may serve as tools in identifying potential technology demonstration candidates or serve as directories for technology vendors. Examples of these databases include, but are not limited to, Remediation and Characterization Innovative Technologies (REACHIT) online system (*http://epareachit.org*), and the Bioremediation in the Field Search System (BFSS, http://www.epa.gov). Descriptions of the databases and publication ordering information are provided in Appendix D.

The development of technical documents within the SITE Program is a dynamic process, with a continual drive towards presenting data in its most usable form. The primary products of these efforts are information documents on a variety of technologies or applications for a specific area of interest. For example, SITE is currently developing a summary documentation and cost model for innovative remediation technology performance and cost information for wood preserving sites. This information allows the user community to compare the technical capabilities of these technologies, expected cost for the application, and the compliance of the technology with regulatory guidelines.

The SITE Program aggressively pursues opportunities for direct interaction with the user community and technology developers to anticipate needs and emphasis areas for development of future innovative technologies. Meetings and conferences continue to be an important factor in the dissemination of technical information generated by the SITE Program and were utilized to their full potential during FY 99. The SITE Program provided a booth and representation at 16 conferences in FY 99, with staffing to provide information, documentation, and guidance to conference participants interested in the program. These forums offer face-to-face discussion among the user community, technology developers, and the SITE Program, serving to generate ideas for future development and use of innovative technologies. The following mechanisms are used by the SITE Program to disseminate information and increase interaction with the user community:

- Program-specific brochures and exhibits
- Conferences, workshops, and technical working groups
- Publications and videotapes (see Appendix C)
- Electronic media, including the Internet and electronic bulletin boards
- Technical assistance to regions, states, and remediation contractors
- Technology seminars

FY 99 SITE Program Cost Savings and Vendor Benefits

Promotion of Innovative Technologies

SITE is recognized by EPA as one of its principal programs to advance innovative site monitoring, characterization, and cleanup technologies with the potential to treat hazardous wastes more efficiently, less expensively, and more safely than existing methods. SITE's mission is to promote the development and application of innovative technologies that reduce or eliminate risks to human health and the environment due to contamination. The goal of the program is to interact with the technology user community, understand its needs, integrate those needs with EPA's research mission, and expeditiously address those needs. Identifying and responding to the technology needs of the remediation community is the driving force behind today's SITE Program.

Responding to technology needs is the driving force behind the SITE Program.

The need for credible and reliable data for innovative technologies remains significant. For example, of the 80 RODs signed in 1994 that selected established technologies as the best alternative, 16 (or 20 percent) considered an innovative technology as an alternative for remediation of the site. The majority of the RODs indicated that innovative technologies were not chosen due to a lack of verified performance and implementability. The SITE Program serves to fill this need for credible evaluations so that more effective, cost-efficient methods can be used on remediation problems.

During the first 10 years of the SITE Program, an emphasis was placed on innovative technologies for permanent treatment that usually required the removal of soil or groundwater. Most field demonstrations during this period in the program's history involved ex situ physical/chemical and thermal technologies that could be field tested in a matter of days or weeks. The need for innovative, in situ technologies that are more cost-effective, result in less secondary waste, and are less intrusive will continue to increase. The SITE Program has recognized this need and has emphasized the development of in situ technologies.

Historical Program Cost Savings and Vendor Contracting

Since its establishment in 1986, the SITE Program has assisted in the development and use of innovative technologies, resulting in substantial cost savings for cleaning up contaminated sites. The cost savings realized by federal facilities has been estimated by analysis of RODs from 1993 - 1998; this analysis is described below. The SITE Program has also assisted vendors in advancing innovative technologies from the development phase to full-scale application, and has promoted greater acceptance of these technologies. The following subsections provide examples of the financial success of the SITE Program in terms of federal cost savings, and vendor successes.

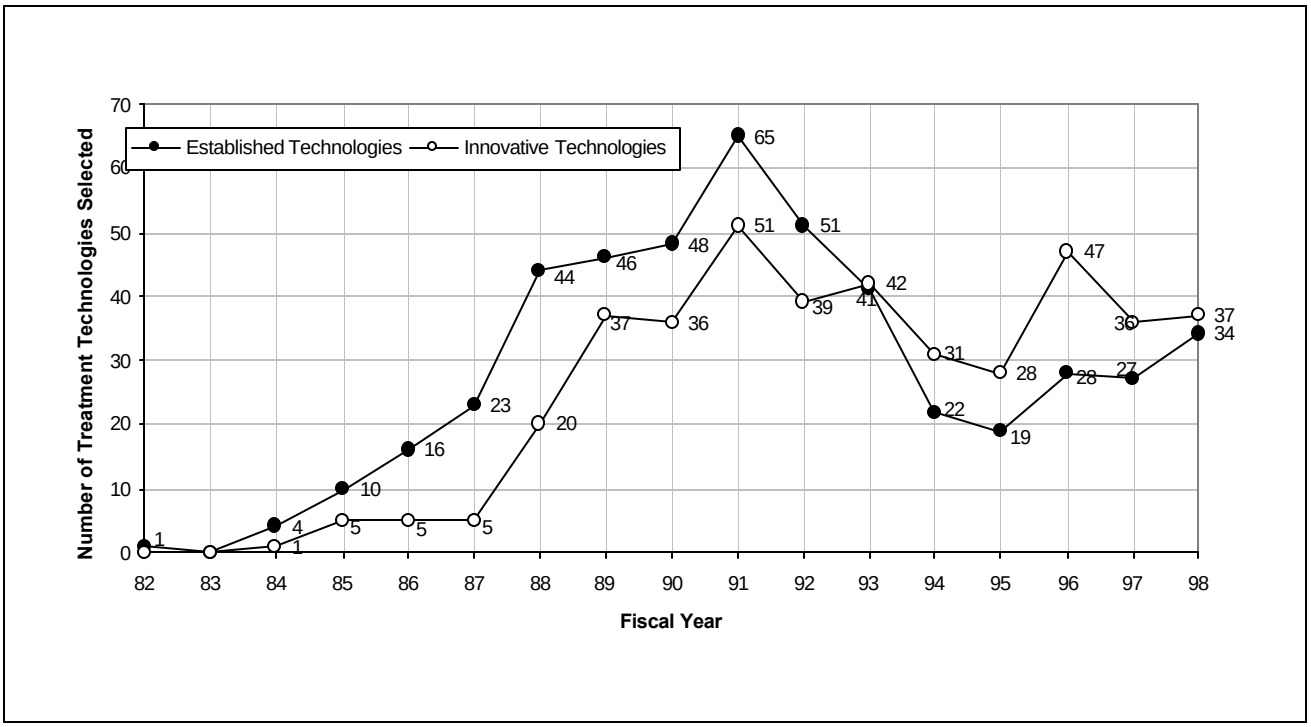


Figure 2 Treatment technologies for source control chosen in RODs. Sites selecting no further action, monitoring, institutional controls, and natural attenuation are not included in totals.
(Adapted from: U.S. EPA Office of Solid Waste and Emergency Response, Innovative Treatment Technologies Annual Status Report, Eighth Edition (EPA/542/r-96/010) & Ninth Edition (S42-R-99-001).

SITE Program Accomplishments - Federal Cost Savings from RODs Analysis

Figure 2 displays the number of innovative and established treatment technologies selected in RODs by year. This figure shows that interest in innovative technologies as a sound remediation action increased in the late 1980s. Since 1993, the use of innovative technologies has outpaced that of established technologies, resulting in dramatic cost savings.

During 1996 and 1999, the SITE Program collected information from signed RODs (dated 1993-1998) in all 10 EPA Regions that selected an innovative technology as the remedy. These technologies include thermal desorption, bioremediation, phytoremediation, surfactant flooding, and many other technologies that have passed through the Program. The data compiled by the SITE Program allowed environmental managers to compare innovative technologies to conventional technologies, especially with respect to cost. This time period was selected for evaluation because more innovative technologies than conventional technologies were selected in RODs signed in each of these years. Documentation was obtained from updated data on a total of 168 RODs that selected innovative technologies for part or all of the remediation. EPA guidance recommends that ROD estimates assess remedial alternatives with an accuracy of +50 percent to -30 percent. Of the 168 RODs that selected innovative technologies, 84 had sufficient information to make a cost comparison between the selected technology and a conventional technology. Cost savings realized by using innovative technologies for the 84 RODs was estimated at $2.3 billion in 1999 dollars, with an average percent savings per site of over 70 percent. Only 11 of the 84 RODs reported that the innovative technology was more expensive than or equal to the established technology.

To estimate SITE Program net benefits, the FY 93-98 RODs and the SITE Program budget were inflated to the end of 1999 using Consumer Price Index (CPI) inflation figures. The total inflated cost savings for RODs dated 1993-1998 was $2.3 billion, and the total inflated SITE Program budget from 1986-1999 was $175 million. This comparison represents an estimated inflated cost savings of over $2.1 billion for various site cleanups.

Figure 3 shows a breakdown of savings by technology type. Soil vapor extraction (SVE) showed the highest savings of over $1.0 billion, followed by $500 million for bioremediation. SVE was one of the initial technologies accepted into the SITE Program (in the late 1980s), and large savings would therefore be expected from this technology. Solvent extraction, thermal desorption, and vitrification each accounted for over $100 million in savings. Phytoremediation is a newer technology that is beginning to be chosen in RODs, with four sites having specified the use of phytoremediation, with an associated cost savings of $17 million dollars as compared to conventional technologies. The number of sites and associated costs savings for phytoremediation and treatment barrier sites are expected to increase rapidly in coming years.

Historical Vendor Benefits

Technology vendors are a central part of the SITE Program, providing remediation services for sites requiring clean-up solutions. Vendors experience various benefits by participating in the SITE Program, namely increased exposure, market share, technical acceptance, and recognition. Increased acceptance of innovative technologies is demonstrated by the level of commercial activity experienced by SITE Program vendors. For example, 1999 information indicated that since completing SITE demonstration projects, vendors received 1,921 remediation contracts, and 1,308 treatability studies (Figure 4).

As part of a SITE Program evaluation in 1999, 43

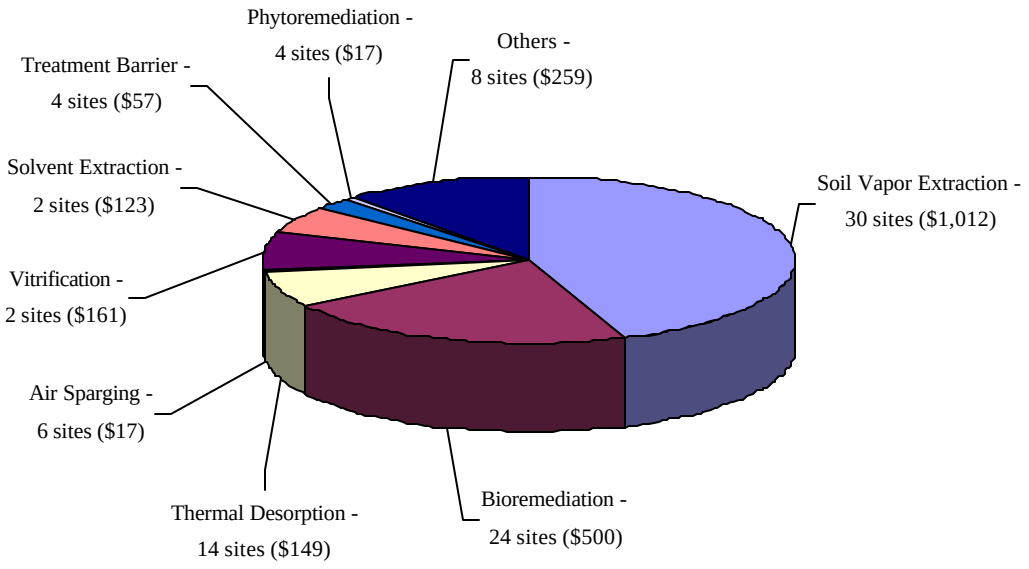


Figure 3 Cost savings estimated from RODs analysis by technology type (millions of 1999 dollars). Savings estimated based on comparison of innovative to conventional technologies for FY 93 - 98.

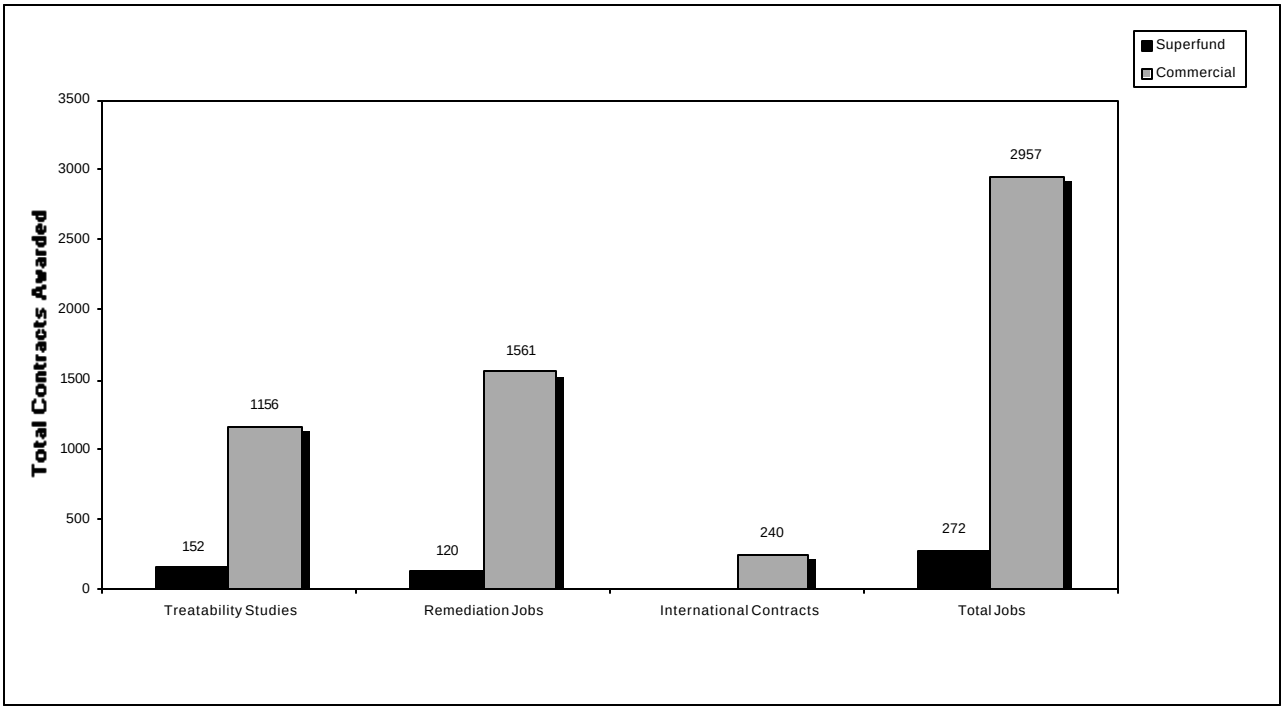


Figure 4 Number of contracts awarded to SITE vendors following program participation (Source: 1999 vendor information)

Demonstration Program vendors provided information regarding company revenues after completion of their demonstration. Following participation in the SITE Program, 58 percent of vendors were awarded commercial remediation jobs using technologies demonstrated in the SITE Program. Thirty-three percent of the vendors were awarded more than 10 contracts each. Over 35 percent of the SITE vendors reported one or more international contracts, identifying 37 countries where jobs were contracted. Figure 5 provides a historical perspective of growth in the number of contracts awarded to SITE vendors since 1990.

The 1999 Demonstration Program vendor information has been broken down by technology type to ascertain which technologies demonstrated the greatest commercial success. Figure 6 shows the share by technology type of the 3,229 remediation and treatability contracts awarded to vendors. It is clear from this chart that soil vapor extraction and bioremediation technologies have had the most commercial success. This trend from the vendor information is consistent with the RODs analysis results which are shown in Figure 2, providing two sources of data to confirm the outstanding commercial success of these technologies.

In addition to the 43 Demonstration Program vendors, information was obtained in 1999 from 14 vendors that participated in the MMT Program. This information clearly demonstrated the benefits that vendors receive from the program, indicating that 71 percent of the vendors sold more than 25 units since their demonstration in the SITE Program. Over 64 percent of the vendors indicated that their technologies were used on international remediation projects. In total, the MMT vendors reported selling over 3,550 units on over 900 jobs, including 48 international jobs.

Overall, vendor information shows that SITE technology developers in the Demonstration and MMT Programs are achieving commercial success for demonstrated technologies. The impact of the SITE Program continues to grow over time, as illustrated by the consistent growth in vendor contracts over the last decade (Figure 5).

There is also a clear connection between the commercial success of particular remediation technology types (that is, SVE and bioremediation) as measured from vendor information (Figure 6), and the cost savings determined from the RODs analysis (Figure 3). Therefore, those technologies in the SITE Program that succeed commercially can be seen to provide economic savings for federal facilities in terms of cost saving from ROD estimates.

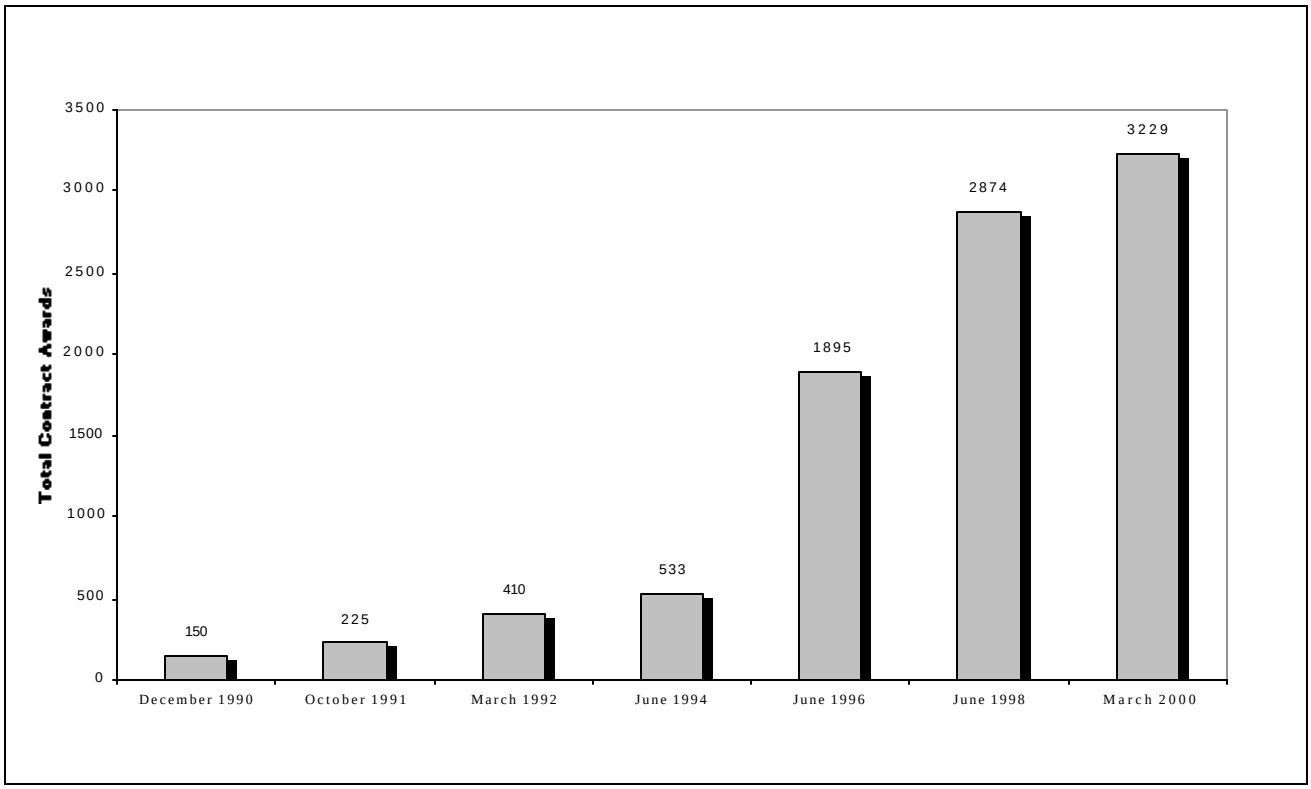


Figure 5 Total number of contracts awarded to SITE vendors after program participation (Source: 1990 - 1999 vendor information)

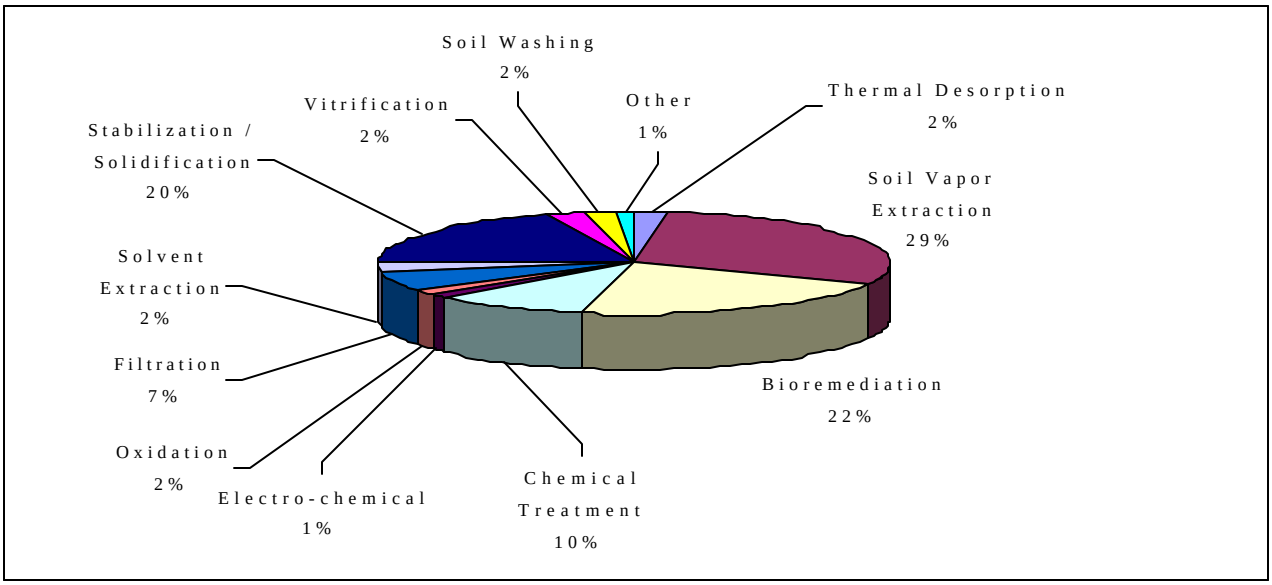


Figure 6 Share of 3,229 total contracts awarded to SITE Demonstration vendors by technology type (Source: 1999 vendor information)

Innovative Technology Highlights

SITE Program Case Studies

This section presents case studies of innovative remediation technologies for vendors that have participated in the SITE Program through either the Demonstration Program (case studies 1 through 3) or the MMT Program (case study 4).

