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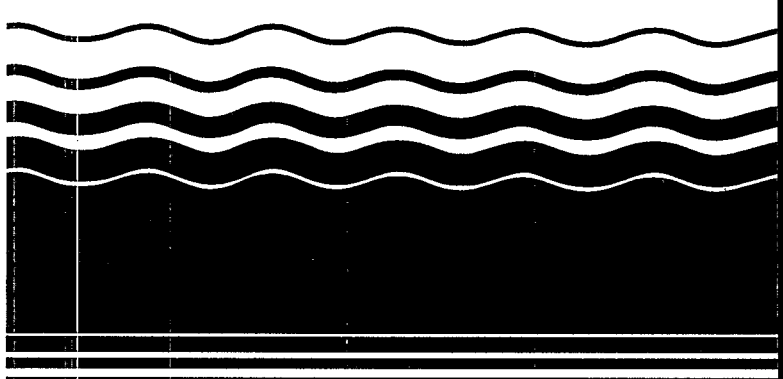
EPA

The Superfund Innovative Technology Evaluation Program

Annual Report to Congress FY 1994

SITE

SUPERFUND INNOVATIVE TECHNOLOGY EVALUATION



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THE SUPERFUND INNOVATIVE TECHNOLOGY EVALUATION PROGRAM

ANNUAL REPORT TO CONGRESS
FY 1994

Office of Research and Development
U.S. Environmental Protection Agency
Washington, DC 20460

NOTICE

This document has been reviewed in accordance with the U.S. Environmental Protection Agency policy and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendations for use.

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

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

E. Timothy Oppelt, Director
National Risk Management Research Laboratory

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EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency's (EPA) Superfund Innovative Technology Evaluation (SITE) Program evaluates innovative technologies for the remediation of contaminated Superfund and Resource Conservation and Recovery Act (RCRA) corrective actions sites.

Historically the use of innovative treatment technologies at contaminated sites has been impeded due to the lack of reliable cost and performance data. The SITE Program was created to overcome these impediments and respond to the increased demand for validated hazardous waste treatment technologies. The Superfund Amendments and Reauthorization Act of 1986 (SARA) directs EPA "to carry out a program of research, evaluation, testing, development, and demonstration of alternative or innovative treatment technologies . . . which may be utilized in response actions to achieve more permanent protection of human health and welfare and the environment" [SARA Section 209(b), CERCLA Section 311 (b)1]. Therefore, the Program's primary mission, is fully compatible with the legislative mandate.

From its inception in 1986 through fiscal year 1994, the SITE Program has evaluated 72 technologies by field demonstration, 13 of which were completed during the 1994 fiscal year. The SITE Program is now considered to be the pioneer program and model for demonstrating and evaluating full-scale, viable innovative treatment technologies at hazardous waste sites. It is the first program to provide cost sharing opportunities for the private sector. The program is currently participating cooperatively with 86 technology developers.

The result of the continuing effort by the SITE Program to compile and communicate data to the user community has been an increase in the number of innovative technologies being used to clean up waste sites. The program is very effective in implementing the congressional mandate. A survey of four EPA regions indicates savings of 62% using innovative instead of conventional clean up technologies, or $21 million per site.

To ensure the timely introduction of new technologies into the marketplace, the program maintains flexibility and has fortified its effort to leverage resources. This effort is being implemented through an increased focus on joint participation with other federal agencies, the private sector, EPA Regional Offices, and technology developers. One example of that leverage is the $4,253,400 that private Technology developers committed to SITE Demonstrations and projects in FY94

This report highlights the Program's successes, discusses the Program's progress and accomplishments over the past fiscal year, catalogues current projects being undertaken and cumulative projects, and provides an indication of future directions.

SITE PROGRAM OVERVIEW

INTRODUCTION

The U.S. Environmental Protection Agency (EPA) Superfund Innovative Technology Evaluation (SITE) Program encourages the development of innovative technologies for faster, more effective, and less costly treatment of hazardous waste. Through the SITE Program, EPA evaluates technologies in conjunction with technology developers to determine each innovative technology's effectiveness in meeting performance and cost objectives.

The SITE Program consists of the following four components: 1) The Emerging Technology Program (ETP), 2) the Demonstration Program (DP), 3) the Monitoring and Measurement Technologies Program (MMTP), and 4) Technology Transfer.

The SITE Program fosters technology development and demonstration which in turn stimulates and supports economic growth. Since the onset of the program the number of innovative technology projects completed in the program and technologies selected for remedial action by the hazardous waste remediation community has increased substantiality. The program can claim a high degree of experience and knowledge, as well as producing credible and reliable information from its nine years of existence. The program provides:

1) Technical assistance to vendors
2) High quality performance data to users
3) Economic analysis of technologies
4) Financial assistance for emerging technology developers
5) An opportunity for the technology to use actual hazardous material.

The SITE Program supports all stages of technology development and demonstrates field-ready technologies to document performance. This documentation assists the user community in making selections for remediation and assists the developer in commercialization.

The development sequence that the SITE Program supports are shown in Figure 1. The

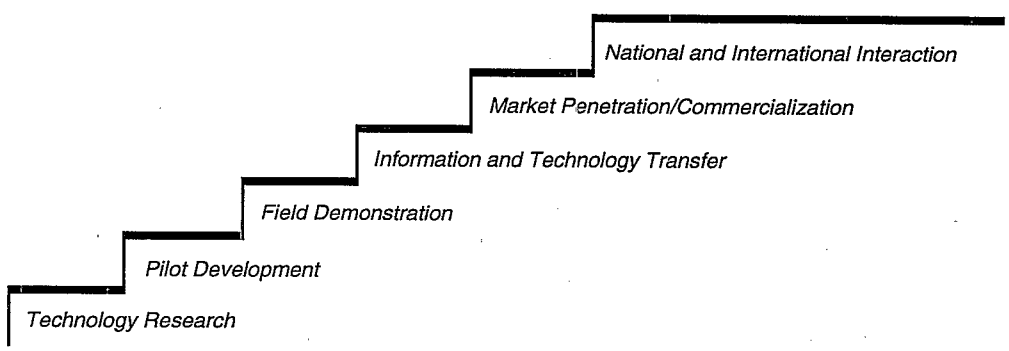

Figure 1. *Developmental steps the SITE Program supports.*

SITE Program is the only program which carries its technologies through all development steps with nine years of experience.

SITE Success

Success in any program depends on the perspective of those looking at the program. SITE successes can be illustrated through three major viewpoints, (1) SITE Program, (2) SITE Developer, and (3) User Community. These three areas will be discussed and examples given to illustrate the difference between them and the similarities which tie them together.

Program Success

The SITE program is ultimately successful if there is a positive impact on the needs of the user community. SITE Program successes can be measured as meeting the objectives also set forth in SARA (e.g. demonstrating 10 projects per year). This year the goal of 10 completed field demonstrations was exceeded with 13 completed projects. There were also nine emerging technology projects, and five monitoring and measurement projects completed in FY 94. Out of the 13 completed technology demonstrations, five were technologies from the ETP. Specific information on each program is discussed under the next section entitled, "FY 94 Progress and Accomplishments".

The ETP achievements through September, 1994 include: 1) 53 preproposals received, 2) 8 new technologies selected from the 1993 solicitation, 3) 9 projects completed, 3) 18 EPA journal articles/reports written and, 4) 23 research presentations at the EPA's 5th Forum on Innovative Hazardous Waste Treatment Technologies.

Demonstration Program highlights for FY 94 include 1) 17 new technologies were accepted into the program, 2) 13 demonstrations were completed, and 3) 66 demonstrations are ongoing.

The Measuring and Monitoring program demonstrated five test methodologies for PCP measurement on two sample sites, and three cone penetrometer technologies on three different sites in FY 94.

SITE emphasis on community relations at demonstration sites is shown by the informational meetings preceding the actual demonstrations and by the attendance at the Visitors' Days at each demonstration. Average attendance at a demonstration visitors' days in FY 94 was 62. More than 11,600 people viewed the SITE Community Outreach Booth at conferences, meetings and exhibitions.

The SITE Program is currently involved with partnership activities with other Federal Agencies. In previous years Interagency Agreements have aided funding of ET projects. In FY 94 the Department of Energy (DOE) and the Department of Defense (DOD) have provided sites for three SITE emerging projects and five demonstrations. These include: Rocky Flats, Savannah River, and Oak Ridge for DOE, and Kelly AFB, McClellan AFB, March AFB, North Island NAS, Twin Cities AAP, and Weldon Springs for the DOD.

SITE also participates in the Public/Private Partnership Programs coordinated through OSWER's Technology Innovation Office (TIO) (McClellan AFB, Pinellas Plant, and the Joliet Arsenal). Partnership activities with the State of New York have accounted for three ongoing demonstrations as of September 1994.

The SITE program also partners with private developers for its projects and demonstrations. All of the ET projects enter into cooperative agreements, with cofunding from each developer. In FY 94 those developers entering the Emerging Program average $110,800 per project. In the Demonstration Program, the developer receives no EPA funding, and each developer spends an average

of about $259,000 of its own funds during the course of the demonstration.

An example of program success can also be described by a technology advancing through all the major steps toward commercialization (e.g. research-development-demonstration); High Voltage Environmental Applications (HVEA) is one such example. Two universities involved in collaborative research entered into the Emerging Technology Program. The principals went on to develop their own company, fabricate mobile equipment, and in September 1994 demonstrated the technology at the Savannah River DOE facility. This is an example where SITE helped a technology develop, and with DOE partnership, demonstrated the resultant technique. HVEA has created international as well as domestic interest, having recently taken its equipment to Germany for testing.

Developer Success

Private sector technology developers in the SITE Program have a unique viewpoint of the success of their involvement with the program. Their goals include a fair and comprehensive evaluation of the technology, widespread dissemination of the evaluation information, and commercial opportunities resulting in the use of their technology. The most essential is economic growth. It is essential for a developer to acquire clients, or even the best technology will not be able to stay in existence.

The private sector developers continue to show a high interest in the SITE program and those who experience the program have indicated favorable results. In 1994 ETP developers and DP vendors provided comments and information on which the following was based.

In 1994 60% of ETP participants were pursuing commercialization of their products, 22% had acquired one to three clients, and 9% had more than three clients. Sixty five percent have contacted 30 countries. Seventeen percent of SITE demonstration vendors reported international market achievements, while an additional 20% had inquiries from international markets. These same vendors report 533 contract awards.

