

The Superfund Innovative Technology Evaluation Program

Annual Report to Congress
FY 1996

Office of Research and Development
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Notice

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Foreword

The U.S. Environmental Protection Agency is charged by Congress with protecting the Nation's land, air, and water resources. 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 the natural systems to support and nurture life. To meet these mandates, 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 investigating 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 preventing and controlling pollution to air, land, water, and subsurface resources; protecting water quality in public water systems; remediating contaminated sites and ground water; and preventing and controlling 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 been successfully promoting the development, commercialization and implementation of innovative hazardous waste treatment technologies for more than 10 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 relevant data on new, viable remediation technologies that may have performance or cost advantages compared to conventional treatment technologies.

Today, SITE is recognized as one of EPA's principal programs to advance innovative site monitoring, characterization, and cleanup technologies, with the potential to treat hazardous waste more efficiently, less expensively, and more safely than many existing methods. The SITE Program has successfully demonstrated 86 technologies, 4 of which were completed during FY96. One hundred and fourteen technology developers are currently participating in the demonstration program. A total of 77 technologies development projects were initiated under the Emerging Technology Program and 31 monitoring and characterization projects under the Consortium for Site Characterization Technologies Program.

The SITE Program has been estimating program cost savings since 1993. During 1996, the SITE Program collected information from signed Records of Decision (RODs dated 1993-1995) in all 10 Regions that selected an innovative technology as the selected remedy. This time period was selected for evaluation because more innovative technologies than conventional technologies were selected in RODs signed during this time period. Of 96 RODs selecting innovative technologies, 46 used technology types tested in the SITE Program and had enough cost information to allow a comparison of the innovative and standard treatment technology. The total cost savings for the 46 RODs was 1.4 billion dollars. Six of the 46 RODs included in this estimate reported that the use of innovative technologies was more expensive than the established technology or treatment. The average percent savings per site was 70%.

Using the 1986 SITE Program initiation date, total discounted costing savings for the SITE Program is 780 million dollars and the total SITE Program budget is 100 million dollars. The SITE Program is only one part of the cost associated with developing and commercializing innovative technologies.

During FY96, a Subcommittee of the Environmental Engineering Committee (ECC) of EPA's Science Advisory Board (SAB) conducted a formal review of the SITE Program. The preliminary review was favorable. In general the committee found that the accomplishments of the SITE Program had been met or exceeded. The SAB recommended that "the Agency should build upon the success of SITE either by continuing the existing program with some improvements or by creating a new technology evaluation program built upon the precepts of the current program."

In an effort to reduce expenditures, the SITE program has reviewed its approach to advancing innovative technologies. Building on existing strengths, the program will shift from a technology-driven focus to a remediation-problem driven focus driven by the needs of the hazardous waste remediation community. With this change in focus, the SITE Program can be defined in four operating principles, including (1) program planning; (2) matching priority sites with innovative technology solutions; (3) conducting technology field demonstrations; and (4) information dissemination. To ensure the highest possible quality, overall program direction and strategies will be evaluated each year based on input from the user community and other private and public sector stakeholders. Priority areas of highest interest during FY97 include topics such as groundwater contaminated with organics and inorganics, metals in soils and chlorinated organics. These areas will be reassessed during FY97 as part of the overall program planning.

The objective of the SITE Program is to conduct field demonstrations and high technical quality performance verifications of viable remediation technologies. The resulting data and reports are intended for use by the site owners and state and federal decision-makers in selecting remediation options and for adding credibility to technology vendors. Technology demonstrations are increasingly being conducted in partnership with other EPA offices, other federal agencies, states, private industry, and universities. SITE reports and dissemination of program information have been and continue to be a valuable resource to the technology user community.

SITE Program Overview

Introduction

The Superfund Innovative Technology Evaluation (SITE) Program of the United States Environmental Protection Agency (EPA) has been successfully promoting the development, commercialization, and implementation of innovative hazardous waste site remediation technologies for more than ten 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 relevant data on new, viable remediation technologies that may have performance or cost advantages compared to conventional treatment technologies.

Background

The discovery of uncontrolled hazardous waste sites in the late seventies, such as New York's Love Canal, New Jersey's Chemical Control site, and Kentucky's Valley of the Drums, focused national attention on an increasingly serious problem. Inadequate or faulty disposal practices and the mishandling of toxic wastes over several decades had resulted in thousands of sites across the United States that potentially threatened human health and the environment. The magnitude of the problem moved Congress in 1980 to enact the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA—commonly known as Super-fund) to deal with the dangers posed by the nation's worst abandoned and uncontrolled hazardous waste sites.

As cleanup activities began at hazardous waste sites under CERCLA, treatment technologies then available were often found to be inadequate for the highly complex problems they were

expected to solve. Consequently, the demand for treatment often outstripped the availability and capability of existing technologies. Concern was growing among the scientific community, citizens, and government officials over the sometimes limited effectiveness and high cost of conventional methods for treating hazardous wastes at Superfund sites. Such technologies typically involved containment of the waste on-site or transport to an off-site incinerator or landfill. While the original Superfund legislation contained no research and development provisions, it became clear that additional technologies that work better, faster, and less expensive were needed.

The 1986 Super-fund Amendments and Reauthorization Act (SARA) addressed this need. Besides reauthorizing Superfund, SARA directed EPA to develop a formal research, development, and demonstration program to promote innovative hazardous waste cleanup technologies as alternatives to containment and incineration. In response, EPA's Office of Research and Development (ORD) and Office of Solid Waste and Emergency Response (OSWER) jointly developed the Super-fund Innovative Technology Evaluation Program. The SITE Program was created to meet the increased demand for alternative hazardous waste treatment technologies and was the first major program for demonstrating and evaluating full-scale, innovative treatment technologies at hazardous waste sites. The program is administered by ORD through its National Risk Management Research Laboratory (NRMRL), in partnership with the National Exposure Research Laboratory (NERL).

Program Description

SITE is a partnership between the public and private sectors, where the costs and responsibili-

ties are shared by EPA, hazardous waste site owners, and technology developers. Under the program, EPA enters into cooperative-type 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 engineering, performance, and cost data intended to aid in decisions regarding the use of the technologies at similar 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.

Historically, one of the greatest factors inhibiting the use of innovative cleanup technologies has been the unavailability of adequate and credible cost and performance data during technology development at or near the commercial scale. Understandably, many problem-owners are unwilling to risk the use of innovative technologies without assurance of the technology's success. By addressing this need, SITE has been successful in aiding the first-time field use of many technologies. Providing credible, unbiased cost and performance data remains the strong foundation of SITE. Key elements that contribute to the SITE Program's position as an effective evaluating program include credibility, objectivity, and technical expertise.

Program Design

The SITE Program is comprised of three components, including the Demonstration Program, the Consortium for Site Characterization Technology Program, and Technology Transfer Activities.

- *Demonstration Program* – Conduct and evaluate demonstrations of promising innovative technologies at selected hazardous waste sites to provide reliable performance, cost, and applicability information for site cleanup decision-making.

- *Consortium for Site Characterization Technology (CSCT) Program* – Evaluate technologies that detect, monitor, and measure hazardous and toxic substances to provide more cost-effective methods for producing real-time data during site characterization and remediation.

- *Information Transfer Activities* – Disseminate technical information, including engineering, performance, and cost data to assist in removing impediments for selection and use of innovative and alternative technologies.

SITE 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), 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 for review by potential users to evaluate their applicability to similar waste sites or to compare their 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 (e.g., soil, sludge, water, sediment), potential operating problems, limitations, and approximate capital, operating, and maintenance costs.

The Demonstration Program, as of September 30, 1996, included 124 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.

Consortium for Site Characterization Technology (CSCT) Program

In the CSCT Program, developers of innovative hazardous waste measurement and monitoring technologies are given the opportunity to

demonstrate their technologies' performance under rigorous field conditions. EPA compiles the results and prepares a report summarizing the findings. The distribution of the report may enhance market acceptance or define new applications for the technology.

The purpose of the CSCT Program is to accelerate the acceptance and use of effective innovative measurement and monitoring technologies in the field. This includes new or modified technologies that can detect, monitor, and measure hazardous and toxic substances in the subsurface, air, biological tissues, waste materials, and surface waters. Technologies include chemical sensors for *in situ* (in place) measurements, groundwater sampling devices, soil and core sampling devices, soil gas sampling devices, fluid sampling devices, laboratory and field-portable analytical equipment, and systems that support field sampling or data acquisition and analysis.

Such 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 help select the most appropriate cleanup action, and monitor the effectiveness of a selected remediation technology. The CSCT Program 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. As with the Demonstration Program, innovative technologies are demonstrated under field conditions and results are compiled, evaluated, published, and disseminated by ORD.

The primary objectives of this portion of the SITE program are:

- to test existing field analytical technologies that enhance monitoring and site characterization capabilities
- to identify the attributes of new technologies to address field characterization and monitoring problem in a more cost-effective and efficient manner
- to prepare protocols, guidelines, and meth-

ods that enhance the acceptance of these technologies for routine use

Evaluations or demonstrations have now been completed for nearly 30 projects. This program is administered by ORD'S National Exposure Research Laboratory at the Characterization Research Division in Las Vegas, NV. Technologies demonstrated under the CSCT Program are listed in Appendix A.

SITE Information Transfer

Information transfer activities ensure that valuable technical information on innovative technologies from the Demonstration and CSCT Programs is disseminated through various communication mechanisms. This includes technical networking, publications, and electronic distribution. The most important products are the published technical reports on each field demonstration. All such activities increase the awareness and promote the use of innovative technologies for assessment and remediation at Super-fund sites. The primary goal of information transfer is to promote communication among environmental stakeholders requiring up-to-date technical information.

Mechanisms for providing information on technology demonstrations and the SITE Program include:

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

A number of technology databases summarize information on innovative treatment technologies and associated vendors. These databases may serve as tools in identifying potential technologies demonstration candidates or serve as a “yellow pages” for technology vendors. Examples of these databases include, but are not limited to, Vendor Information System for Innovative Treatment Technologies (VISITT), Vendor Field Ana-

lytical and Characterization Technologies System (Vendor FACTS), and the Bioremediation in the Field Search System (BFSS). This information is accessible via Internet through the SITE Homepage (<http://www.epa.gov/ORD/SITE/>) or the Technology Innovation Office (TIO) Homepage (<http://www.clu-in.com>). Descriptions of the databases and publication ordering information are contained in Appendix C.

SITE Program Accomplishments and Highlights

SITE Impact

Today, SITE is recognized as one of EPA's 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 many 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.

Over the past ten years, SITE has earned increased recognition as a leader in advancing innovative technology development and commercialization and is currently participating cooperatively with more than 94 hazardous waste sites and 114 technology developers. Through fiscal year (FY) 1996, the SITE Program has successfully demonstrated 86 technologies, 4 of which were completed during FY96. This represents a tremendous amount of new information available on the performance, costs, and applicability of innovative cleanup technologies.

Innovative Technology Use Has Increased

Significant increases in the types and numbers of innovative technologies being selected for Superfund remedial action began after the passage of SARA. While rarely used during the early 1980s, innovative technologies comprised approximately one-quarter of the total number of

technologies selected for Superfund projects between fiscal years (FY) 1986 and 1987. Since then, the number has continued to rise, indicating increased credibility for a number of innovative treatment technologies. Figure 1 shows that more innovative technologies were selected in Records of Decisions (RODs—official records documenting selection of Superfund site cleanup methods) signed during fiscal years 1993, 1994, and 1995 than established technologies. Although SITE is only one contributing factor in increasing innovative technology selection, the program has played a significant role.