The case studies provide brief descriptions on the use and status of various technologies and, where available, general information on the cost of applying each technology. These case studies represent the SITE Program's approach to promoting innovative technologies by identifying user needs. In response to user needs, the Demonstration Program assessed the performance of an electrokinetic technology for chromium extraction, a bioremediation technology for chlorinated solvents, and a surfactant flood for NAPL extraction (case studies 1 - 3). The environmental community is also in need of low-cost, accurate, and easy-to-use methods for sediment sampling. The MMT Program has addressed this issue by evaluating the performance of two sediment sampling technologies (case study 4).

The technologies presented in these case studies are typical of the SITE Program and represent SITE's remediation problem focus, which is driven by the needs of the hazardous waste community. These technologies represent real or potential solutions to actual cleanup problems faced by the environmental community.

Case Study 1: Sandia National Laboratory (In Situ Electrokinetic Extraction)

The In Situ Electrokinetic Extraction (ISEE) system, developed by Sandia National Laboratory (SNL) is a treatment process that facilitates extraction of metals from unsaturated and saturated soil. The ISEE system consists of three main units: an electrode assembly installed in situ, a vacuum system, and a power supply. Activation of the drive electrode causes contaminants and other ions to be attracted to the electrode casing. The water level control system adds water to, and extracts water from the electrodes. At the same time, water is continuously pumped out from the electrode casing at a constant rate. A metering pump controlled by in-line pH meters regulates the introduction of neutralization chemicals at each electrode.

Waste Applicability

SNL has developed its electrokinetic extraction system to treat anionic heavy metals such as chromate in unsaturated soil. There is no lower limit to the contaminant concentration that can be treated; however, there may be a lower limit on the ratio of contaminant ions to other ions in the soil. Soils with high salinity content or sites with buried metal debris would provide exceedingly difficult technical challenges to this technology. The technology can be expanded to treat saturated soils.

Status

The ISEE technology was accepted into the Demonstration Program in June 1994. The demonstration was initiated in May 1996, at an unlined chromic acid pit within a SNL RCRA regulated landfill. The system was operated for a total of 2,727 hours, and approximately 520 grams of hexavalent chromium were removed during the entire demonstration.

Case Study 2: ITT Night Vision (In Situ Enhanced Bioremediation of Groundwater)

ITT Night Vision is conducting in situ enhanced aerobic bioremediation of contaminated groundwater in fractured bedrock utilizing technologies developed at the U.S. Department of Energy Savannah River Site. This project involves remediation of groundwater in the vicinity of one contaminant source area as a pilot-scale operation, with the possibility of applying the technology elsewhere on site. Contaminants of concern in on-site groundwater include chlorinated solvents and their daughter products, plus acetone and isopropanol. To accelerate the intrinsic biodegradation observed at the site, the selected remedy involves the subsurface injection of air, gaseous-phase nutrients (triethyl phosphate and nitrous oxide), and methane. The amendments are being added to stimulate existing microbial populations (particularly methanotrophs) so that they can more aggressively break down the contaminants of concern. Amendment delivery to the subsurface is accomplished through an injection well, and the injection zone of influence is confirmed using surrounding groundwater monitoring wells and soil vapor monitoring points.

The patented PHOSter™ process for injection of triethyl phosphate in a gaseous phase was licensed for use at this site as an integral element of the enhanced bioremediation operation. This technology maximizes the subsurface zone of influence of nutrient injection as compared to technologies injecting nutrients in liquid or slurry form. Monitoring of contaminant (and breakdown product) concentrations in groundwater and soil vapor, measurement of microbiological population density and diversity, and monitoring of nutrient concentrations and groundwater geochemical parameters provides feedback on system effectiveness. This in turn allows adjustments to be made in the sequencing and rate of delivery of air, nutrients, and methane in response to change in subsurface conditions.

Waste Applicability

This enhanced bioremediation technology is capable of breaking down organic compounds in groundwater. Compounds which are amendable to intrinsic (natural) biodegradation can be degraded more rapidly when the subsurface microbial populations are stimulated through the injection of air, gaseous-phase nutrients, and methane. By providing an aerobic environment for contaminant degradation, harmless breakdown products are produced and toxic daughter products of anaerobic degradation of chlorinated solvents (such as vinyl chloride) can be broken down completely. This in situ technology is especially applicable in situations where subsurface infrastructure (for example, networks of utilities) limit or preclude excavation or extraction technologies.

Status

The enhanced bioremediation system is being used in the ongoing RCRA corrective action interim measure at the ITT Night Vision facility. It was accepted into the SITE Program in 1997, with system start up occurring in March of 1998. The technology had previously been approved by EPA Region 3 as an Interim Measure part of the facility's ongoing RCRA Corrective Action Program.

Case Study 3: Duke Engineering and Services, Inc. (Surfactant Enhanced Aquifer Remediation of Nonaqueous Phase Liquids)

Surfactant enhanced aquifer remediation (SEAR) technology greatly enhances the removal of residual nonaqueous phase liquids (NAPL) from the subsurface by increasing the solubility of the NAPL and lowering the interfacial tension between the NAPL and aqueous surfactant solution. Increasing the solubility of the NAPL with surfactants substantially enhances the removal of the NAPL mass through pumping. Lowering the interfacial tension between the NAPL and the aqueous surfactant solution reduces the capillary forces that trap the NAPL in the pore spaces of the aquifer. Under certain conditions, the interfacial tension can be lowered sufficiently to drain NAPL from the pore

spaces. This forms an oil bank in the subsurface, which is then recovered at extraction wells.

Before SEAR technology can be implemented, site specific characteristics must be determined. Normal aquifer properties such as stratigraphy, grain size distribution, mineralogy, hydraulic conductivity, vertical and horizontal gradients, and depth to groundwater must be determined. In addition, a fundamental understanding of the NAPL composition, distribution, and quantity in the subsurface is required. Knowledge of the quantity of NAPL present prior to using SEAR prevents either under- or over-designing the surfactant flood. Laboratory experiments using soil core, contaminant, groundwater, and source water from the site are conducted to determine the optimum surfactant solution mix. A geosystem model is then developed which incorporates all the data gathered. Simulations are run to determine optimum injection and extraction well placement, percent recoveries of the compounds injected, contaminant concentration levels in the effluent, percent removal of the contaminant mass, and all other pertinent results of the surfactant flood.

Once the surfactant flood has been fully designed, the surfactant solution is injected into the contaminated zone in the subsurface through one or more wells. The surfactant is drawn through the subsurface by pumping at surrounding extraction wells. As the surfactant moves through the subsurface it solubilizes or mobilizes (depending on the design) the NAPL for recovery at the extraction wells. The recovered groundwater and NAPL are then typically sent to a phase separator. The recovered NAPL is either disposed of or recycled, and the groundwater and surfactant is treated. For large scale projects, recovery and reuse of the surfactant from the effluent stream can be economical.

Waste Applicability

SEAR technology is applicable for the rapid removal of residual phase NAPL in the subsurface. Although it does not directly remediate the dissolved phase plume, removal of the source zone contamination can greatly reduce long term liability and risk. SEAR technology can be effective for the removal of a broad range of organic contaminants. This technology may not be suitable for sites with low hydraulic permeabilities (10^{-5} cm/sec or less) because of increased difficulty in imposing the flood.

Status

SEAR technology was accepted into the SITE Demonstration Program in 1997. The technology completed field work on a demonstration at Pearl Harbor in FY 99.

Case Study 4: MMT Program - Sediment Sampling Technologies

The MMT Program demonstrated the effectiveness of two sediment sampling technologies to evaluate the ability of the samplers to obtain a defined volume sediment sample at a specific depth interval. The Demonstration also investigated the ability of the samplers to collect representative samples, ease of decontamination, time between samples, and overall cost-effectiveness of the technologies.

The technology demonstrations took place at two sites in EPA Regions 1 and 5. One site represented open-water conditions with low water flow and a depth of approximately 10 feet, while the other demonstration was a low lying wetland with very slow moving water at a depth less than 2 feet. The Demonstration was conducted in April and May 1999.

AMS Split Core Sampler for Submerged Sediments (AMS Sampler)

The AMS Sampler is designed to collect undisturbed samples in a variety of sediments at depths up to 3 feet below the sediment surface. The AMS Sampler has an inside diameter of 2 inches, and is designed to collect sample volumes of 0.62, 1.24, and 1.86 liters using one to three pairs of interlocking split core cups. The sampler can be manually pushed, or hammered into sediments depending on the desired application. The design innovation incorporated into the AMS Sampler is a ball check valve in the top cap to allow water to escape as the sampler is deployed,

while creating a vacuum to retain the sample during retrieval.

The AMS Sampler showed performance that was superior to conventional alternatives in the reliability of sample recovery. It performed with equivalent efficiency in collecting samples of defined volumes at the specified depth intervals. The AMS Sampler showed reductions in sampling time requirements, and potential economic benefits relative to conventional technologies. The sampler provided more efficient sample recovery by using an electric hammer to induce vibrations in the sampler.

ARI Russian Peat Borer (ARI Borer)

The ARI Borer is a manual drive core sampler designed to collect uncompressed samples of bog and marsh sediments. The sampler operates in water depths up to 15 feet, and can operate at depth up to 65 feet below the sediment surface. The ARI Borer can be used with 20 or 40 inch core tube lengths, with associated sample volumes of 0.5 and 1.0 liters. The Borer incorporates an innovate core head and bottom point made of a thermoplastic polymer with desirable mechanical properties.

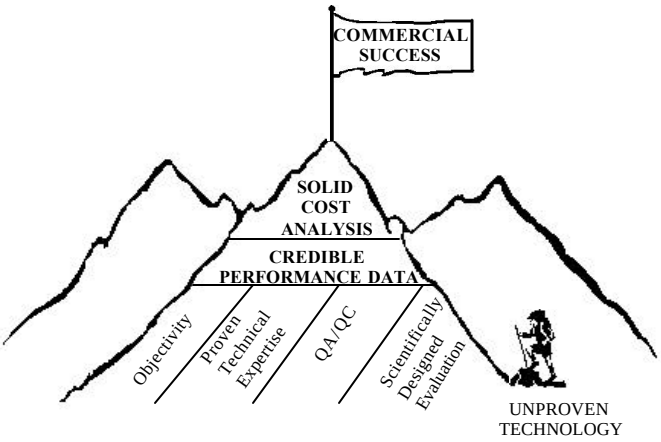
The ARI Borer showed remarkable superiority to the reference method by consistently obtaining samples from depths below 4 feet where the conventional technologies had difficulty. In addition, the ARI Borer reduced sampling time by 16 to 77 percent, and collected samples with minimal compression. However, the Borer required more attempts to take samples, and showed significantly lower sample recovery as compared to the reference methods.

FY 99 Progress and Accomplishments

Demonstration Program

The objective of the Demonstration Program is to conduct field demonstrations and high-quality performance verifications of viable remediation technologies at sites that pose high risks to human health and/or the environment, are common throughout a region or the nation, or where existing remediation methods are inadequate, unsafe, or too costly. The SITE Program solicits applications annually from those responsible for cleanup operations at hazardous waste sites. A panel of SITE Program scientists, engineers, and associated environmental experts reviews the applications to identify those technologies that best represent solutions for the most pressing environmental problems. The resulting data and reports are intended for use by decision-makers in selecting remediation options and for increasing credibility in innovative applications.

Over the past 14 years, SITE has earned increased recognition as a leader in advancing innovative technology development and commercialization and has participated cooperatively with more than 128 technology developers. Through FY 99, the SITE Program has successfully demonstrated 108 technologies, 7 of which were demonstrated during FY 99. These demonstrations have provided a tremendous amount of information on the performance, costs, and applicability of innovative cleanup technologies, which greatly assists managers of environmental remediation projects in developing appropriate and effective cleanup solutions. SITE has been responsive to the user community during this time, and has recently focused on the need for in situ



remediation technologies to more cost effectively remediate sites. As shown in Figure 7, 67 completed SITE projects have been ex situ and 41 in situ. Of the 22 ongoing or planned demonstrations, 13 are in situ, while 9 are ex situ.

The types and numbers of innovative technologies selected for remediation at Superfund sites increased significantly after the passage of the Superfund Amendments and Reauthorization Act (SARA). While rarely used during the early 1980s, innovative technologies comprised approximately one-quarter of the total number of technologies selected for Superfund remediation projects between FY 86 and FY 87. Since then, the number has continued to rise, indicating increased credibility and confidence in a number of innovative treatment technologies. Figure 2 shows that more innovative technologies than conventional technologies were selected in Records of Decisions (RODs—official records documenting selection of Superfund site cleanup methods) signed during FY 93 through FY 98.

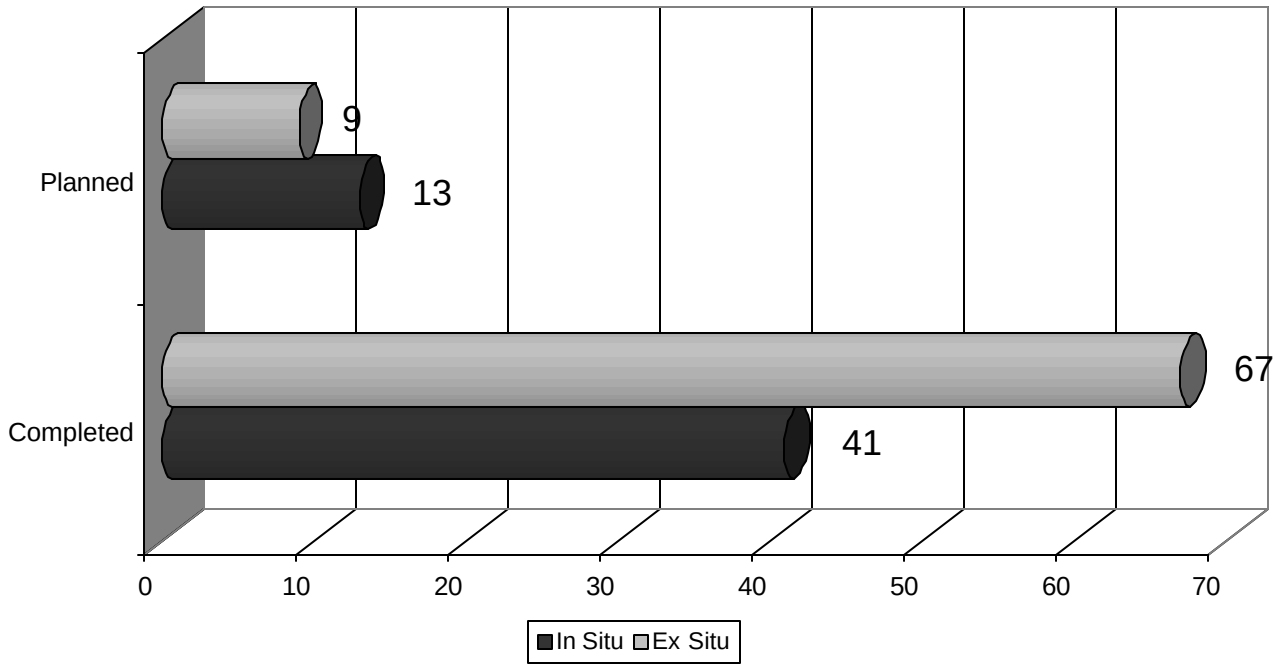


Figure 7 Distribution of in situ and ex situ SITE Demonstration projects at the end of FY 99.

Although SITE is only one contributing factor in increasing innovative technology selection, the program has played a significant role in this activity.

Field demonstration and evaluation of in situ technologies may require several months or years of data collection. Based on the SITE Program's increased emphasis on in situ technologies, the number of ongoing demonstrations will likely increase, with fewer moving from ongoing to completed status each year than in the past. It is estimated that six field demonstrations will be completed each year.

During FY 99, seven new innovative technologies were evaluated in the field. Completed demonstration projects are listed in Table 1, and ongoing projects are provided in Table 2. All completed and ongoing projects in the Demonstration Program, ETP, and MMT Program are listed in Appendices A and B.

Emerging Technology Program

Nine solicitations were issued from November 1987 (E01 Solicitation) to July 1995 (E09 Solicitation). A total of 77 technology development projects were initiated under the ETP, and 66 projects were successfully completed. Eighteen of the former ETP projects entered into the Demonstration Program.

Monitoring and Measurement Technologies Program

The MMT Program has leveraged its resources with EPA's Environmental Technology Verification Program. These two programs, known collectively as the Consortium for Site Characterization Technologies, have developed a partnership with the DOE. Resources from the SITE Program are used solely for those technologies addressing hazardous waste. This partnership will help to address the demands on the MMT Program and reduce the backlog of applications submitted by developers of innovative technologies.

To further advance the MMT Program, a stakeholder group was formed to assist in outreach activities and in the selection of technologies. An advocates program involving the EPA Regional offices was also established to assist in the MMT demonstration process and to ensure that the products of the demonstrations address issues

relevant to EPA.