Participant companies are enthusiastic about the success that has come to their businesses as a result of their involvement with SITE. *"The Emerging Technology Program has made a considerable difference to the R & D of the electrokinetic soil processing technology."* ElectroKinetics, Inc.

"The Emerging Technology Program has unquestionably made a difference in the research and development efforts toward furthering our technology . . . As a not-for-profit organization, the University would have had no other source of funding to develop this promising concept outside of our participation with ETP." University of Dayton.

"At a time when other federal agencies are striving to become world leaders in the development of environmental technologies they could learn a lot from EPA's SITE and ETP programs. The centralization and extensive information dissemination efforts of the SITE/ETP programs make them leaders in environmental transfer." International Technology Corporation.

As an example to show how participation in SITE can help a technology developer grow, Filter Flow Technology developed an innovative technique to filter radioactive and heavy metals from water. The company was selected to participate in a SITE demonstration at the DOE Rocky Flats site in September 1992. The demonstration provided enough credibility and exposure to propel Filter Flow into the marketplace; it has since won the prime contract at a site in Hanford, WA. From

a single founder in 1992, the company has grown to 15 full- and part-time employees in 1994, and the expectation is to hire 6-7 more in 1995.

User Success

The user of a hazardous waste clean up technology has a different perspective on when the SITE program is successful. The owner of a site, the EPA RPM, the remediation contractor and consultant have a definite need to determine the best solution (cost and performance) in addressing and remediating hazardous waste problems. The more reliable information the user can obtain, the higher level of confidence the user has in the technology. The ultimate goal of the SITE Program is to assist the user community by providing credible information about technologies for selection.

In the nine years of the SITE Program, technologies such as soil vapor extraction, thermal desorption, solidification and stabilization and some methods of bioremediation have advanced from innovative technologies to commercial acceptance. Advanced oxidation, electrokinetics, biodegradation (in-situ/ex-situ), soil washing, in-situ vitrification, dechlorination, solvent extraction, chemical treatment, and air sparging are other technologies moving toward commercialization which the SITE Program has evaluated.

An example of an overall success with a technology developed through the SITE program is Terra-Kleen Response Group. Their experience demonstrates SITE program success (reliable performance and cost data), developer success (clients), and user success in the form of less expensive, more effective hazardous waste clean up.

Terra-Kleen is a solvent extraction process, aimed at removing PCBs from soil. The vendor contacted the Demonstration program in 1991, and after a season of field testing and some resultant redesign, moved to field demonstration in 1994. The technology was demonstrated between May 16 and June 11, 1994, at the North Island Naval Air Station (NAS) in San Diego, CA. The demonstration showed that the solvent extraction was effective in successfully reducing PCB concentrations from 170 ppm to less than 2 ppm.

As a result of the information provided in the demonstration, the U.S. Navy Environmental Leadership Program (NELP) at NAS has reconsidered clean up for three sites contaminated with PCBs. NELP selected the Terra-Kleen system because *"... it meets all the selection criteria, it is new and innovative, it can be completed in a relatively short time period, and it removes and isolates PCBs from the three sites."* The decision also saves about $3.5 million compared to solidification/stabilization, the previous choice.

Since the demonstration, Terra-Kleen has received many other inquiries from states and countries regarding use of their technology. The founder of Terra-Kleen stated in a July 1994 letter to President Clinton, *"These individuals connected with the EPA's SITE program have been of untold assistance in allowing this technology to be demonstrated so that it can now be used in full scale at other sites. Currently, we are removing DDT from soil at the Naval Communication Station, Stockton, saving the Navy considerable cost over incineration destruction of the soil. Again, none of this would have been possible without the ever-present help and assistance of the EPA's SITE program."*

FY 94 PROGRESS AND ACCOMPLISHMENTS

EMERGING TECHNOLOGY PROGRAM

The SITE Emerging Technology Program (ETP) is the EPA's first program to provide an opportunity to cost-share with the private sector, and to research, develop and move a technology forward to field demonstration and commercialization. The process is accomplished through cooperative agreements with each vendor.

This effort to bring government and the private sector together has been the primary direction of the SITE ETP since its inception in 1987. The following describes the accomplishments of the program within the initiatives set forth by the current administration.

Fostering Government and Private Partnerships to Promote Innovative Technologies: Currently, 72 cooperative agreements are in effect between the ETP and the private sector. Eight of these were initiated in FY 94.

Encouraging Collaborative Efforts Among Government Agencies Such as EPA, DOE and DOD: DOE has co-funded 21 ETP technology development projects; DOD has co-funded 8 ETP projects.

Supporting and Encouraging the Development of Innovative Technologies for Commercialization: ETP has completed 42 technology development projects; 16 of these have been invited into the demonstration program while others have ventured directly into the commercial arena, bypassing the demonstration program.

Stimulating the Economic Growth of Small Businesses in the Environmental Field: Approximately 97 percent of developers in the ETP are small businesses.

The ETP includes technologies that are at different levels of development. Developments range from bench-, pilot- and field-levels of research, with over 20 of the 30 ongoing technologies involved in field development. This gives greater assurance that the technologies will be moving into the Demonstration Program and be ready for commercialization.

Seventy-two treatment technologies have been or are being supported by the ETP. The program funds approximately 10 projects per year (depending on funding), and in FY 94 the program received 53 preproposals. From these preproposals 14 developers were invited to submit Cooperative Agreement Applications. Since 1987, the program has received over 3,800 requests for the Request for Preproposals (RFPs) and has received approximately 840 preproposals. In FY 94, 292 requests were received.

In April of 1994, the ETP selected 8 technologies from the 1993 solicitation. These technologies are described in Table 1. Because the program is restricted to a 2-year funding limit, the ETP prefers to accept technologies that show promise of being able to move into the field upon completion. The maximum funding level is $150,000 per year, $300,000 for 2 years and the developer must contribute at least 5 percent of the total project cost. FY 94 entrants contributed on average 37 % of the project cost. Table 2 describes the nine

TABLE1. NEW SITE EMERGING TECHNOLOGY PROJECTS AWARDED IN FY 94

STATE	DEVELOPER	TECHNOLOGY	TREATMENT CATEGORY
IL	Institute of Gas Technology	A Supercritical Extraction/Liquid Phase Oxidation process has been developed to remove and destroy contaminants from soil and sludge. The process uses supercritical fluid extraction and wet-air oxidation steps to treat chlorinated and nonchlorinated PAHs, PCBs, and other organic compounds. Both high and low concentrations of organic contaminants are suitable for this process.	Chemical
MA	ABB Environmental Services	This technology involves in-situ biological treatment of compounds such as tetrachloroethylene and trichlorethylene in saturated soils and aquifers. An advanced anaerobic/aerobic sequential biodegradation is a key element in this process.	Biological
MN	Membran Corp.	A membrane apparatus has been developed to transfer gases into water without bubble formation and VOC emissions. This device will be tested in bioreactors that require the transfer of oxygen, methane, and hydrogen into the water phase to biodegrade petroleum hydrocarbons and chlorinated solvents. Applications for this device also includes in-situ groundwater treatment.	Chemical
NJ	M.L. Energia	The technology uses Reductive Thermal Oxidation and Reductive Photo-Thermal Oxidation to convert chlorinated hydrocarbons into environmentally benign and useful materials such as hydrocarbons, hydrogen chloride, and carbon dioxide. This process is applicable for treating air streams contaminated with chlorinated hydrocarbons.	Chemical
NM	TMA Eberline (Thermo Analytic)	This is a material handling process to automatically separate radioactive material from otherwise clean soil. This process may dramatically reduce the overall amount of material requiring disposal by minimizing the amount of clean soil that is co-mingled with radioactive material.	Materials Handling
OH	IT Corporation	This process removes heavy metals from contaminated soils and sludges by forming a soluble chelate that can be separated, leaving clean soil. The technology is potentially applicable for treating a wide variety of metal-contaminated hazardous wastes.	Chemical
OK	Geo-Microbial Technologies	Anaerobic biotreatment is used to release toxic metals from contaminated soil. This has advantages over aerobic biotreatment which can produce waste streams containing sulfuric acid and soluble heavy metals. This process is applicable for treating soils, sludges, and sediments contaminated with metals, hydrocarbons and organic pollutants.	Biological
TX	University of Houston	This technology uses a concentrated aqueous salt solution to extract lead from contaminated soil. The technology is especially applicable to battery waste sites. However, the project will also evaluate the extraction of other heavy metals.	Chemical

TABLE 2. SITE EMERGING TECHNOLOGY PROJECTS COMPLETED IN FY 94

STATE	DEVELOPER	TECHNOLOGY	TREATMENT CATEGORY
CA	Cognis	The technology, known as TERRAMET soil remediation system, leaches and recovers lead and other metals from soil, dust, sludge or sediment. An aqueous leachant is used to remove most types of lead contamination: metallic lead, soluble ions, and insoluble lead oxides and salts. Results show that greater than 98% lead removal was achieved. This technology has also been evaluated in the SITE Demonstration program.	Chemical
CA	Pulse Sciences Inc.	High energy X-rays are used to destroy organic contaminants while only nontoxic by-products remain. This technology has application to treating groundwater and wastewater contaminated with chlorinated and nonchlorinated organic compounds, and substances that can deplete the ozone layer such as Freon.	Physical
MT	Montana College of Mineral Science	This technology uses a specially designed hydrocyclone to treat mining wastes that contain heavy metals that are a source of ground or surface water contamination. This process is especially applicable to heavy metal sulfides. Currently, investigators are in search of waste sites to demonstrate this technology.	Materials Handling
NJ	ART International	A special combination of organic solvents are used in an innovative chemical process to extract organic pollutants from soil, sediments, and sludges. The technology known as the LEEP process has application for a wide range of contaminants including tar, chlorinated hydrocarbons, PAHs, PCBs, pesticides, and wood preserving compounds. A pilot plant has been constructed and commercialization activities for a full-scale unit are underway.	Chemical
NJ	NJ Institute of Technology	This technology integrates two innovative techniques--pneumatic fracturing of soil and bioremediation to enhance in-situ remediation of soils contaminated with petroleum hydrocarbons and BTEX compounds. The project was successful and a full scale demonstration is anticipated. A two-year field development was completed at a British Petroleum site in Maryland.	Biological
OH	University of Dayton	This air treatment process involves photothermal reactions conducted at moderate temperatures (200 - 500°F) to destroy a wide range of organic compounds including PCBs and chlorinated solvents. The process offers much higher throughput compared to other photo-oxidation processes. In addition there was no formation of dioxins or furans which are a problematic by-product of conventional thermal oxidation processes. A full-scale demonstration is anticipated.	Thermal
TX	Western Product Recovery	The CCBA process converts heavy metals in soils, sediments and sludges to nonleaching ceramic silicate pellets that can be either left on site or used as an aggregate for concrete or other applications. The process can also oxidize organics in the waste stream and the resulting ceramic pellets will be organic free. Efforts are underway to design a transportable production unit.	Solidification/ Stabilization
ONT., CAN	Matrix Photocatalytic	Organic contaminants in air are destroyed by a titanium dioxide photocatalytic reactor. The system can treat a wide range of chlorinated and nonchlorinated VOCs including more resistant compounds such as CCl_4. The developer has been invited into the SITE demonstration program where both air and water waste streams will be evaluated.	Chemical
U. K.	AEA Technology	This is a comprehensive soil separation and washing process that has been developed to remove metals as well as petroleum hydrocarbons, and polynuclear aromatic hydrocarbons. Sediments and sludges may also be amenable to this process. This technology can provide stand alone treatment or be incorporated into a treatment train.	Materials Handling