SITE Program Cost Savings

The SITE Program has been estimating program cost savings since 1993. During 1996, the SITE Program collected information from signed Records of Decisions (RODs dated 1993-1995) in all 10 Regions that selected an innovative ^{technology} as the selected remedy. This time period was selected for evaluation because more innovative technologies than conventional technologies were selected in RODs signed in each of these years (Figure 1). A total of 96 RODs used innovative technologies. Of the 96 RODs, 46 used technology types tested in the SITE Program and had adequate cost information to enable a comparison of the selected innovative and standard treatment technology. The cost savings reflect preliminary estimates and were inflated to the end of 1996 using median Consumer Price Index (CPI) figures. The total cost savings for the 46 RODs was 1.4 billion dollars. Six of the 46 RODs included in this esti-

Innovative technologies are defined as those that lack sufficient published cost and performance data

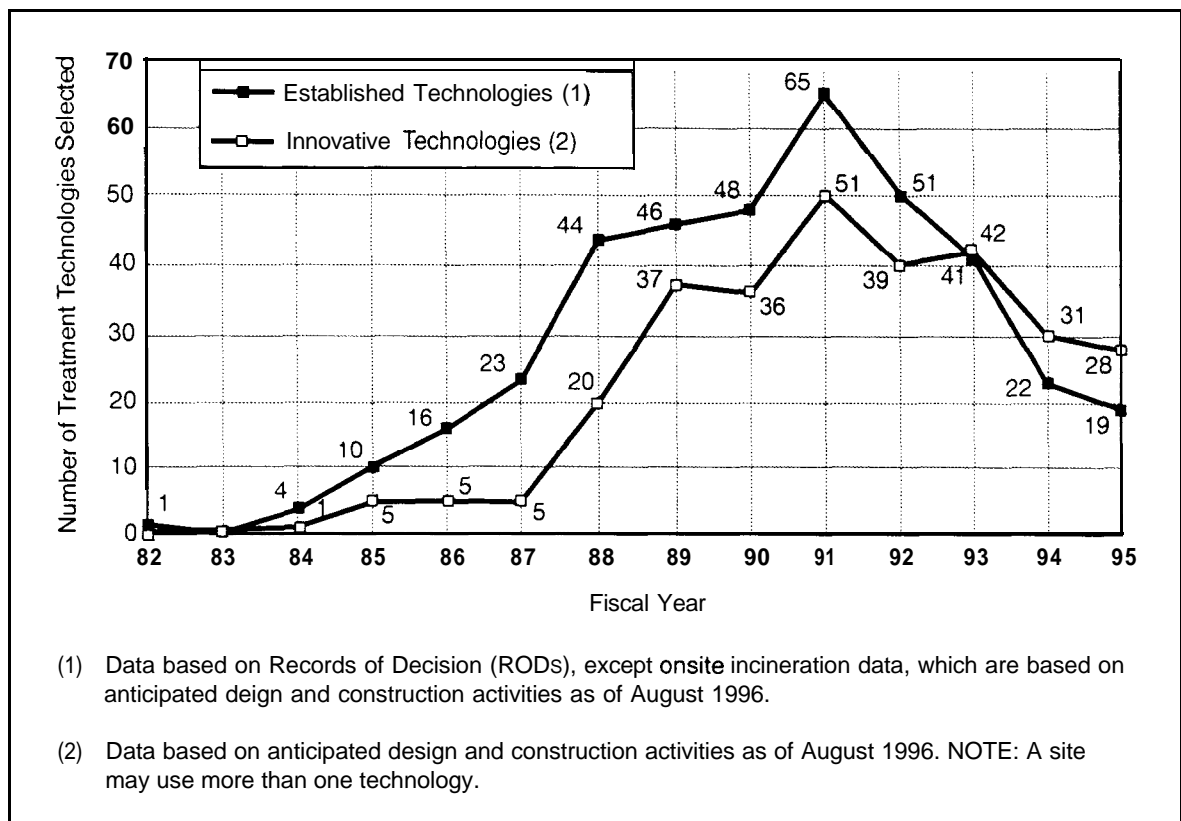


Figure 1. Innovative vs. established treatment technologies by year.
 (Source: U.S. EPA, Office of Solid Waste and Emergency Response, Technology Innovation Office, *Innovative Treatment Technologies: Annual Status Report - Eighth Edition, EPA/542/R-96/010, November 1996.*)

mate reported that the use of innovative technologies was more expensive than the established technology. The average percent savings per site was 70%. However, the RODs in this data set may represent particularly difficult cleanup problems as the cost savings per ROD were found to be higher, on average, than the cost per ROD in the Super-fund Program overall.

In order to estimate SITE Program net benefit, the 1993-1995 RODs and the SITE Program budget were first inflated to the end of 1996 using CPI figures and then normalized to 1986 end-of-year levels using a 7% discount rate, as specified in OMB-Circular A-94. The 1986 date was selected as the baseline since the SITE Program was initiated in SARA 1986. *The total discounted cost savings for RODs from 1993-1995 is 780 million dollars. For comparison, the total discounted*

SITE Program budget from 1986-1996 was 100 million dollars. The SITE Program is only one part of the cost associated with developing and commercializing innovative technologies.

Figure 1 illustrates the number of innovative versus established treatment technologies selected by year. This figure shows a peak in 1993, when more innovative technologies were selected than conventional technologies. A peak in the savings associated with the use of innovative technologies is also observed in 1993.

Since more innovative technologies were selected from 1993-1995, and more than 1.4 billion was estimated in savings, the increased use of innovative technologies appears to correlate with an increase in savings realized from the use of innovative technologies.

Agency Science Advisory Board Review

During FY 1996, a Subcommittee of the Environmental Engineering Committee (EEC) of EPA's Science Advisory Board (SAB) conducted a formal review of the SITE Program. This review primarily focused on the following:

- The extent to which stated program objectives have been met
- Scientific and technical aspects of the program

- Impacts of the program and recommendations for potential improvements
- How well the program has supported innovative technology commercialization

The Subcommittee's final report was approved by the EEC and the Science Advisory Board's Executive Committee in July 1997.

The SAB Report Includes the Following Statements:

*The subcommittee found the accomplishments **of** the SITE Program to be impressive. Stated program objectives have been generally met or exceeded, and the program has provided credible information on mostly innovative technologies, many **of** which are in use today at Superfund or RCRA Corrective Action Sites.*

*The need **for** improved technology to prevent, reduce, or remediate environmental contamination remains a national priority. The Subcommittee believes that in order to meet this need, the Agency should build upon the success **of** SITE either by continuing the existing program with some improvements or by creating a new technology evaluation program built upon the precepts **of** the current program.*

*The SITE Program has met the objectives set **for** it, has become a model **for** at least one other technology evaluation program, **EnTICE** [now called ETV-Environmental Technology Verification Program], and has played a substantial role in joint technology evaluations with the Departments **of** Energy and Defense.*

Demonstration Program Vendor Highlights

SITE Demonstration Program Case Studies

Technology vendors are a very important part of the program. They provide the service for the sites needing clean-up solutions. Seventy-seven vendors completing a SITE Program evaluation were asked about company revenues. Roughly 50% of the responses claimed a 20%-75% increase in revenues as a result of SITE Program involvement (Figure 2). The majority of the vendors indicated that their companies were awarded between 1-5 Superfund and 1-5 commercial remediation jobs following their participation in SITE. Thirty percent of the vendors reported 1-2 international contracts. This number has increased from the SITE Program vendor responses in 1994. Vendors specified 20 countries where bids were submitted.

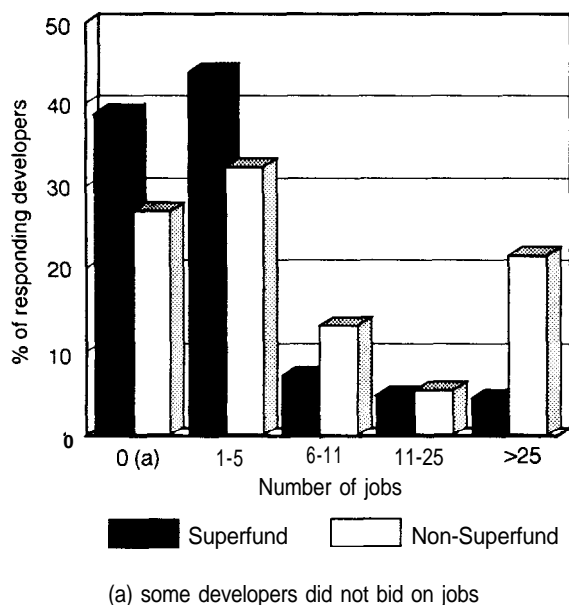


Figure 2. Jobs reportedly awarded to developers following their SITE demonstration.

The following case studies are examples of innovative remediation technologies that have participated in the SITE Program and were later selected for full-scale remediation of specific sites. The case studies also present the estimated cost savings resulting from the use of innovative technologies compared to the cost estimates for established technologies also considered at the site.

Case Study 1: X*TRAX Thermal Desorption Technology (OHM Remediation Services Corporation)

A SITE demonstration was conducted at the Re-solve, Inc., Super-fund site in Dartmouth, MA, using X*TRAX thermal desorption technology. Primary waste materials at the site included solvents, waste oils, and PCBs. The X*TRAX thermal desorption technology is a patented process that uses heat to physically separate and remove contaminants from soils, sediments, or sludges. The process involves heating contaminated material at relatively low temperatures, typically 200 to 1,000°F, so that contaminants with low boiling points will vaporize and separate from the medium. The separated contaminants, along with any water vapor and particulates, are then captured and treated.

Demonstration data indicated that the X*TRAX system removed PCBs from feed soil and met the site-specific endpoint of 25 milligrams per kilogram for treated soils exiting the process. PCB concentrations were reduced from an average of 247 milligrams per kilogram in feed soils to an average of 0.13 milligrams per kilogram in treated soils. The average PCB removal efficiency was calculated to be 99.95%. Concentrations of

oil, grease, total recoverable petroleum hydrocarbons, and tetrachloroethane were reduced to below detectable limits in the treated soil.

Full-Scale Remediation

Based on the success of the SITE demonstration, the technology was selected for full-scale use in remediation of the Re-solve, Inc. site. The full-scale X*TRAX system, Model 200, was used to remediate 50,000 tons of PCB-contaminated soil at the site.

Cost Comparison

A cost comparison between excavation and incineration and excavation and on-site thermal desorption (using X*TRAX) was presented in the ROD. According to the ROD, the estimated cost to remediate the site using the incineration alternative is \$3 1,347,000. The estimated cost using the innovative desorption (X*TRAX) technology is \$17,038,000. Selection of the innovative X*TRAX technology resulted in a savings of \$14,309,000 or approximately 46%.

Case Study 2: Solvent Extraction Technology (Terra-Kleen Response Group, Inc.)

Terra-Kleen Response Group, Inc. (Terra-Kleen) has developed a solvent extraction system that removes PCBs and other organic compounds from waste material. This process applies an organic chemical solvent to the waste material to extract contaminants. Like water-based soil washing, solvent extraction does not typically destroy wastes but is a means of separating hazardous contaminants from soils, sludges, and sediments. Solvent extraction operates on the principle that, with the appropriate solvent, organic contaminants can be preferentially solubilized and removed from the waste.

A technology demonstration was conducted at Naval Air Station North Island (NASNI) in California. The primary objective of the SITE dem-

onstration was to determine whether the Terra-Kleen technology could reduce PCBs to below the Toxic Substances Control Act (TSCA) incineration equivalency level (2 milligrams per kilogram [mg/kg]). Analyses of untreated versus treated soil at the NASNI demonstration site indicated that the Terra-Kleen technology reduced PCB concentrations from an average of 144 mg/kg to less than 1.7 mg/kg, representing a removal efficiency of 98.8%.

Removing contaminants from the solvent following treatment permits the reuse of the solvent. Regenerated solvent from the SITE demonstration was analyzed to determine if it was acceptable for reuse. PCB extracted from the solvent was removed in proprietary media and incinerated following the demonstration. Analytical results indicated that the PCB concentration in the solvent was below the laboratory method detection limit of 0.08 mg/kg. Since the PCB concentration was less than the TSCA incineration equivalency level for PCBs, the solvent was deemed acceptable for reuse at other contaminated sites. Reuse of the solvent material reduces the cost of using the system.

Full-Scale Remediation

Terra-Kleen was later asked to conduct a full-scale remediation of three pesticide-contaminated sites at Naval Communication Station (NCS) Stockton. Conducted under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Program, Terra-Kleen remediated soils at NCS Stockton sites that were contaminated with pesticides. The goal of the remediation was to reduce the concentrations of each pesticide to below 1 mg/kg. This concentration was based on the threshold limit concentration for these compounds and was below the EPA Region 9 preliminary remediation goal for DDT in residential soil.

The successful treatment of the NCS Stockton soils has led the Navy to consider the Terra-Kleen technology for treatment of other sites at NCS Stockton and at other naval facilities.

Cost Comparison

Cost comparison data generated for the feasibility study (FS) for the Stockton site compared the Terra-Kleen technology to off-site incineration, a second alternative under consideration for use at the site. According to the FS data, the total estimated cost for off-site incineration was \$10,051,700. The total estimated cost to use the Terra-Kleen technology was estimated to be \$4,324,000. Using this cost comparison data, which was also presented in the Record Of Decision (ROD), selection of the innovative Terra-Kleen technology alternative resulted in a savings of \$5,727,700, or 57%, in comparison to off-site incineration.

"We would not be in business if it weren't for the SITE Program."

Alan Cash
Terra Kleen Response Group, Inc

Case Study 3: Center Pivot Spray Irrigation System (University of Nebraska-Lincoln)

Research conducted by the University of Nebraska and the U.S. Department of Agriculture indicated that a traditional Center Pivot Spray Irrigation System could be modified for use as an air stripping unit to remediate volatile organic compounds (VOCs). The premise behind the technology involved the potential to address the need for irrigation water through the use of contaminated groundwater that could be converted for use on crops. The key to the successful use of such a system involves controlling the droplet size exiting the irrigation unit to allow evaporation of up to 500 parts per million (ppm) VOC. The residual contaminants are transferred to the atmosphere, where they are dispersed and rapidly degraded in ultraviolet light.