Table 1. SITE Demonstration Projects Completed in FY 99

Developer Location	Developer	Technology	Site Location
TX	Duke Engineering	Surfactant enhanced aquifer remediation (SEAR) technology greatly enhances the removal of residual NAPLs. The technology works by increasing the solubility of the NAPL, thereby allowing the removal of contaminants by pumping.	Pearl Harbor, HA
VA	ITT Nightvision	The ITT Night Vision technology uses in situ enhanced aerobic bioremediation in fractured bedrock. The process accelerates intrinsic bioremedation by injection of nutrients, electron donors, and electron acceptors.	Roanoke, VA
MA	KSE, Inc.	The KSE Adsorption-Integrated-Reaction (AIR) Process combines adsorption and chemical reaction to treat air streams contaminated with VOCs. The AIR Process was demonstrated to treat chlorinated organic laden gases from a soil vapor extraction system at a contamination Superfund site in Rhode Island.	N. Smithfield, RI
PA	MACTEC	The NoVOCs in-well stripping technology combines air-lift pumping with in-well vapor stripping to remove VOCs from contaminated groundwater.	San Diego, CA
UT	Phytokinetics, Inc.	The technology uses plants to reduce concentrations of petroleum hydrocarbons in near-surface soils and the saturated zone. The demonstration investigated the use of alfalfa and fescue to treat soil, and poplar and juniper trees to treat the saturated groundwater zone.	Ogden, UT
NJ	Phytotech	The phytoremediation technology uses specially selected and engineered plants to treat soil and sediment contaminated with toxic metals and radionuclides. The technology is being demonstrated at a former metal-plating facility.	Trenton, NJ
NM	Sandia National Laboratory	The In Situ Electrokinetic Extraction (ISEE) Technology uses electrokinetic technology to remediate metals and ionic contaminants in soil. The technology is being demonstrated at a chromic acid disposal pit at Sandia National Laboratory.	Sandia, NM

Table 2. SITE Demonstration Ongoing Projects in FY 99

Developer Location	Developer	Technology	Site Location
NM	Commodore Advanced Sciences, Inc.	Solvated Electron Technology(SET) remediation system chemically reduces toxic contaminants. The solvating system uses a solution of ammonia and an "active" metal to create a powerful reducing agent that can clean up contaminated soils, sediments and liquids.	Pearl Harbor, HI
CA	Eco Mat, Inc.	This technology uses denitryfing bacteria to convert nitrogen compounds to harmless byproducts. The process uses common bacteria that live on a sponge-like medium inside a reactor. The reactor circulates these materials with contaminated water to enhance biodegradation rates.	Bendena, KS
LA	Electrokinetics	Electrokinetic's soil process extracts and remediates heavy metal or organic contamination in soils. Electrodes are placed in situ, and a current is applied to mobilize ions and remove contamination.	Fort Polk, LA
NJ	Envirogen, Inc.	The Envirogen demonstration involves the use of solvent extraction and bioremediation for PCBs at the Lower Colorado River Authority Electrical Substation.	Goldthwaite, TX
Ontario, Canada	EnviroMetal Technologies, Inc.	The In Situ Reactive Barrier uses zero-valent iron to reduce oxidized metals and to induce reductive dechlorination of chlorinated VOCs. In addition, this technology can immobilize some metals by reduction and sorption.	Rocky Flats, CO
CA	Geokinetics International, Inc.	This thermal technology applies AC current to the soil matrix in order to produce heat. This process reduces LNAPL viscosity, causes DNAPL to float to the top of the saturated zone, reduces the size of the smear zone, and can increase the biological activity in the heated zone.	Pearl Harbor, HI
VT	Green Mountain Laboratories	A study is being performed on the applicability of enhanced biodegradation of PCBs in contaminated soil at the Beede Waste Oil Site.	Plaistow, NH
ID	Idaho National Environment and Engineering Laboratory	Surfactant-enhanced aquifer remediation at neutral buoyancy allows for increased solubilization of DNAPLs to allow for removal from the subsurface. The technology incorporates a cosolvent to provide neutral buoyancy of treatment water to provide vertical migration of contamination in the subsurface.	Milford, NH
CO	Pintail Systems, Inc.	The technology involves growing and augmenting indigenous bacteria in culture to reduce the leaching of lead at contaminated sites. The cultures are grown in a laboratory setting, and applied in situ to biostabilize lead contamination in soil.	Crooksville, OH; Aurora, CO
CO	Pintail Systems, Inc.	Isolated indigenous organisms capable of remineralizing arsenic are grown and augmented in lab cultures. These organisms are being used to remineralize arsenic at the Argonaut Mine site.	Jackson, CA; Aurora, CO

Table 2 (continued). SITE Demonstration Ongoing Projects in FY 99			
Developer Location	Developer	Technology	Site Location
ID	Process Technologies, Inc.	The Photolytic Destruction Technology is a method of photochemically oxidizing gaseous organic compounds within a reaction chamber. The technology uses ultraviolet light to break apart chemical bonds of VOC molecules.	Sacramento, CA
IN	Sevenson Environmental Services, Inc.	The MAECTITE® chemical treatment process can be applied to soils, waste and other materials containing lead and other heavy metals. The technology uses reagents and processing equipment to stimulate the nucleation of crystals by chemical bonding.	Sparta, WI
OH	U.S. EPA, NRMRL	Alternate Cover Assessment Program (ACAP) - The ACAP is a cooperative partnership of industry, government, and research institutions that will evaluate evapotranspiration and break cover systems. The program is expected to provide cost-effective alternative cover designs, and assist in the development of designs at other sites.	10 sites around the nation

Technology Verification Process

The technology verification process is designed to generate high-quality data that can be used by EPA to confirm technology performance. Four key steps are inherent in the process:

< Needs identification and technology selection
< Demonstration planning and implementation
< Report preparation
< Information distribution

Needs Identification and Technology Selection

The first aspect of the technology verification process is to determine the most important technology needs of EPA and the regulated community. EPA, the Department of Defense, DOE, the private sector, and state agencies are asked to identify technology needs and interest in a technology area. Once a consensus is established on a characterization or analysis need, a search is conducted to identify suitable technologies that will address the need. The technology search and identification process consists of reviewing responses to *Commerce Business Daily* announcements, searches of industry and trade publications, attendance at related conferences, and leads from technology developers. MMTs are evaluated against the following criteria:

< Meets regulatory or user needs
< May be used in the field or in a mobile laboratory
< Applicable to a wide variety of environmentally impacted sites
< High potential for resolving problems for which current methods are unsatisfactory
< Costs are competitive with current methods
< Performance is better than current methods in areas such as data quality, sample preparation, or analytical turnaround time
< Uses techniques that are easier and safer than current methods
< Is a commercially available, field-ready technology

Demonstration Planning and Implementation

After a technology has been selected, EPA, the support contractor, and the technology developer agree to responsibilities for conducting the demonstration and evaluating the technology. The following issues are addressed at this time:

- Identifying demonstration sites that will provide the appropriate physical or chemical attributes, in the desired environmental media
- Identifying and defining the roles of demonstration participants, observers, and reviewers
- Determining logistical and support requirements (such as field equipment, power and water sources, mobile laboratory, or communications network)
- Arranging analytical and sampling support
- Preparing and implementing a demonstration plan that addresses the experimental design, sampling design, quality assurance/quality control (QA/QC), health and safety considerations, scheduling of field and laboratory operations, data analysis procedures, and reporting requirements.

Report Preparation

Innovative technologies are evaluated independently and, when possible, against reference technologies. The field technologies are operated by the developers in the presence of independent technology observers. Technology observers are provided by EPA or a third party group. Demonstration data are used to evaluate the capabilities, limitations, and field applications of each technology. Following the demonstration, all raw and reduced data used to evaluate each technology are compiled into a technology evaluation report, which is mandated by EPA as a record of the demonstration. A data summary and performance evaluation of each technology are published in an Environmental Technology Verification Report (ETVR).

Demonstrations in FY 99

During FY 99, field demonstrations were completed on two sediment sampling technologies (Table 3). The technologies were demonstrated at sites with different sediment characteristics in Massachusetts and Wisconsin. A brief description of the technologies and the field demonstrations is given in the Innovative Technology Highlights section of this report.

Ongoing Demonstrations

The MMT Program has identified TPH analytical technologies for a demonstration to be conducted during FY 00. Because TPH analysis is one of the most commonly used methods, improvements in the technology can have a broad impact across the industry. The science and practice of TPH analysis is of considerable interest to the private sector, as well as EPA Regional and Program Offices. This MMT project will test nine innovative analysis technologies that may prove to be more efficient or cost-effective than current technologies. The performance of each technology will be compared to commonly used conventional procedures. The demonstration will also collect information describing the ease of operation, cost and other relevant performance characteristics of these devices. The demonstration results will assist EPA and others in considering the applicability of these technologies, so they can be used with a complete understandings of the strengths and limitations of the technique.

Table 3. SITE MMT Program Demonstrations Completed in FY 99

Developer Location	Developer	Technology	Site Location
ID	Aquatic Research Instruments	The ARI Russian Peat Borer can collect sediment samples under field operating conditions.	MA, WI
WI	Art's Manufacturing and Supply	The AMS Split Core Sampler can be used to collect and return sediment samples in various conditions.	

Future Direction

Introduction

During FY 99, the SITE Demonstration Program began its third year operating under a market driven approach. This approach continues to emphasize the importance of first selecting a site and, secondly, evaluating one or more appropriate innovative technologies. The selection of these sites and technologies is important in meeting the needs of those responsible for selecting and implementing hazardous waste cleanup.

Three sites were selected under the first host site solicitation. A wide range of representation ensures that the most pressing issues are prioritized and addressed. These sites were selected by a review group comprised of representatives from the following organizations:

- **DOD Environmental Security and Technology Certification Program (ESTCP)**
- **DOE Office of Science and Technology**
- **EPA Office of Solid Waste and Emergency Response**
- **EPA Regional Offices**
- **Interstate Technology and Regulatory Cooperation (ITRC) Workgroup**

One of the selected sites completed an evaluation of two technologies during FY 98. The two additional sites are continuing evaluation of technologies through FY 00.

In response to stakeholders demand, the MMT Program initiated a series of demonstrations designed to evaluate innovative sampling and analysis technologies. In FY 98, soil and soil gas sampling technologies were evaluated. In FY 99, a field demonstration of sediment sampling technologies was conducted. In FY 00, the program will investigate the applicability of nine TPH measurement devices. These projects are designed to address ongoing difficulties in obtaining representative samples at defined depths, or obtaining accurate analytical results using less expensive and less complex equipment.

Demonstration Program Areas of Interest

The areas of primary interest remain an important part of appropriate site selection. Stakeholder groups, like those used in selecting the sites and technologies, identify these areas with technical staff within ORD. This helps ensure that the most pressing needs are met.

In FY 99 the SITE Program continued to emphasize the need for technologies capable of in situ remediation of dense non-aqueous phase liquids (DNAPLs) in difficult geological formations. This continues to be a theme through the remediation community as a whole. This also parallels the theme set in the 1997 National Research Council (NRC) report titled Innovation in Groundwater and Soil Cleanup (www.NAP.EDV/readingroom ISBN #0309-06358-2). As the complexity of the geological formation increases so does the need for innovative technologies to treat or detect DNAPL. The search for effective remediation technologies for metals in soils, treatment of recalcitrant compounds, and the general need for in situ treatment remain high on the priority list.

Because of technical difficulties related to sediment remediation, this is another area where the remediation community would benefit from new processes, approaches or less expensive methods for treatment. In situ treatment, sampling,

and containment are technology areas of interest to be addressed by both the MMT and Demonstration Programs. An increase of projects in these areas is expected in the future.

Redevelopment of sites contaminated with environmentally toxic or hazardous materials is a global concern that requires an integrated approach to mitigate the risks to human health and the environment. Many of these sites can be redeveloped under Brownfields initiatives that are active all over the world. There are currently many regulatory, liability, remediation, and financial obstacles that hinder these redevelopment efforts. The SITE Program will play an important and leading role in the areas of innovative technology and technical assistance . The goal of this support would be to reduce barriers to redevelopment while protecting public health and the environment. The SITE Program has taken the first step in this process on an international scale by participating in the US/German Bilateral Working Group. The Bilateral Working Group will initiate technology demonstrations that are designed to support commercialization of remediation and characterization technologies that can be used in redevelopment efforts. Table 4 outlines the areas of interest of the SITE Program, and Table 5 describes the planned demonstrations for FY 00.

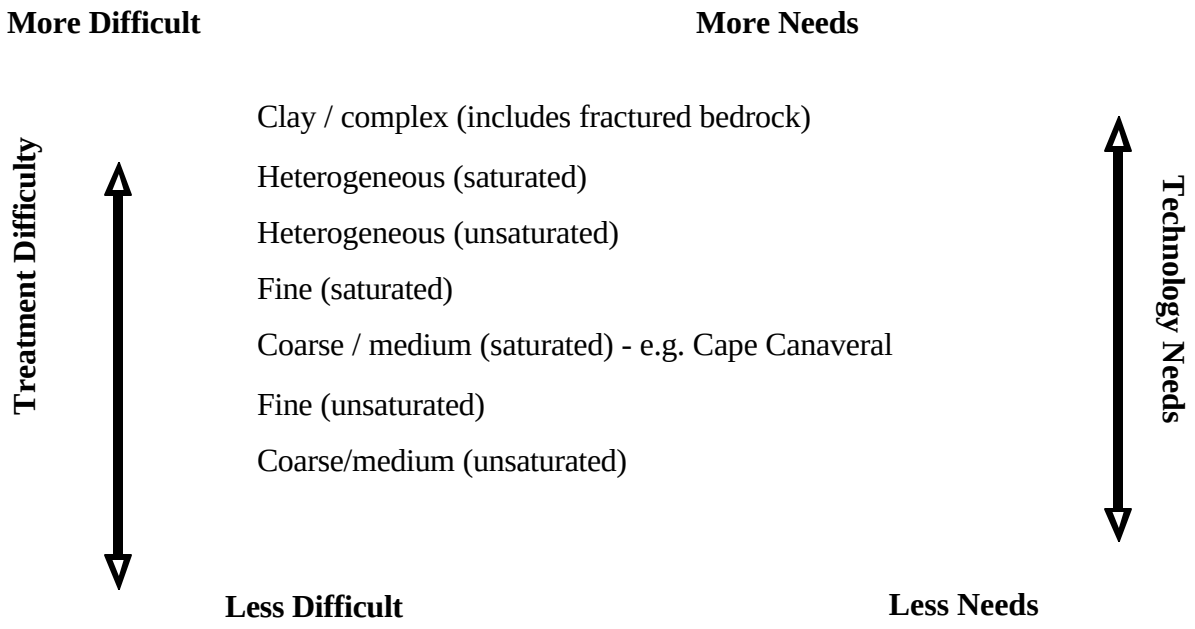


Figure 8. DNAPL Testing Site Roadmap: Media (Based on NRC Report, 1997)

Table 4. SITE Future Emphasis Areas 2001 - 2004	
GROUNDWATER/SOILS	SEDIMENTS

Mining Issues/Acid Mine Drainage Manufactured Gas Plants Wood Treating Pesticide Manufacturers/Formulators Brownfields Chlorinated Oxygenates	In-situ Treatment Ex-situ Dredged Material Treatment – Confined Disposal Facilities (CDF)

Table 5. SITE Program Projects FY 00

Site Name/ Location	Technology	Project Description	Proposed Schedule
Offutt Air Force Base, Omaha, NE	Electrokinetics	Electrokinetic extraction of TCE from soil and groundwater	Treatability studies FY 98, Technology demonstration FY 00
Beede Waste Oil/Cash Energy Plainstow, NH	In situ bioremedation under consideration	Surface soils contaminated with chlorinated VOCs, lead, PAHs and PCBs	Treatability tests FY 98; Demonstration FY 00
Cape Canaveral Cocoa Beach, FL	In situ thermal and in situ oxidative technology ongoing, in situ thermal planned	Groundwater and soils contaminated with TCE	Technology selection FY 98, technology demonstration FY 99-01
Loring AFB Aroostook, ME	4 in situ technologies under consideration by the site	Groundwater contaminated with VOCs, BTEX and TPH	Demonstration FY 00
Two sites in EPA Regions 1 and 5	Evaluation of 9 TPH measurement devices	TPH technologies will be tested at two sites	Technology demonstrations FY 00

MMT Program Areas of Interest

Emerging field analytical areas which will be included in the MMT Program include in situ monitoring technologies, especially for ground water. In addition to the FY 00 TPH testing, the MMT Program is interested in testing non-invasive techniques for site characterization, including a variety of geophysical techniques which claim to be able to map a DNAPL plume without the need for drilling wells. Evaluation of geophysical technologies will be very complex and will likely be conducted at controlled spill facilities.

Because of the importance of effective water quality monitoring to human and environmental health, the MMT Program is planning a demonstration to evaluate the performance of water quality monitoring equipment. This demonstration will evaluate a number of new and portable devices that have been proposed to measure various chemical indicators more accurately and inexpensively.

There are a number of biological tests for toxicity in soils and water that are relevant to ecological risk assessment, and that may be useful in waste and drinking water treatment facilities. A demonstration is planned for FY 01 in order to evaluate the effectiveness of new biological assessment techniques that may be highly sensitive and inexpensive test methods.

Since the program has matured, a number of developers in the area of X-ray fluorescence and gas chromatography / mass spectrometry

have made significant improvements in their technology and will be candidates for abbreviated demonstrations which will evaluate the improvements.

Partnerships for Success

Federal to Federal Interface

The SITE Program recognizes the importance of cooperation between federal agencies to find common areas of need and interest. Federal to federal interface is an important aspect to enhancing the benefits of technology demonstrations. It allows for leveraging resources, expedited cost and performance information exchange and cross fertilization of technical expertise between agencies. In common environmental areas of interest this type of joint research is of great benefit to all parties involved. One example of this type of approach is the Interagency DNAPL Consortium (IDC).

Federal Interface: Cape Canaveral Air Station SITE Demonstration

The IDC at the Cape Canaveral site is comprised of EPA, DOE, DOD, and NASA. The objective of the group is to conduct side-by-side demonstrations of 3 innovative technologies for DNAPL remediation. The demonstration is being conducted at Cape Canaveral Air Station Launch Complex 34. The SITE Program will provide the independent cost and performance evaluation. The Air Force and DOE are combining resources to contract the technology vendors to complete demonstrations. NASA is providing the site and in-kind services for the completion of the demonstrations. NASA plans to use successful demonstration results as a basis for selecting the appropriate technology for remediating Launch Complex 34. The geological formation at the NASA Cape Canaveral site is in what is considered a less difficult to treat formation (Figure 8). In FY 00-01, the IDC is interested in performing work at more difficult to treat geological formations such as heterogeneous saturated and unsaturated zones, fractured bedrock and complex clays. It is expected that different types of technologies may be needed to treat varying complex formations. These joint projects could potentially identify several innovative options or approaches to solving environmental problems where currently there are no solutions.

Federal to State Interface

Where there are common environmental areas of interest, it is equally important to have federal to state interactions as it is federal to federal cooperation. The ITRC provides a mechanism to interact with multiple state regulatory agencies and state specific verification programs. Direct interaction with multiple state agencies provides many benefits. State regulatory agencies are also faced with the difficult problems associated with hazardous waste clean-up, and the variation of regulations between states. Interaction among multiple states on SITE projects can result in multiple technical issues being addressed in one field demonstration. This reduces duplication of field demonstrations to answer one or more state specific regulatory questions.

The ITRC currently has several workgroups that crosscut the SITE Program's environmental priority areas of interest. The various groups are as follows: 1) Passive Barrier Workgroup, 2) DNAPL Workgroup, 3) Phytoremediation Workgroup. These groups are invited to participate in SITE Program demonstration projects. Groups choose to participate at a level required by the objectives of the workgroup. Involvement of the workgroups allows for better planning and exchange of technical requirements early in the project planning.

State Interface: Phytoremediation Workgroup

An example of multistate and SITE participation is the ITRC Phytoremediation Work Group. Phytoremediation technology uses plants to remediate or stabilize contaminants in various media, and has gained considerable interest from regulators, environmental advocacy groups, site

stakeholders, consultants, and the general public. Phytoremediation has great promise to provide an alternative remediation choice that can be more cost-effective, safer, and more acceptable to the public. However, like any other technology, phytoremediation has inherent limitations in the types of sites and contaminants where it can be used for successful remediation to desired concentration levels. The Phytoremediation Work Group is working to better understand and clarify many of the following phytoremediation issues:

- Provide a better understanding of fundamental concepts of phytoremediation technology
- The types of sites and contaminants that are appropriate for the technology
- Evaluate contaminant mobilization and by-product toxicity concerns
- Consider issues related of disposal of harvested plants or falling leaves
- Continue to evaluate seasonal and climate effects on remediation
- Evaluate the effectiveness of the technology on sorbed and highly concentrated contaminants

Another important workgroup within the ITRC is the verification team. This team worked with 11 different verification programs including SITE in evaluating and documenting technical and cost parameters that are important to the different states. The document produced by the team will be a useful tool in determining and meeting the technical information needs of the state regulatory agencies. The report includes a variety of elements to be included in verification program reports. The states participating in the ITRC were encouraged by the willingness of the programs to accommodate states' needs. This type of cooperation will enhance states' confidence in the results of verification and allow them to make more informed decisions regarding use of innovative remediation technologies.

Information Transfer

Information transfer is accomplished through a number of mechanisms. While the internet information distribution is an effective mechanism, published documentation, meetings, and conferences remain an essential part of technical information dissemination. Coordination with existing remediation workgroups and programs is also essential. The SITE Program continues to work cooperatively with numerous programs, such as DOD's ESTCP Program, the Environmental Council of States (ECOS) sponsored ITRC, and as stated previously plans a much stronger technical relationship with the DOE's Office of Science and Technology.

Internet service allows for quick and easily accessible information, and saves time and costs in publication. In FY 98, SITE converted all earlier publications to electronic format and has made those documents accessible through the SITE homepage. General program information is available as well as quarterly reports, most recent documents, program highlights and the technology profiles of the vendors participating in the program. As a result of the homepage, the number of documents printed has been reduced by 75%. According to Web Server Statistics, the monthly average number of hits for electronic information solicited from the SITE homepage over the last year was 724. Numerous requests come from outside the US, reflecting an increased global interest in the SITE Program.