technologies completed in FY 94. Four of these have been invited into the Demonstration Program. Figure 2 presents the various types of treatment exhibited by completed and ongoing ETP projects.

At the end of the first year, EPA reviews each project to determine whether the progress made warrants funding for the second year. At the completion of each project, the technology's performance is documented in a final report and/or journal article, as well as an Emerging Technology Summary and Bulletin. In FY 94 there were 14 documents published on ETP projects.

Some developers are initiating activity outside of the United States and have international partners, or have established companies in foreign countries. From 1994 information submitted by ETP developers, it appears that 65 percent had participated in dialogues regarding their respective technologies with at least one foreign country. In total, ETP developers have contacted and been in dialogue with 30 countries. The SITE ETP also accepts technologies from foreign countries, and at present seven technologies developed in Canada and the United Kingdom are part of the program. Three projects are ongoing and four have been completed.

Funding from other federal agencies has been extremely beneficial. The Department of Energy (DOE) has cofunded a total of 21 projects at $3 million, and the Department of Defense (DOD) Air Force has cofunded eight projects at $1.2 million. Both Agencies have a high interest in accelerating the development of innovative technologies and moving these technologies to sites that need cleanup. This additional funding has made it possible for the ETP to accept a greater number of technologies in previous years. No outside funding was received in FY 94, though funding is anticipated for FY 95.

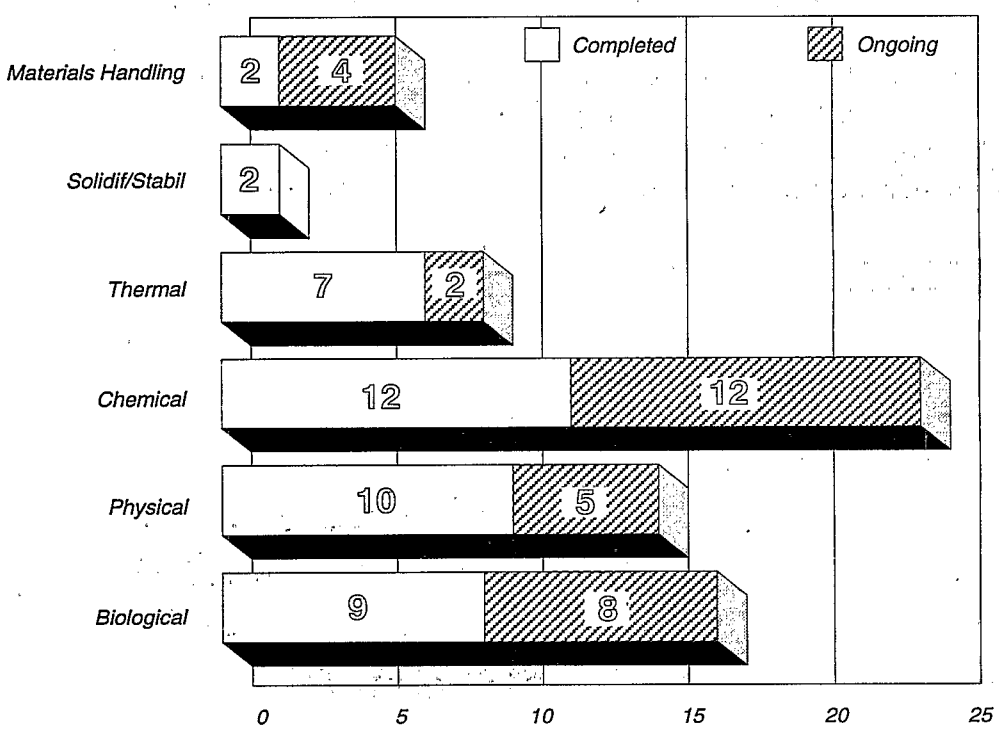

Figure 2. *ETP projects by treatment category.*

The solicitation in 1994 discussed the need for technologies to address the primary interest of EPA Regional Offices and other governmental agencies. These included: technologies for distillation of wastewater; in-situ soil treatment processes that do not generate air emissions; treatment of mixed and low-level radioactive and organic waste in soils and groundwater; groundwater treatment technologies that separate inorganics from organics as part of a treatment train; treatment technologies for munitions other than detonation, explosion, or combustion; chromium and arsenic speciation techniques for soils and sediments; thermal treatment processes, including plasma, molten metal, supercritical water, and steam reforming; non-thermal treatment processes, including wet oxidation, and acid digestion; closed loop treatment systems; chemical, mechanical, and thermal surface cleaning and substrate removal processes; and technologies that will address Dense Non-Aqueous Phase Liquids (DNAPLs) and Non-Aqueous Phase Liquids (NAPLs).

DEMONSTRATION PROGRAM

The SITE Demonstration Program evaluates and verifies the performance and cost of innovative treatment technologies for hazardous waste. The goal of the SITE Program is to encourage the commercial use of innovative treatment technologies that are better, faster or more cost effective than available treatment technologies. Demonstrations are conducted on 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.

The success of the SITE Program can be attributed to its credibility and flexibility. These features have attracted new technology developers and new partnerships. The SITE Program encourages commercialization of new environmental technologies by working cooperatively with private companies, other government agencies, universities, and nonprofit organizations to provide reliable cost and performance data. More and more technology demonstrations are conducted cooperatively with other government agencies including both states and federal agencies (Figure 3). In 1994, the number of entrants sponsored by other government agencies was greater than the number of entrants attracted solely through SITE's open solicitation. Programs such as this serve as models for initiatives such as the Western Governors Association (WGA) and the new Environmental Technology Innovation

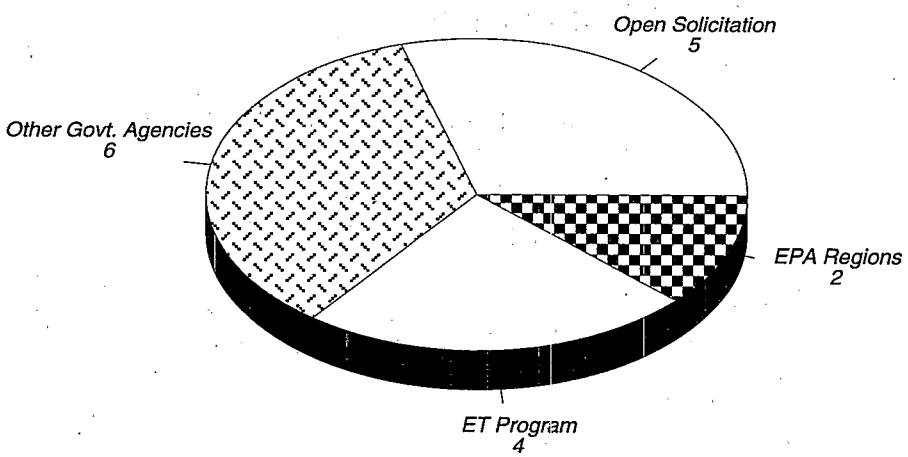

Figure 3. '94 New demonstrations by source.

Commercialization and Enhancement (EnTICE) Program under the Environmental Technology Initiative (ETI).

Once a demonstration site has been established, the SITE Demonstration process typically consists of four steps: (1) preparation of a plan including the test plan, sampling and analysis plan, quality assurance project plan, and health and safety plan; (2) performing community relations activities; (3) conducting the demonstration (ranging from days to months); (4) documenting results in two documents: an Engineering Capsule and an Innovative Technology Evaluation Report.

A cooperative arrangement between EPA and the developer generally sets forth responsibilities for conducting the demonstration. These responsibilities may vary when multiple parties are a part of the cooperative arrangement. Responsibilities for a simple arrangement between the developers and EPA are as follows:

Developer	EPA
Systems operation	Project planning
Equipment transportation	Sampling and analysis
Equipment set-up	Qualitycontrol\quality Assurance
Equipment removal	Waste disposal
Equipment decon-tamination	Report preparation\dissemi-nation

The most important product from a technology demonstration is the credible data collected during the demonstration. The evaluation of the technology and the data provide many technology users with both quantitative and qualitative information on the technology performance, potential need for waste pre- and post-processing, applicable waste and media types, potential operating problems, and approximate capital and operating costs. Technology evaluations can provide insight into long-term operation and maintenance costs and long-term risks.

The Demonstration Program, as of September 30, 1994, included 117 accepted, ongoing, and completed technologies. These technologies are presented alphabetically in Appendix A according to the state in which the developer's business is located.

During FY 94, 13 new innovative technologies were evaluated in the field. More and more technologies are entering the program through public-private partnerships and the ET program, and an increase in the number of technology demonstrations through similar partnerships is expected in FY 95.

The number of technologies evaluated in a particular treatment category vary from year to year. Each year in the annual SITE Demonstration solicitation, technologies of interest and problem areas are listed. For the past several years the material handling and solidification/stabilization areas have not been emphasized. This has been reflected in the completed projects for FY 94 (Figure 4). More emphasis has been placed on the physical/ chemical and biological categories.