As part of the Western Governors Association initiative for innovative technologies, several

state environmental agencies, representatives of the Navy Facility Engineering Centers, U.S. Army Corps of Engineers, and other stakeholders participated in the review of the technology demonstration. The purpose of the demonstration was the identification of appropriate applications of the Center Pivot Spray Irrigation technology alternative for use by state programs and federal facilities.

The technology was demonstrated in conjunction with the SITE Program at the North Landfill **Subsite** in Hastings, Nebraska. The system used in the SITE demonstration was a center pivot unit located in a 50-acre, furrow-irrigated corn field underlain by commingled plumes of VOC contaminated groundwater. The primary goal of the demonstration was to determine the efficiency of the system in the remediation of VOCs in groundwater to concentrations below the maximum contaminant levels (MCLs).

The demonstration included a great deal of community involvement and was considered a success based on the final results.

Full-Scale Remediation

The successful SITE demonstration led the management of the Lindsay Manufacturing (Lindsay) **Superfund** Site in Nebraska to apply to EPA Region 7 for approval to add the technology to an existing groundwater pump-and-treat system. The technology also is being considered for use at several grain elevator sites being investigated and remediated by Argonne National Laboratory.

Cost Comparison

Lindsay provided limited cost comparison information with the request for approval. According to Lindsay, the average operation and maintenance (O&M) costs associated with operating the existing groundwater extraction and treatment system and the soil vapor extraction (SVE) system was \$16,500 per month, plus utilities. Lindsay estimated that the proposed use of the Center Pivot Irrigation System during dryer months would result in an average monthly O&M expenditure of \$6,000 per month. Lindsay's estimate in-

dicates that operation of the Center Pivot Irrigation System will result in a savings of \$100,000 to \$125,000 per year, or an approximate savings on O&M costs of 37%. EPA Region 7 approved

addition of the technology to the existing treatment efforts in November 1996. Irrigation using the system is scheduled to begin in the spring of 1997.

FY96 Progress and Accomplishments

Demonstration Program

During FY96, four new innovative technologies were evaluated in the field. Due to an unusual budgetary year, the annual SITE Program solicitation was not announced. Only ongoing field projects initiated prior to FY96 were completed. Completed projects are listed in Table 1.

Over the past ten years an emphasis was placed on innovative technologies for permanent treatment. The majority of the field demonstrations were with ex situ physical/chemical and thermal technology types. Many projects were field tested in a matter of days or weeks. As we move toward more non-invasive *in situ* techniques with the potential for lower cost application, field demonstration and verification may take several months to years of data collection. There continues to be a need for innovative ex *situ* technologies that provide a more cost-effective approach or where quicker treatment is required to protect human health and the environment from immediate risk.

In general, the need for credible and reliable data on innovative treatment technologies provided by SITE remains significant. Eighty RODs, signed during 1994 that selected established technologies as the best alternative, were reviewed. Of the 80 RODs, 16 (20%) considered an innovative technology as an alternative for remediation of the site. The majority of the RODs stated that the innovation options were not chosen due to a lack of verified performance, effectiveness, and implementability associated with the innovative technologies. Six of the RODs cited cost as an issue and two cited state and community concerns about the innovative technology.

Based on the increased emphasis in *in situ* technologies, the list of ongoing demonstrations will increase with fewer moving from the ongoing to completed status annually than in the past. It is still estimated that six field demonstrations will be completed each year. A list of ongoing projects is provided in Table 2.

Emerging Technology Program

The Emerging Technology Program (ETP) fosters the research and development of innovative technologies for remediation of Super-fund and other hazardous waste sites. Technologies enter the program at the bench- or pilot-scale stage of development. EPA provides developers the opportunity to move a technology forward through bench- and pilot-scale testing to demonstration.

The SITE ETP was discontinued in 1996 due to reductions in funding to the Super-fund research and development budget. The program continues to honor commitments to technology developers currently in the program but new technologies were not admitted into the program after 1995.

Technologies were solicited yearly for the ETP through requests for preproposals. Selected candidates were invited to submit a Cooperative Agreement application that underwent full technical review. Applications were considered for a Cooperative Agreement with a duration of up to two years, and funding of \$150,000 per year with a \$300,000 maximum. Second year funding depended on significant progress during the first year. Upon completion of the ETP, technologies were considered for the SITE Demonstration Program. Many technology vendors chose to fully commercialize their technology after participating in the ETP.

Table 1. SITE Demonstration Projects Completed in FY 1996			
Company Location	Developer	Technology	Site Location
ID	Morrison Knudsen Corporation/STG	This technology uses clay slurries as a base for grout solutions, which are injected into bedrock fracture systems to inhibit or eliminate groundwater flow in these pathways. The technology was tested at the Mike Horse Mine site.	Mike Horse Mines, MT
NE	University of Nebraska	The Center Pivot spray irrigation system is used to remediate groundwater contaminated with volatile organics. A thin film of water produced by impact pads breaks up into small droplets as it leaves the pads. This technique may be limited to low VOC groundwater concentrations. The demonstration was conducted at the Hastings, Nebraska Superfund site.	Hastings, NE
NJ	Accutech, Inc.	The Accutech, pneumatic fracturing and catalytic oxidation process, forces gases into geologic formations at pressures that exceed the natural in situ stresses, creating a fracture network. These fractures allow subsurface air to circulate faster and more efficiently throughout the formation. The catalytic oxidation unit is equipped with a special catalyst to destroy halogenated organics. The demonstration was conducted at the Highland Park site in New Jersey.	Highland, Park, NJ
Canada	EnviroMetal Technologies, Inc.	This technology degrades dissolved halogenated organic compounds in groundwater with an in situ permeable wall containing reactive metal such as iron. The demonstration was conducted at an industrial facility in New York.	Chenango County New York

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 ETI? Fifty-nine ETP projects have been completed. Eighteen of the ETP projects are in the SITE Demonstration Program. To date, six of the demonstration projects have been completed and twelve are ongoing. The completed emerging technology projects for FY96 are listed in Table 3.

Consortium for Site Characterization Technologies

During FY96, the Characterization and Monitoring program made improvements to the guidance manual for preparing Demonstration plans. The primary intent of these revisions was to clarify the selection criteria for the reference

laboratory and field test sites. This document also underwent an external peer review and received many favorable comments. The guidance manual is now in routine use and has streamlined the planning process. The document has been used as a model in a number of states, most notably California, as a basis for the state certification program.

The Characterization and Monitoring program has leveraged its resources with EPA's Environmental Technology Verification Program. These programs now known collectively as the Consortium for Site Characterization Technologies (CSCT) have developed a partnership agreement with the Department of Energy (DOE). A formal Memorandum of Understanding has been developed to identify the topics and procedures of mutual interest. This agreement will allow the

Table 2. SITE Demonstration Ongoing Projects

Company Location	Developer	Technology	Proposed Site Location
DO	Pintail Systems	This technology uses microbial detoxification of cyanide in heap leach processes to reduce cyanide levels in spent ore and process solutions. The biotreatment populations of natural soil bacteria are grown to elevated concentrations, which are applied to spent ore by drip or spray irrigation.	Battle Mountain, NV
MO	Monsanto	The Lasagna process combines electroosmosis with treatment layers which are installed directly into the contaminated soil to form an integrated, <i>in situ</i> remedial process. The process is designed to treat soils and groundwater contaminated with VOCs. The technology demonstration is located at the U.S. DOE Paducah Gaseous Diffusion Plant.	Paducah, KY
NJ	Phytotech, Inc.	The Phytoremediation technology uses specially selected and engineered plants to treat soil and water contaminated with toxic metals such as lead and cadmium, as well as radionuclides. The demonstration is currently being conducted.	Trenton, NJ
NM	Sandia National Laboratory	The Sandia National Laboratory electrokinetic extraction system is for treating metal contaminated soils. This technology was developed for use in unsaturated soils without adding significant amounts of water. The technology is currently operating at an unlined chromic acid pit within a Sandia National Laboratory landfill.	Albuquerque NM
OH	Commodore Environmental Services, Inc.	The solvated electron remediation system chemically transforms toxic contaminants such as PCBs, pesticides and other halogenated compounds into relatively benign substances. This project is part of the White House Rapid Commercialization initiative (RCI). The demonstration is for treating PCB contaminated soils from the Construction Battalion Supply Center in Port Hueneme, DOD facility.	Port Hueneme, CA
OH	U.S. EPA/ NRMRL	The bioventing biological system treats contaminated soil <i>in situ</i> by injecting atmospheric air. The air provides a continuous oxygen source, which enhances the growth of microorganisms naturally present in the soil. The demonstration is being conducted at the Reilly Tar site on polynuclear aromatic hydrocarbon (PAH) contaminated soils.	St. Louis, MN
OH	U.S. DOD/ Air Force	The Air Force is field testing the effectiveness of eastern cottonwood trees in remediating shallow groundwater contaminated with TCE. The cottonwood trees are expected to bioremediate the contaminated groundwater and soils. This project is in conjunction with the DOD Environmental Security Technology Certification Program (ESTCP) at the Air Force Plant 4 at the Naval Air Station.	Fort Worth, TX
JT	Phytokinetics, Inc.	This demonstration will assess the ability of plants to reduce the concentrations of petroleum hydrocarbons in near-surface soils, saturated zone and to modify the groundwater gradient. Alfalfa and fescue plantings will be evaluated for soil remediation, while poplar and juniper trees will be investigated for their ability to treat the saturated groundwater zone. Demonstration currently underway at a former Chevron transfer station.	Ogden, UT

Table 3. SITE Emerging Technology Projects Completed in FY1996			
State	Developer	Technology Description	Treatment Category
CA	Environmental Biotechnologies, Inc.	This technology is designed to treat soil and sediments contaminated with coal tar and wastes from former Manufactured Gas Plant sites. The technology uses a fungal augmented system designed to enhance natural bioprocesses.	Biological
CA	COGNIS. Inc.	This soil remediation system leaches and recovers lead and other metals from contaminated soil, dust, sludge, or sediment. The system uses a patented aqueous leachant that is optimized through treatability tests for the media and contaminant.	Chemical
AZ	Arizona State University	The photocatalytic oxidation process removes VOCs from air streams. The technology utilizes air stripping for removal of VOCs from groundwater and soil, followed by PCO treatment. This system has been field tested.	Chemical
FL	High Voltage Environmental Applications, Inc.	This high-energy electron beam irradiation technology is a low-temperature method for destroying complex mixtures of hazardous organic chemicals in contaminated media. The technology is available for full-scale remediations.	Physical

CSCT portion of the SITE Program to supplement its funding of characterization and monitoring demonstrations and will also include the expertise of DOE's national laboratories to assist in the demonstration process. It is anticipated that EPA funding for the SITE program will continue to be required but, that this alliance will help address the demand for this program and eliminate the backlog of technologies that have submitted applications.

A stakeholder group was formulated to assist in outreach activities and in the process of technology selection. An advocates program, involving the EPA regional offices, was also established to assist in the demonstration process and to ensure that the products of the demonstration address agency issues.

As a result of decreased funding, no new demonstrations were conducted during FY96.

Activities were confined to preparing reports on the FY95 field demonstration involving the test of seven field Portable X-Ray fluorescence (FP-XRF) systems. This technology can be used to provide rapid, real-time analysis of toxic metals in the soil. The commercial systems evaluated during this demonstration were:

- MAP Spectrum Analyzer for Sciетec Corporation
- XL Spectrum Analyzer from Nitron Corporation
- TN 9000 and
- TN Lead Analyzer from TN Spectrace
- SEFA-P Analyzer from HNU Systems
- X-MET 920-P Analyzer from Metorex
- X-MET 920-MP Analyzer from Metorex

These technologies were tested at sites in Tacoma, WA and Davenport, IA.

In FY97, a demonstration of four soil sampling and two soil gas samples are planned. Technologies participating in this demonstration included:

These technologies were demonstrated in Albert City, IA and Commerce City, CO. The reports will be completed in FY98.

Simulprobe	Core Barrel Samples
Geoprobe	Large Bore Soil Samples
AMS	Dual Tube Liner Samples
Clements	Environmentalists Subsoil Probe
W-L Gore	Gore Sorber Soil Gas Samples
Quadrel	Emflux Soil Gas System

Future Direction

In an effort to reduce expenditures, the SITE Program has reviewed its approach to advancing innovative technologies. This review indicated that operational shifts are necessary to remain in a “state-of-the-art” position. Building on existing strengths (e.g., demonstration design, quality assurance, technology transfer), the program will shift from a technology-driven focus to a remediation-problem focus driven by the needs of the hazardous waste remediation community. With this focus the remediation community should offer sites that pose high risk to human health and/or the environment, are common throughout a region or nationwide, or where existing remediation methods are inadequate or too costly. The vision for the program is to remain the premiere organization in enhancing the credibility and implementation of effective innovative remediation options.