The program will continue pursuing and supporting the development of document summaries in areas where data exists on a variety of technologies or applications. The information is useful in providing the user community with comparative technical information and costs within an area. Documentation will continue for some time since many of the technologies are in situ and highly complex. In situ technology evaluations are tested over varying lengths of time, with a minimum time of 3-6 months. Most are evaluated for one year. In the case of phytoremediation, growing seasons span 2-3 years. The summaries will need updating as the technologies mature and information becomes

available.

http://www.epa.gov/ORD/SITE

Appendix A

SITE PROJECTS
(Alphabetically by Developer State)

SITE PROJECTS - BY DEVELOPER STATE

State	Developer	Technology	Contact	Program	Status
Alabama	CMS Research Corporation Birmingham, AL	Portable Gas Chromatograph	H. Ashley Page 205-773-6911	Monitoring and Measurement Technologies	Completed 1992
Alaska	Arctic Foundations Anchorage, AK	Freeze Barrier	Ed Yarmak 907-562-2741	Demonstration	Ongoing
	Brice Environmental Service Corp. (BESCORP) Fairbanks, AK	Soil Washing Plant	Craig Jones 907-452-2512	Demonstration	Completed 1992
Arizona	Arizona State University Tempe, AZ	Photocatalytic Oxidation and Air Stripping	Gregory Raupp 606-965-2828 Elliot Berman 352-867-1320	Emerging Technology	Completed 1999
	STC Omega (formerly Silicate Technology Corporation) Scottsdale, AZ	Solidification and Stabilization Treatment	Stephen Pelger Scott Larsen 602-948-7100	Demonstration	Completed 1990
California	Analytical and Remedial Technology, Inc., Milpitas, CA	Automated Sampling and Analytical Platform	Gary Hopkins 408-263-8931	Monitoring and Measurement Technologies	Completed 1991
	Berkeley Environmental Restoration Center (formerly Udell Technologies, Inc.) Emeryville, CA	In situ Enhanced Extraction	Kent Udell 510-642-2928 Steve Collins 510-643-1300	Demonstration	Completed 1993
	Binax Corp., Antox Division Sunnyville, CA	Imunoassay for PCB in Soil	Richard Lankow 408-752-1353	Monitoring and Measurement Technologies	Completed 1992
	COGNIS, Inc. Santa Rosa, CA	Biological/ Chemical Treatment	Steve Rock U.S. EPA 513-569-7149	Emerging Technology	Completed 1995
	Eco Mat, Inc. Hayward, CA	Biological Denitrification	Kim Halley 510-783-5885	Demonstration	Ongoing

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	Energy and Environmental Research Corporation Irvine, CA	Hybrid Fluidized Bed System	Richard Koppang 714-859-8851	Emerging Technology	Completed 1992
California	Energy and Environmental Research Corporation Irvine, CA	Reactor Filter System	Neil Widmer 714-859-8851	Emerging Technology	Completed 1995
	Environmental Biotechnologies Montara, CA	Microbial Composting	Douglas Munnecke 415-596-1020	Emerging Technology Demonstration	Completed 1999 Ongoing
	EPOC Water, Inc. Fresno, CA	Precipitation, Microfiltration, Sludge Dewatering	Scott Jackson 209-291-8144	Demonstration	Completed 1993
	General Atomics (formerly Ogden Environmental Services) San Diego, CA	Circulating Bed Combuster	Robert Goforth 619-455-2499	Demonstration	Completed 1989
		Acoustic Barrier Separator	Anthony Gattuso 619-455-2910	Emerging Technology	Completed 1995
	Geokinetics	Electrokinetics	Steven Clark 510-704-2940	Demonstration	Ongoing
	Geokinetics & Duke Engineering	Electrokinetic Heating & Surfactant Flushing	Steven Clark 510-704-2940	Demonstration	Completed 1999
	GIS\Solutions, Inc. Concord, CA	GIS\Key Environmental Data Management Software	Garry Reid 510-827-5400	Demonstration	Completed 1993

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	Groundwater Technology Government Services, Inc. Concord, CA	Biological Composting	Ronald Hicks 510-671-2387	Emerging Technology	Completed 1995
	Hughes Environmental Systems, Inc. Manhattan Beach, CA	Steam Enhanced Recovery Process	Paul De Percin U.S. EPA 513-569-7797	Demonstration	Completed 1993
	Lockheed Martin Missiles & Space Co., Inc. Palo Alto, CA	Electrokinetic Remediation	Steven H. Schwartzkopf 415-424-3176	Demonstration	Ongoing
California	Magnum Water Technology El Segundo, CA	CAV-OX Process	Dale Cox 310-322-4143 Jack Simser 310-640-7000	Demonstration	Completed 1993
	Membrane Technology and Research, Inc. Menlo Park, CA	VaporSep Membrane Process	Marc Jacobs Doug Gottschlich 415-328-2228	Emerging Technology	Completed 1991
	North American Technologies Aprotek San Ramon, CA	Oleofilter	Cathryn Wimberly 916-366-6185	Demonstration	Completed
	NOVATERRA, Inc. (formerly Toxic Treatments USA, Inc.) Los Angeles, CA	In-situ and Air Stripping	Philip LaMori 310-328-9433	Demonstration	Completed 1989
	Praxis Environmental Services Burlingame, CA	In-situ Steam Enhanced Extraction	Lloyd Stewart 415-641-9044	Demonstration	Completed 1997
	Pulse Sciences, San Leandro, CA	X-Ray Treatment (Aqueous)	Vernon Bailey 510-632-5100 ext. 227	Emerging Technology	Completed 1994
		X-Ray Treatment (Soils)	Vernon Bailey 510-632-5100 ext. 227	Emerging Technology	Ongoing

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	Radian Corporation (formerly AWD Technologies, Inc.) Walnut Creek, CA	Integrated Vapor Extraction and Steam Vacuum Stripping	David Bluestein 415-227-0822	Demonstration	Completed 1990
	Retech, Inc. Ukiah, CA	Plasma Arc Vitrification	Ronald Womack Leroy B. Leland 707-462-6522	Demonstration	Completed 1991
	Rochem Separation Systems, Inc. Torrance, CA	Rochem Disc Tube Module System	David LaMonica 310-370-3160	Demonstration	Completed 1994
	Roy F. Weston Sherman Oaks, CA	In well Air Stripping	Jeff Bannon 818-971-4900 Eric Klingel 704-660-1673	Demonstration	Completed 1994
	Simulprobe Technologies, Inc.	Core Barrel Soil Sampler	Richard Laton 415-883-8787	Monitoring and Measurement Technologies	Completed
California	SIVE Services Dixon, CA	Steam Injection and Vacuum Extraction	Douglas Dieter 916-678-8358	Demonstration	Ongoing
	SRI Instruments Torrance, CA	Portable Gas Chromatograph	Douglas Gavilanes 310-214-5092	Monitoring and Measurement Technologies	Completed 1992
	Terra-Kleen Response Group, Inc. Del Mar, CA	Solvent Extraction	Alan Cash 619-558-8762	Demonstration	Completed 1994 Completed 1997
	Texaco, Inc. S. El Monte, CA	Entrained-Bed Gasification	John Wintor 310-908-7387	Demonstration	Completed 1994
	Thermatrix, Inc. (Formerly Purus, Inc.) San Jose, CA	Photolytic Oxidation	Steve McAdams 408-453-0490	Emerging Technology	Completed 1992
	U.S. EPA Region IX San Francisco, CA	Excavation and Foam Suppression of Volatiles	John Blevins 415-744-2400	Demonstration	Completed 1990

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	U.S. Filter (formerly Ultrox) Santa Ana, CA	Ultraviolet Radiation and Oxidation	John Lowry 412-722-1247	Demonstration	Completed 1989
	Xon Tech, Inc. Van Nuys, CA	Xon Tech Sector Sampler	Matt Young 818-787-7380	Monitoring and Measurement Technologies	Completed 1991
Colorado	CF Systems Corporation Arvada, CO	Solvent Extraction	L.V. Benningfield 303-420-1550	Demonstration	Completed 1988
		Batch Organics Extraction Unit	L.V. Benningfield 303-420-1550	Demonstration	Ongoing
	Colorado Dept. of Health Denver, CO	Wetland-Based Treatment for Mineral Mine Drainage	Jim Lewis 303-692-3390	Demonstration	Completed 1999
	Colorado School of Mines, Golden, CO and Colorado Department of Health Denver, CO	Wetlands-Based Treatment	Thomas Wildeman 303-273-3642	Emerging Technology	Completed
Colorado	General Environmental Corporation Englewood, CO	Electrocoagulation	Carl Dalrymple 303-761-6960	Demonstration	Completed 1995
	Pintail Systems, Inc. Aurora, CO	Biodegradation of Cyanide	Caren Caldwell 303-367-8443	Demonstration	Completed 1998
		Biostabilization of Lead	Leslie Thompson 303-367-8443	Demonstration	Ongoing
		Biostabilization of Mercury Mining Wastes	Leslie Thompson 303-367-8443	Demonstration	Ongoing
		Biological Stabilization of Arsenic in Soils	Leslie Thompson 303-367-8443	Demonstration	Ongoing
	Region 8 and State of Colorado	Multiple Innovative Passive mine Drainage Technologies	Victor Kettellapper 303-312-6578	Demonstration	Ongoing

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	Rocky Mountain Remediation Services Golden, CO	Environmental Soil Amendment (Stabilization)	Jim Barthel 303-215-6620	Demonstration	Completed
	Smith Environmental Technologies Corporation (formerly Canonie Environmental Services Corp.) Englewood, CO	Low Temperature Thermal Aeration	Joseph Hutton 303-790-1747	Demonstration	Completed 1992
		Anaerobic Thermal Processor	Joseph Hutton 303-790-1747	Demonstration	Completed 1991
Connecticut	Dexsil Corporation Hamden, CT 4 demonstrations	Environmental Test Kits (PCB) Chlor-N-Soil L2000 PCB/Chloride Analyzer	Jack Mahon 203-288-3509	Monitoring and Measurement Technologies	Completed 1993
Delaware	E.I. DuPont de Nemours and Co. and Oberlin Filter Co. Newark, DE and Waukesha, WI	Membrane Microfiltration	Ernest Mayer 302-774-2277	Demonstration	Completed 1990
Delaware	Hewlett-Packard (formerly MTI Analytical Instruments) Wilmington, DE	Portable Gas Chromatograph	Hewlett-Packard 800-227-9770 Bob Belair 302-633-8487	Monitoring and Measurement Technologies	Completed 1992
Florida	Strategic Diagnostics Inc. (formerly Ensys, Inc.) Newark, DE	Immunoassay for PCP	Tim Lawruk 800-544-8881 302-456-6782	Monitoring and Measurement Technologies	Completed 1993
	Funderburk and Associates Apollo Beach, FL	Dechlorination and Immobilization	Ray Funderburk 800-723-8847	Demonstration	Completed 1997

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	High Voltage Environmental Applications, Inc./Florida International University and University of Miami Miami, FL	High-Energy Electron Irradiation (Aqueous)	William Cooper 910-962-3450	Emerging Technology Demonstration	Completed 1993 Completed 1994
	High Voltage Environmental Applications, Inc. Miami, FL	High Energy Electronic Beam (Solids)	William Cooper 305-593-5330	Emerging Technology	Completed
	PCP, Inc. West Palm Beach, FL	Ion Mobility Spectrometry	Martin Cohen 407-683-0507	Monitoring and Measurement Technologies	Completed 1991
Georgia	American Combustion, Inc. Norcross, GA	PYRETRON Thermal Destruction	Gregory Gitman 404-564-4180	Demonstration	Completed 1988
	ETG., Inc. Norcross, GA	Long-Path Fourier Transform Infrared Spectrometer	Orman Simpson 404-242-0977	Monitoring and Measurement Technologies	Completed 1992
	Sonotech, Inc. Atlanta, GA	Frequency Tunable Pulse Combustion System	Ben Zinn 404-894-3033	Demonstration	Completed 1995
	Williams Environmental Services, Inc. (Formerly Harmon Environmental Services, Inc.) Stone Mountain, GA	Soil Washing	S. Jackson Hubbard (U.S. EPA) 513-569-7507	Emerging Technology	Exited 1992
Idaho	Aquatic Research Instruments	Sediment Core Sampler	Will Young 208-768-2222	Monitoring and Measurement	Completed
	Aquatic Research Instruments	Russian Peat Borer	Will Young 208-768-2222	Monitoring and Measurement Technologies	Completed
	Argonne National Laboratory West Idaho Fall, ID	Phytoremediation of Radionuclides	Scott Lee 208-533-7829	Demonstration	Ongoing

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	Art's Manufacturing and Supply	AMS™ Dual-Tube Liner Soil Sampler	Brian Anderson 800-635-7330	Monitoring and Measurement Technologies	Completed
		AMS™ Split Core Sampler	Brian Anderson 800-635-7330	Monitoring and Measurement Technologies	Completed 1999
	J.R. Simplot Co. Pocatello, ID	Anaerobic Biological Process	Russell Kaake 208-235-5620	Emerging Technology	Completed 1993
		Anaerobic Biological Process	Tom Yergovich 209-858-2511	Demonstration	Completed 1994
	Morrison Knudsen Corp./STG Technologies Boise, ID	Grouting Technique	Kathryn Levihn Rick Raymondi 208-386-6115	Demonstration	Completed
	Process Technologies, Inc. Boise, ID	Photolytic Destruction of SVE off-gases	Michael Swan 208-385-0900	Demonstration	Ongoing
	U.S. DOE/ Duke Engineering Lockheed, ID	Surfactant Enhanced Acquifer Remediation	Michael Shook 208-526-6945	Demonstration	Ongoing
Illinois	Allied Signal Corporation Des Plains, IL	Submerged Aerobic Fixed Film Reactor	Steve Lupton 708-391-3500	Demonstration	Completed
	Institute of Gas Technology	Chemical and Biological Treatment	Robert Kelley 847-768-0722	Emerging Technology	Completed 1993
		Fluid Extraction-Biological Degradation Process	Albert Paterek 847-768-0720	Emerging Technology	Completed 1992
		Fluidized-Bed Cyclonic Agglomerating Incinerator	Mike Mensinger 847-768-0602 Amir Rehmat 847-768-0588	Emerging Technology	Completed
Illinois	Institute of Gas Technology	Superficial Extraction/Liquid Phase Oxidation of Waste	Mike Mensinger 847-768-0602	Emerging Technology	Completed

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	OHM Environmental (formerly RUST Remedial Services, Inc.) Lombard, IL	X-TRAX Thermal Desorption	Dick Ayen 803-646-2413	Demonstration	Completed 1992
	Recycling Sciences, Inc. Chicago, IL	Desorption and Vapor Extraction System	William Meenan 312-663-4269	Demonstration	Ongoing
	Wheelabrator Clean Air Systems (formerly Chemical Waste Management) Schaumburg, IL	Evaporation and Chemical Oxidation	Bob Hernquist 708-706-6900	Demonstration	Completed
Indiana	Bio-Rem, Inc. Butler, IN	Augmented In-situ Subsurface Bioremediation Process	David Mann 219-868-5823 800-428-4626	Demonstration	Completed 1993
	Geoprobe Salina, KS	Soil, Water, Vapor Sampling Cone Penetrometer	Wes McCall Tom Omli 800-436-7762	Monitoring and Measuring Technologies	Completed 1995
	Sevenson Environmental Services, Inc. Munster, IN	Chemical Stabilization of Mercury Mining Wastes	Steve Chisick 219-836-0116	Demonstration	Ongoing
	Sevenson Environmental Services, Inc. Munster, IN	MAECTITE® Treatment Process	Chuck McPheeters 219-836-0116	Demonstration	Ongoing
	Soil Tech, ATP Systems Inc Porter, IN	Thermal Desorption	Joe Hutton 219-926-8651	Demonstration	Completed 1992
Iowa	Clements Associates, Inc.	JMC Environmentalist's Subsoil Probe	Jim Clements 515-792-8285	Monitoring and Measurements Technologies	Completed
Kansas	Geoprobe Systems Salina, KS	Large Bore Soil Sampler	Wesley McCall Tom Omli 800-436-7762	Monitoring and Measurements Technologies	Completed
Kentucky	Microsensor System, Inc. Bowling Green, KY	Portable Gas Chromatograph	Norman Davis 502-752-1353	Monitoring and Measurement Technologies	Completed 1995

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
Louisiana	Advanced Remediation Mixing, Inc. (Formerly Chemfix Technologies, Inc.) Kenner, LA	Solidification and Stabilization	Sam Pizzitola 504-461-0466	Demonstration	Completed 1989
	Electrokinetics, Inc. Baton Rouge, LA	Electrokinetic Remediation	Elif Acar 504-388-3992	Emerging Technology Demonstration	Completed 1989 Ongoing
		Electro-Klean Electrokinetic Soil Remediation	Elif Acar 504-753-8004	Emerging Technology	Ongoing
	SBP Technologies, Inc. Baton Rouge, LA	Membrane Separation and Bioremediation	Clayton Page 504-755-7711	Demonstration	Completed 1995
Maryland	Quadrel Services, Inc.	Emflux® Soil-Gas Survey System	Bruce Tucker Paul Henning 301-874-5510	Monitoring and Measurement Technologies	Completed
	W. L. Gore and Associates, Inc.	Gore-Scrubber® Passive Soil Gas Sampler	Ray Fenstermacher 410-392-7600	Monitoring and Measurement Technologies	Completed
Massachusetts	ABB Environmental Services, Inc. Wakefield, MA	Anaerobic/ Aerobic Sequential Bioremediation	Willard Murray 617-245-6606	Emerging Technology	Completed 1998
	Harding Lawson Associates (formally ABB Environmental Services, Inc.) Wakefield, MA	Two-Zone Plume Interception In-situ Treatment Strategy	Jaret Johnson Willard Murray 617-245-6606	Emerging Technology	Completed
	Bruker Instruments Billerica, MA	Bruker Mobile Environmental Monitor	Dr. Brian Abraham 508-667-9580	Monitoring and Measurement Technologies	Completed
	HNU Systems, Inc. Newtown, MA	Portable Gas Chromatograph	Jack Driscoll 800-724-6690 617-964-6690	Monitoring and Measurement Technologies	Completed 1992
	HNU Systems, Inc. Newtown, MA	Portable X-Ray Fluorescence Spectrometer	Jack Driscoll 800-724-6690 617-964-6690	Monitoring and Measurement Technologies	Completed 1995

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
Massachusetts	KSE, Inc. Amherst, MA	Air II Photocatalytic Technology for Air Streams	James Kittrell 413-549-5506	Demonstration	Completed 1999
	Maxymillian Technologies, Inc. (formerly Clean Berkshires) Lanesboro, MA	High Temperature Thermal Process	Jim Maxymillian 413-499-3050	Demonstration	Completed 1993
	Millipore Corporation Bedford, MA	EnviroGard PCB Immunoassay Test Kit	Alan Weiss 617-275-9200	Monitoring and Measurement Technologies	Completed 1992
		Immunoassay for PCP (Soil, Water)	Alan Weiss 617-275-9200	Monitoring and Measurement Technologies	Completed 1993
	Niton Corporation Bedford, MA	Portable X-Ray Fluorescence Spectrometer	Don Sackett 781-275-9275	Monitoring and Measurement Technologies	Completed 1995
	Ohmicron Corporation Newton, MA	Immunoassay for PCP in Soil	Mary Hayes 215-860-5115	Monitoring and Measurement Technologies	Completed 1993
	PSI Technology Co. Andover, MA	Immobilize and Decontaminate Metals in Aggregate Solids	Joseph Morency 508-689-0003	Emerging Technology	Completed 1993
	UV Technologies, Inc. (formerly Energy and Environmental Engineering, Inc.) East Cambridge, MA	Laser-Induced Photochemical Oxidative Destruction	John Roll James Porter 617-666-5500	Emerging Technology	Completed 1993
Minnesota	BioTrol Inc. Eden Prairie, MN	Biotreatment of Groundwater	Dennis Chilcote 612-942-8032	Demonstration	Completed 1989
	BioTrol, Inc. Eden Prairie, MN	Methanotropic Bioreactor System	Durell Dobbins 612-942-8032	Emerging Technology	Completed 1992
	BioTrol, Inc. Eden Prairie, MN	Biological Aqueous Treatment System	Durell Dobbins 612-942-8032	Demonstration	Completed 1989

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	BioTrol, Inc. Eden Prairie, MN	Soil Washing System	Dennis Chilcote 612-942-8032	Demonstration	Completed 1989
Minnesota	Membrane Corporation Minneapolis, MN	Membrane Gas Transfer in Waste Remediation	Charles Gantzer 612-378-2160	Emerging Technology	Discontinued
Missouri	COGNIS TERRAMET Gross, MO	Removal of Lead from Soils	Lou Magdits 573-626-3476	Demonstration	Completed 1994
Montana	Montana College of Mineral Science and Technology Butte, MT	Air-Sparged Hydrocyclone	Theodore Jordan 406-496-4112 406-496-4193	Emerging Technology	Completed 1994
		Campbell Centrifugal Jig	Gordon Ziesing 406-496-1573 406-496-4193	Emerging Technology	Ongoing
Nebraska	University of Nebraska Lincoln, NE	Spray Irrigation	Ray Spalding 402-483-3931	Demonstration	Completed 1996
Nevada	U.S. EPA Las Vegas, NV	Field Analytical Screening Program (FASP)	Howard Fribush 703-603-8831 Larry Jack 702-798-2373	Demonstration	Completed 1996
New Jersey	Accutech Inc Keyport, NJ and New Jersey Institute of Technology Newark, NJ	Pneumatic Fracturing Extraction and Hot Gas Injection	John Liskowitz 908-739-6444	Demonstration	Completed 1992
	ART International, Inc. (formerly Enviro Sciences, Inc.) Denville, NJ	Low-Energy Solvent Extraction Process	Werner Steiner 201-627-7601	Emerging Technology	Completed 1994
	Dehydro-Tech. Corporation Somerville, NJ	Carver-Greenfield Process for Extraction of Oily Waste	Theodore Trowbridge 908-904-1606	Demonstration	Completed 1991