The completed demonstrations for FY 94 are summarized in Table 3.

Seventeen new technologies were accepted into the Demonstration Program in FY 94. These technologies were added through SITE's open solicitation (5), nominations by EPA's regional offices and other government agencies (8), and the Emerging Technology program (4). The greatest increase from FY 93 was in the requests from EPA's regional offices and

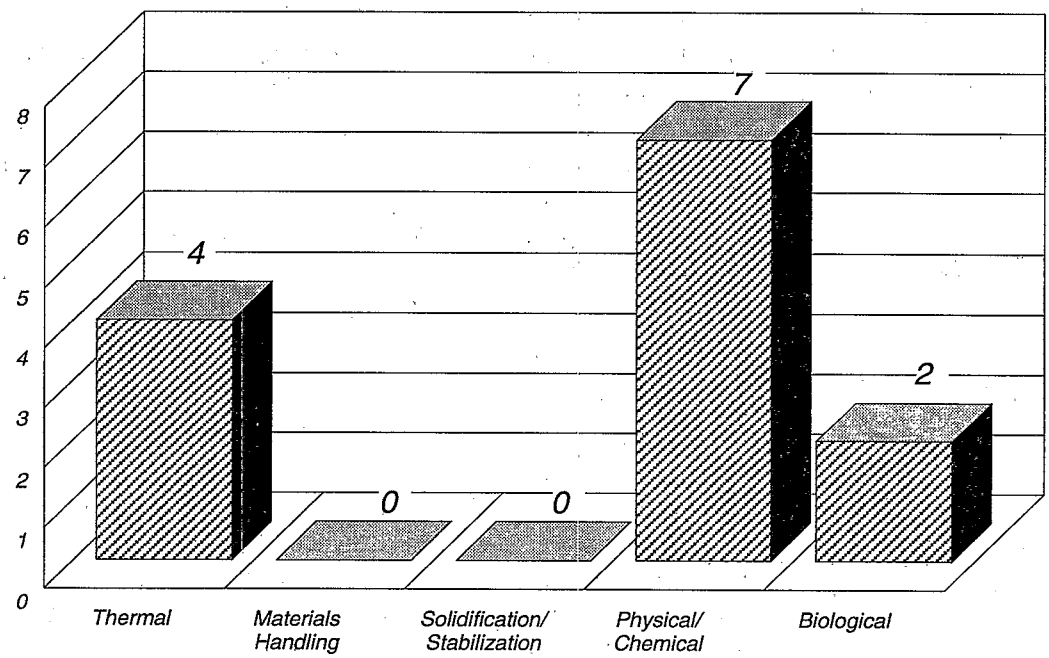

Figure 4. *'94 Completed demonstration projects by technology area.*

other federal agencies. In FY 93, one technology was nominated, whereas in FY 94 the number has increased to eight.

One unique project was added to the list. A partnership was formed between the EPA's SITE Program, EPA's Office of Solid Waste and Emergency Response, The New York Department of Environmental Conservation, The Center for Hazardous Waste Management, and three technology vendors (SBP and Environmental Laboratories, Inc.; R.E. Wright Associates, Inc.; and ENSR Consulting & Engineering and Larson Engineering). This is a unique partnership in that two EPA program offices are cooperating with a state agency in testing and evaluating three different innovative biological treatment technologies at one site. The testing of these three technologies will be complete at the end of FY 95.

New participants are listed and the technologies summarized in Table 4.

MONITORING AND MEASUREMENT TECHNOLOGIES PROGRAM

The SITE Monitoring and Measurement Technologies Program explores new and innovative technologies for assessing the nature and extent of contamination and evaluating achievement of cleanup levels at Superfund sites. Effective measurement and monitoring technologies are needed to accurately assess the degree of contamination at a site, to provide data and information to determine the effects on public health and the environment, to supply

TABLE 3. SITE DEMONSTRATION PROJECTS COMPLETED IN FY 94

STATE	DEVELOPER	TECHNOLOGY	SITE LOCATION	TREATMENT CATEGORY
CA	Cognis, Inc.	The Cognis, TERRAMET soil remediation system leaches and recovers lead and other metals from contaminated soil, dust, sludge or sediment. Appropriate sites include contaminated ammunition testing areas, firing ranges, battery recycling centers, scrap yards, metal plating shops, and chemical manufacturers. The technology was demonstrated at the Twin Cities Army Ammunition Plant.	New Brighton, MN	Physical/ Chemical
CA	North American Tech./ Aprotek	This hydrocarbon recovery technology is based on an oleophilic amine-coated ceramic chip that separates suspended and dissolved hydrocarbons, and some chemical emulsions from aqueous solutions. The technology is effective on gasoline, crude oil, diesel fuel, benzene, toluene, ethylbenzene, xylene compounds as well as polynuclear aromatic hydrocarbons. The unit also removes a variety of chlorinated hydrocarbons.	Fort Lauderdale, FL	Physical/ Chemical
CA	ROCHEM	The ROCHEM Disc Tube Module System uses membrane separation to treat aqueous solutions ranging from wastewater to leachate contaminated with organic solvents. Many types of waste material can be treated with this system, including sanitary and hazardous landfill leachate containing both organic and inorganic chemical species.	Johnston, RI	Physical/ Chemical
CA	Roy F. Weston	The Unterdruck-Verdampfer Brunnen (UVB) vacuum vaporizing well is an in situ system for remediating contaminated aquifers, especially those contaminated with volatile organic compounds. Depending on the circumstances, the UVB system may also remediate semivolatile compounds and heavy metals. The demonstration was conducted at March Air Force Base.	Ontario, CA	Physical/ Chemical
ID	J.R. Simplot	The Simplot Anaerobic Biological Remediation process is designed to treat soils contaminated with nitroaromatic pollutants. The technology was demonstrated on TNT at The Weldon Springs Ordnance Works, an abandoned manufacturing site.	Weldon Springs, MI	Biological
MA	KAI Technology	The radio frequency heating (RFH) is an in situ process that uses electromagnetic energy to heat soil and enhance soil vapor extraction (SVE). The RFH technique has been tested in removing petroleum hydrocarbons and volatile and semivolatile organics from soils. It was demonstrated at Kelly Air Force Base as part of a joint project with the U.S. Air Force Armstrong Laboratory.	San Antonio, TX	Thermal
MA	Maxymillian Tech., Inc.	This technology is a portable thermal desorption system (TDS) that uses rotary kiln technology to remove contaminants from soils. The TDS is designed to remediate soils contaminated with volatile organic compounds (VOCs), semivolatile compounds (SVOCs), and polynuclear aromatic hydrocarbons (PAHs).	Utica, NY	Thermal

TABLE 3. *Site Demonstration Projects Completed in FY 94* continued				
NM	Billings & Associates, Inc.	The SVVS technology uses a network of injection and extraction wells to treat subsurface organic contamination through soil vacuum extraction combined with in situ biodegradation. This system applies to sites with leaks or spills of gasoline, diesel fuels, and other hydrocarbons, including halogenated compounds.	Buchanan, MI	Physical/ Chemical
NY	Texaco Syngas, Inc.	The Texaco entrained-bed gasification process is a noncatalytic, partial oxidation process in which carbonaceous substances react at elevated temperatures and pressures, producing a gas containing primarily carbon monoxide and hydrogen. This gas can be used to produce other chemicals or burned as fuel. The system can treat soils, sludge and sediment contaminated with both organic and inorganic constituents, chemical wastes and petroleum residues.	Fresno, CA	Thermal
OK	Terra Kleen Response Group, Inc.	The solvent extraction treatment system is a waste minimization process designed to remove SVOCs, VOCs, and chlorinated compounds from soils.	San Diego, CA	Physical/ Chemical
VA	Dynaphore Inc.	The Dynaphore FORAGER Sponge is an open-celled cellulose sponge with an amine-containing polymer that has a selective affinity for aqueous heavy metals in both cationic and anionic states. The Sponge can scavenge metals in concentration levels of parts per million and parts per billion from industrial discharges, municipal sewage, process streams and acid mine drainage waters.	Pedricktown NJ	Physical/ Chemical
WA	Geosafe, Corp.	The Geosafe technology is an in situ vitrification system that uses an electric current to melt soil or other earthen materials at high temperatures destroying organic pollutants by pyrolysis. Inorganics are incorporated within the vitrified glass and crystalline mass.	Grand Ledge, MI	Thermal
Canada	Grace Dearborn, Inc,	The organic amendment-enhanced bioremediation technology (DARAMEND) is designed to degrade organic contaminants, including pentachlorophenol (PCP), polynuclear aromatic hydrocarbons (PAH), and petroleum hydrocarbons in industrial soils and sediments. The technology treats batches of soil by incorporating DARAMEND amendments into the soil using conventional agricultural methods.	Ontario, Canada	Biological

TABLE 4. NEW TECHNOLOGIES ACCEPTED INTO SITE DEMONSTRATION PROGRAM IN FY 94

STATE	DEVELOPER	TECHNOLOGY	TREATMENT CATEGORY
CA	SIVE Services	SIVE-LF is an enhanced steam injection and vacuum extraction method designed for in situ treatment of contaminated soil at relatively shallow depths.	Physical/ Chemical
CA	Lockheed Missiles and Space Co.	The Batch Electrokinetic Remediation (BEKR) Process uses ceramic electrodes to move contaminates through soils. Water is circulated through the electrode casings to collect and remove contaminants. The BEKR process is designed to remove both toxic anions and cations from soils, muds, and sludges. Regeneration of the system produces a concentrated contaminant brine which can be further treated or disposed.	Palo Alto, CA
CO	Pintail Systems, Inc.	This technology uses microbial detoxification of cyanide in heap leach processes to reduce cyanide levels in spent ore and process solutions. Two full-scale cyanide detoxification projects have been completed. The demonstration is planned for the Summitville Mine Superfund Site in Colorado.	Biological
ID	Morrison Knudsen, Corp.	The STG clay based grouting technology is an integrated method involving three primary phases: obtaining detailed information about site characteristics; developing a site-specific grout formulation; and placing the grout. The technology was developed by a Ukrainian firm. The technology is being evaluated at an abandon mine in Montana.	Physical/ Chemical
ID	Process Technologies, Inc.	The Photolytic Destruction process photolyses vapor-phase halogens. One key feature of the technology is that there are no moving parts, and its modular design allows for easy scale-up. The technology demonstration began in late September at McClellan Air Force Base in Sacramento, CA on off-gases from an existing soil vapor extraction system.	Physical/ Chemical
CT	SBP and Environmental Laboratories, Inc.	The Vacuum-Vaporized Well (UVB) System consists of a specially adapted groundwater well, a negative pressure stripping reactor, an in situ bioreactor and an aboveground vapor-phase bioreactor. This technology is a part of the jointly sponsored demonstration with the New York State Department of Environmental Conservation and the New York State Center for Hazardous Waste Management.	Biological
LA	Electro-kinetics	The Electro-Klean electrokinetics soil process separates and extracts heavy metals and organic contaminants from soils. This technology may be applied in situ or ex situ, and uses direct currents with electrodes placed on each side of the contaminated mass. Several studies of this technology have been conducted under the Emerging Technology Program.	Physical/ Chemical
NM	Sandia National Laboratories	The Electrokinetic remediation technology is an in situ process designed to treat cadmium in arid soils. The demonstration is planned for mid 1995 in Albuquerque, NM.	Physical/ Chemical
NY	Xerox, Corp.	The two-phase extraction process uses a high-vacuum source applied to an extraction tube within a water well to increase groundwater removal rates and to volatilize and extract that portion of contaminant from the sorbed or free product phases. The demonstration of this process began in August of 1994 at the McClellan Air Force Base in Sacramento, CA.	Physical/ Chemical