Next Generation SITE Program

The next generation of SITE can be defined in four operating principles, including (1) program planning; (2) matching priority sites with technology solutions; (3) conducting technology field demonstrations; and (4) information dissemination.

Program Planning

To ensure the highest possible quality, overall program direction and strategies will be 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, SITE will develop and implement a quality management plan based on the ISO standards.

As part of this planning, the program has identified its major research areas of focus for the next six years (see Figure 3).

Matching Priority Sites with Technology Solutions

The goal for this action is to identify the technology needs of the user community, via working groups, forums, personal communication, and documentation. In the past, identifying sites for technology vendors solicited through the program has been an ongoing process-and at times has been problematic. The redesigned program takes this activity a step further by soliciting and prioritizing sites, and then seeking appropriate technologies for demonstration at these sites. Sites have the option of evaluating one or more technologies.

Matching sites and technologies will remain flexible. During the solicitation, hazardous waste sites may apply for participation in SITE in several ways. Some example scenarios are as follows:

- The site has a particular vendor and technology chosen to address their particular hazardous waste need.
- The site has chosen a family or category of technology with no particular vendor in mind (i.e., in situ bioremediation, in *situ* physical treatment).
- The site may choose to solicit for one or more technologies in a variety of technology areas.

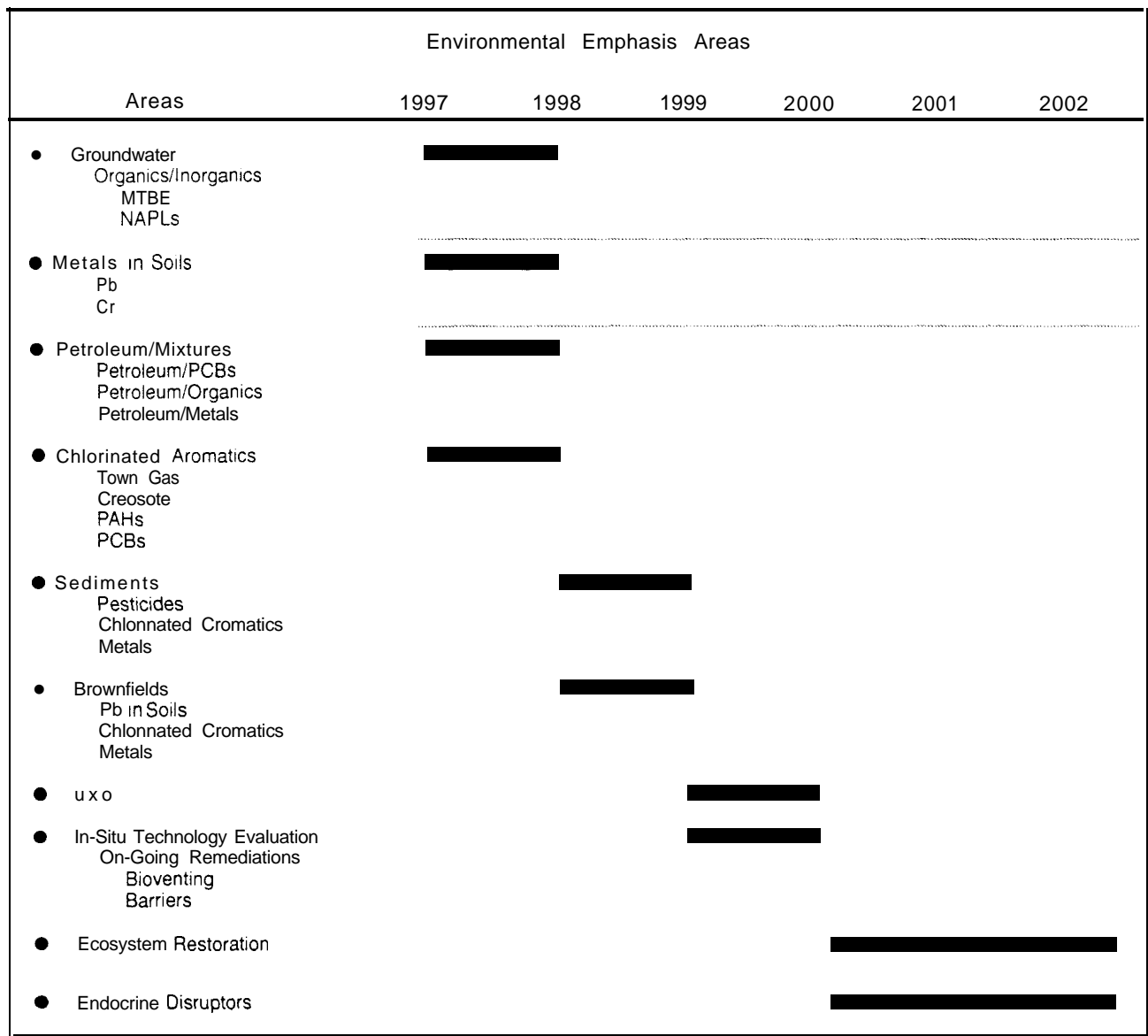


Figure 3. Environmental emphasis areas through fiscal year 2002.

If no specific technology or vendor has been submitted in the proposals, technologies and vendors will be matched to chosen sites by a team of project participants. Participants would include, but not be limited to, state and federal regulators, public representatives, where appropriate, and other federal Agencies. The team representatives will be selected by the host site project lead and SITE program representative.

An important aspect of technology selection is that more than one technology may be introduced for the team's review and demonstration. This allows an innovative technology match to user sites in a manner that is advantageous to the

user from both a cost and performance perspective. The site may choose to solicit for vendors through a specific SITE Program vendor solicitation or use contractual mechanisms available to the host site.

Technology Areas of Primary Interest

The selection of sites for the SITE Demonstration Program will be based on the needs of EPA, other federal agencies, and the user community. Keeping apprised of these needs will require an ongoing dialogue with the user community, EPA Regional Project Managers, Super-fund Technical Liaisons, other federal agencies, states,

and others. This dialogue will ensure that the needs of the personnel who are directly involved with site remediation are addressed. The SITE Program has an interest in receiving responses to its solicitation for participation from any site that has a specific site problem or technology that requires evaluation. However, the SITE Program currently has a particular interest in evaluating in situ and lower cost technologies. Four high priority areas of interest for FY 1997:

1. Groundwater contaminated with organics and inorganics.
2. Soils, sludges, and sediments containing inorganics, heavy metals, and radioactive components alone or in combination with organics.
3. Sites contaminated with petroleum combined with other compounds.
4. Recalcitrant organics with low water solubility (e.g., PAHs from town gas sites and creosote sites), PCBs, and pesticides).

Technology Field Demonstrations

The objective of the SITE program is to conduct field demonstrations and high technical quality performance verifications of viable remediation technologies. The resulting data and reports are intended for use by the site owners and state and federal decision-makers in selecting remediation options and for adding credibility to technology vendors in promoting their processes. Technology demonstrations are increasingly being conducted in partnership with other EPA offices, other federal agencies (such as Department of Defense and Department of Energy), states, private industry, and universities.

The SITE Program annually solicits applications from interested private firms and federal and state agencies with responsibility for on-site cleanup operations at hazardous waste sites for participation in the Demonstration Program. Cooperative arrangements or Memoranda of Understanding between the SITE Program and the parties responsible for the host site form the relationship between SITE and the host site. There is no contractual agreement and no funds are given to

the site as part of this arrangement. The selection of sites for the program is based on the needs of EPA, other federal agencies, and the technology user community.

In the Demonstration Program, host site owners are responsible for providing necessary data related to the hydrogeology and other site conditions, results of feasibility studies, and results of waste analyses. The host site is also 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 being 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 responsible for project planning, sampling and analysis, quality assurance and quality control, preparing full evaluation reports, and disseminating cost and performance information to environmental managers in government agencies, the engineering community, industry, and the public. EPA also prepares bulletins, project summaries, and videos to document demonstrations. These reports evaluate all available information on the technology and analyze its overall applicability to other site characteristics, waste types, and waste matrices. Reports also include testing procedures and the quality assurance and quality control standards.

Information Transfer

SITE reports have been, and continue to be, a valuable resource to the technology user community. Modifications to these reports may be necessary as the program changes over the next couple of years. Other mechanisms for information dissemination will be necessary as electronic communication becomes more widely used. Published documentation, meetings, and conferences will continue to be a large part of the dissemination for technical information. The program will continue to focus on developing documents sum-

marizing technology areas where data exist on a variety of technologies or applications. This information will allow the user community to compare these technologies, along with their costs and

applications. More technology areas will be summarized as the SITE Program matures and information becomes available.

Appendix A
All SITE Projects
(Alphabetically by State)

State	Developer	Technology	Technology Contact	Program	Status
Alabama	CMS Research Corp. Birmingham, AL	Portable Gas Chromatograph	H. Ashley Page 205-773-6911	Monitoring and Measurement Technologies	Completed 1992
Alaska	Brice Environmental Service Corp. (BESCORP) Fairbanks, AK	Soil Washing Plant	Craig Jones 907-452-2512	Demonstration	Completed September 1992
Arizona	Arizona State Univ. Tempe, AZ	Photocatalytic Oxidation and Air Stripping	Gregory Raupp 602-965-2828	Emerging Technology	Ongoing
	STC Omega (formerly Silicate Technology Corp.) Scottsdale, AZ	Solidification and Stabilization Treatment	Stephen Pelger or Scott Larsen 602-948-7100	Demonstration	Completed November 1990
California	Analytical and Remedial Technology, inc. Menlo Park, CA	Automated Volatile Organic Analytical System	D. MacKay 415-324-2259	Monitoring and Measurement Technologies	Completed May 1991
	Radian Corp. (formerly AWD Technologies, Inc.) Walnut Creek, CA	Integrated Vapor Extraction and Steam Vacuum Stripping	David Bluestein 51 O-988-1 125	Demonstration	Completed September 1990
	Berkeley Environ. Restoration Ctr. (formerly Udell Technologies, Inc.) Emeryville, CA	<i>In situ</i> Enhanced Extraction	Kent Udell 51 O-642-2928	Demonstration	Completed 1993
	COGNIS, Inc. Santa Rosa, CA	Biological/ Chemical Treatment	Steve Rock USEPA 513-569-7149	Emerging Technology	Completed 1995
			Mike Royer USEPA 908-321-6633	Emerging Technology Demonstration	Completed 1994 Completed 1994
Energy and Environmental Research Corp. Irvine, CA	Hybrid Fluidized Bed System	Richard Koppang 714-859-8851	Emerging Technology	Completed 1992	
	Reactor Filter System	Neil Widmer 714-859-8851	Emerging Technology	Completed 1995	

State	Developer	Technology	Technology Contact	Program	Status
California	Environmental Biotechnologies Montara, CA	Microbial Compostmg	Douglas Munnecke 415-596-1020	Emerging Technology Demonstration	Ongoing Ongoing
	EPOC Water, Inc. Fresno, CA	Precipitation, Microfiltration, Sludge Dewatering	Rodney Squires 209-291-8144	Demonstration	Completed May 1992
	GIS\Solutions, Inc. Concord, CA	GIS\Key Environmental Data Management Software	John Saguto 415-827-5400	Demonstration	Completed August 1993
	Groundwater Technology Government Services, Inc. Concord, CA	Biological Composting	Ronald Hicks 51 0-671 -2387	Emerging Technology	Completed 1995
	Hughes Environmental Systems, Inc. Manhattan Beach, CA	StreamEnhanced Recovery Process	Paul dePercin USEPA 513-569-7797	Demonstration	Completed September 1993
	Lockheed Martin Missiles & Space Co., Inc., Palo Alto, CA	Electrokinetic Remediation	Steven H. Schwartzkopf 4 15-424-3176	Demonstration	Ongoing
	Magnum Water Technology El Segundo, CA	CAV-OX@ Process	Dale Cox 31 0-640-7000	Demonstration	Completed March 1993
	Membrane Technology and Research, Inc. Menlo Park, CA	VaporSep Membrane Process	Marc Jacobs Doug Gofschlich 415-328-2228	Emerging Technology	Completed 1991
	MTI Analytical Instruments (formerly Microsensor Technology, Inc.) Fremont, CA	Portable Gas Chromatograph	Gary Lee 415-490-0900	Monitoring and Measurement Technologies	Completed 1992
	NOVATERRA, Inc. (formerly Toxic Treatments USA, Inc.) Los Angeles, CA	In situ and Air Stripping	Philip LaMori 213-969-9782	Demonstration	Completed September 1989
	General Atomics (formerly Ogden Environmental Services) San Diego, CA	Circulating Bed Combuster	Jeffrey Broido 619-455-4495	Demonstration	Completed March 1989
		Acoustic Barrier Separator	Robert Goforth 619-455-4057	Emerging Technology	Completed 1995
	Praxis Environmental Services Burlingame, CA	<i>In situ</i> Steam Enhanced Extraction	Lloyd Stewart 415-548-9288	Demonstration	Ongoing