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	Geotech Development Corporation Newark, NJ	Cold Top Vitrification	William Librizzi 201-596-5846 Thomas Tate 610-337-8515	Demonstration	Ongoing
	Envirogen, Inc. Lawrenceville, NJ	Microbial Degradation/ Solvent Extraction	Ronald Unterman (609) 936-9300	Demonstration	Ongoing
New Jersey	M.L. ENERGIA, Inc. Princeton, NJ	Reductive Photo-Dechlorination Treatment	Moshe Lavid 609-799-7970	Emerging Technology	Completed 1995
	M.L. ENERGIA, Inc. Princeton, NJ	Reductive Photo-Thermal Oxidation Processes for Chlorocarbons	Moshe Lavid 609-799-7970	Emerging Technology	Ongoing
	New Jersey Institute of Technology, Hazardous Substance Management Research Center Newark, NJ	Pneumatic Fracturing/ Bioremediation	John Schuring 201-596-5849 David Kosson 908-445-4346	Emerging Technology	Completed 1992
	New Jersey Institute of Technology Newark, NJ and GeoTech Development Corporation King of Prussia, PA	Cold Top Vitrification	William Librizzi 201-596-5846 Thomas Tate 610-337-8515	Demonstration	Ongoing
	New Jersey Institute of Technology Newark, NJ	GHEA Associates Process	Itzhak Gottlieb 201-226-4642	Emerging Technology	Completed 1992
	Phytotech, Inc. Monmouth, NJ	Phytoextraction of metal from soil	Burt Ensley 908-438-0900	Demonstration	Completed 1998
	Sentex Sensing Technology, Inc. Ridgefield, NJ	Portable Gas Chromatograph	Amos Linenberg 201-945-3694	Monitoring and Measurement Technologies	Completed 1992
	Solucorp Saddle Back, NJ	Molecular Bonding System	Robert Kuhn 914-623-2333	Demonstration	ompleted

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
New Mexico	Billings and Associates, Inc. Albuquerque, NM	Subsurface Volatilization and Ventilation System	Gale Billings 505-345-1116 Don Brenneman 713-676-5324	Demonstration	Completed 1994
	Commodore Advanced Sciences, Inc. Albuquerque, NM	Set Process for PCBs in soil	Mark Jones 505-872-6803	Demonstration	Ongoing
	Resource Management and Recovery (formerly Bio-Recovery Systems, Inc.) Las Cruces, NM	AlgaSorb Biological Sorption	Mike Hosea 505-382-9228	Emerging Technology	Completed 1990
New Mexico	Sandia National Laboratories Albuquerque, NM	Electrokinetic Extraction in Unsaturated Soils	Eric Lindgren 505-844-3820 Earl Mattson 505-856-3311	Demonstration	Completed 1999
	Thermo Nutech (formerly TMA Eberline) Albuquerque, NM	Segmented Gate System for Radioactive Materials	Jeff Brown 423-481-0683	Emerging Technology	Completed
New York	Photovac International, Inc. Deer Park, NY	Portable Gas Chromatograph	Mark Collins 516-254-4199	Monitoring and Measurement Technologies	Completed 1992
	SBP Technologies, Inc. White Plains, NY	Bioventing, Air Sparging, Biological Treatment for Ground Water (multi-developer project with State of New York)	Richard Desrosiers 914-694-2280 Nick Kolak 518-457-3372	Demonstration	Completed 1995
	RECRA Environmental, Inc. (formerly Electro-Pure Systems, Inc.) Amherst, NY	Alternating Current Electrocoagula-tion Technology	Kenneth Kinecki 800-527-3272	Emerging Technology	Completed 1992
	State University of New York at Oswego Oswego, NY	Photocatalytic Treatment for Sediments	Ronald Scrudato Jeffrey Shiarenzelli 315-341-3639	Emerging Technology	Completed 1995

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	Texaco Syngas, Inc. White Plains, NY	Gasification Process	John Winter 316-251-4000 ext. 536	Demonstration	Completed 1994
	Xerox Corporation Webster, NY	Ground Water Extraction	Ron Hess 716-422-3694 Phil Mook 916-643-5443	Demonstration	Completed 1995
Ohio	ASC/EMR Wright Patterson AFB Dayton, OH	Phytoremedia-tion of TCE in Groundwater	Greg Harvey 513-255-7716	Demonstration	Completed 1998
	Babock and Wilcox Alliance Research Center Alliance, OH	Cyclone Vitrification	Lawrence King 216-829-7576	Demonstration	Completed 1991
	Battelle Memorial Institute Columbus, OH	In-situ Electroacoustic Soil Decontamina-tion	Satya Chauhan 614-424-4812	Emerging Technology	Completed
Ohio	Commodore Environmental Columbus, Ohio	Solvated Electron Treatment of Chlorinated Organics	Neil Dronby 614-297-0365	Demonstration	Completed 1996
	Ferro Corporation Independence, OH	Waste Vitrification Through Electric Melting	S.K. Muralidhar 216-641-8580	Emerging Technology	Completed
	IT Corporation Cincinnati, OH	Chelation/ Electro-deposition of Toxic Metals from Soil	Radha Krishnan 513-782-4700	Emerging Technology	Completed
	IT Corporation (formerly OHM Remediation Services Corp.) Findlay, OH	Oxygen Microbubble In-situ Bioremediation	Douglas Jerger 423-690-3211	Emerging Technology	Completed 1998

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	Monsanto/ Dupont Cincinnati, OH	In-situ Electroosmosis of TCE in soil/ Groundwaters "Lasagna Process"	Thomas Holdsworth 513-569-7675	Demonstration	Completed 1998
	University of Dayton Research Institute Dayton, OH	Photothermal Detoxification Unit (PDU)	Berry Dellinger John Graham 513-229-2846	Emerging Technology	Completed 1994
	US EPA Mobile Volume Reduction Unit Cincinnati, Ohio	Soil Washing	Richard Griffith 908-321-6629	Demonstration	Completed 1992
	U.S. EPA NRMRL Cincinnati, OH	Bioventing	Paul McCauley 513-569-7444	Demonstration	Completed 1997
	U.S. EPA NRMRL and ETG Environmental Cincinnati, OH	Base-Catalyzed Dechlorination Process	George Huffman 513-569-7341 Yei-Shong Shieh 215-832-0700	Demonstration	Completed 1993
	U.S. EPA Risk Reduction Engineering Laboratory and IT Corporation Cincinnati, OH	Debris Washing System	Michael Taylor 513-782-4700	Demonstration	Completed 1990
Ohio	U.S. EPA Risk Reduction Engineering Laboratory and FRX, Inc. Cincinnati, OH	Hydraulic Fracturing	William Slack 513-469-6040	Demonstration	Completed 1992
	U.S. EPA NRMRL Cincinnati, OH	Alternate Cover Assessment Program (ACAP)	Steve Rock 513-569-7149	Demonstration	Ongoing
Oklahoma	Geo-Microbial Technologies, Ochelata, OK	Technology for Metals Release and Removal from Wastes	Donald Hitzman 918-535-2281	Emerging Technology	Ongoing
Oregon	Metorex, Inc. Bend, OR	Field Portable X-Ray Fluorescence (FPXRF)	Jim Pasmore 800-229-9209 541-385-6748	Monitoring and Measuring Technologies	Completed 1995

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
Pennsylvania	Aluminum Company of America (formerly Alcoa Separations Technology, Inc.) Pittsburgh, PA	Bioscrubber	Paul Liu 412-826-3711	Emerging Technology	Completed 1993
	Calgon Carbon Oxidation Technologies (formerly Peroxidation Systems, Inc.) Pittsburgh, PA	Perox-Pur Chemical Oxidation	Bertrand Dussert 412-787-6681	Demonstration	Completed 1995
	Center for Hazardous Materials Research Pittsburgh, PA	Acid Extraction Treatment System	Stephe Paff 412-826-5321	Emerging Technology	Completed 1992
	Center for Hazardous Materials Research Pittsburgh, PA	Organics Destruction and Metals Stabilization	B Stephe Paff 412-826-5321 Brian Bosilovich 412-826-5321	Emerging Technology	Completed 1995
	Concurrent Technologies (formerly Center for Hazardous Materials Research) Pittsburgh, PA	Lead Smelting	Brian Bosilovich 412-826-5321	Emerging Technology	Completed 1993
Pennsylvania	MacTec-SPB Technologies Company Pittsburgh, PA	In Well Vapor Stripping of Ground Water	Mark McGlathery 800-444-6221	Demonstration	Completed 1999
Pennsylvania	Geo-Con, Inc. Monroeville, PA 2 Demonstrations	In-situ Solidification/ Stabilization	Linda Ward Robert Hayden 412-856-7700	Demonstration	Completed 1988
	Horsehead Resource Development Co. Inc. Monaca, PA	Flame Reactor	Regis Zagrocki 610-826-8810	Demonstration	Completed
	Lewis Environmental Services, Inc. Pittsburgh, PA	Soil Leaching Process	Tom Lewis III 412-322-8100	Emerging Technology	Ongoing
	Strategic Diagnostics, Inc. Newtown, PA	Immunoassay for PCP	Craig Kostyshyn 215-860-5115 ext. 634	Monitoring and Measurement Technologies	Completed 1993

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	Remediation Technologies, Inc. Pitsburgh, PA	Slurry Biodegradation	David Nakles 412-826-3340	Demonstration	Completed 1991
	R.E. Wright Middletown, PA	Bioventing, Air Sparging, Biological Treatment for Ground Water (multi-developer project with state of New York)	Richard Cronce 717-944-5501	Demonstration	Completed 1992
	Roy F. Weston, Inc. West Chester, PA	Thermal Desorption	Mike Cosmos 215-430-7423	Demonstration	Completed 1992
	Roy F. Weston, Inc. West Chester, PA	Steam Regeneration Adsorption System (Ambersorb)	John Thoroughgood 610-701-3728 Deborah Plantz 215-537-4061	Emerging Technology	Completed 1995
	Vortec Corp Collegeville, PA	Oxidation and Vitrification Process	James Hnat 610-489-2255	Emerging Technology Demonstration	Completed 1993 Ongoing
South Carolina	E&C Williams Summerville, SC	Chemical Stabilization of Mercury Mining Wastes	Charlie Williams 843-821-4200	Demonstration	Ongoing
	University of South Carolina Columbia, SC	In-situ Mitigation of Acid Water	Frank Caruccio 803-777-4512	Emerging Technology	Completed 1995
Tennessee	Bergmann USA Gallatin, TN	Soil and Sediment Washing Technology	George Jones 615-230-2217	Demonstration	Completed 1992
	Brown and Root Environmental/ Illinois Institute of Technology Oak Ridge, TN	Radio Frequency Heating	Clifton Blanchard 423-483-9900	Demonstration	Completed 1994
	IT Corporation Knoxville, TN	Batch Steam Distillation and Metal Extraction	Stuart Shealy 423-690-3211	Emerging Technology	Completed 1992

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
		Eimco Biolift Slurry Reactor as developed by Tekno Associates	Kandi Brown 423-690-3211	Emerging Technology	Completed 1992
		Mixed Waste Treatment Process	Ed Alperin 615-690-3211	Emerging Technology	Completed 1995
	IT Corporation Knoxville, TN	Photocalytic and Biological Soil Detoxificaiton	Duane Graves 423-690-3211	Emerging Technology	Completed 1993
	WASTECH, Inc. Oak Ridge, TN	Solidification/ Stabilization	Terrence Lyons U.S. EPA 513-569-7859	Demonstration	Completed 1991
Texas	Geokinetics and Duke Engineering	Electrokinetic Flushing & Surfactant Flushing	Harry Linnemeyer 512-425-2000 Steven Clark 510-704-2940	Demonstration	Completed 1999
	EET, Inc. Bellaire, TX	PCB/Metals Extraction from Porous Surfaces	Tim Tarrillion 713-662-0727	Demonstration	Completed 1997
	ENSR Consulting Engineering and Larson Engineering Houston, TX	Bioventing, Air Sparging, Biological Treatment for Ground Water (multi-developer project with the State of New York)	David Ramsden (ENSR) 713-520-6802 N. Sathi-yakumar 716-272-7310	Demonstration	Completed 1995
	Filter Flow Technology, Inc. League City, TX	Colloid Polishing Method	Todd Johnson 713-334-6080	Demonstration	Completed 1992
Texas	Fugro Geosciences, Inc. Houston, TX	Laser Fluorescence PAH, BTEX Screening Cone Penetrometer	Andrew Taer 713-778-5580	Monitoring and Measuring Technologies	Completed 1996

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	Hanby Environmental Laboratory Wimberly, TX	PCP Test Kit	John Hanby 512-847-1212	Monitoring and Measurement Technologies	Completed 1993
	Hrubetz Environmental Services, Inc. Dallas, TX	HRUBOUT Process	Barbara Hrubetz Michael Hrubetz 214-363-7833	Demonstration	Completed 1993
	Solidtech, Inc. Houston, TX	Solidification and Stabilization	Bill Stallworth 713-497-8558	Demonstration	Completed 1988
	Star Organics Dallas, TX	Injection Soil Amendment (Stabilization)	Phil Clarke 214-522-0742	Demonstration	Completed 1999
	TN Spectrace Round Rock, TX	Portable X-Ray Fluorescence Spectrometer	Peter Barry 512-388-9100	Monitoring and Measuring Technologies	Completed 1995
	University of Houston Houston, TX	Concentrated Salt Extraction of Lead	Dennis Clifford 713-743-4266	Emerging Technology	Completed 1999
	Western Product Recovery Group, Inc. Houston, TX	CCBA Physical and Chemical Treatment	Donald Kelly 713-493-9321 Bert Elkins 619-749-8856	Emerging Technology	Completed 1994
Utah	Phytokinetics, Inc. North Logan, UT	Phytoremedia-tion of Soils	Ari Ferro 801-750-0985	Emerging Technology Demonstration	Completed 1999 Completed 1999
Vermont	Green Mountain Laboratories	Biodegradation of PCBs in Soils	Adam Longee 802-223-1468	Demonstration	Ongoing
Virginia	BioGenesis Enterprises, Inc. Fairfax Station, VA	Soil Washing/ Biological Treatment	Charles Wilde 703-250-3442	Demonstration	Completed 1992

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	BWX Tech., Inc. (Affiliate of Babcock and Wilcox Co. Lynchburg, VA	Cyclone Furnace	Evan Reynolds 804-522-6000	Emerging Technology Demonstration	Completed 1992 Completed 1991
	Dynaphore, Inc. Richmond, VA	Removal of Dissolved Heavy Metals via FORAGER Sponge	Norman Rainer 804-288-7109	Demonstration	Completed 1994
Virginia	ITT Industries Roanoke, VA	Enhanced In-Situ Bioremediation of Chlorinated Compounds	Rosann Kryczkowski 540-362-7356	Demonstration	Completed 1999
Washington	ECOVA Corporation Redmond, WA	Bioslurry Reactor	Alan Jones 206-883-1900	Demonstration	Completed 1991
	Geosafe Corporation Richland, WA	In-situ Vitrification	James Hansen Matthew Haass 509-375-0710	Demonstration	Completed 1994
	Ionics/ Resources Conservation Co. Bellevue, WA	BEST Solvent Extraction	William Hines 206-828-2400	Demonstration	Completed 1992
	Remediation Technologies, Inc. (ReTec) Seattle, WA	Methanotrophic Biofilm Reactor	Hans Stroo 206-624-9349	Emerging Technology	Completed 1995
	Remediation Technologies, Inc. (ReTec) Seattle, WA	Liquid and Soils Biological Treatment	Merv Cooper 206-624-9349	Demonstration	Completed 1994
	Scitec Corporation Richland, WA	Field Portable X-Ray Fluorescence	Steve Santy 800-466-5323 509-783-9850	Monitoring and Measurement Technologies	Completed 1995
	University of Washington Seattle, WA	Asdorptive Filtration	Mark Benjamin 206-543-7645	Emerging Technology	Completed 1992
Wisconsin	Svedala Industries (formerly Allis Mineral Systems) Oak Creek, WI	Pyrokiln Thermal Encapsulation Process	Jim Kidd 414-798-6341 Glenn Heian 414-762-1190	Emerging Technology	Completed 1993

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	US EPA/ NRMRL US-DA Forest Products Lab Madison	Fungus Treatment Technology	Richard Lamar 608-231-9469	Demonstration	Completed 1991
	University of Wisconsin, Madison, WI	Photoelectro-catalytic Treatment of Metals and Organics in Water	Marc Anderson 608-262-2674 Charles Hill, Jr. 608-263-4593	Emerging Technology	Completed
Wyoming	Western Research Institute Laramie, WY	Contained Recovery of Oily Wastes (CROW)	James Speight 307-721-2011	Emerging Technology Demonstration	Completed 1991 Completed 1997
Canada	Atomic Energy of Canada, Limited Chalk River, Ontario	Ultrasonic-Acid Leachate Treatment for Mixed Wastes	Shiv Vijayan 613-583-3311 ext. 3220/6057	Emerging Technology	Completed
	Atomic Energy of Canada, Limited Chalk River, Ontario	Chemical Treatment and Ultrafiltration	Leo Buckley 613-584-3311	Emerging Technology	Completed 1993
	Cone Tech Investigations Vancouver, British Colombia	Resistivity, pH, Seismic, Temperature, Cone Penetrometer	Ward Phillips 604-327-4311	Monitoring and Measuring Technologies	Completed 1992
	ELI Ecologic International, Inc. Rockwood, Ontario	Thermal Gas Phase Reduction Process and Thermal Desorption	Jim Nash 519-856-9591	Demonstration	Completed 1992
	EnviroMetal Technologies, Inc.	In Situ Reactive Barrier	John Vogan 519-824-0432	Demonstration	Ongoing
	EnviroMetal Technologies, Inc. Guelph, Ontario 2 Demonstrations	Metal Enhanced Abiotic Degradation	William Matulewicz 609-722-6700	Demonstration Ex-situ In-situ	 Completed 1995 Completed

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	Grace Dearborn, Inc. Mississauga, Ontario	Daramend Process	Alan Seech Paul Bucen 905-272-7480	Demonstration	Completed 1994
	Matrix Photocatalytic Limited (formerly Nutech Environmental) London, Ontario, Canada	TiO_2 Photocatalytic Treatment of Aqueous Waste Streams	Bob Henderson 519-660-8669	Emerging Technology	Completed 1994
	Matrix Photocatalytic Limited	TiO_2 Photocatalytic Air Treatment	Bob Henderson 519-660-8669	Demonstration	Completed 1995
	Toronto Harbour Comission Toronto, Ontario	Soil Recycling	Dennis Lang 416-863-2047	Demonstration	Completed 1992
	Wastewater Technology Centre Burlington, Ontario	Cross-Flow Pervaporation System	Chris Lipski 905-639-6320	Emerging Technology	Completed 1992
Canada	Zenon Environmental Systems, Inc. Burlington, Ontario	Bioreactor Integrated with an Ultrafiltration Membrane System	Lisa Ashton 905-639-6320 ext. 244	Demonstration	Completed 1995
	Zenon Environmental Systems, Inc. Burlington, Ontario	Cross-Flow Pervaporation System	Phil Canning Tony Tonelli 905-639-6320	Demonstration	Completed 1995
	Zenon Environmental Systems, Inc. Burlington, Ontario	ZenoGem Process	Chris Lipski 905-639-6320	Demonstration	Completed 1995
England/United Kingdom	AEA Technology (formerly Warren Spring Laboratory) Oxfordshire, England	Physical and Chemical Treatment	Steve Barber 011-44-1235-463062	Emerging Technology	Completed 1994

SITE PROJECTS - BY DEVELOPER STATE (continued)

State	Developer	Technology	Contact	Program	Status
	Graseby Ionics, Limited Waterford Herts, England	Ion Mobility Spectrometry	John Brokenshire 011-44-1923-816166 Martin Cohen 561-683-0507	Measuring and Monitoring Technologies	Completed 1990
Italy	Gruppo Italimpresse (developed by Shirco Infrared Systems, Inc.) (formerly ECOVA) Rome, Italy 2 Demonstrations	Infrared Thermal Destruction	John Cioffi 206-883-1900	Demonstration	Completed 1987
Puerto Rico	Terra Vac, Inc. San Juan, PR	In-situ Vacuum Extraction	James Malot 787-725-8750	Demonstration	Completed