TABLE 4. *New Technologies Accepted Into SITE Demonstration Program In FY 94* continued			
Pa	R.E Wright Associates, Inc.	This process uses a bioventing technology where injection and extraction wells allow the developer to regulate oxygen and nutrient levels to stimulate the native bacteria in the soil into biodegrading the contaminants of concern. This technology is a part of the jointly sponsored demonstration with the New York State Department of Environmental Conservation and the New York State Center for Hazardous Waste Management.	Biological
PA	Vortec, Corp.	The Vortec system oxidizes and vitrifies soils, sediments, sludges and mill tailings that have organic, inorganic and heavy metal contamination. This technology has been tested under the Emerging Technology Program. Transportable systems are being developed for DOE soil remediation.	Thermal
TN	RKK, Ltd.	CRYOCELL is a frozen soil barrier that completely contains waste migration to the soil or isolates a contaminated area during an in situ remediation program. Preliminary tests have been conducted at the DOE Oak Ridge National Laboratory. The demonstration is planned for the DOE Hanford facility in Richland, WA.	Physical/ Chemical
TX	EET, Inc.	The TECHXTRACT process employs proprietary chemical formulations in successive steps to remove polychlorinated biphenyls (PCB), toxic hydrocarbons, heavy metals, and radionuclides from the subsurface of porous materials such as concrete, wood, brick and steel.	Physical/ Chemical
TX	ENSR Consulting & Engineering and Larson Engineering	The ENSR process treats volatile organic contaminated soils in biovaults. Nutrients, moisture and oxygen levels may be controlled within the constructed vaults. This technology is a part of the jointly sponsored demonstration with the New York State Department of Environmental Conservation and the New York State Center for Hazardous Waste Management.	Biological
VA	BioGenesis Enterprises, Inc.	The Biogenesis process uses specialized equipment, surfactants and water to clean soil and sediments contaminated with PCBs. A different BioGenesis system was tested under the SITE program in 1992 on hydrocarbons. The PCB sediment washing system will be tested in early 1995 at the Alameda Naval Station in Alameda, CA.	Physical/ Chemical
Canada	Matrix Photo-catalytic, Ltd.	The Photocatalytic oxidation system removes and destroys dissolved organic contaminants from water in a continuous flow process at ambient temperatures. The Matrix system also treated chlorinated compounds such as PCBs. A demonstration is planned at the DOE Oak Ridge National Laboratory.	Physical/ Chemical
Canada	Matrix Photo-catalytic, Ltd.	The Photocatalytic oxidation system removes and destroys organic contaminants from air.	Physical/ Chemical
Canada	TriWaste Reduction Services, Inc.	The TriWaste Reduction system combines a thermal phase separation system with a soil washing treatment system. The system is designed to treat metals and chlorinated organic compounds.	Physical/ Chemical

data to help select the most appropriate remedial action, and to monitor the success or failure of a selected remedy. The objectives of this portion of the SITE Program are:

- to identify existing technologies that can enhance field monitoring and site characterization;
- to support the development of monitoring capabilities that current technologies cannot address in a cost-effective manner; and
- to prepare protocols, guidelines, and standard operating procedures for new methods.

The goal of the SITE Monitoring and Measurement Technologies Program is to accelerate the recognition and use of those technologies that have the potential to provide more cost-effective, better, faster, or safer means to detect and monitor contaminants and the geophysical characteristics of Superfund sites. Candidate technologies may come from within the federal government or from the private sector. Through the program, developers are provided the opportunity for rigorous evaluation of their technology's performance. By distributing the results and recommendations of that evaluation, the market for the technology is enhanced. This Program is administered by ORD's Environmental Monitoring Systems Laboratory in Las Vegas, NV (EMSL-LV).

To the best of our knowledge, this is the only program that exists at the federal, state, or private level for demonstrating the performance of monitoring, measurement, and site characterization technologies under field conditions; reporting on the performance; and communicating the results to the user community. The technologies in this program are listed in Appendix A.

During FY 1994 the MMTP redesigned its report format after the draft reports for the polychlorinatedbiphenyl (PCB) screening technologies were prepared. The most significant improvement was a condensation from hundreds of pages to about 50 pages by removing much of the laboratory quality control (QC) data and by eliminating redundant text. While this created a delay, the reports are now more manageable and easier to read. The reports still contain all the performance data, a description of the technology, and cost information. All the laboratory QC data and other seldom used or referenced data are available as a single volume, available on request. This new report format was also used to present the results of the pentachlorophenol (PCP) and the cone penetrometer-deployed sensor demonstrations.

The PCB and PCP reports were sent out for peer review in the fourth quarter of FY 1994. The PCP demonstration involved five technologies. These were: PENTA RISc (Ensys, Inc.); HNU-Hanby Test Kit (HNU Systems); Envirogard PCP raPID Assay (Ohmicron Corporation). In addition, an abbreviated version of a standard EPA laboratory method for the analysis of PCP was evaluated. The demonstration was conducted at the Koppers Wood Treatment site in Morrisville, NC, along with a demonstration of the Base Catalyzed Decomposition Process (BCD) technology. Additional samples were also collected from the Winonia Post site in Winona, MO. These samples were used to evaluate the impact of different matrices on the performance of the technologies.

The demonstration of the cone penetrometer-deployed sensors was conducted in August 1994 at three sites in the Midwest. The sites were located in Atlantic, IA; Fort Riley, KS; and York, NE. The technologies included the GeoProbe conductivity sensor (GeoProbe Systems, Inc.); the Rapid Optical Screen Tool (ROST, from Unisys Corporation); and the Site Characterization Analysis Penetrometer System (SCAPS) which

currently is being developed through the Department of Defense Tri-Services cone penetrometer-deployed sensor program. The reports from this demonstration will be produced in FY 1995.

TECHNOLOGY TRANSFER ACTIVITIES

In the Technology Transfer Program, technical information on innovative technologies in the Demonstration, Emerging Technology, and Measuring and Monitoring Technologies Programs is disseminated through various activities. These activities increase awareness and promote the commercial use of innovative technologies for assessment and remediation at Superfund sites. The goal of technology transfer activities is to promote communication requiring up-to-date technical information.

SITE Reports Brochures, Publications, and Videos

EPA's Center for Environmental Research Information (CERI) has published the following SITE documents: Program publication outputs through FY 94 totalling 33 Applications Analysis Reports (AARs), 224 Bulletins and numerous of Journal Articles. In FY 94 16,508 Technology Profiles had been distributed as well as 108,698 AARs, 9,456 Technical Evaluation Reports (TERs), 75,932 Demonstration Bulletins, 43,023 Emerging Technology Bulletins, 39,900 Demonstration Project Summaries and 29,219 Emerging Technology Project Summaries (Figure 5).

In total, 322,740 publications for the SITE Program have been distributed to requesters in FY 94, up approximately 14% from FY 1993. The highest percent of requesters were from engineering consulting firms with approximately 44% (Figure 6). Appendix B lists available SITE documents and videotapes.

Community Outreach

The Technology Transfer Program reaches the environmental community through various media, including:

- program-specific regional, state, and industry brochures;
- onsite Visitor's Days and demonstration videotapes;