State	Developer	Technology	Technology Contact	Program	Status
California	Pulse Sciences, San Leandro, CA	X-Ray Treatment (Aqueous)	Vernon Bailey 510-632-5100 Ext. 227	Emerging Technology	Completed 1994
	Thermatrix, Inc. (formerly Purus, Inc.) San Jose, CA	Photolytic Oxidation	Steve McAdams 408-453-0490	Emerging Technology	Completed 1992
	Retech, Inc. Ukiah, CA	Plasma Arc Vitrification	Ronald Womack and Leroy B. Leland 707-462-6522	Demonstration	Completed July 1991
	Rochem Separation Systems, Inc. Torrance, CA	Rochem Disc Tube Module System	David LaMonica 310-370-3160	Demonstration	Completed August 1994
	Roy F. Weston Woodland Hills, CA	Air Sparging Process	Jeff Bannon 818-971-4900	Demonstration	Completed 1994
	SRI Instruments Torrance, CA	Portable Gas Chromatograph	Dave Quinn 310-214-5092	Monitoring and Measurement Technologies	Completed January 1992
	SIVE Services Dixon, CA	Steam Injection and Vacuum Extraction	Douglas Dieter 916-678-8358	Demonstration	Ongoing
	Pulse Sciences San Leandro, CA	X-Ray Treatment (Soils)	Vernon Bailey 510-632-5100	Emerging Technology	Ongoing
	U.S. Fiher (formerly Ultrox) Huntington, CA	Ultraviolet Radiation and Oxidation	William Himebaugh 714-545-5557	Demonstration	Completed March 1989
	U.S. EPA Region IX San Francisco, CA	Excavation and foam suppression of volatiles	Jack Hubbard USEPA 513-569-7507	Demonstration	Completed July 1990
	XonTech, Inc. Van Nuys, CA	XonTech Sector Sampler	Matt Young 818-787-7380	Monitoring and Measurement Technologies	Completed 1991
	Texaco, Inc. S. El Monte, CA	Entrained-Bed Gasification	John Winton 310-908-7387	Demonstration	Completed 1994
	Terra-Kleen Response Group, Inc. Del Mar, CA	Solvent Extraction (2 Demonstrations)	Alan Cash 619-558-8762	Demonstration	(1) Completed 1994 (2) Ongoing
Colorado	Colorado School of Mines Golden, CO Colorado Department of Health Denver, CO	Wetlands-Based Treatment	Thomas Wildeman 303-273-3642	Emerging Technology	Completed
			James Lewis 303-692-3383	Demonstration	Ongoing

State	Developer	Technology	Technology Contact	Program	status
Colorado	General Environmental Corp. (formerly known as Hydrologics, Inc.) Englewood, CO	CURE@ Electrocoagulation	Carl Dalrymple 303-761-6960	Demonstration	Completed 1995
	Pintail Systems, Inc. Aurora, CO	Biodegradation of Cyanide	Leslie Thompson 303-367-8443	Demonstration	Ongoing
	Pintail Systems, Inc. Aurora, CO	Biominalization of Metals	Leslie Thompson 303-367-8443	Emerging Technology	Ongoing
	Smith Environmental Technologies Corp. (formerly Canonic Environmental Services Corp) Englewood, CO	Low Temperature Thermal Aeration	Joseph Hutton 303-790-1 747	Demonstration	Completed September 1992
	Smith Environmental Technologies Corp. (formerly Soil Tech ATP Systems, Inc.) Englewood, CO (2 Demonstrations)	Anerobic Thermal Processor	Joseph Hutton 303-790-1 747	Demonstration	Completed May 1991 and June 1992
	CF Systems Corp. Arvada, CO (2 Demonstrations)	Solvent Extraction Batch Organics Extraction Unit	L. V. Benningfield 303-420-2890	Demonstration	Completed December 1988 Ongoing
	Walsh Environmental Scientists and Engineers Boulder, CO	Bioslurry Reactor (Technology developed by ECOVA Corp.)	William Mahaffey 303-670-2875	Demonstration	Completed September 1991
Connecticut	Dexsil Corp. 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 August 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 April-May 1990
Florida	High Voltage Environmental Applications, Inc./ Florida International University and University of Miami Miami, FL	High-Energy Electron Irradiation (Aqueous)	William Cooper 305-593-5330	Emerging Technology Demonstration	Completed 1993 Completed 1994

State	Developer	Technology	Technology Contact	Program	Status
Florida	High Voltage Environmental Applications, Inc. Miami, FL	High Energy Electronic Beam (Solids)	William Cooper 305-593-5330	Emerging Technology	Ongoing
	PCP, Inc. West Palm Beach, FL	Ion Mobility Spectrometry	Martin Cohen 407-683-0507	Monitoring and Measurement Technologies	Completed 1991
	Funderburk and Associates Apollo Beach, FL	Dechlorination and Immobilization	Ray Funderburk 800-723-8847	Demonstration	Completed October 1987
Georgia	American Combustion, Inc. Norcross, GA	PYRETRON® Thermal Destruction	Gregory Gitman 404-564-4180	Demonstration	Completed January 1988
	ETG, Inc. Norcross, GA	Long-Path Fourier Transform Infrared Spectrometer	Orman Simpson 404-242-0977	Monitoring and Measurement Technologies	Completed January 1992
	SBP Technologies, Inc. Stone Mountain, GA	Membrane Separation and Bioremediation	Clayton Page 504-755-7711	Demonstration	Completed October 1991
	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) 5 13-569-7507	Emerging Technology	Exited 1992
Idaho	J. R. Simplot Co. Pocatello, ID (2 Demonstrations)	Anaerobic Biological Process	Russell Kaare 208-235-5620 Tom Yergovich 208-238-2850	Emerging Technology Demonstration Dinoseb TNT	Completed 1993 Completed July 1993 Completed February 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 offgases offgases	Michael Swan 208-385-0900	Demonstration	Ongoing
Illinois	Allied Signal Corp. Des Plaines, IL	Submerged Fixed Film Reactor	Steve Lupton 847-391-3224	Demonstration	Ongoing
	Institute of Gas Technology Chicago, IL	Chemical and Biological Treatment	Robert Kelley 847-768-0722	Emerging Technology	Completed 1993
		Fluid Extraction-Biological Degradation Process	Albert Paterk 847-768-0720	Emerging Technology	Completed 1992

State	Developer	Technology	Technology Contact	Program	Status
Illinois	Institute of Gas	Fluidized-Bed Cyclonic Agglomerating Incinerator	Mike Mensinger 847-768-0602	Emerging Technology	Completed
		Supercritical Extraction/Liquid Phase Oxidation of Waste	Anil Goyal 847-768-0516 Mike Mensinger 847-768-0510	Emerging Technology	Ongoing
	OHM Remediation Services (formerly RUST Remedial Services, Inc.) Lombard, IL	X*TRAX™ Thermal Desorption	Chetan Trivedi 630-261-3958	Demonstration	Completed May 1992
	Recycling Sciences, Inc. Chicago, IL	Desorption and Vapor Extractron System	William Meenan 312-663-4242	Demonstration	Ongoing
	Wheelabrator Clean Air Systems (formerly Chemical Waste Management, Inc.) Schaumbura, IL	PO'WW'ER Technology	Myron Reicher 708-706-6900	Demonstration	Completed September 1992
Indiana	Bio-Rem, Inc. Butler, IN	Augmented In <i>situ</i> Subsurface Bioremediation Process	David Mann 219-868-5823	Demonstration	Completed December 1993
	Sevenson Environmental Services Munster, IN	MAECTITE™ Treatment Process	Karl Yost 219-836-0116	Demonstration	Ongoing
Kansas	Geoprobe Salina, KS	Soil, Water, Vapor Sampling Cone Penetrometer	Wes McCall 913-825-1842	Monitoring and Measuring Technologies	Completed 1995
	Trinity Environmental Technologies, Inc. Mound Valley, KS	Ultrasonically Assisted Detoxification of Hazardous Materials	Duane Koszalka 316-328-3222	Emerging Technology	Completed 1992
Louisiana	Advanced Remediation Mixing, Inc. (formerly Chemfix Technologies, Inc.) Kenner, LA	Solidification and Stabilization	David Donaldson 504-831-3600	Demonstration	Completed March 1989
	Electrokinetics, Inc. Baton Rouge, LA	Electrokinetic Remediation	Elif Acar 504-753-8004	Emerging Technology Demonstration	Completed 1993 Ongoing
		Electro-Klean™ Electrokinetic Soil Remediation		Emerging Technology	Ongoing

State	Developer	Technology	Technology Contact	Program	Status
Maine	Binax Corp., Antox Div. South Portland, ME	Immunoassay for PCB in Soil	Roger Piasio 207-772-3544	Monitoring and Measurement Technologies	Completed 1992
Maryland	Microsensor System, Inc. Havre de Grace, MD	Portable Gas Chromatograph	N. L. Jarvis 410-939-1089	Monitoring and Measurement Technologies	Completed 1995
	SCAPS U.S. Army Environmental Center APG, MD	Laser Fluorescence PAH, BTEX, Screening Cone Penetrometer	George Robitaille 401-671-1576	Monitoring and Measurement Technologies	Completed 1995
Massachusetts	ABB Environmental Services, Inc. Wakefield, MA	Two-Zone Plume Interception <i>In situ</i> Treatment Strategy	Willard Murray 617-245-6606	Emerging Technology	Completed
		Anaerobic/Aerobic Sequential Bioremediation of	Willard Murray 617-245-6606	Emerging Technology	Ongoing
	Bruker Instruments Billerica, MA	Bruker Mobile Environmental Monitor	John Wronka 506-667-9580	Monitoring and Measurement Technologies	Completed September
	Maxymillian Tech., Inc. (formerly known as Clean Berkshires) Lanesboro, MA	High Temperature Thermal Process	Jim Maxymillian 617-557-6077	Demonstration	Completed December 1993
	UV Technologies, Inc. (formerly Energy and Environmental Engineering, Inc.) East Cambridge, MA	Laser-induced Photochemical Oxidative Destruction	James Porter 617-666-5500	Emerging Technology	Completed 1993
	HNU Systems, Inc. Newtown, MA (3 Demonstrations)	Portable Gas Chromatograph	Clayton Wood 617-964-6690	Monitoring and Measurement Technologies	Completed January 1992
		Portable X-ray Fluorescence Spectrometer	John Moore 617-964-6690	Monitoring and Measurement Technologies	Completed 1995
		PCP Test Kit	Bob Labiberte 800-726-6690	Monitoring and Measurement Technologies	Completed 1993
	KSE, Inc. Amherst, MA	Air Integrated Reaction Photocatalytic Treatment of Air	J. R. Kittrell 413-549-5506	Emerging Technology	Ongoing
	Millipore Corp. Bedford, MA	EnviroGard™ PCB Immunoassay Test Kit	Alan Weiss 617-275-9200	Monitoring and Measurement Technologies	Completed 1992
		Immunoassay for PCP (Soil, Water)			Completed 1993
Niton Corp. Bedford, MA	Portable X-ray Fluorescence Spectrometer	Stephen Shefsky 617-275-9275	Monitoring and Measurement Technologies	Completed 1995	

State	Developer	Technology	Technology Contact	Program	Status
Massachusetts	Dhmicon Corp. Newton, MA	Immunoassay for PCP in Soil	Mary Hayes 2 15-860-5115	Monitoring and Measurement Technologies	Completed 1993
	PSI Technology Co. Andover, MA	Metals Immobilization and Decontamination of Aggregate Solids	Joseph Morency 508-689-0003	Emerging Technology	Completed 1993
Minnesota	BioTrol, Inc. Eden Prairie, MN	Methanotrophic Bioreactor System	Durell Dobbins 612-942-8032	Emerging Technology	Completed 1992
		Biological Aqueous Treatment System	Dennis Chilcote 612-942-8032	Demonstration	Completed July- September 1989
		Soil Washing System	Dennis Chilcote 612-942-8032	Demonstration	Completed September- October 1989
	Membrane Corp. Minneapolis, MN	Membrane Gas Transfer in Waste Remediation	Charles Gantzer 612-378-2160	Emerging Technology	Ongoing
Montana	Montana College of Mineral Science & Technology Butte, MT	Air-Sparged Hydrocyclone	Theodore Jordan 406-496-4112	Emerging Technology	Completed 1994
		Campbell Centrifugal Jig	Gordon Ziesing 406-496-1 473	Emerging Technology	Ongoing
Nebraska	University of Nebraska Lincoln, NE	Spray Irrigation	Roy Spalding	Demonstration	Completed 1996
Nevada	U.S. EPA Las Vegas, NV	Field Analytical Screening Program (FASP)	Lary Jack 702-798-2373	Monitoring and Measurement Technologies	Completed
New Jersey	Accutech Remedial Systems, Inc. Keyport, NJ	Pneumatic Fracturing Extraction and Catalytic Oxidation	John Liskowite 908-739-6444	Demonstration	Completed August 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. Corp. Somerville, NJ	Carver-Greenfield Process@ for Extraction of Oily Waste	Theodore Trowbridge 908-904-1 606	Demonstration	Completed August 1991
	M. L. ENERGIA, Inc. Princeton, NJ	Reductive Photo- Dechlorination Treatment	Moshe Lavid 609-799-7970	Emerging Technology	Completed 1995
		Reductive Photo-Thermal Oxidation Processes for for Chlorocarbons	Moshe Lavid 609-799-7970	Emerging Technology	Ongoing