Appendix B

SITE TECHNOLOGY DEMONSTRATION SITES
(Alphabetically by Demonstration Site State)

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE

State	Demonstration Location	Technology	Contact	Program	Status
Alaska	Fairbanks, AK ABE Superfund Site (Region 10)	Soil Washing	Brice Environmental Services Corporation (BESCORP) Fairbanks, AK Craig Jones 907-452-2515	Demonstration	Completed 1992
Arizona	Phoenix, AZ Pesticide Site (Region 9)	Low Temperature Thermal Aeration	Smith Environmental Services (formerly Canonie) Englewood, CO Joe Hutton 219-926-8651	Demonstration	Completed 1992
	Phoenix, AZ Pesticide Site (Region 9)	Anaerobic Thermal Processor	Smith Environmental Services (formerly Canonie) Englewood, CO Joe Hutton 219-926-8651	Demonstration	Completed
	Phoenix, AZ Williams AFB (Region 9)	In-situ Subsurface Bioremediation	Bio-Rem Butler, IN David O. Mann 219-868-5823	Demonstration	Completed 1993
Arkansas	Jefferson, AR Incineration Research Facility (IRF) (Region 6)	Tunable-Pulse Combustion	Sonotech, Inc. Atlanta, GA Ben Zinn 404-894-3033	Demonstration	Completed 1995
		Pyreton Burner (Thermal Destruction)	American Combustion Technologies Norcross, GA Gregory Gitman 404-564-4180	Demonstration	Completed 1988
California	Burbank, CA Lockheed Site (Region 9)	Integrated In-situ Vapor Extraction and Steam Vacuum Stripping Process	Radian Corporation (formerly AWD Technologies, Inc.) Walnut Creek, CA David Bluestein 415-227-0822	Demonstration	Completed 1990

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
	Clear Lake, CA	Biostabilization of Mercury Mining Wastes	Pintail Systems, Inc. Aurora, CO Leslie Thompson 303-367-8443	Demonstration	Ongoing
California	Clear Lake, CA	Chemical Stabilization of Mercury Mining Wastes	Sevenson, W.C. Munster, IN Steve Chisick 219-836-0116	Demonstration	Ongoing
	Clear Lake, CA	Chemical Stabilization of Mercury Mining Wastes	E&C Williams Summerville, SC Charlie Williams 84-821-4200	Demonstration	Ongoing
	Edwards AFB, CA (Region 9)	CAV-OX Oxidation Process	Magnum Water Technology El Segundo, CA Dale Cox 310-640-7000	Demonstration	Completed 1993
	Fresno, CA Selma Site (Region 9)	Entrained-Bed Gasfication	Texaco, Inc. S. El Monte, CA John Wintor 310-908-7387	Demonstration	Completed 1994
	Fresno, CA Selma Site (Region 9)	Silicate Compounds by Solidification/ Stabilizatioin	STC Omega (formerly Silicate Technology Corporation) Scottsdale, AZ Steve Pegler 602-948-7100	Demonstration	Completed 1990
	Fullerton, CA McColl Superfund Site (Region 9)	Excavation and Foam Suppression of Volatiles	U.S. EPA Region 9 San Francisco, CA Jon Blevins 415-744-2400	Demonstration	Completed 1990
	Huntington Beach, CA Rainbow Disposal (Region 9)	Steam Injection/ Vacuum Extraction (SIVE)	Hughes Environmental Manhattan Beach, CA (No longer a vendor for SIVE) Paul De Percin U.S. EPA 513-569-7797	Demonstration	Completed 1993

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
	Jackson, CA Pintail Systems, Inc. (Region 9)	Biological Stabilization of Arsenic in Soils	Pintail Systems, Inc. Aurora, CO Leslie Thompson 303-367-8443	Demonstration	Ongoing
California	Livermore, CA Lawrence Livermore National Laboratory (LLNL) (Region 9)	Chemical Oxidation Perox-Pure	Calgon Carbon Oxidation Technologies (formerly Peroxidation Systems, Inc. Pittsburgh, PA Bertrand Dussert 412-787-6681	Demonstration	Completed 1995
	Livermore, CA LLNL (Region 9)	In-situ Enhanced Extraction	Berkley Environmental Restoration (formerly Udell Technologies, Inc.) Emeryville, CA Kent Udell 510-653-9477	Demonstration	Completed 1993
	March AFB, CA (Region 9)	In well Air Stripping	Roy Weston Woodland Hills, CA Jeff Bannon 818-971-4900	Demonstration	Completed 1994
	Port Hueneme, CA Naval Facilities Engineering Service Center (Region 9)	Solvated Electron Treatment of Chlorinated Organics	Commodore Environmental Columbus, OH Neil Dronby 614-297-0365	Demonstration	Completed 1996
	Redding, CA Iron Mountain Superfund Site	Precipitation, Microfiltration, Sludge Dewatering	EPOC Water, Inc. Fresno, CA Scott Jackson 209-291-8144	Demonstration	Completed 1993
	Sacramento, CA McClellan AFB (Region 9)	Photolytic Destruction for SVE Off-gases	Process Technologies, Inc. Boise, ID Michael Swan 208-385-0900	Demonstration	Ongoing
	Sacramento, CA McClellan AFB (Region 9)	Groundwater Extraction	Xerox Two Phase Extraction Webster, NY Ron Hess 716-422-3694	Demonstration	Completed 1995

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
	San Diego, CA	Circulating Bed Cumbuster	General Atomics (formerlt Ogden Environmental Services) San Diego, CA Robert Goforth 619-455-2499	Demonstration	Completed 1989
California	San Diego, CA Naval Air Station North Island (NASNI) (Region 9)	In Well Vapor Stripping of Ground Water	MACTEC Environmental, Inc. Pittsburgh, PA Mark McGlathery 800-444-6221	Demonstration	Completed 1999
	San Diego, CA NASNI Site 9 (Region 9)	Cross-flow Pervaporation System for Removal of VOCs from Groundwater	Zenon Environmental, Inc. Burlington, Ontario, Canada Phil Canning 905-639-6320	Demonstration	Completed 1995
	San Francisco, CA Westin Hotel (Region 9)	GIS/KEY Software for HW Site Data Management	GIS Solutions, Inc. Concord, CA Garry Reid 510-827-5400	Demonstration	Completed 1993
	San Jose, CA Lorentz Barrel and Drum Site (Region 9)	Ultraviolet Ozone Treatment for Liquids	US Filter (formerly Ultrox International, Inc) Santa Ana, CA John Lowry 412-772-1247	Demonstration	Completed
	San Pedro, CA Annex Terminal (Region 9)	In-situ Steam/ Air Stripping	Novaterra, Inc. (formerly Toxic Treatment, Inc.) Torrance, CA Phil La Mori 310-328-9433	Demonstration	Completed 1989
	Santa Barbara, CA Santa Marie Health Care Services (UST Site) (Region 9)	Soil Washing/ Geological Treatment	BioGenesis Enterprises (formerly BioVersal USA) Fairfax Station, VA Charles Wilde 703-250-3442 Mohsen Amiran 708-827-0024	Demonstration	Completed 1992

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
	South El Monte, CA (Region 9)	Gasification Process	Texaco Syngas, Inc. White Plains, NY John Winter 316-251-4000 ext. 536	Demonstration	Completed 1994
Colorado	Clear Creek, CO Burleigh Tunnel (Region 8)	Wetland-Based Treatment for Mineral Mine Drainage	Colorado Department of Health Denver, CO Jim Lewis 303-692-3390	Demonstration	Completed 1999
	Denver, CO Rocky Flats (Region 8)	Colloid Polishing Method	Filter Flow Technology League City, TX Tod Johnson 713-334-6080	Demonstration	Completed 1992
	Denver, CO DOE Rocky Flats (Region 8)	Core Barrel Soil Sampler	Simulprobe Technologies, Inc. CA Richard Laton 415-883-8787	Monitoring and Measurement	Completed
	Denver, CO (Region 8)	Dual Tube Liner Soil Sampler	Art's Manufacturing and Supply American Falls, ID Brian Anderson 800-635-7330	Monitoring and Measurement	Completed
	Denver, CO (Region 8)	Electrocoa-gulation	General Environmental Inc. (formerly Hydrologics, Inc.) Englewood, CO Carl Dalrymple 303-761-6960	Demonstration	Completed 1995
	Denver, CO (Region 8)	EMFLUX Soil Gas Survey System	Quadrel Services, Inc. MD Bruce Tucker Paul Henning 301-874-5510	Monitoring and Measurement	Completed
	Denver, CO (Region 8)	Gore-Scrubber Passive Soil Gas Sampler	W. L. Gore and Associates, Inc. Elkton, MD Ray Fenstermacher 410-392-7600	Monitoring and Measurement	Completed

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
	Denver, CO (Region 8)	JMC Environmentalist's Subsoil Probe	Clements Associates, Inc. IA Jim Clements 515-792-8285	Monitoring and Measurement	Completed
Colorado	Denver, CO (Region 8)	Large Bore Soil Sampler	Geoprobe Systems Salina, KS Wesley McCall Tom Omli 800-436-7762	Monitoring and Measurement	Completed
	Rocky Flats, CO (Region 8)	In-situ Reactive Barrier	EnviroMetal Technologies, Inc. Guelph, Ontario John Vogan 519-824-0432	Demonstration	Ongoing
	Summitville, CO (Region 8)	Multiple Innovative Passive mine Drainage Technologies	Region 8 and Sate of Colorado Victor Kettellapper 303-312-6578	Demonstration	Ongoing
Florida	Brandon, FL Peak Oil Superfund Site (Region 4)	Infrared Incinerator	Grupo Italimprese (Ecova Europa) (formerly ECOVA) Rome, Italy John Cioffi 206-883-1900	Demonstration	Completed 1987
	Hialeah, FL General Electric Service Shop	In-situ Solidification/ Stabilization	Geo-Con, Inc. Monroville, PA Linda Ward Robert Hayden 412-856-7700	Demonstration	Completed 1988
	Pensacola, FL American Creosote Works (Region 4)	Filtration	SBP Technologies, Inc. Baton Rouge, LA Clayton Page 504-755-7711	Demonstration	Completed 1992
	Pensacola, FL Escanbia Wood Preserving Site (Region 4)	Soil Washing	U.S. EPA Mobile Volume Reduction Unit Cincinnati, OH Richard Griffith 908-321-6629	Demonstration	Completed 1992

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
	Petroleum Products Corporation Miami, FL	Oleofilter	North American Technologies Aprotek San Ramon, CA Cathryn Wmberly 916-366-6185	Demonstration	Completed
Georgia	Chickamuga, GA and Hopkinsville, GA (Region 4)	Debris Washing System	U.S. EPA NRMRL Cincinnati, OH Mike Taylor 512-782-4700	Demonstration	Completed 1990
Georgia	Warner Robins, GA Robins AFB (Region 4)	Stabilization of Organics	WASTECH, Inc. Oak Ridge, TN Benjamin Peacock 615-483-6515	Demonstration	Completed 1991
Hawaii	Pearl Harbor, HI (Region 9)	PCB/Metals Extraction from Porous Surfaces	EET Inc. Bellaire, TX Tim Tarrillion 713-662-0727	Demonstration	Completed 1997
	Pearl Harbor, HI Naval Facility (Region 9)	Electrokinetics	Geokinetics CA Steven Clark 510-704-2940	Demonstration	Ongoing
	Pearl Harbor, HI Naval Facility (Region 9)	Electrokinetic Flushing & Surfactant Flushing	Geokinetics and Duke Engineering TX Steven Clark 510-704-2940 Harry Linnemeyer 512-425-2000	Demonstration	Completed 1999
	Pearl Harbor, HI Naval Facility (Region 9	Set Process for PCBs in Soil	Commodore Advanced Sciences, Inc. Albuquerque, NM Mark Jones 505-872-6803	Demonstration	Ongoing
Idaho	Aberjona River	Sediment Core Sampler	Aquatic Research ID Will Young (208) 768-2222	Monitoring and Measurements	Completed
	INEEL Lab	Phytoremediation	Argonne National Laboratory West Idaho Fall, ID Scott Lee (208) 533-7829	Demonstration	Ongoing

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
Illinois	Chicago, IL (Region 4)	Hydraulic Fracturing	U.S. EPA/ NRMRL Cincinnati, OH William Slack 513-469-6040	Demonstration	Completed 1992
	Waukegan Harbor, IL (Region 5)	Thermal Desorption	SoilTech, ATP Systems Inc. Porter, IN Joe Hutton 219-926-8651	Demonstration	Completed 1992
Indiana	Gary, IN Indiana Harbour (Region 5)	Solvent Extraction	Ionics/Resources Conservation, Co. Bellevue, WA Bill Hines 206-828-2400	Demonstration	Completed 1992
Iowa	Albert City, IA (Region 7)	Core Barrel Soil Sampler	Simulprobe Technologies, Inc. CA Richard Laton 415-883-8787	Monitoring and Measurement	Completed
	Albert City, IA (Region 7)	Dual Tube Liner Soil Sampler	Art's Manufacturing and Supply American Falls, ID Brian Anderson 800-635-7330	Monitoring and Measurement	Completed
	Albert City, IA (Region 7)	EMFLUX Soil Gas Survey System	Quadrel Services, Inc. MD Bruce Tucker Paul Henning 301-874-5510	Monitoring and Measurement	Completed
	Albert City, IA (Region 7)	Gore-Scrubber Passive Soil Gas Sampler	W. L. Gore and Associates, Inc. Elkton, MD Ray Fenstermacher 410-392-7600	Monitoring and Measurement	Completed
	Albert City, IA (Region 7)	JMC Environmentalist's Subsoil Probe	Clements Associates, Inc. IA Jim Clements 515-792-8285	Monitoring and Measurement	Completed
	Albert City, IA (Region 7)	Large Bore Soil Sampler	Geoprobe Systems Salina, KS Wesley McCall Tom Omli 800-436-7762	Monitoring and Measurement	Completed

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
Kansas	Bendena, KS (Region 7)	Biological Denitrification	Eco Mat, Inc. Hayward, CA Kim Halley 510-783-5885	Demonstration	Ongoing
Kentucky	Paducah, KY Gaseous Diffustion Plant (Region 4)	In-situ Electroosmosis of TCE in Soil/ Groundwaters "Lasagna" Process	Monsanto/Dupont OH Thomas Holdsworth 513-569-7675	Demonstration	Completed 1998
Kentucky	DOE- Paducah, KY	Oxidation and Vitrification Process	Vortec Corporation Collegeville, PA James Hnat 610-489-2255	Demonstration	Ongoing
Louisiana	Fort Polk, LA (Region 6)	Electrokinetic Extraction	Electrokinetics, Inc. Baton Rouge, LA Elif Acar 504-388-3992	Demonstration	Ongoing
	Lake Charles, LA	Evaporation and Chemical Oxidation	Wheelbrator Clean Air Systems (formerly Chemical Waste Management) Schaumburg, IL Bob Hernquist 708-706-6900	Demonstration	Completed
Massachusetts	Boston, MA (Region 1)	AMS Split Core Sampler	Art's Manufacturing and Supply ID Brian Anderson 800-635-7330	Monitoring and Measurement	Ongoing
	Boston, MA (Region 1)	Russian Peat Borer	Aquatic Research Instruments ID Will Young 208-768-2222	Monitoring and Measurement	Ongoing
	Groveland, MA Groveland Wells Superfund Site	In-situ Vacuum Extraction	Terra Vac, Inc. San Juan, PR James Malot 787-725-8750	Demonstration	Completed

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
	New Bedford, MA (Region 1)	Batch Organics Extraction Unit	CF Systems Corporation Arvada, CO L.V. Benningfield 303-420-1550	Demonstration	Ongoing
	New Bedford, MA (Region 1)	Solvent Extraction	CF Systems Corporation Arvada, CO L.V. Benningfield 303-420-1550	Demonstration	Completed 1988
Massachusetts	North Dartsmouth, MA Resolve Superfund Site (Region 1)	Thermal Desorption	OHM Environmental (formerly Chemical Waste Management Inc.) Lombarda, IL Dick Ayen 803-846-2413	Demonstration	Completed 1992
Michigan	Adrian, MI Anderson Development (Region 5)	Thermal Desorption (physical)	Roy F. Weston, Inc. West Chester, PA Michael Cosmos 215-430-7423	Demonstration	Completed 1992
	Bay City, MI Bay City Municipal Landfill (Region 5)	Thermal Gas Phase Reduction Process and Thermal Desorption	ELI Eco Logic International, Inc. Rockwood, Ontario, Canada Jim Nash 519-856-9591	Demonstration	Completed 1992
	Buchanan, MI Electro-Voice (Region 5)	Subsurface Volatilization and Ventilation System (SVVS)	Billings & Associates, Inc. Albuquerque, NM Gale Billings 505-345-1116	Demonstration	Completed 1994
	Detroit, MI (Region 5)	Debris Washing System	U.S. EPA/ NRMRL Cincinnati, Ohio Donald Sanning 513-569-7444	Demonstration	Completed 1990
	Essexville, MI Saginaw Bay Confined Disposal Facility (Region 5)	Sediment Soil Washing	Bergmann, USA Gallatin, TN George Jones 615-230-2217	Demonstration	Completed 1992

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
	Grand Ledge, MI Parsons Chemical Site (Region 5)	In-situ Vitrification	Geosafe Corporation Richland, WA James Hansen 509-375-0710	Demonstration	Completed 1994
	Rose Township, MI (Region 5)	Infrared Incinerator	Grupo Italimprese (Ecova Europa) (formerly ECOVA) Jon Cioffi 206-883-1900	Demonstration	Completed 1987
Michigan	St. Joseph, MI	Submerged Aerobic Fixed Film Reactor	Allied Signal Corporation Des Plains, IL Steve Lupton 708-391-3500	Demonstration	Completed
Minnesota	McGillis & Gibbs Superfund Site New Bridge, MN (Region 5)	Biotreatment of Groundwater	BioTrol, Inc. Eden Prairie, MN Dennis Chilcote 612-942-8032	Demonstration	Completed 1989
	McGillis & Gibbs Superfund Site New Bridge, MN (Region 5)	Soil Washing	BioTrol, Inc. Eden Prairie, MN Dennis Chilcote 612-942-8032	Demonstration	Completed 1989
	McGillis & Gibbs Superfund Site New Bridge, MN (Region 5)	Biological Aqueous Treatment System	BioTrol, Inc. Eden Prairie, MN Dennis Chilcote 612-942-8032	Demonstration	Completed 1989
	Minneapolis, MN Private Oil Refining Company (Region 5)	Soil Washing/ Biological Treatment	BioGenesis Enterprises, Inc. (formerly BioVersal USA) Fairfax Station, VA Charles Wilde 703-250-3442 Mohsen Amiran 708-827-0024	Demonstration	Completed 1992
	New Brighton, MN Twin Cities Army Ammunition Plant (TCAAP) (Region 5)	Removal of Lead from Soils	COGNIS TARRAMET Goss, MO Lou Magdits 573-626-3476	Demonstration	Completed 1994

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
	St. Louis Park, MN (Region 5)	Bioventing (air-injection)	U.S. EPA/NRMRL Cincinnati, OH Paul McCauley 513-569-7444	Demonstration	Completed 1997
Mississippi	Brookhaven, MS Brookhaven Wood Preserving (Region 4)	Fungus Treatment Technology	U.S. EPA/NRMRL USDA-Forest Products Lab Madison, WI Richard Lamar 608-231-9469	Demonstration	Completed 1991
Montana	Butte, MT Butte-Silverbow Site (Region 8)	Plasma Heat	Retech, Inc. Ukiah, CA R.C. Eschenback 707-462-6522	Demonstration	Completed 1991
	Mike Horse Mine, MT (Region 8)	Grouting Technique	Morrison Knudsen Corporation Boise, ID Kathryn Levihn Rick Raymondi 208-386-6115	Demonstration	Completed 1996
	St. Louis, MT Welldon Spring (Region 7)	Anaerobic Biological Destruction of TNT in Soil	J.R. Simplot Company Pocatello, ID Tom Yergovich 209-858-2511	Demonstration	Completed 1994
Nebraska	Hastings, NE (Region 7)	Spray Irrigation	University of Nebraska-Lincoln Hasting, NE Ray Spalding 402-783-3931	Demonstration	Completed 1996
Nevada	Battle Mountain, NV (Region 9)	Biodegradation of Cyanide	Pintail Systems, Inc. Aurora, CO Caren Caldwell 303-367-8443	Demonstration	Completed 1998
New Hampshire	Milford, NH Savage Superfund Site (Region 1)	Surfactant Enanced Aquifer Remediation	U.S. DOE. Duke Engineering G. Michael Shook 208-526-6945	Demonstration	Ongoing