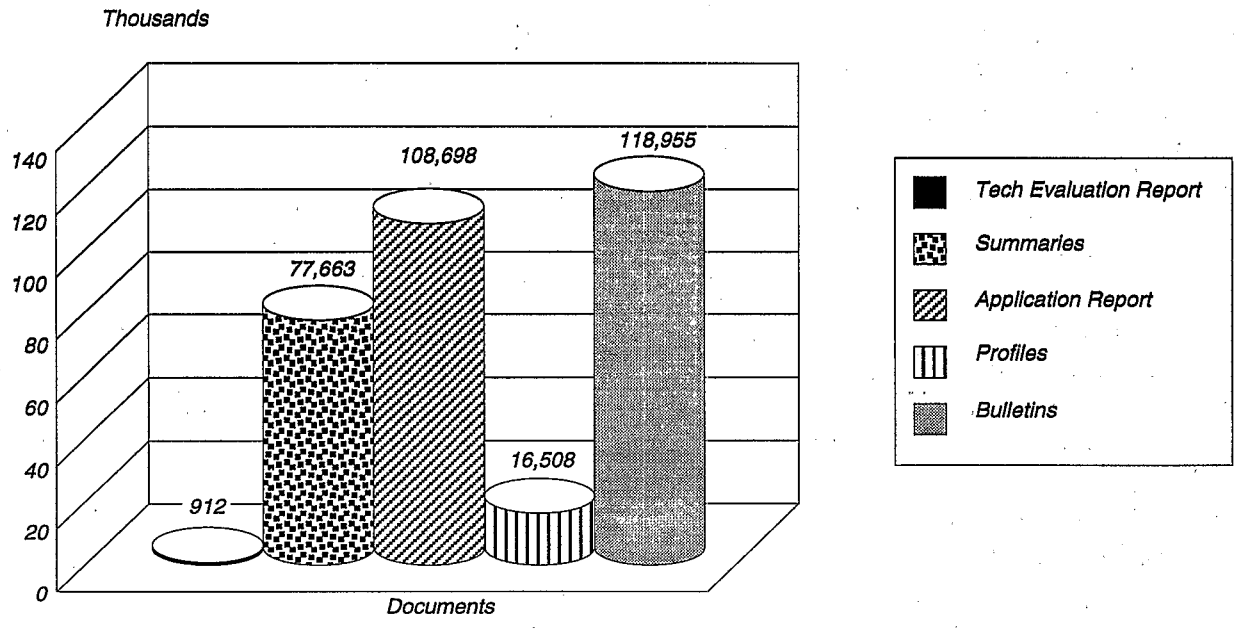

Figure 5. *SITE Documents distributed during FY 94.*

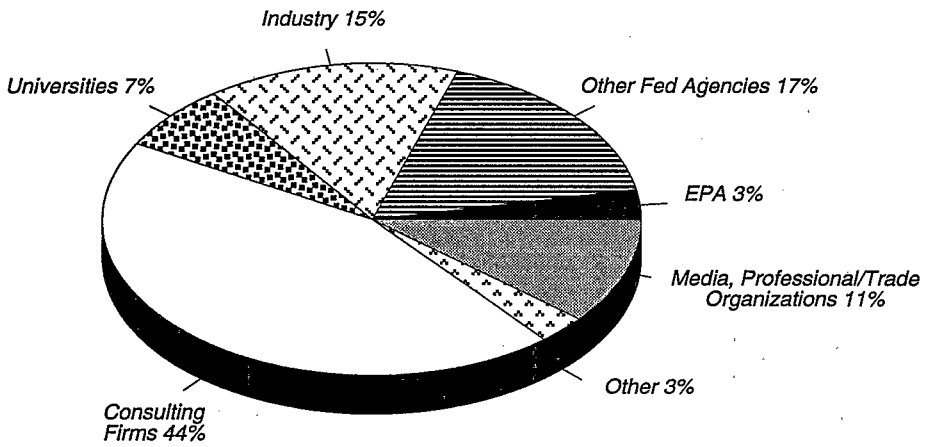

Figure 6. Distributed SITE documents by occupation of requestor.

- project-specific fact sheets, bulletins, Capsules, Application Reports (AARs & ITERs) and project-specific technical data packages;
- the SITE exhibit, displayed nationwide at conferences;
- networking through forums, interagency task forces, associations, regions and states;
- technical assistance to regions, states, and remediation cleanup contractors.

Databases Available

SITE information is also available through the following on-line information clearinghouses:

- The Alternative Treatment Technology Information Center (ATTIC) System (Hotline: 703-908-2137) provides up-to-date information on innovative treatment technologies to clean up hazardous waste sites. It provides access to several independent databases and is a mechanism for retrieving full-text documents of key literature. It can be accessed with a personal computer and modem 24 hours a day, and there are no user fees.

ATTIC provides "one-stop shopping" for information on alternative treatment options. it provides access to:

Treatment Technology Database

This contains abstracts from the literature on all types of treatment technologies, including biological, chemical, physical, and thermal methods. The best literature as viewed by experts is highlighted.

Treatability Study Database

This provides performance information on technologies to remove contaminants from wastewaters and soils. It is derived from treatability studies. This database is available through ATTIC or separately as a disk that can be mailed.

Underground Storage Tank Database

This presents information on underground storage tank corrective actions, surface spills, emergency response, and remedial actions.

Oil/Chemical Spill Database

This provides abstracts on treatment and disposal of spilled oil and chemicals.

ATTIC allows immediate access to other disk-based systems such as the Vendor Information System for Innovative Treatment Technologies (VISITT) and the Bioremediation in the Field Search System (BFSS). Users may download these programs to their own PC via a high-speed modem.

- The Vendor Information System for Innovative Treatment Technologies database (VISITT version 3.0) (Hotline: 800-245-4505) is designed to capture current information on the availability, performance, and cost of innovative technologies to remediate contaminated waste sites. It gives innovative technology companies an opportunity to market their capabilities and enables federal, state and private sector environmental professionals to screen innovative technologies for application to specific sites. The database contains information on 277 technologies offered by 171 developers.
- The OSWER CLU-IN electronic bulletin board facilitates communication on status of SITE technology demonstrations.

Vendor Facts

EPA is currently developing the Vendor Field Analytical and Characterization Technology System. This system will contain information on innovative field methods that may streamline the site assessment process. Vendor FACTS will be a Dos-based, menu-driven database requiring little set-up time and will be available on diskette. This database is being developed jointly by the Technology Innovation Office (TIO) and the National Exposure Research Laboratory (NERL-LV).

Technical reports may be obtained by contacting the Center for Environmental Research Information (CERI), 26 W. Martin Luther King Drive in Cincinnati, OH 45268 at 513-569-7562.

FUTURE TRENDS

The basic functions of the SITE Program, development and demonstration of technologies for hazardous waste site remediation and monitoring, are anticipated to continue into FY 95 and beyond; but the emphasis of the Program and its operation are shifting to meet current market and regulatory needs. Technology development and commercialization, interagency cooperation, regulatory changes, and cleanup needs contribute to define the SITE Program course.

Some technologies in the program have passed the innovative stage and are now accepted as applicable standards. One of these technologies, Terra Vac's soil vapor extraction (SVE), is now considered a standard option for removal of VOCs from the unsaturated zone. As a testimonial to the strength of the market, many other companies have developed and are now marketing SVE technologies, some with enhancements such as hot air injection combined with groundwater extraction. Several of these SVE companies are participants in the SITE Program.

Many thermal desorption systems are also moving into the arena of accepted technology since performance and cost information is becoming easier to obtain. Similarly, the solidification and stabilization systems offered for metal contamination may also be considered available technology in many applications.

PROGRAM STRUCTURE

The ETP provides a firm foundation for collecting data on innovative technologies at bench-, pilot-, and field-scale, and will continue to support innovative technology developers through cooperative agreements for technical and financial assistance.

The future of the ETP will be determined by (1) the availability of funding and (2) the quality and quantity of innovative technologies submitted to the program. Several technologies moved from the ETP to the Demonstration Program this year, and it is anticipated that this trend will grow over the next two to three years.

Both the ETP and the Demonstration Program will continue to solicit cooperative ventures with other federal agencies and states as a means of extending SITE's productivity and influence. Partnership programs in the demonstration Program have grown over the past year, and are expected to become an increasing part of the SITE operation. Work with state and federal Agencies, along with private companies brings technology expertise, funding support, and increased public support to SITE projects.

The MMTP will continue to operate demonstrations with an increased emphasis on conducting concurrent work with SITE's technology demonstrations. In support of the Superfund Program, projects will highlight rapid, field-worthy techniques for real-time data production.

TECHNOLOGY AREAS

For FY 95 and 96, SITE is particularly interested in in-situ technologies for groundwater remediation other than pump and treat. One of the critical needs for remediation technology is for methods to accelerate aquifer cleanup. By nature, groundwater is a slow-moving, slow-to-change medium. Groundwater contamination may consist of multi-phasic contaminant plumes, light non-aqueous phase liquids (LNAPLS), and dense

non-aqueous phase liquids (DNAPLS), which can potentially move in different directions. Other emphasis areas include: treatment technologies for metals in soil and combinations of metals and organics in soil; treatment for mixed, low level radioactive waste in soil and groundwater; in-situ and onsite bioremediation processes for contaminated soil containing compounds that are resistant to biodegradation (e.g. TCE and PCBs); and combined methods for improved delivery and/or recovery along with in-situ remediation operations (e.g. soil fracturing or directional drilling combined with bioremediation, soil flushing, etc.).

Technologies for on-site aqueous treatment, biological degradation of simple hydrocarbons, off-gas treatment, data management systems, thermal destruction processes, and solidification/stabilization techniques are a lower priority for SITE. Specific soil pollutants posing a continuing problem for remediation technologies include lead, arsenic, pentachlorophenol (PCP), polynuclear aromatic (PNA) compounds, creosote, and dioxins and furans. Petrochemical wastes with high levels of volatile organic compounds (VOCs) also are noted to pose significant problems during construction, excavation, and other material handling activities.

Some of the most important technology breakthroughs are anticipated in chemical conversion methodologies. Technologies which rely on chemical conversion of the contaminant species rather than destruction or stabilization will end the remediation process at treatment. Conversion eliminates the need for further environmental engineering, containment, or control of waste products or byproducts (for example, incineration ash, solidified waste material). These technologies are also at the core of in-line, chemical conversion research that could eventually supply solutions for re-engineered processes to reduce waste material generation. The need for recycling and reuse will help drive the development of chemical conversion technologies because of their potential for cost savings and for limiting liability.

TECHNOLOGY TRANSFER

In addition to the standard SITE reports, the program anticipates additional formats tailored to the needs of the partnership projects which will increase in FY 95 and FY 96. These may be published by more than one agency. Work on several documents to summarize technology areas will also be initiated. For instance, a great deal of data now exists about thermal desorption systems. SITE will be in a position to analyze and collect this data into a format which will allow the user community to compare these technologies, along with their costs and applications. These summary documents, departing from the normal project reports, will be available as the Program matures and its data base becomes more complete.