State	Developer	Technology	Technology Contact	Program	Status
New Jersey	Hazardous Substance Management Research Center at New Jersey Institute of Technology Newark, NJ	Pneumatic Fracturing/ Bioremediation	John Schuring 201-596-5849	Emerging Technology	Completed 1994
	New Jersey Institute of Technology Newark, NJ	GHEA Associates Process	Itzhak Gottlieb 201-226-4642	Emerging Technology	Completed 1992
	New Jersey Institute of Technology Jersey City, NJ	Cold Top Vitrification	William Librizzi 201-596-5846	Demonstration	Ongoing
	Sentex Sensing Technology, Inc. Ridgefield, NJ	Portable Gas Chromatograph	Amos Linenberg 201-945-3694	Monitoring and Measurement Technologies	Completed January 1992
New Mexico	Billings and Associates, Inc. Albuquerque, NM	Subsurface Volatilization and Ventilation System	Gale Billings 505-345-1116	Demonstration	Completed May 1994
	Resource Management and Recovery (formerly Bio-Recovery Systems, Inc. Las Cruces, NM	AlgaSorb Biological Sorption	Mike Hosea 505-382-9228	Emerging Technology	Completed 1990
	Sandia National Laboratories Albuquerque, NM	Electrokinetic Extraction in Unsaturated Soils	Eric Lindgren 505-844-0543	Demonstration	Ongoing
New York	SBP Technologies, Inc. White Plains, NY	Bioventing, Air Sparging, Biological Treatment for Ground Water (Multideveloper project with State of New York)	Richard Desrosiers 914-694-2280	Demonstration	Completed 1995
	Solucorp Industries West Nyack, NY	Molecular Bonding System	Robert Kuhn 914-623-2333	Demonstration	Ongoing
	RECRA Environmental, Inc. (formerly Electra-Pure Systems, Inc.) Amherst, NY	Alternating Current Electrocoagulation Technology	Kenneth Kinecki 800-527-3272	Emerging Technology	Completed 1992
	Photovac International, Inc. Deer Park, NY	Portable Gas Chromatograph	Mark Collins 516-254-4199	Monitoring and Measurement Technologies	Completed January 1992
	State University of New York at Oswego Oswego, NY	Photocatalytic Treatment for Sediments	Ronald Scudato 315-341-3639	Emerging Technology	Completed 1995
	Xerox Corp. Webster, NY	Ground Water Extraction	Ron Hess 716-422-9211	Demonstration	Completed 1995

State	Developer	Technology	Technology Contact	Program	Status
North Carolina	Ensys, Inc. Research Triangle Park, NC	Immunoassay for PCP	Stephen Friedman 9 14-941-5509	Monitoring and Measurement	Completed September 1993
	Ensys, Inc. Morrisville, NC (2 Demonstrations)	Immunoassay for PCP	Aisling Scallen 919-941-5509	Monitoring and Measurement Technologies	Completed
					Completed
Ohio	Battelle Memorial Institute Columbus, OH	<i>In Situ</i> Electroacoustic Soil Decontamination	Satya Chauhan 614-424-4812	Emerging Technology	Completed
	Ferro Corp. Independence, OH	Waste Vitrification Through Electric Melting	S. K. Muralidhar 216-641-8580	Emerging Technology	Completed
	IT Corp. Cincinnati, OH	Chelation/Electro- deposition of Toxic Metals from Soils	Radha Krishnan 513-782-4700	Emerging Technology	Ongoing
	OHM Remediation Services Corp. Findlay, OH	Oxygen Microbubble In Situ Bioremediation	Douglas Jerger 419-424-4932	Emerging Technology	Ongoing
	University of Dayton Research Institute Dayton, OH	Photothermal Detoxification Unit (PDU)	John Graham 513-229-2846	Emerging Technology	Completed 1994
	U.S. EPA NRMRL and ETG Environmental Cincinnati, OH	Base-Catalyzed Dechlorination Process	George Huffman 513-569-7431 Yei-Shong Shieh 215-832-0700	Demonstration	Completed August 1993
	U.S. EPA NRMRL Cincinnati, OH	Bioventing	Paul McCauley 513-569-7444	Demonstration	Ongoing
		Volume Reduction Unit	Richard Griffiths 513-569-7832	Demonstration	Completed November 1992
	U.S. EPA Risk Reduction Engineering Laboratory and IT Corp. Cincinnati, OH	Debris Washing System	Michael Taylor or Majid Dosani 513-782-4700	Demonstration	Completed August 1990
	U.S. EPA NRMRL Cincinnati, OH (and Intech 180 Corp. N. Logan, UT)	Fungal Treatment Technology	John Glaser 513-569-7568 Richard Lamar 801-753-2111	Demonstration	Completed November 1992
U.S. EPA Risk Reduction Engineering Laboratory and FRX, Inc. Cincinnati, OH	Hydraulic Fracturing	William Slack 513-556-2526	Demonstration	Completed September 1992	

State	Developer	Technology	Technology Contact	Program	Status
Oklahoma	Geo-Microbial Technologies Ochelata, OK	New Technology for Metals Release and Removal from Wastes	Donald Hitzman 9 185352281	Emerging Technology	Ongoing
Oregon	Metorex, inc. Bend, OR	Field Portable X-ray Fluorescence (FPXRF)	Jim Pasmore 503-385-6748	Monitoring and Measuring Technologies	Completed 1995
Pennsylvania	Aluminum Company of America (formerly Alcoa Separations Technology, Inc.) Pittsburgh, PA	Bioscrubber	Paul Liu 4 12-826-3711	Emerging Technology	Completed 1993
	EG&G Environmental, Inc. Pittsburgh, PA	NoVOCs™ In Well Stripping	James Beninati 412-920-5401	Demonstration	Ongoing
	Center for Hazardous Materials Research Pittsburgh, PA	Acid Extraction Treatment System	Stephen Paff 412-826-5321	Emerging Technology	Completed 1992
		Lead Smelting			Completed 1993
		Organics Destruction and Metals Stabilization			Completed 1995
	Horsehead Resource Development Co., inc. Palmerton, PA	Flame Reactor	Regis Zagrocki 61 0-826-881 8	Demonstration 1)	Completed 1991
	Lewis Environmental Services, Inc. Pittsburgh, PA	Soil Leaching Process	Tom Lewis III 412-322-8100	Emerging Technology	Ongoing
	Ohmicron Corp. Newtown, PA	Immunoassay for PCP	Dave Hertzog 215-860-5115	Monitoring and Measurement Technologies	Completed 1993
	Calgon Carbon Oxidation Technologies (formerly Peroxidation Systems, Inc.) Pittsburgh, PA	perox-pur™ Chemical Oxidation	Bertrand Dussert 412-787-6681	Demonstration	Completed September 1992
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 1995	
Geo-Con, Inc. Monroeville, PA (2 Demonstrations)	<i>In situ</i> Solidification and Stabilization	Linda Ward Robert Hayden 412-856-7700	Demonstration	Completed April - May 1988	

State	Developer	Technology	Technology Contact	Program	Status
Pennsylvania	Roy F. Weston, Inc. West Chester, PA	Low Temperature Thermal Treatment System	Mike Cosmos 215-430-7423	Demonstration	Completed December 1992
		Steam Regeneration Adsorption System (Ambersorb™)	John Thoroughgood 610-701-3728	Emerging Technology	Completed 1995
	Vortec Corp. Collegeville, PA	Oxidation and Vitrification Process	James Hnat 215-489-2255	Emerging Technology Demonstration	Completed 1993 Ongoing
South Carolina	University of South Carolina Columbia, SC	<i>In Situ</i> 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 423-230-2217	Demonstration	Completed May 1992
	IT Corporation Knoxville, TN	Batch Steam Distillation and Metal Extraction	Stuart Shealy 423-690-3211	Emerging Technology	Completed 1992
		Eimco Biolift™ Slurry Reactor as developed by Tekno Associates	Kandi Brown 423-690-3211	Emerging Technology	Completed 1995
		Mixed Waste Treatment Process	Ed Alperin 423-690-3211	Emerging Technology	Completed 1995
		Photolytic and Biological Soil Detoxification	Duane Graves 615-690-3211	Emerging Technology	Completed 1993
	Brown and Root Environmental/ Illinois Institute of Technology Oak Ridge, TN	Radio Frequency Heating	Clifton Blanchard 423-483-9900 Harsh Dev 312-567-4257	Demonstration	Completed August 1993
	Brown and Root/KAI Oak Ridge, TN	Radio Frequency Heating	Clifton Blanchard 615-483-9900 Raymond Kasevich 603-431-2266	Demonstration	Completed 1994
	WASTECH, Inc. Oak Ridge, TN	Solidification and Stabilization	Terrence Lyons USEPA 513-569-7589	Demonstration	Completed August 1991
Thermo NUtech (formerly TMA Eberline) Oak Ridge, TN	Segmented Gate System for Radioactive Materials	Jeff Brown 423-481-0683	Emerging Technology	Ongoing	
Texas	North American Technologies, Inc./ APROTEK Bellaire, TX	Oleofilter	Alan Bell 713-662-2699	Demonstration	Completed June 1994

State	Developer	Technology	Technology Contact	Program	Status
Texas	EET, Inc. Bellaire, TX	PCB/Metals Extraction from Porous Services	Mike Bonem 713-662-0727	Demonstration	Ongoing
	ENSR Consulting Engineering and Larson Engineering Houston, TX	Bioventing, Air Sparging, Biological Treatment for Ground Water (Multi-developer project with state of New York)	David Ramsden (ENSR) 713-520-6802 N. Satthyakumar 716-272-7310	Demonstration	Completed 1995
	Filter Flow Technology, Inc. League City, TX	Heavy Metals and Radionuclide Sorption Method	Todd Johnson 281-332-3438	Demonstration September	Completed 1993
	Fugro Geosciences, Inc. Houston, TX	Laser Fluorescence PAH, BTEX Screening Cone Penetrometer	1-800-753-8476	Monitoring and Measuring Technologies	Completed 1996
	Hrubetz Environmental Services, Inc. Dallas, TX	HRUBOUTB Process	Michael Hrubetz or Barbara Hrubetz 214-363-7833	Demonstration	Completed February 1993
	Solidtech, Inc. Houston, TX	Solidification and Stabilization	Jack Hubbard USEPA 513-569-7507	Demonstration	Completed December 1988
	TN Spectrace Round Rock, TX	Portable X-ray Fluorescence Spectrometer	Raj Natrajan 512-388-9200	Monitoring and Measuring Technologies	Completed 1995
	University of Houston Houston, TX	Concentrated Salt Extraction of Lead	Dennis Clifford 713-743-4266	Emerging Technology	Ongoing
	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	Phytoremediation of Soils	An Ferro 801-750-0985	Emerging Technology	Ongoing
				Demo	Ongoing
Virginia	BioGenesis Enterprises, Inc. (formerly BioVersal USA) Fairfax Station, VA	BioGenesis™ Soil Washing Process	Charles Wilde 703-913-9700	Demonstration	Completed November 1992
	Dynaphore, Inc. Richmond, VA	Removal of Dissolved Heavy Metals via FORAGER sponge	Norman Rainer 804-288-7109	Demonstration	Completed April 1994
	Babcock and Wilcox co. Lynchburg, VA	Cyclone Furnace	Evan Reynolds 804-522-6000	Emerging Technology Demonstration	Completed 1992 Completed November 1991