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
	Plaistow, NH (Region 1)	Biodegradation of PCB's in Soils	Green Mountain Laboratories Montpelier, VT Adam Longee 802-223-1468	Demonstration	Ongoing
New Jersey	Edison, NJ EPA (Region 2)	Solvent Extraction Carver-Greenfield Process	Dehydro Tech Corporation East Hanover, NJ Theodore Trowbridge 908-904-1606	Demonstration	Completed 1991
New Jersey	Hillsborough, NJ (Region 2)	Pneumatic Fracturing, Extraction and Hot Gas Injection	Accutech, Inc. Keyport NJ & New Jersey Institute of Technology, Newark, NJ John Liskowitz 908-739-6444	Demonstration	Completed 1992
	Millville, NJ Nascoilte Site (Region 2)	Bioreactor Integrated with an Ultrafiltration Membrane System	Zenon Environmental, Inc. Burlington, Ontario, Canada Lisa Ashton 905-639-6320 ext. 244	Demonstration	Completed 1995
	Millville, NJ Nascoilte Site (Region 2)	ZenoGem Process	Zenon Environmental, Inc. Burlington, Ontario, Canada Chris Lipski 905-639-6320	Demonstration	Completed
	Morganville, NJ Imperial Oil Co., Inc. Site (Region 3)	Solidification	Solidtech, Inc. Houston, TX Bill Stallworth 713-497-8558	Demonstration	Completed 1988
	Pedricktown, NJ National Lead Industries (Region 2)	Removal of Dissolved Metals	Dynaphore/ Forager Sponge Richmond, VA Norman Rainer 804-288-7109	Demonstration	Completed 1994

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
	Trenton, NJ (Region 2)	Phytoextraction of Metal from Soil	Phytotech, Inc. Monmouth, NJ Burt Ensley 908-438-0900	Demonstration	Completed 1998
	Wayne, NJ (Region 2)	Ex-situ Metal-enhanced Abiotic Degredation	EnviroMetal Technologies, Inc. Guelph, Ontario William Matulewicz 609-722-6700	Demonstration	Completed 1995
New Mexico	Albuquerque, NM (Region 6)	Electrokenitic Extraction in Unsaturated Soils	Sandia National Laboratories, Albuquerque, NM Eric Lindgren 505-844-3820	Demonstration	Completed 1999
New York	Brant, NY Wide Beach (Region 2)	Thermal Desorption Dechlorination	SoilTech, ATP Systems, Inc. Porter, IN Joe Hutton 219-926-8651	Demonstration	Completed 1992
	Brockport, NY Sweden-3 Chapman Site (Region 2)	Biovault, Bioventing and Groundwater Circulation Biological Treatment Process (multi-developer project)	NY State Bioremediation and SBP Technologies, Inc. White Plains, NY Clayton Page 504-755-7711	Demonstration	Completed 1995
	Niagara Falls, NY (Region 2)	Cold Top Vitrification	New Jersey Institute of Technology (NJIT) Newark, NJ and Geo Tech Development Corporation, King of Prussia, PA William Librizzi 201-596-5846 Thomas Tate 610-337-8515	Demonstration	Ongoing

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
	Upstate NY (Region 2)	In-situ Metal-enhanced Abiotic Degredation	EnviroMetal Technologies, Inc. Guelph, Ontario John Vogan 519-824-0432	Demonstration	Ongoing
	Utica, NY (Region 2)	High Temperature Thermal Processor	Maxymillian Technologies, Inc. (Formerly Clean Berkshires) Lanesboro, MA Jim Maxymillian 413-499-3050	Demonstration	Completed 1993
	Utica, NY Town Gas Site (Region 2)	Slurry Biodegradation	Remediation Technologies Inc. (ReTec) (formerly Mo Tec Inc.) Pitsburgh, PA David Nakles 412-826-3340	Demonstration	Completed 1991
North Carolina	Morrisville, NC Koppers Site (Region 4)	Base-Catalyzed Destruction (Dehalogenation)	U.S. EPA/ NRMRL Cincinnati, OH George Huffman 513-569-7341 Environmental Inc. Blue Bell, PA Yei-Shong Shieh 215-832-0700	Demonstration	Completed 1993
Ohio	Aliance, OH Babcock & Wilcox Alliance Research Center (Region 5)	Cyclone Vitrification	Babcock & Wilcox Alliance Research Center Alliance, OH Lawrence King 216-829-7576	Demonstration	Completed 1991
	Cincinnati, OH EPA T&E Facility (Region 5)	Bioslurry Reactor	ECOVA Corporation Redmond, WA Alan Jones 206-883-1900	Demonstration	Completed 1991
	Crooksville, OH Pintail Systems, Inc. (Region 5)	Biostabilization of Lead	Pintail Systems, Inc. Aurora, CO Leslie Thompson 303-367-8443	Demonstration	Ongoing

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
	Dayton, OH (Region 5)	Hydraulic Fracturing	U.S. EPA/ NRMRL Cincinnati, OH William Slack 513-469-6040	Demonstration	Completed 1992
	DOE Fernald Facility, OH (Region 5)	Solvent Extraction	Terra Kleen Corporation (name changed back from Sevenson Extraction Technology, Inc.) Del Mar, CA Alan Cash 619-558-8762	Demonstration	Completed 1997
	Roseville/ Crooksville, OH	Envirobond Soil Amendment (Stabilization)	Rocky Mountain Remedation Services Jim Barthel 303-215-6620	Demonstration	Completed
	Roseville/ Crooksville, OH	Injection Soil Amendment (Stabilization)	Star Organics Phil Clarke 214-522-0742	Demonstration	Completed
Oregon	Clackamas, OR Portable Equipment Co. Site (Region 10)	Chemical Fixation/ Stabilization	Advanced Remediation Mixing, Inc. (formerly Chemfix Technologies, Inc.) Metarie, LA Sam Pizzitola 504-461-0466	Demonstration	Completed 1989
Pennsylvania	Douglassville, PA (Region 3)	Solidification/ Stabilization	Hazcon and Funderburk & Associates) Apollo Beach, FL Ray Funderburk 813-645-9620	Demonstration	Completed 1987
	Monaca, PA	Flame Reactor	Horsehead Resource Development Co., Inc. Regis Zagrocki 610-826-8810	Demonstration	Completed

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
	Palmerton, PA Palmerton Zinc Pile (Region 3)	Membrane Microfiltration	E.I. DuPont DeNemours & Company Newark, DE Oberlin Filter Company Waukesha, WI Ernest Mayer 302-774-2277	Demonstration	Completed 1990
	Stroudsburg, PA (Region 3)	Contained Recovery of Oil Wastes	Western Research Institute Laramie, WY James Speight 307-721-2011	Demonstration	Completed 1997
Rhode Island	Central Landfill, RI (Region 1)	Reverse Osmosis: Disc-Tube Module Technology	ROCHEM Separations, Inc. Torrence, CA David LaMonica 310-370-3160	Demonstration	Completed 1994
	N. Smithfield, RI (Region 1)	AIR II Photocatalytic Technology for Air Streams	KSE, Inc. Amhurst, MA James Kittrell 413-549-5506	Demonstration	Completed 1999
South Carolina	Savannah River Site, SC (Region 4)	High Energy Irradiation for Destruction of Organics in Aqueous Solutions and Sludge	High Voltage Environmental Application, Inc. Florida and International University Miami, FL William Cooper 910-962-3450	Demonstration	Completed 1994
Tennessee	Oak Ridge, TN (Region 4)	Photocatalytic Aqueous Phase Organics Destruction Matrix	Matrix, Inc. London, ON Robert Henderson 519-660-8669	Demonstration	Completed 1995
	Oak Ridge, TN DOE Oak Ridge Facility (Region 4)	Freeze Barrier	Arctic Foundations Anchorage, AK Ed Yarmak 907-562-2741	Demonstration	Ongoing

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
Texas	Fort Worth, TX Carswell AFB (Region 6)	Phytoremediation of TCE in Groundwater	ASC/EMR Wright Patterson AFB Dayton, Ohio Greg Harvey 513-255-7716	Demonstration	Completed 1998
	Goldthwaite, TX Lower Colorado River Authority Electrical Substation	Microbial Degradation/ Solvant Extraction	Envirogen, Inc. Lawrenceville, NJ Ronald Unterman 609-936-9300	Demonstration	Ongoing
	San Antonio, TX Kelly AFB (Region 6)	Hot Air Injection	Hrubetz Evironmental Services, Inc. Dallas, TX Michael or Barbara Hrubetz 214-363-7833	Demonstration	Completed 1993
	San Antonio, TX Kelly AFB (Region 6)	Radio-frequency Heating	IITRI/NUS IITRI-Chicago, IL and Haliburton/ NUS Oak Ridge, TN Clifford Blanchard 615-483-9900	Demonstration	Completed 1994
	San Antonio, TX Kelly AFB (Region 6)	Radio-frequency Heating	KAI/HNUS Oak Ridge, TN Cliff Blanchard 615-483-9900	Demonstration	Completed 1994
Utah	Hill AFB, UT (Region 8)	Steam Injection/ Vacuum Extraction	Praxis Environmental Services San Francisco, CA Dr. Lloyd Steward 415-641-9044	Demonstration	Completed 1997
	Midvale Slag, UT	Molecular Bonding System	Solucorp Saddleback, NJ Robert Kuhn 914-623-2333	Demonstration	Completed
	Ogden, UT Chevron Transfer Facility (Region 8)	Phytoremediation of Petroleum in Soil and Groundwater	Phytokinetics, Inc. Logan, UT Ari Ferro 801-750-0985	Demonstration	Completed 1999

TECHNOLOGY DEMONSTRATION SITES - BY SITE STATE (continued)

State	Demonstration Location	Technology	Contact	Program	Status
Virginia	Roanoke, VA ITT Night Vision Facility (Region 3)	Enhanced In-situ Bioremediation of Chlorinated Compounds	ITT Industries Roanoke, VA Rosann Kryczkowski 540-362-7356	Demonstration	Completed 1999
Washington	Ellensburg, WA (Region 10)	Anaerobic Biological Destruction of Dinoseb in Soil	J. R. Simplot Company Pocatello, ID Tom Yergovich 209-858-2511	Demonstration	Completed July 1993
Wisconsin	Green Bay, WI (Region 5)	AMS Split Core Sampler	Art's Manufacturing and Supply ID Brian Anderson 800-635-7330	Monitoring and Measurement	Completed 1999
	Green Bay, WI (Region 5)	Russian Peat Borer	Aquatic Research Instruments ID Will Young 208-768-2222	Monitoring and Measurement	Completed
	Sparta, WI U.S. DOD Fort McCoy (Region 5)	MAECTITE® Treatment Process	Sevenson Environmental Services, Inc. Munster, IN Chuck McPheeters 219-836-0116	Demonstration	Ongoing
Various locations in U.S.	10 sites around the nation	Alternate Cover Assessment Program (ACAP)	U.S. EPA NRMRL	Demonstration	Ongoing
Canada	Toronto, Canada Toronto Port Industrial Division	Treatment Train for Contaminated Soils	Toronto Harbor Commissioners Toronto, Canada Dennis Lang 416-863-2047	Demonstration	Completed 1992
	Trenton, Ontario Domtar Wood Preserving Site	Bioremediation	GRACE Bioremediation Technologies Mississauga, Ontario, Canada Alan Seech 905-272-7480	Demonstration	Completed 1994

Appendix C

PUBLICATIONS - INFORMATION TRANSFER PRODUCT DESCRIPTIONS

Documents from the
US EPA National Risk Management Research Laboratory
Land Remediation & Pollution Control Division
Measuring & Monitoring Program
General Publications

- SITE Program: Annual Report to Congress 1997 (EPA/540/R-98/503), and Annual Report to Congress 1998 (EPA/540/R-99/504)
- SITE Profiles, Ninth Edition (EPA/540/R-97/502), and Tenth Edition (EPA/540/R-99/500a)
- Survey of Materials Handling Technologies Used at Hazardous Waste Sites (EPA/540/2-91/010) PB91-921283[2]
- Superfund Innovative Technology Evaluation Program: - Innovation Making a Difference (EPA/540/F-94/505)
- Superfund Innovative Technology Evaluation Program: - Technology with an Impact (EPA/540/F-93/500)
- Interim Status Report U.S. and German Bilateral Agreement on Remediation of Hazardous Waste Sites (EPA/540/R-94/500) PB94-164811[2]
- SITE Innovation on the Move (EPA/540/F-97/500)
- Land Remediation & Pollution Control Division; Science and Technology to Treat Contaminated Soils, Sludge & Sediments (EPA/504/F-98/501) PB92-222215[2]
- Technology Evaluation Vol. 11 (EPA/540/R-92/017B) PB92-222223[2]

Demonstration Project Results

Accutech Remedial Systems, Inc.--Pneumatic Fracturing Extraction and Hot Gas Injec., Phase 1
- Technology Evaluation (EPA/540/R-93/509) PB93-216596[2]
- Technology Demo. Summary (EPA/540/SR-93/509)[3]
- Demonstration Bulletin (EPA/540/MR-93/509)[3]
- Applications Analysis (EPA/540/AR-93/509) PB94-117439[2]

American Combustion, Inc. - Oxygen Enhanced Incineration
- Technology Evaluation (EPA/540/5-89/008)
- Applications Analysis (EPA/540/A5-89/008)
- Technology Demo. Summary (EPA/540/S5-89/008)[3]
- Demonstration Bulletin (EPA/540/M5-89/008)[3]

AWD Technologies, Inc. - Integrated Vapor Extraction and Steam Vacuum Stripping
- Applications Analysis (EPA/540/A5-91/002) PB92-218379[2]
- Demonstration Bulletin (EPA/540/M5-91/002)[3]

Babcock & Wilcox Co-Cyclone Furnace Vitrification
- Technology Evaluation Vol. 1 (EPA/540/R-92/017A) PB92-222215[2]
- Technology Evaluation Vol. 11 (EPA/540/R-92/017B) PB92-222223[2]
- Applications Analysis (EPA/540/AR-92/017) PB93-122315[2]
- Technology Demo. Summary (EPA/540/SR-92/017)[3]
- Demonstration Bulletin (EPA/540/MR-92/011)

Bergman USA - Soil and Sediment Washing System
- Demonstration Bulletin (EPA/540/MR-92/075)[3]
- Applications Analysis (EPA/540/AR-92/075)

Biogenesis Enterprises, Inc . - Soil and Sediment Washing Processes
- Demonstration Bulletin (EPA/540/MR-93/510)
- Innovative Tech. Eval. Report (EPA/540/R-93/510)
- SITE Technology Capsule (EPA/540/SR-93/510)

Bio-Rem, Inc. - Augmented In-Situ Subsurface Biorem Process
- Demonstration Bulletin (EPA/540/MR-93/527)[3]

BioTrol - Biological Aqueous Treatment System

[1] Order documents free of charge by calling EPA's Center for Environmental Research Information (CERI) at 513-569-7562 or Fax 513-569-8695.
[2] Documents with a PB number are out of stock and must be ordered by that number at cost from:
National Technical Information Service
5285 Port Royal Road
Springfield VA 22161
Telephone 703-487-4650 or 1-800-553-6847
[3] Out of stock

- Technology Evaluation (EPA/540/5-91/001) PB92-110048[2]
- Applications Analysis (EPA/540/A5-91/001) PB91-227983[2]
- Technology Demo. Summary (EPA/540/S5-91/001)[3]
- Demonstration Bulletin (EPA/540/M5-91/001)[3]

- Soil Washing System (continued)

- Technology Evaluation Vol. 1 (EPA/540/5-91/003a) PB92-115310[2]
- Technology Evaluation Vol. 11 Part A (EPA/540/5-91/003b) PB92-115328[2]
- Technology Evaluation Vol. 11 Part B (EPA/540/5-91/003c) PB92-115336[2]
- Applications Analysis (EPA/540/A5-91/003) PB92-115245[2]
- Technology Demo. Summary (EPA/540/S5-91/003) PB92-224393[2]
- Demonstration Bulletin (EPA/540/M5-91/003)[3]

Brice Environmental Services Corporation - Bescorp Soil Washing System Battery Enterprises Site

- Demonstration Bulletin (EPA/540/MR-93/503)[3]
- Applications Analysis (EPA/540/AR-93/503) PB95-199741[2]

Brown and Root Environmental - Subsurface Volatilization and Ventilation System

- Demonstration Bulletin (EPA/540/MR-94/529)
- Capsule (EPA/540/R-94/529a)
- Innovative Tech. Eval. Report (EPA/540/R-94/529)

Canonie Environmental Services Corporation - Low Temperature Thermal Aeration (LTTA)

- Demonstration Bulletin (EPA/540/MR-93/504)[3]
- Applications Analysis (EPA/540/AR-93/504)

CF Systems Corporation - Liquified Gas Solvent Extraction

- Technology Evaluation Vol. 1 (EPA/540/5-90/002)
- Technology Evaluation Vol. 11 (EPA/540/5-90/002a) PB90-186503[2]
- Applications Analysis (EPA/540/A5-90/002)
- Technology Demo. Summary (EPA/540/S5-90/002)

Chemfix Technologies, Inc. (Now Advanced Remediation Mixing, Inc.) - Chemical Fixation/Stabilization

- Technology Evaluation Vol. 1 (EPA/540/5- 89/011a) PB91-127696[2]
- Technology Evauation Vol.11 (EPA/540/5-89/011b) PB90-274127[2]
- Applications Analysis (EPA/540/A5-89/011)
- Technology Demo. Summary (EPA/540/S5-89/011) PB91-921373[2]
- Demonstration Bulletin (EPA/540/M5-89/011)[3]

Chemical Waste Management, Inc. - X-TRAX Thermal Desorption System (Now OHM Environmental)

- Demonstration Bulletin (EPA/540/MR-93/502)[3]

Cognis, Inc. Removal of Lead from Soils

- Demonstration Bulletin (EPA/540/MR-95/535)

Dehydro-Tech Corporation - Carver - Greenfield Process

- Technology Evaluation (EPA/540/R-92/002) PB92-217462[2]
- Applications Analysis (EPA/540/AR-92/002)
- Technology Demo. Summary (EPA/540/SR-92/002)
- Demonstration Bulletin (EPA/540/MR-92/002)

Dupont/Oberlin - Membrane Microfiltration System

- Technology Evaluation (EPA/540/5-90/007) PB92-153410[2]
- Applications Analysis (EPA/540/A5-90/007) PB92-119023[2]
- Technology Demo. Summary (EPA/540/S5-90/007) PB92-22435[2]
- Demonstration Bulletin (EPA/540/M5-90/007)[3]

Dynaphore, Inc. - Forager Sponge Technology

- Demonstration Bulletin (EPA/540/MR-94/522)
- Capsule (EPA/540/R-94/522a) PB95-213229[2]
- Innovative Tech. Eval. Rept. (EPA/540/R-94/522) PB95-268041[2]

ECOVA Corporation - Bioslurry Reactor [Pilot-Scale Demonstration of Slurry-Phase Biological Reactor for Creosote-Contaminated Wastewater]

- Technology Evaluation Vol. 1 (EPA/540/5-91/009) PB93-205532[2]
- Applications Analysis (EPA/540/A5-91/009) PB94-124039[2]
- Technology Demo. Summary (EPA/540/S5-91/009)
- Demonstration Bulletin (EPA/540/M5-91/009)[3]

ELI Eco Logic International, Inc. - GasPhase Chemical Reduction

- Demonstration Bulletin (EPA/540/MR-93/522)[3]
- Technology Evaluation Vol. 1 (EPA/540/R-93/522a) PB95-100251[2]
- Technology Evaluation Appendices (EPA/540/R-93/522b) PB95-100251[2]
- Applications Analysis (EPA/540/AR-93/522)
- Technology Demo. Summary (EPA/540/SR-93/522)

- Thermal Desorption Unit

- Demonstration Bulletin (EPA/540/MR-94/504)[3]
- Applications Analysis (EPA/540/AR-94/504)

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[1] Order documents free of charge by calling EPA's Center for Environmental Research Information (CERI) at 513-569-7562 or Fax 513-569-8695.