APPENDIX A
ALL SITE PROJECTS, MAY 1994

SITE PROGRAM PARTICIPANTS, September 1994

State	Developer	Technology	Technology Contact	Program	Status
Alabama	CMS Research Corporation Birmingham, AL	Minicams	H. Ashley Page 205-773-6911	Monitoring and Measurement Technologies Program	Completed
Alaska	Brice Environmental Services Corporation (BESCORP), Fairbanks, AK	Soil Washing Plant	Craig Jones 907-452-2512	Demonstration Program	Completed, September 1992
Arizona	Arizona State University Tempe, AZ	Photocatalytic Oxidation and Air Stripping	Gregory Raupp 602-965-2828	Emerging Technology Program	Ongoing
	STC Omega (formerly Silicate Technology Corporation, Scottsdale, AZ	Solidification and Stabilization Treatment Technology	Stephen Pelger or Scott Larsen 602-948-7100	Demonstration Program	Completed, November 1990
	Vulcan Peroxidation Systems, Inc. (formerly Peroxidation Systems, Inc.) Tucson, AZ	perox-pure™ Chemical Oxidation Technology	Chris Giggy 602-790-8383	Demonstration Program	Completed, September 1992
California	Analytical and Remedial Technology, Inc., Menlo Park, CA	Automated Volatile Organic Analytical System	D. MacKay 415-324-2259	Monitoring and Measurement Technologies Program	Completed, May 1991
	APROTEK Suisun, CA	Ion Conduction Agglomeration System	Cathryn Wimberly 916-366-6165	Demonstration Program	Ongoing
	AWD Technologies, Inc., San Francisco, CA	Integrated Vapor Extraction and Steam Vacuum Stripping	David Bluestein 415-227-0822	Demonstration Program	Completed, September 1990
	Berkeley Env. Restoration Ctr. (formerly, Udell Technologies) Emeryville, CA	In Situ Enhanced Extraction	Kent Udell 510-653-9477	Demonstration Program	Completed 1993
	COGNIS, Inc., Santa Rosa, CA	Biological/ Chemical Treatment	Ron Wilson 707-576-6231	Emerging Technology Program	Ongoing
		Chemical Treatment	William Fristad 707-576-6235	Emerging Technology Program Demonstration Program	Completed, 1994 Completed, 1994

State	Developer	Technology	Technology Contact	Program	Status
California	Energy and Environmental Research Corporation, Irvine, CA	Hybrid Fluidized Bed System	Richard Koppang 714-859-8851	Emerging Technology Program	Completed 1992
		Reactor Filter System	Jerald Cole 714-859-8851	Emerging Technology Program	Ongoing
	Environmental Biotechnologies Montara, CA	Microbial Composting	Douglas Munnecke 415-728-8609	Emerging Technology Program	Ongoing
	EPOC Water, Inc., Fresno, CA	Precipitation, Microfiltration, and Sludge Dewatering	Ray Groves 209-291-8144	Demonstration Program	Completed, May 1992
	GIS/Solutions, Inc., Concord, CA	GIS/Key Environmental Data Management Software	Asad Al-Malazi 510-827-5400	Demonstration Program	Completed, August 1993
	Groundwater Technology Government Services, Inc., Concord, CA	Biological Composting	Ronald Hicks 510-671-2387	Emerging Technology Program	Ongoing
	Hughes Environmental Systems, Inc., Manhattan Beach, CA	Steam Enhanced Recovery Process	Ron Van Sickle 310-616-6634	Demonstration Program	Completed, September 1993
	IT Corporation, San Bernardino, CA	Air Sparging Process	Walter Grinyer 909-799-6869	Demonstration Program	Ongoing
	Lockheed Missiles & Space Company, Inc. Palo Alto, CA	Electro-chemical process for contaminated sludges	Steven H. Schwartzkopf 415-424-3176	Demonstration Program	Ongoing
	Magnum Water Technology, El Segundo, CA	CAV-OX® Process	Dale Cox 310-640-7000	Demonstration Program	Completed, March 1993
	Membrane Technology and Research, Inc., Menlo Park, CA	VaporSep Membrane Process	Tessa Annals 415-328-2228	Emerging Technology Program	Completed, 1991
	MTI Analytical Instruments (formerly Microsensor Technology Inc.) Fremont, CA	Portable Gas Chromatograph	Gary Lee 415-490-0900	Monitoring and Measurement Technologies Program	Completed
	North American Technologies, Inc., San Ramon, CA	Ex-situ Bioremediation	Cathryn Wimberly 916-366-6165	Demonstration Program	Ongoing
	North American Technologies, Inc.,/APROTEK San Ramon, CA	Oleofilter	Cathryn Wimberly 916-366-6165	Demonstration Program	Completed, June 1994

State	Developer	Technology	Technology Contact	Program	Status
California	NOVATERRA, Inc. (formerly Toxic Treatments USA, Inc.), Torrance, CA	In Situ Steam and Air Stripping	Philip LaMori 310-328-9433	Demonstration Program	Completed, September 1989
	NRT/General Atomics (formerly, Ogden Environmental Services), San Diego, CA	Circulating Bed Combuster	Jeffrey Broido 619-455-4495	Demonstration Program	Completed, March 1989
		Acoustic Barrier Separator	Robert Goforth 619-455-2499	Emerging Technology Program	Ongoing
	Praxis Environmental Services, San Francisco, CA	In Situ Steam Enhanced Extraction	Lloyd Steward 415-641-9044	Demonstration Program	Ongoing
	Pulse Sciences, Inc., San Leandro, CA	X-Ray Treatment (Aqueous)	Vernon Bailey 510-632-5100	Emerging Technology Program	Completed, 1994
	Purus, Inc., San Jose, CA	Photolytic Oxidation	Paul Blystone 408-955-1000	Emerging Technology Demonstration Program	Completed, 1992 Ongoing
	Retech, Inc., Ukiah, CA	Plasma Arc Vitrification	R.C. Eschenbach or L.B. Leland 707-462-6522	Demonstration Program	Completed, July 1991
	Rochem Separation Systems, Inc., Torrance, CA	Rochem Disc Tube Module System	David LaMonica 310-370-3160	Demonstration Program	Completed, August 1994
	Roy F. Weston, Woodland Hills, CA	Air Sparging Process	John Chicca 818-596-6900	Demonstration Program	Completed, 1994
	S.M.W. Seiko, Inc., Hayward, CA	In Situ Solidification and Stabilization	David Yang 510-783-4105	Demonstration Program	Ongoing
	SRI Instruments, Torrance, CA	Gas Chromatograph	Dave Quinn 310-214-5092	Monitoring and Measurement Technologies Program	Completed, January 1992
	Separation and Recovery Systems, Inc., Irvine, CA	SAREX Chemical Fixation Process	Joseph DeFranco 714-261-8860	Demonstration Program	Ongoing
	SIVE Services Dixon, CA	Steam Injection and Vacuum Extraction	916-678-8358	Demonstration Program	Ongoing
	Titan/Pulse Sciences, San Leandro, CA	X-Ray Treatment (Soils)	Vernon Bailey 510-632-5100	Emerging Technology Program	Ongoing

State	Developer	Technology	Technology Contact	Program	Status
California	Ultrox a Division of Zimpro Environmental, Inc. Santa Ana, CA	Ultraviolet Radiation and Oxidation	David Fletcher 714-545-5557	Demonstration Program	Completed, March 1989
	U.S. EPA Region IX, San Francisco, CA	Excavation and Foam Suppression of Volatiles	John Blevins 415-744-2241	Demonstration Program	Completed, July 1990
	XonTech, Inc., Van Nuys, CA	XonTech Sector Sampler	Matt Young 818-787-7380	Monitoring and Measurement Technologies Program	Completed
Colorado	Colorado School of Mines, Golden, CO Colorado Department of Health, Denver, CO	Wetlands-Based Treatment	Thomas Wildeman 303-273-3642 Rick Brown 303-692-3383	Emerging Technology Program Demonstration Program	Completed 1991 Ongoing
	GEOCHEM, A Division of Terra Vac, Lakewood, CO	In Situ Remediation of Chromium in Groundwater	Jim Rouse 303-988-8902	Demonstration Program	Ongoing
	Hydrologics, Inc., Englewood, CO	Electro-coagulation	Carl Dalrymple 303-761-6960	Demonstration Program	Ongoing
	Pintail Systems, Inc., Aurora, CO	Biodegradation of Cyanide	David Nakles 412-826-3340	Demonstration Program	Ongoing
Connecticut	Dexsil Corporation, Hamden, CT (4 Demonstrations)	Environmental Test Kits (PCB) Clor-N-Soil L2000 PCB/Chloride Analyzer	Steve Finch 203-288-3509	Monitoring and Measurement Technologies Program	Completed, August 1992,1993
	SBP and Environmental Laboratories, Inc.	Bioventing, Air Sparging, Biological Treatment for groundwater (Multi-developer project with state of New York)	Richard Desrosiers 208-789-8261	Demonstration Program	Ongoing
Delaware	E.I. DuPont de Nemours and Co. and Oberlin Filter Co., Newark, DE and Waukesha, WI	Membrane Microfiltration	Ernest Mayer 302-366-3652	Demonstration Program	Completed, April-May 1990
Florida	ASI Environmental Technologies, Inc./ Dames & Moore Tampa, FL	Hydrolytic Terrestrial Dissipation	Stoddard Pickrell 813-626-3811	Demonstration Program	Ongoing

State	Developer	Technology	Technology Contact	Program	Status
Florida	High Voltage Environmental Applications, Inc. with Florida International University and University of Miami, Miami, FL	High-Energy Electron Irradiation (Aqueous)	William Cooper 305-593-5330	Emerging Technology Program Demonstration Program	Completed, 1993 Completed, 1994
	High Voltage Environmental Applications; Inc. Miami, FL	High Energy Electronic Beam (Solids)	William Cooper 305-593-5330	Emerging Technology Program	Ongoing
	PCP, Inc. West Palm Beach, FL	Ion Mobility Spectrometry	Martin Cohen 407-683-0507	Monitoring and Measurement Technologies Program	Completed
Georgia	American Combustion, Inc., Norcross, GA	PYRETRON® Thermal Destruction	Gregory Gitman 404-564-4180	Demonstration Program	Completed, January 1988
	ETG, Inc. Norcross, GA	Long-Path Fourier Transform Infrared Spectrometer	Orman Simpson 404-242-0977	Monitoring and Measurement Technologies Program	Completed, January 1992
	SBP Technologies, Inc., Stone Mountain, GA	Membrane Separation and Bioremediation	David Drahos 404-498-6666	Demonstration Program	Completed, October 1991
	Sonotech, Inc., Atlanta, GA	Frequency Tunable Pulse Combustion System	Zin Plavnik 404-525-8530	Demonstration Program	Ongoing
	Williams Environmental Services, Inc., (formerly Harmon Environmental Services, Inc.), Stone Mountain, GA	Soil Washing	S. Jackson Hubbard (US. EPA) 513-569-7507	Emerging Technology Program	Exited, 1992
Idaho	J.R. Simplot Company, Pocatello, ID (2 demonstrations)	Anaerobic Biological Process	Dane Higdem 208-234-5367	Emerging Technology Program Demonstration Programs 1) Dinoseb 2) TNT	Completed, 1993 Completed, July 1993; Completed, Feb. 1994
	Morrison Knudsen, Corp./STG Technologies Boise, ID	Grouting Technique	Kathryn Levihn R. MacHartley 208-386-6115	Demonstration Program	Ongoing
	Process Technologies, Inc. Boise, ID	Photolytic Destruction of SVE Off-Gases	Michael Swan 208-385-0900	Demonstration Program	Ongoing