State	Developer	Technology	Technology Contact	Program	Status
Washington	RKK Ltd. Arlington, WA	CRYOCELL Freeze Barrier	Ronald Krieg 360-653-4844	Demonstration	Ongoing
	Geosafe Corp. Richland, WA	<i>InSitu</i> Vitrification	James Hansen 509-375-0710	Demonstration	Completed 1994
	Remediation Technologies, inc. (ReTec) Seattle, WA	Methanotrophic Biofilm Reactor	Hans Stroo 206-624-9349	Emerging Technology	Completed 1995
		Liquid and Solids Biological Treatment	Merv Cooper 206-624-9349	Demonstration	Completed 1996
	Ionics/Resources Conservation Co. Bellevue, WA	BEST Solvent Extraction	William Heins 206-828-2400	Demonstration	Completed July 1992
	Scitec Corp. Richland, WA	Field Portable X-ray Fluorescence	Steve Santy 1-800-466-5323	Monitoring and Measurement Technologies	Completed 1995
University of Washington Seattle, WA	Adsorptive Filtration	Mark Benjamin 206-543-7645	Emerging Technology	Completed 1992	
Wisconsin	Svedala Industries (formerly Allis Mineral Systems, Inc.) Oak Creek, WI	Pyrokiln Thermal Encapsulation Process	Jim Kidd 414-798-6341 Glenn Heian 414-762-1190	Emerging Technology	Completed 1993
	University of Wisconsin Madison, WI	Photoelectrocatalytic Treatment of Metals and Organics in Water	Marc Anderson 602-262-2674	Emerging Technology	Ongoing
Wyoming	Western Research Institute Laramie, WY	Contained Recovery of Oily Wastes (CROW™)	Lyle Johnson 307-721-2281	Emerging Technology Demonstration	Completed 1991 Ongoing

International Participants

State	Developer	Technology	Technology Contact	Program	Status
Canada	Atomic Energy of of Canada, Limited Chalk River, Ontario	Ultrasonic-Acid Leachate Treatment for Mixed Wastes	Shiv Vijayan 613-584-3311 Ext. 3220	Emerging Technology	Completed
		Chemical Treatment and Ultrafiltration	Leo Buckley 613-584-3311	Emerging Technology	Completed 1993
	ConeTech Investigations Vancouver, British Columbia	Resistivity, pH, Seismic, Temperature, Cone Penetrometer	Ward Phillips 604-327-4311	Monitoring and Measuring Technologies	Completed 1992
	ELI Eco Logic International, Inc. Rockwood, Ontario (2 Demonstrations)	Thermal Gas Phase Reduction and Thermal Desorption Process	Jim Nash 519-856-959 1	Demonstration	Completed December 1992
	EnviroMetal Technologies, Inc. (2 Demonstrations) Guelph, Ontario	Metal Enhanced Abiotic Degradation	Larry Kwicinski 51 g-824-0432	Demonstration	Completed 1995
				Ex situ	Ongoing
	Grace Dearborn, Inc. Mississauga, Ontario	Daramend™ Process	Alan Seech 905-272-7480	Demonstration	Completed 1994
	Matrix Photocatalytic Ltd. (formerly Nutech Environmental) London, Ontario	TiO ₂ Photocatalytic Treatment of Aqueous Waste Streams	Bob Henderson 51 g-660-8669	Emerging Technology	Completed 1993
		TiO ₂ Photocatalytic Air Treatment	Bob Henderson 51 g-660-8669	Demonstration	Completed 1995
	Toronto Harbor Commission Toronto, Ontario	Soil Recycling	Teri Richardson USEPA 5135647949	Emerging Technology	Completed 1994
	Wastewater Technology Centre Burlington, Ontario	Cross-Flow Pervaporation System	Chris Lipski 416-336-4689	Demonstration	Ongoing
	Zenon Environmental Systems, Inc. Burlington, Ontario	Cross-Flow Pervaporation System	Phil Canning 905-639-6320	Emerging Technology	Completed 1992
				Demonstration	Completed 1995
	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 44-1 235-463062	Emerging Technology	Completed 1994

State	Developer	Technology	Technology Contact	Program	Status
England/ United Kingdom 1990	Graseby Ionics, Ltd Waterford Herts, England	Ion Mobility Spectrometry	John Brokenshire 01 1-44-923-81 6166 Martin Cohen 407-683-0507	Measuring and Monitoring Technologies	Completed Summer and Fall 1990
Italy	Gruppo Italimpresse [developed by Shirco Infrared Systems, Inc.] (formerly ECOVA) Rome, Italy (2 Demonstrations)	Infrared Thermal Destruction	Laurel Staley USEPA 513-569-7863	Demonstration	Completed, August 1987 and November 1987
Puerto Rico	Terra Vac, Inc. San Juan, PR	<i>In Situ</i> Vacuum Extractron	James Malot 787-725-8750	Demonstration	Completed December 1987-April 1988

Appendix B Publications



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 1995 (EPA/540/R-97/500)
- SITE Profiles, Ninth Edition (EPA/540/R-97/502)
- Survey of Materials Handling Technologies Used at Hazardous Waste Sites (EPA/540/2-91/010) PB91-921283²
- Interim Status Report U.S. and German Bilateral Agreement on Remediation of Hazardous Waste Sites (EPA/540/R-94/500) PB94-1648 1 1²
- SITE Innovation on the Move (EPA/540/F-97/500)

Demonstration Project Results

Accutech Remedial Systems, Inc.--Pneumatic Fracturing Extraction and Hot Gas Injec., Phase 1

- Technology Evaluation (EPA/540/R-93/509) PB93-216596²
- Technology Demo. Summary (EPA/540/SR-931509)¹
- Demonstration Bulletin (EPA/540/MR-93/509)³
- Applications Analysis (EPA/540/AR-93/509) PB94-117439²

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) PB92-218379²
- Demonstration Bulletin (EPA/540/M5-91/002)³

Babcock & Wilcox Co-Cyclone Furnace Vitrification

- Technology Evaluation Vol. 1 (EPA/540/R-92/017A) PB92-222215²
- Technology Evaluation Vol. 11 (EPA/540/R-92/017B) PB92-222223²
- Applications Analysis (EPA/540/AR-92/0 17) PB93-122315²
- 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-93/5 10)
- Innovative Technology Evaluation Report (EPA/540/R-93/5 10)
- 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

- Technology Evaluation (EPA/540/5-91/001) PB92-110048²
- Applications Analysis (EPA/540/A5-91/001) PB91-227983
- Technology Demo. Summary (EPA/540/S5-91/001)
- Demonstration Bulletin (EPA/540/M5-91/001)³

- Soil Washing System

- Technology Evaluation Vol. 1 (EPA/540/5-91/003a) PB92-115310²
- Technology Evaluation Vol. 11 Part A (EPA/540/5-91/003b) PB92-115328²
- Technology Evaluation Vol. 11 Part B (EPA/540/5-91/003c) PB92-115336²
- Applications Analysis (EPA/540/A5-91/003) PB92-115245²
- Technology Demo. Summary (EPA/540/S5-91/003) PB92-224393²
- Demonstration Bulletin (EPA/540/M5-91/003)³

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

**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)
PB95-199741²

**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 - Liquitied Gas Solvent
Extraction**

- Technology Evaluation Vol. 1 (EPA/540/5-90/002)
- Technology Evaluation Vol. 11 (EPA/540/5-
90/002a) PB90-186503²
- Applications Analysis (EPA/540/A5-90/002)
- Technology Demo. Summary (EPA/540/S5-90/002)

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

- Technology Evaluation Vol. 1 (EPA/540/5-
89/01 1a) PB91-127696²
- Technology Evaluation Vol. 11 (EPA/540/5-89/011b)
PB90-274127²
- Applications Analysis (EPA/540/A5-89/011)
- Technology Demo. Summary (EPA/540/S5-89/011)
PB91-921373²
- 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)³
PB92-217462²
- 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)³
PB92-153410²

- Applications Analysis (EPA/540/A5-90/007)
PB92-119023²
- Technology Demo. Summary (EPA/540/S5-90/007)
PB92-224351²
- 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)
PB95-213229²
- Innovative Tech. Eval. Rept. (EPA/540/R-94/522)
PB95-268041²

**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)
PB93-205532²
- Applications Analysis (EPA/540/A5-91/009)
PB94-124039
- 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)
PB95-100251²
- Technology Evaluation Appendices
(EPA/540/R-93/522b) PB95-100251²
- 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)

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

- Demonstration Bulletin (EPA/540/MR-95/510)³

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)
PB95-122792²
- Innovative Tech. Eval. Rept. (EPA/540/R-94/501)

Geosafe Corporation - In-Situ Vitrification

- Demonstration Bulletin (EPA/540/MR-94/520)³

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5285 Port Royal Road
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Telephone 703-487-4650 or 1-800-553-6847
³ Out of stock

- Capsule (EPA/540/R-94/520a)
PB95-177101²
- 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)
PB95-138319²

Grace Dearborn Bioremediation Technology

- Capsule (EPA/540/R-95/536a)

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

- Technology Evaluation - Peake Oil Vol. 1 (EPA/540/5-88/002a) PB89-125991²
- Technology Evaluation Report - Peake Oil Vol. 11 (EPA/540/5-88/002b) PB89-116024²
- Technology Evaluation - Rose Township (EPA/540/5-89/007a) PB89-167902²
- Technology Evaluation- Rose Township Vol. 11 (EPA/540/5-89/007b) PB89-167910²
- Applications Analysis (EPA/540/A5-89/010) PB89-233423²
- 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) PB89-158810²
- Technology Evaluation Vol. 11 (EPA/540/5-89/001b) PB89-158828³
- Applications Analysis (EPA/540/A5-89/001) PB89-206031²
- Technology Demo Summary (EPA/540/S5-89/001)³
- Demonstration Bulletin (EPA/540/M5-89/001)³

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
- 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

- Technology Evaluation Vol. 1 (EPA/540/5-89/004a) PB90-194161²
- Technology Evaluation Appendices (EPA/540/R-93/522b) PB95-100251²
- Technology Evaluation Vol. 11 (EPA/540/5-89/004b) PB89-194179²
- Technology Evaluation Vol. 111 (EPA/540/5-89/004c) PB90-269069²
- Technology Evaluation Vol. IV (EPA/540/5-89/004d) PB90-269077²
- Applications Analysis (EPA/540/A5-89/004) PB90-269085²
- Technology Demo. Summary (EPA/540/S5-89/004)³
Technology Demo. Summary, Update Report (EPA/540/S5-89/004a)³
- Demonstration Bulletin (EPA/540/M5-89/004)³

KAI Technologies Inc./Brown and Root Environmental Radio Frequency Heating

- Demonstration Bulletin (EPA/540/MR-94/528)
- Capsule (EPA/540/R-94/528a)
- Innovative Tech. Eval. Report (EPA/540/R-94/528)

Magnum Water Technology - CAV-OX Ultraviolet Oxidation Process

- Demonstration Bulletin (EPA/540/MR-93/520)³
- Applications Analysis (EPA/540/AR-93/520) PB94-189438²
- Technology Evaluation Rep. (EPA/540/R-93/520) PB95-166161²
- Technology Demo Summary (EPA/540/SR-93/520)³

Maxymillian Technologies (formerly Clean Berkshires, Inc.) - Thermal Desorption System

- Demonstration Bulletin (EPA/540/MR-94/507)
- Capsule (EPA/540/R-94/507a) PB95-122800²

New York State Multi-Vendor Bioremediation: - ENSR Consulting & Engineering/Larson Engineers - Ex-Situ Biovault

- Demonstration Bulletin (EPA/540/MR-95/524)

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.

*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

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- R.E. Wright Environmental Inc. - In-Situ Bioremediation System

- Demonstration Bulletin (EPA/540/MR-95/525)

North American Technologies Group, Inc. - SFC Oleoiltration System

- Demonstration Bulletin (EPA/540/MR-94/525)
- Capsule (EPA/540/R-94/525a) PB95-167227²
- Innovative Tech. Eval. Rept. (EPA/540/R-94/525)

Ogden Environmental Services, Inc. (now General Atomics) - Ogden Circulating Bed Combustor

- Demonstration Bulletin (EPA/540/MR-92/001)³
- Technology Evaluation Rep. (EPA/540/R-92/001) PB92-227289²

Peroxidation Systems, Inc. (now Calgon Carbon Oxidation Technologies) - Perox-Pure™ Chemical Oxidation

- Demonstration Bulletin (EPA/540/MR-93/501)³
- Applications Analysis (EPA/540/AR-93/501) PB94-130325²
- Technology Evaluation Rep. (EPA/540/R-93/501) PB93-213528²
- Technology Demo Summary (EPA/540/SR-93/501)³

Resources Conservation Company - The Basic Extractive Sludge Treatment (B.E.S.T.) - Solvent Extraction

- Demonstration Bulletin (EPA/540/MR-92/079)³
- Applications Analysis (EPA/540/AR-92/079)
- Technology Evaluation -Vol. 1 (EPA/540/R-921079a) PB93-227122
- Technology Evaluation Vol. 11, Part 1 (EPA/540/R-92/079b) PB93-227130²
- Technology Evaluation Vol. 11, Part 2 (EPA/540/R-92/079c) PB93-227148²
- Technology Evaluation Vol. 11, Part 3 (EPA/540/R-92/079d) PB93-227155²
- Technology Demo Summary (EPA/540/SR-92/079)

Retech, Inc. - Plasma Centrifugal Furnace (Plasma Arc Vitrification)

- Demonstration Bulletin (EPA/540/M5-91/007)
- Technology Evaluation -Vol. 1 (EPA/540/5-91/007a) PB92-216035²
- Technology Evaluation Vol. 11 (EPA/540/5-91/007b) PB92-216043²
- Applications Analysis (EPA/540/A5-91/007) PB92-218791²
- Technology Demo Summary (EPA/540/S5-91/007)

Risk Reduction Engineering Laboratory - and IT Corporation - Debris Washing System

- Technology Evaluation -Vol. 1 (EPA/540/5-91/006a) PB91-231456²
- Technology Evaluation Vol. 11 (EPA/540/5-91/006b) PB91-231464²

- and University of Cincinnati-Hydraulic Fracturing of Contaminated Soil

- Technology Demo Summary (EPA/540/S5-91/006)³
- Demonstration Bulletin (EPA/540/MR-93/505)³
- Technology Evaluation and Applications Analysis Combined (EPA/540/R-93/505) PB94-100161²
- Technology Demo Summary (EPA/540/SR-93/505)³

-and USDA-Forest Products Technology - Fungal Treatment Technology

- Demonstration Bulletin (EPA/540/MR-93/514)³

-Mobile Volume Reduction Unit at the Sand Creek Superfund Site

- Treatability Study Bulletin (EPA/540/MR-93/512)³

-Mobile Volume Reduction Unit at the Escambia Superfund Site

- Treatability Study Bulletin (EPA/540/MR-93/511)³

-Volume Reduction Unit

- Demonstration Bulletin (EPA/540/MR-93/508)
- Applications Analysis (EPA/540/AR-93/508)
- Technology Evaluation (EPA/540/R-93/508)³ PB94-136264²
- Technology Demo Summary (EPA/540/SR-93/508)

Roy F. Weston, Inc.