[2] Documents with a PB number are out of stock and must be ordered by that number at cost from:
National Technical Information Service
5285 Port Royal Road
Springfield VA 22161
Telephone 703-487-4650 or 1-800-553-6847

[3] Out of stock

EnviroMetal Technologies, Inc . - Metal-Enhanced Abiotic Degradation Technology

- Demonstration Bulletin (EPA/540/MR-95/510)[3]
- Capsule (EPA/540/R-96/503a)
- Innovative Tech. Eval. Rept. (EPA/540/R-96/503)

EPOC Water, Inc. - Microfiltration Technology

- Demonstration Bulletin (EPA/540/MR-93/513)[3]
- Applications Analysis (EPA/540/AR-93/513)

Filter Flow Technology, Inc. - Colloid Polishing Filter Method

- Demonstration Bulletin (EPA/540/MR-94/501)
- Capsule (EPA/540/R-94/501a) PB95-122792[2]
- Innovative Tech. Eval. Rept. (EPA/540/R-94/501)

GeoTech Development Corporation - Cold Top Vitrification

- Demonstration Bulletin (EPA/540/MR-97/506)

Geosafe Corporation - In-Situ Vitrification

- Demonstration Bulletin (EPA/540/MR-94/520)[3]
- Capsule (EPA/540/R-94/520a) PB95-177101[2]
- Innovative Tech. Eval. Rept. (EPA/540/R-94/520)

GIS/Solutions, Inc. - GIS/KEY Environmental Data Management System

- Demonstration Bulletin (EPA/540/MR-94/505)[3]
- Capsule (EPA/540/SR-94/505)[3]
- Innovative Tech. Eval. Rept. (EPA/540/R-94/505) PB95-138319[2]

Grace Dearborn Bioremediation Technology

- Demonstration Bulletin (EPA/540/MR-95/536)
- Capsule (EPA/540/R-95/536a)
- Innovative Tech. Eval. Rept. (EPA/540/R-95/536)

Gruppa Italimpresse (developed by Shirco Infrared Systems, Inc.) - Infrared Incineration

- Technology Evaluation - Peake Oil Vol. 1 (EPA/540/5-88/002a) PB89-125991[2]
- Technology Evaluation Report - Peake Oil Vol. 11 (EPA/540/5-88/002b) PB89-116024[2]
- Technology Evaluation - Rose Township (EPA/540/5-89/007a) PB89-167902[2]
- Technology Evaluation- Rose Township Vol. 11 (EPA/540/5-89/007b) PB89-167910[2]
- Applications Analysis (EPA/540/A5-89/010) PB89-233423[2]
- Technology Demo Summary (EPA/540/S5-89/007)[3]
- Demonstration Bulletin (EPA/540/M5-88/002)[3]

Hazcon, Inc. (now Funderburk and Assoc.) - Solidification Process

- Technology Evaluation Vol. 1 (EPA/540/5-89/001a) PB89-158810[2]
- Technology Evaluation Vol. 11 (EPA/540/5-89/001b) PB89-158828[2]
- Applications Analysis (EPA/540/A5-89/001) PB89-206031[2]
- Technology Demo Summary (EPA/540/S5-89/001)[3]
- Demonstration Bulletin (EPA/540/M5-89/001)[3]

High Voltage Environmental Applications, Inc.

- Demonstration Bulletin (EPA/540/MR-96/504)
- Innovative Tech. Eval. Rept. (EPA/540/R-96/504)

Horsehead Resource Development Co., Inc. - Flame Reactor

- Technology Evaluation Vol. 1 (EPA/540/5-91/005) PB92-2058552
- Applications Analysis (EPA/540/A5-91/005) PB92-213214[2]
- Technology Demo Summary (EPA/540/S5-91/005)
- Demonstration Bulletin (EPA/540/M5-91/005)

Hrubetz Environmental Services, Inc. - HRUBOUT Process

- Demonstration Bulletin (EPA/540/MR-93/524)[3]

Hughes Environmental Systems, Inc. - Steam Enhanced Recovery Process

- Demonstration Bulletin (EPA/540/MR-94/510)[3]
- Capsule (EPA/540/R-94/510a)
- Innovative Tech. Eval. Rept. (EPA/540/R-94/510)

IT Research Institute (Brown and Root Environmental, Inc.) - Radio Frequency Heating

- Demonstration Bulletin (EPA/540/MR-94/527)
- Capsule (EPA/540/R-94/527a)
- Innovative Tech. Eval. Rept. (EPA/540/R-94/527)

International Waste Technologies/Geo-Con, Inc . - In-Situ Solidification and Stabilization Process

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- Applications Analysis (EPA/540/AR-92/014)

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- Demonstration Bulletin (EPA/540/MR-92/010)[3]
- Applications Analysis (EPA/540/AR-92/010) PB93-172948[2]

Silicate Technology Corporation (Now STC Omega) - Solidification/Stabilization of Organic/Inorganic Contaminants (continued)
- Technology Evaluation (EPA/540/R-92/010) PB95-255709[2]
- Technology Demo Summary (EPA/540/SR-92/010)[3]
- Capsule (EPA/540/R-94/514a)
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Wheelabrator Clean Air Systems, Inc. (formerly Chemical Waste Management, Inc.) - PO*WW*ER™ Technology

- Demonstration Bulletin (EPA/540/MR-93/506)[3]
- Applications Analysis (EPA/540/AR-93/506)
- Technology Evaluation -Vol. 1 (EPA/540/R-93/506a) PB94-1606372
- Technology Evaluation Vol. 11(EPA/540/R-93/506b) PB94-160660[2]
- Technology Demo Summary (EPA/540/SR-93/506)

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- Capsule (EPA/540/R-95/511a)

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- Journal Article AWMA Vol. 44, No. 3, March 1994

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Babcock & Wilcox Co. - Cyclone Furace (Soil Vitrification)

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- Emerging Tech. Bulletin (EPA/540/F-95/509)

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- Journal Article App. Env. Micro, Vol.58, No. 5, May 1992, pp. 1683-89

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- Published Paper (EPA/600/A-93/282) PB94-130184[2]

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- Published Paper, Glass Production Technol International, 1994, p. 103 - 106
- Emerging Tech. Summary (EPA/540/S-97/501)[4]

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Bruker Mobiel Environmental Monitor
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- Innovative Tech. Eval. Report (EPA/540/MR-95/528)

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- Innovative Tech. Eval. Report (EPA/540/MR-95/521)

HNU Portable Gas Chromatograph
- Results reported in the Proceedings of the U.S. EPA Third International Field Screening Symposium Volume 2, Pages 682-693 (1993)

Photovac Portable Gas Chromatograph
- Results reported in the Proceedings of the U.S. EPA Third International Field Screening Symposium Volume 2, Pages 682-693 (1993)

Sentex Portable Gas Chromatograph
- Results reported in the Proceedings of the U.S. EPA Third International Field Screening Symposium Volume 2, Pages 682-693 (1993)

SRI Instruments Low Temperature Thermal Desorption System
- Results reported in the Proceedings of the U.S. EPA Third International Field Screening Symposium Volume 2, Pages 682-693 (1993)

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MDA Scientific Long-Path Fourier Transform Infrared Spectrometer
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- Innovative Tech. Eval. Report (EPA/600/R-98/097)

Geoprobe® Soil Sampler
- Innovative Tech. Eval. Report (EPA/600/R-98/092)

Simulprobe® Soil Sampler
- Innovative Tech. Eval. Report (EPA/600/R-98/094)

Quandrel Soil Gas Sampler
- Innovative Tech. Eval. Report (EPA/600/R-98/096)

W.L. Gore & Associates Soil Gas Sampler
- Innovative Tech. Eval. Report (EPA/600/R-98/095)

[1] Order documents free of charge by calling EPA's Center for Environmental Research Information (CERI) at 513-569-7562 or Fax 513-569-8695.
[2] Documents with a PB number are out of stock and must be ordered by that number at cost from:
National Technical Information Service
5285 Port Royal Road
Springfield VA 22161
Telephone 703-487-4650 or 1-800-553-6847
[3] Out of stock

Appendix D

ELECTRONIC TECHNICAL INFORMATION RESOURCES

EPA Sources of Information on
Innovative Remediation and Site Characterization Technologies

Listed below are U.S. Environmental Protection Agency (EPA) sources of information on Innovative Remediation and Site Characterization Technologies. Sources of information include: electronic information sources in the form of databases or Internet sites, as well as programs, partnerships and organizations accessible on the Internet.

REMEDIATION TECHNOLOGIES

Electronic Information Sources

Alternative Treatment Technology Information Center (ATTIC). The Alternative Treatment Technology Information Center (ATTIC) is a comprehensive computer database system that provides up-to-date information about innovative treatment technologies. The database contains information about biological, chemical, and physical treatment processes; solidification and stabilization processes; and thermal treatment technologies. The on-line automated bibliographic reference integrates existing data on hazardous waste into a unified searchable resource. The ATTIC system provides users with access to several independent databases, an electronic bulletin board system, a hotline, and a repository of publications related to alternative and innovative treatment technologies. The ATTIC database can be accessed through the Internet at ***<http://www.epa.gov/attic>***.

Bioremediation in the Field Search System (BFSS) Version 2.1. BFSS is a PC-based searchable database of information about greater than 450 sites at which bioremediation is being tested or implemented or at which cleanup by bioremediation has been completed. The database covers sites being addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Resource Conservation and Recovery Act (RCRA), the Toxic Substances Control Act (TSCA), as well as those being addressed under the Underground Storage Tank (UST) Program. Information is available about location, media, contaminants, technology, cost and performance. BFSS can be downloaded free of charge from the ATTIC or the Hazardous Waste Clean-Up Information (CLU-IN) Internet sites at ***<http://clu-in.org/PRODUCTS/MOREINFO/Btss.htm>***.

Completed North American Innovative Remediation Technology Demonstration Projects Database. The searchable database contains information about more than 300 completed innovative technology field demonstration projects in North America. The purpose of the database is to consolidate key information from innovative demonstration projects into a single source and present that information in a format that enables the user to easily identify innovative technologies that may be appropriate to the user's particular site remediation needs. The database, which is limited to completed demonstration projects and a small number of full-scale cleanup efforts, does not include emerging technologies or laboratory-scale projects. The database can be downloaded free of charge from the CLU-IN Internet site at ***<http://clu-in.org>***.

Hazardous Waste Clean-Up Information (CLU-IN) Home Page. CLU-IN is a streamlined source of information about innovative remediation and site characterization technologies for hazardous waste cleanup professionals. It provides access to information about programs, organizations, publications, and other tools for EPA and other Federal and State personnel, consulting engineers, technology developers and venders, remediation contractors, researchers, community groups, and individual citizens. Access to various pools of information is presented in the form of downloadable publications and databases. Sources of additional information on the Internet also are presented through a series of links. CLU-IN is sponsored by EPA's Technology Innovation Office (TIO). For additional information about the CLU-IN home page, call (301) 589-5318. CLU-IN can be accessed through the Internet at ***<http://clu-in.org>***.

Innovative Treatment Technologies: Annual Status Report (Ninth Edition) This contains information about remedies selected at contaminated waste sites. The sites include Superfund remedial and removal sites and some non-Superfund sites being remediated by the U.S. Department of Energy (DOE), the U.S. Department of Defense (DoD), or under the RCRA corrective action program. The EPA REACHIT online system database includes such site-specific data as contaminants and media treated, project status, and site contact. If you have questions or comments about the system, please call EPA's TIO at (703) 589-5318. The database can be downloaded free of charge from the CLU-IN Internet site at ***<http://clu-in.org>***. To obtain a copy of the report, call EPA's National Center for Environmental Publications and Information (NCEPI) at (800) 490-9198 or (513) 489-8190.

Remediation Technologies Screening Matrix and Reference Guide, Version 3.0. The Remediation Technologies Screening Matrix and Reference Guide,

Version 3.0, prepared for federal agencies participating on the Federal Remediation Technology Roundtable (FRTR), provides a "yellow pages" of remediation technologies information. The guide is intended to assist remedial project managers (RPM) to screen and evaluate candidate cleanup technologies and select the best remedial alternative(s) for contaminated installations, facilities, or waste sites. The guide also assists environmental professionals in gathering essential descriptive information on the respective technologies. The guide incorporates cost and performance data to the maximum extent available and focuses primarily on demonstrated technologies. However, information on emerging technologies also is included in the guide. The guide can be accessed through the Internet at ***<http://www.frtr.gov>***.

TechDirect. TechDirect, hosted by EPA's TIO, is an information service that highlights new publications and events of interest to environmental professionals. Information about site characterization and remediation technologies is available through this Internet subscription service. Approximately once a month, the service distributes by electronic mail a message describing the availability of publications and announcements of events. For publications, the message explains how to obtain a hard copy or how to download an electronic version from the Internet. For additional information about TechDirect, contact Jeff Heimermann at (703) 603-7191 or by E-mail at *heimerman.jeff@epamail.epa.gov*. TechDirect can be accessed through the Internet at ***<http://clu-in.org/membersh.htm>***.

Programs, Partnerships, And Organizations

EPA Library Network Program. The EPA National Library Network Program is a repository of information from EPA's Headquarters, Regional and Field Offices, Research Centers, and specialized laboratories throughout the country. The Library Network provides access to its collection through the On-line Library System (OLS), a menu-driven database of the library's holdings. The OLS provides users with the ability to perform online searches by author, title, or keyword. The EPA National Library Network Program can be accessed through the Internet at ***<http://www.epa.gov/natlibra>***.

Federal Remediation Technologies Roundtable (FRTR). FRTR is an interagency working group that provides a forum for the exchange of information regarding the development and demonstration of innovative technologies for the remediation of hazardous waste sites. The forum also synthesizes the technical knowledge that Federal Agencies have compiled and provides a more comprehensive record of performance and cost of the technologies. Participating agencies include DoD, the U.S. Army Corps of Engineers, the U.S. Navy, the U.S. Air Force, DOE, the U.S. Department of the Interior, and EPA. FRTR can be accessed through the Internet at ***<http://www.frtr.gov>***.

Ground-Water Remediation Technologies Analysis Center (GWRTAC). GWRTAC was established through a cooperative agreement between the National Environmental Technology Applications Center (NETAC) of the Center for Hazardous Materials Research (CHMR) and EPA. The goal of GWRTAC is to compile, analyze, and disseminate information about innovative ground-water remediation technologies to industry, the research community, contractors, government, investors, and the public. The center currently is compiling information to be included in databases of interactive case studies and vendor information that will be available on the GWRTAC Internet site. GWRTAC can be accessed through the Internet at ***<http://www.gwrtac.org>***.

Office of Research and Development (ORD). ORD, under the Assistant Administrator, Norine E. Noonan, Ph. D., is the scientific and technological arm of EPA. Comprised of three headquarters offices, three national research laboratories and two national centers, ORD is organized around a basic strategy of risk assessment and risk assessment management to remediate environmental and human health problems. ORD focuses on the advancement of basic peer-reviewed scientific research and the implementation of cost-effective, common sense technology. Fundamental to ORD's mission is a partnership with the academic scientific community through extramural research grants and fellowships to help develop the sound environmental research necessary to ensure effective policy and regulatory decisions. ORD also implements such programs as the Superfund Innovative Technology Evaluation (SITE) program which focuses on treatment technologies and EPA's Environmental Technology Verification Program (ETV) which focuses on site characterization technologies. ORD can be accessed through the Internet at ***<http://www.epa.gov/ORD/>***.

Remediation Technologies Development Forum (RTDF). RTDF was established by EPA to foster public-private partnerships that would conduct laboratory and applied research to develop, test, and evaluate innovative remediation technologies. RTDF's home page provides access to information about various remediation technologies currently being designed, developed and evaluated through seven action teams of RTDF including: the Bioremediation of Chlorinated Solvents Consortium, the LASAGNA™ Partnership, the Permeable Reactive Barriers Action Team, the Sediments Remediation Action Team, the In-Place Inactivation and Natural Ecological Restoration Technologies (IINERT) Soil-Metals Action Team, the Phytoremediation of Organics Action Team, and the *In Situ* Flushing Action Team. RTDF can be accessed through the Internet at ***<http://www.rtdf.org>***.

Superfund Innovative Technology Evaluation (SITE) Demonstration Program. The SITE Demonstration program was established by EPA's Office of Solid Waste and Emergency Response and the Office of Research and Development to encourage the development and implementation of innovative treatment technologies for the remediation of hazardous waste sites, and monitoring and measurement. Through the program, technologies are field-tested on hazardous waste materials and engineering and cost data are gathered on the innovative technology so that potential users can assess the technology's applicability to a particular site. Data collected during the field demonstrations are used to assess the performance of the technology, the potential need for pre- and post-processing of the waste, applicable types of wastes and waste matrices, potential operating problems, and approximate capital and operating costs. The collected information is then provided in a Innovative Technology Evaluation Report, Technology Capsule, and Demonstration Bulletin. These reports evaluate all available information on the technology and analyze its overall applicability to other site characteristics, waste types, and waste matrices. Testing procedures, performance and cost data, and quality assurance and quality standards also are presented. The SITE Demonstration program can be accessed through the Internet at ***<http://www.epa.gov/ORD/SITE>***.

Technology Innovation Office (TIO). The U.S. Environmental Protection Agency's (EPA) TIO was created in 1990 to act as an advocate for new technologies. TIO's mission is to increase the application of innovative treatment technologies to contaminated waste sites, soils, and groundwater. To meet that mission, TIO has expanded its focus from treatment technologies to include site characterization technologies in order to improve the remediation process. TIO has encouraged and relied on cooperative ventures with other partners to accomplish many of its goals. This effort to effectively use resources has led to numerous joint efforts that have enhanced the state of both remediation and site characterization. For additional information about TIO, contact Jeff Heimerman of EPA's TIO at (703) 603-7191. TIO can be accessed through the Internet at ***<http://clu-in.org/tiomiss.htm>***.

SITE CHARACTERIZATION TECHNOLOGIES

Electronic Sources of Information

EPA, National Exposure Research Laboratory - Hazardous Waste Site Characterization (on CD-ROM) (EPA 600-C-96-001). The Hazardous Waste Site Characterization CD-ROM, developed by NERL's ESD-LV, compiles guidance documents and related software to aid environmental professionals in the complex, multidisciplinary, characterizing of hazardous waste sites. The CD-ROM is a compilation of computer programs related to EPA's RCRA and Superfund programs that can be printed, as well as searched by key words. Using the CD-ROM requires a personal computer with DOS Version 3.0 or higher, 640K of Ram, and 3 MB of hard disk space. A math co-processor is recommended but not required. The CD-ROM can be ordered on-line through the NTIS Internet site at ***<www.ntis.gov>***.

Field Sampling and Analysis Technologies Matrix. The Matrix, developed by participating agencies of the Federal Remediation Technologies Roundtable (FRTR), is a matrix and reference guide that is intended to provide users with an understanding of the site characterization technologies available to them and the applicability of various technologies to their particular problem(s). The Matrix provides a general understanding of state-of-the-art technologies for site characterization. The Matrix and reference guide also enhances technology information transfer and provides much needed comparison among competing technologies. The Matrix can be accessed through the Internet at ***<http://www.frtr.gov/site>***.

Hazardous Waste Clean-Up Information (CLU-IN) Home Page. CLU-IN is a streamlined source of information about innovative remediation and site characterization technologies for hazardous waste cleanup professionals. It provides access to information about programs, organizations, publications, and other tools for EPA and other Federal and State personnel, consulting engineers, technology developers and venders, remediation contractors, researchers, community groups, and individual citizens. Access to various tools of information is presented in the form of downloadable publications and databases. Sources of additional information on the Internet also are presented through a series of links. CLU-IN is sponsored by EPA's Technology Innovation Office (TIO). For additional information about the CLU-IN home page, call (301) 589-5318. CLU-IN can be accessed through the Internet at ***<http://clu-in.org>***.

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<http://clu-in.org/membersh.htm>.

Programs, Partnerships, and Organizations

Consortium for Site Characterization and Technology (CSCT). CSCT was established as one of 12 pilot projects currently implemented by EPA's Environmental Technology Verification (ETV) Program. The CSCT is a partnership program among the U.S. Environmental Protection Agency (EPA), the U.S. Department of Defense (DoD), and the U.S. Department of Energy (DOE) that is responsible for evaluating and verifying the performance of innovative site characterization technologies. The CSCT provides support to technology developers, evaluates and verifies data generated during demonstrations, and develops and disseminates information about the performance of site characterization technologies. CSCT can be accessed through the Internet at ***<http://clu-in.org/csct.htm>***.

Environmental Technology Verification Program. The ETV program seeks to provide credible performance data on environmental technologies from independent third parties under the auspices of EPA. It verifies the performance of innovative technical solutions to problems that threaten human health or the environment. Managed by EPA's ORD, ETV was created to substantially accelerate the entrance of new environmental technologies into domestic and international marketplaces. It supplies buyers of technologies, developers of those technologies, consulting engineers, states, and EPA regions with high-quality data on the performance of new technologies. ETV expands on past verification efforts, such as those conducted under the SITE program for remediation technologies. ETV currently implements 10 pilot projects, including the Consortium for Site Characterization Technology (CSCT). The ETV program can be accessed through the Internet at ***<http://www.epa.gov/etv>***.

EPA Library Network Program. The EPA National Library Network Program is a repository of information from EPA's Headquarters, Regional and Field Offices, Research Centers, and specialized laboratories throughout the country. The Library Network provides access to its collection through the On-line Library System (OLS), a menu-driven database of the library's holdings. The OLS provides users with the ability to perform online searches by author, title, or keyword. The material on OLS is updated every two weeks. The EPA National Library Network Program can be accessed through the Internet at ***<http://www.epa.gov/natlibra>***.

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