-and IEG Technologies-Unterdruck-Verdampfer-Brunner Technology (UVB) Vacuum Vaporizing Well

- Demonstration Bulletin (EPA/540/MR-95/500)
- Capsule (EPA/540/R-95/500a)

- Low Temperature Thermal Treatment (LT3) System

- Demonstration Bulletin (EPA/540/MR-92/019)³
- Applications Analysis (EPA/540/AR-92/019)

SBP Technologies, Inc. - Membrane Filtration and Bioremediation

- Demonstration Bulletin (EPA/540/MR-92/014)³
- Applications Analysis (EPA/540/AR-92/014)

Silicate Technology Corporation (Now STC Omega) - Solidification/Stabilization of Organic/Inorganic Contaminants

- Demonstration Bulletin (EPA/540/MR-92/010)³
- Applications Analysis (EPA/540/AR-92/010) PB93-172948²

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- Technology Evaluation (EPA/540/R-92/010)³
PB95-255709²
- Technology Demo Summary (EPA/540/SR-92/010)³

Simplot, J.R. - Ex Situ Anaerobic Bioremediation Technology: TNT

- Demonstration Bulletin (EPA/540/MR-95/529)
- Capsule (EPA/540/R-95/529a)
- Innovative Tech. Eval. Report (EPA/540/R-95/529)

Simplot, J.R. - Ex-Situ Anaerobic Bioremediation System (The SABRE Process)

- Demonstration Bulletin (EPA/540/MR-94/508)
- Capsule (EPA/540/R-94/508a)
- Innovative Tech. Eval. Report (EPA/540/R-94/508)

Soiltech ATP Systems, Inc.

-Aostra-SoilTech Anaerobic Thermal Process

- Demonstration Bulletin (EPA/540/MR-92/008)

-SoilTech Anaerobic Thermal Processor

- Demonstration Bulletin (EPA/540/MR-92/078)³

Soliditech, Inc. - Solidification and Stabilization

- Technology Evaluation -Vol. I (EPA/540/5-89/005a) PB90-191750²
- Technology Evaluation Vol. II (EPA/540/5-89/005b) PB90-191768²
- Applications Analysis (EPA/540/A5-89/005) PB91-129817²
- Technology Demo Summary (EPA/540/S5-89/005)³
- Demonstration Bulletin (EPA/540/M5-89/005)³

Sonotech, Inc. - Cello Pulse Combustion Burner System

- Demonstration Bulletin (EPA/540/MR-95/502)³
- Capsule (EPA/540/R-95/502a)

TerraKleen Response Group, Inc. - Solvent Extraction Treatment System

- Demonstration Bulletin (EPA/540/MR-94/521)³
- Capsule (EPA/540/R-94/521a) PB95-213617²

Terra Vac, Inc. - In Situ Vacuum Extraction

- Demonstration Bulletin (EPA/540/M5-89/003)³
- Technology Evaluation -Vol. I (EPA/540/5-89/003a) PB89-192025²
- Technology Evaluation Vol. II (EPA/540/5-89/003b) PB89-192033²
- Applications Analysis (EPA/540/A5-89/003)
- Technology Demo Summary (EPA/540/S5-89/003)³

Texaco, Inc. - Entrained-Bed Gasification Process

- Demonstration Bulletin (EPA/540/MR-94/514)
- Capsule (EPA/540/R-94/514a)

- Innovative Tech. Eval. Report (EPA/540/R-94/514)

Thorneco, Inc. - Enzyme - Activated Cellulose Technology

- Treatability Study Bulletin (EPA/540/MR-92/018)³

Toronto Harbour Commission - Soil Recycling Treatment Train

- Demonstration Bulletin (EPA/540/MR-92/015)
- Applications Analysis (EPA/540/AR-93/517)
- Technology Evaluation (EPA/540/R-93/517)³
PB93-216067²
- Technology Demo Summary (EPA/540/SR-93/517)

Toxic Treatments USA, Inc. (Now NOVATERRA, Inc.) - In-Situ Steam/Hot Air Stripping

- Demonstration Bulletin (EPA/540/M5-90/003)
- Applications Analysis (EPA/540/A5-90/008)

Ultrox, a Division of Zimpro Environmental, Inc. - UV Ozone Treatment for Liquids

- Demonstration Bulletin (EPA/540/M5-89/012)³
- Applications Analysis (EPA/540/A5-89/012) PB91-129759²
- Technology Evaluation (EPA/540/5-89/012) PB90-198177²
- Technology Demo Summary (EPA/540/S5-89/012)³

U.S. EPA - McColl Superfund Site - Demonstration of a Trial Excavation

- Technology Evaluation (EPA/540/R-92/015) PB92-226448²
- Applications Analysis (EPA/540/AR-92/015) PB93-100121²
- Technology Demo Summary (EPA/540/SR-92/015)

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. I (EPA/540/R-93/506a) PB94-160637²
- Technology Evaluation Vol. II (EPA/540/R-93/506b) PB94-160660²
- Technology Demo Summary (EPA/540/SR-93/506)

Zenon Environmental, Inc. - Zenon Cross-Flow Pervaporation Technology

- Demonstration Bulletin (EPA/540/MR-95/511)
- Capsule (EPA/540/R-95/511a)

Zenon Environmental Systems - Zenogem Wastewater Treatment Process

- Demonstration Bulletin (EPA/540/MR-95/503)³
- Capsule (EPA/540/R-95/503a)³

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Appendix C
Electronic Technical Information Resources

Electronic Technical Information Resources

The following are EPA on-line bulletin boards or databases featuring information relating to innovative technologies and other pertinent topics.

ATTIC: *The Alternative Treatment Technology Information Center (ATTIC) is a comprehensive automated information retrieval system that integrates existing hazardous waste data sources, including the SITE Program, into a searchable resource. This system provides access to a wide variety of technical information on alternative treatment technologies. The on-line access number for ATTIC is 513-569-7610. For technical support call 513-569-7272. ATTIC is also accessible via Telnet at cinbbs.cin.epa.gov and on the World Wide Web at www.epa.gov/ORD/ATTIC/attic.html.*

BFSS Database: *The Bioremediation in the Field Search System (BFSS) is a PC-based software application developed by the U.S. EPA's Bioremediation Field Initiative. BFSS provides access to a database of information on sites where bioremediation is being tested, implemented, or has already been completed. The database currently contains information on over 500 bioremediation sites. For each site, the database contains information on the site location, media and contaminants being treated, and the operation, status, and costs of the treatment technology being used. BFSS is available on ATTIC, CLU-IN, and the ORD Bulletin Board System. The application is also available on diskette (accompanied by a user manual) from EPA/NRMRL Technology Transfer and Support Division. To order, call 513-549-7562.*

CLU-IN: *The Clean-Up Information Bulletin Board (CLU-IN) allows hazardous waste professionals to communicate and exchange information. CLU-IN also contains a variety of information about site remediation that is accessible in computer files or databases. CLU-IN is accessible via the World Wide Web at [http://](http://www.clu-in.com)*

www.clu-in.com. The on-line access number for CLU-IN is 301-589-8366. The system operator can be reached at 301-589-8368.

NRMRL Treatability Database: *The NRMRL Treatability Database provides a thorough review of the effectiveness of proven hazardous waste treatment technologies in the removal and/or destruction of chemicals in various media. The database contains nearly 1,200 chemical compounds and over 9,200 sets of treatability data. The database is available on PC-compatible diskettes. To order, call Jerry Waterman at 513-569-7834; fax to 513-569-7585; or e-mail waterman.jerry@epamail.epa.gov.*

ORD Electronic Bulletin Board System: *The ORD BBS features up-to-date technical information accessible to personal computer users. This BBS features a bibliographic database containing abstracts of ORD publications and peer-reviewed journal articles since 1977; downloadable information sources including databases, expert systems files, and bulletin files and limited on-line ordering of available ORD publications. The on-line access number for the ORD BBS is 513-569-7610. For technical support call 513-569-7272. The ORDBBS is accessible via Telnet at cinbbs.cin.epa.gov and the World Wide Web at www.epa.gov/ORD/dbases/ordbbs.html.*

Vendor FACTS Database: *The Vendor Field Analytical and Characterization Technologies System (Vendor FACTS) is a database of innovative site characterization technologies and vendors. Specifically, the database contains information provided by vendors, suppliers, and manufacturers on the applicability, performance, and current use of their products. Each technology is screened by EPA for eligibility, applicability, and completeness.*

Version 2.0 contains analytical, geophysical, chemical extraction, and sampling technologies and includes approximately 128 technologies provided by 92 vendors. Users are able to do customized searches on such criteria as technology type, media, contaminants, intended use (e.g., field screening and risk assessment), performance, and cost data. Version 2.0 is downloadable from <http://www.prcemi.com/vfacts> and <http://www.clu-in.com>. The database is expected to be available on PC-compatible diskettes and as a downloadable file on EPA's CLU-IN Bulletin Board System. For more information, contact the Vendor FACTS help line at 800-245-4505 or 703-287-8972.

VISITT: The Vendor Information System for Innovative Treatment Technologies (VISITT Version 5.0) is a user-friendly disk-based system containing information on 346 innovative treatment technologies offered by 210 vendors. The database contains detailed information on availability, per-

formance, and cost supplied to EPA by technology companies and offers customized search capabilities. The VISITT 5.0 database, user manual, and Vendor Information Form (VIF) can be downloaded (free) on the World Wide Web from the VISITT Home Page (<http://www.prcemi.com/visitt>); EPA'S Clean-Up Information (CLU-IN) Web Site (<http://www.clu-in.com>); the Alternative Treatment Technologies Information Center (ATTIC) - 703-908-2138; EPA Home Page (www.epa.gov); and America Online (AOL). For instructions on downloading from these resources, contact the VISITT HELPLINE at 800-245-4505 or 703-287-8927.

VISITT 5.0 is also available on diskette (accompanied by a user manual). System requirements include a 386 class (or higher) personal computer; DOS Version 3.3 or higher; 640K RAM, and 10 megabytes of free hard disk space. To order, contact: USEPA/NCEPI, I? 0. Box 42419, Cincinnati, OH 45242-0419 or fax 513-489-8695.

ORD SITE Web Site Address: <http://www.epa.gov/ORD/SITE>. This web site provides general information about the SITE Program to the waste remediation community. It describes program highlights, project status, publications, a current solicitation and links to other related web sites, both within and outside EPA. New documents are continually loaded. This information is for federal and state personnel, consulting engineers, technology developers and vendors, remediation contractors, researchers, community groups, and private citizens. Web site contact: William Frietsch, e-mail address: frietsch.william@epamail.epa.gov.

Technical Document Resources

Printed copies while in stock are available free of charge and can be ordered from EPA's Center for Environmental Research Information (CERI) by phone: 513-569-7562 and fax: 513-569-7566. When documents are no longer available from EPA, they can be ordered for a fee from the National Technical Information Service: 703-487-4650. Refer to document number or title when placing orders.

Worldwide document distribution is provided via ORD's Home Page on Internet and ORD's Electronic Bulletin Board System (ORDBBS). Electronic versions are downloadable at <http://www.epa.gov/ORD/SITE> (accessible February 1997) and Telnet at cinbbs.cin.epa.gov and via modem on the BBS, 513-569-7610 and 7700.