State	Developer	Technology	Technology Contact	Program	Status
Illinois	Allied Signal Corporation, Des Plaines, IL	Submerged Fixed Film Reactor	Steve Lupton 708-391-3500	Demonstration Program	Ongoing
	Institute of Gas Technology, Chicago, IL	Chemical and Biological Treatment	Robert Kelley 312-949-3809	Emerging Technology Program	Completed, 1993
		Fluid Extraction-Biological Degradation Process	Albert Paterk 708-768-0500	Emerging Technology Program	Completed, 1992
		Fluidized-Bed Cyclonic Agglomerating Incinerator	Mike Mensinger 708-768-0602	Emerging Technology Program	Ongoing
		Supercritical Extraction/ Liquid Phase Oxidation of Waste		Emerging Technology Program	Ongoing
	RUST Remedial Services, Inc. (formerly Chemical Waste Management) Palos Heights, IL	X*TRAX™ Thermal Desorption	Chetan Trivedi 708-361-7520	Demonstration Program	Completed, May 1992
	Wheelabrator Clean Air Systems (formerly Chemical Wasted Management) Schaumburg, IL	PO*WW*ER Technology	AnnaMarie Connoly 708-706-6900	Demonstration Program	Completed September 1992
Indiana	Bio-Rem, Inc., Butler, IN	Augmented In Situ Subsurface Bioremediation Process	David Mann 219-868-5823	Demonstration Program	Completed, December 1993
	Canonie Environmental Services Corporation, Porter, IN	Low Temperature Thermal Aeration	Joseph Hutton 219-926-8651	Demonstration Program	Completed, September 1992
	Sevenson Environmental Services, Inc. Munster, IN	MAECTITE™ Treatment Process	Karl Yost 219-836-0116	Demonstration Program	Ongoing
	SoilTech ATP Systems, Inc., Porter, IN (2 demonstrations)	Anaerobic Thermal Processor	Joseph Hutton 219-926-8651	Demonstration Program	Completed, May 1991 and June 1992
Kansas	Geoprobe Salina, KS	Soil, Water, Vapor Sampling Cone Penetrometer	Stephen Spradlin 913-825-1842	Monitoring and Measuring Technologies Program	Ongoing

State	Developer	Technology	Technology Contact	Program	Status
Kansas	International Waste Technologies/ Geo-Con, Inc., Wichita, KS (2 demonstrations)	In Situ Solidification and Stabilization	Jeff Newton 316-269-2660 Chris Ryan 412-856-7700	Demonstration Program	Completed, April-May 1988
	Trinity Environmental Technologies, Inc., Mound Valley, KS	Ultrasonically Assisted Detoxification of Hazardous Materials	Duane Koszalka 316-328-3222	Emerging Technology Program	Completed, 1992
Louisiana	Advanced Remediation Mixing, Inc. (formerly Chemfix Technologies), Kenner, LA	Solidification and Stabilization	Sam Pizzitola 504-461-0466	Demonstration Program	Completed, March 1989
	Electrokinetics, Inc., Baton Rouge, LA	Electrokinetic Remediation	Yalcin Acar 504-388-3992	Emerging Technology Program Demonstration Program	Completed, 1993 Ongoing
Maine	Binax Corporation, Antox Division, South Portland, ME	Equate® Immunoassay (PCB)	Roger Piasio 207-772-3544	Monitoring and Measurement Technologies Program	Completed, 1992
Maryland	Microsensor Systems, Inc., Havre de Grace, MD	Portable Gas Chromatograph	N.L. Jarvis 410-939-1089	Monitoring and Measurement Technologies Program	Completed, January 1992
	SCAPS U.S. Army Environmental Center APG, MD	Laser Fluorescence PAH, BTEX, Screening Cone Penetrometer	George Robitaille 401-671-1576	Monitoring and Measurement Technologies Program	Ongoing
Massachusetts	ABB Environmental Services, Inc., Wakefield, MA	Two-Zone Plume Interception In Situ Treatment Strategy	Willard Murray 617-245-6606	Emerging Technology Program	Completed
		Anaerobic/ Aerobic Sequential Bioremediation of PCE.	Willard Murray 617-245-6606	Emerging Technology Program	Ongoing
	Bruker Instruments, Billerica, MA	Bruker Mobile Environmental Monitor	John Wronka 506-667-9580	Monitoring and Measurement Technologies Program	Completed, September 1990
	CF Systems Corporation, Woburn, MA (2 Demonstrations)	Solvent Extraction Batch Organics Extraction Unit	Chris Shallice 617-937-0800 Susan Erickson 617-937-0800	Demonstration Program	Completed, September 1988 Ongoing

State	Developer	Technology	Technology Contact	Program	Status
Massachusetts	Clean Berkshires, (Maxymillian Tech. Inc.) Lanesboro, MA	High Temperature Thermal Processor	Jim Maxymillian 413-499-9862	Demonstration Program	Completed, December 1993
	Energy and Environmental Engineering, Inc., East Cambridge, MA	Laser-Induced Photochemical Oxidative Destruction	James Porter 617-666-5500	Emerging Technology Program	Completed, 1993
	HNU Systems, Inc., Newtown, MA (3 Demonstrations)	Portable Gas Chromatograph	Clayton Wood 617-964-6690	Monitoring and Measurement Technologies Program	Completed, January 1992
		Portable X-ray Fluorescence Spectrometer	John Moore 617-964-6690		Ongoing
		PCP Test Kit	Bob Laliberte 800-726-6690		Ongoing
	Millipore Corporation, Bedford, MA (4 Demonstrations)	EnviroGard™ PCB Immunoassay Test Kit	Alan Weiss 617-275-9200	Monitoring and Measurement Technologies Program	Completed, 1991 and 1992
		Immunoassay for PCP (Soil, Water)			Completed 1993
	Niton Corporation Bedford, MA	Portable X-ray Fluorescence Spectrometer	Shephen Shefsky 617-275-9275	Monitoring and Measurement Technologies Program	Ongoing
	Ohmicron Corporation Newton, MA	Ohmicron PCP RaPID Assay	Dave Hertzog Mary Hayes 215-860-5115	Monitoring and Measurement Technologies Program	Completed 1993
	PSI Technology Company, Andover, MA	Metals Immobilization and Decontamination of Aggregate Solids	Steve Johnson 508-689-3232	Emerging Technology Program	Completed, 1993
Minnesota	BioTrol, Inc., Eden Prairie, MN	Methanotrophic Bioreactor System	Durell Dobbins 612-942-8032	Emerging Technology Program	Completed, 1992
		Biological Aqueous Treatment System	Dennis Chilcote 612-942-8032	Demonstration Program	Completed, July-September 1989
		Soil Washing System	Dennis Chilcote 612-942-8032	Demonstration Program	Completed, September-October 1989

State	Developer	Technology	Technology Contact	Program	Status
Minnesota	Membran Corp. Minneapolis, MN	Membrane Gas Transfer in Waste Remediation	Charles Gantzer 612-378-2160	Emerging Technology Program	Ongoing
	Unisys Eagen, MN	Laser Fluorescence PAH, BTEX Screening Cone Penetrometer	David Bohne 612-456-2339	Monitoring and Measuring Technologies Program	Ongoing
Montana	Montana College of Mineral Science & Technology, Butte, MT	Air-Sparged Hydrocyclone	Theodore Jordan 406-496-4112	Emerging Technology Program	Completed, 1994
		Campbell Centrifugal Jig	Gordon Ziesing 406-494-1473	Emerging Technology Program	Ongoing
Nevada	Powerful Green International, Inc. Las Vegas, NV	Soil washing	Robert Schmidt 702-876-0724	Demonstration Program	Ongoing
	U.S. EPA, Las Vegas, NV	Field Analytical Screening Program (FASP)	Lary Jack 702-798-2373	Monitoring and Measurement Technologies Program	Completed
New Hampshire	Wheelabrator Technologies, Inc. Hampton, NH	Solidification/ Stabilization	Mark Lyons 603-929-3000	Demonstration Program	Ongoing
New Jersey	Accutech Remedial Systems, Inc., Keyport, NJ (2 demonstrations)	Pneumatic Fracturing Extraction and Catalytic Oxidation	Harry Moscatello 908-739-6444	Demonstration Program	Completed, July-August 1992; Ongoing
	ART International, Inc., (formerly Enviro Sciences, Inc.), Denville, NJ	Low-Energy Solvent Extraction Process	Werner Steiner 201-627-7601	Emerging Technology Program	Completed, 1994
	Dehydro-Tech Corporation, East Hanover, NJ	Carver-Greenfield Process® for Extraction of Oily Waste	Thomas Holcombe 201-887-2182	Demonstration Program	Completed, August 1991
	M.L. ENERGIA, Inc., Princeton, NJ	Reductive Photo-Dechlorination Treatment	Moshe Lavid 609-799-7970	Emerging Technology Program	Ongoing
		Reductive Photo-Thermal Oxidation Processes for Chlorocarbons	Moshe Lavid 609-799-7970	Emerging Technology Program	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 Program	Completed, 1994
	New Jersey Institute of Technology, Newark, NJ	GHEA Associates Process	Itzhak Gottlieb 201-596-5862	Emerging Technology Program	Completed, 1992
	Sentex Sensing Technology, Incorporated, Ridgefield, NJ	Portable Gas Chromatograph	Amos Linenberg 201-945-3694	Monitoring and Measurement Technologies Program	Completed, January 1992
New Mexico	BCI California/JWF Associates Bloomfield, NM	Enzyme-catalyzed Accelerated Bioremediation (BioTreat™ Land Treatment)	Jerry Finney 505-632-3383 619-399-1372	Demonstration Program	Ongoing
	Billings and Associates, Inc., Albuquerque, NM	Subsurface Volatilization and Ventilation System	Gale Billings 505-345-1116	Demonstration Program	Completed, May 1994
	Bio-Recovery Systems, Inc., Las Cruces, NM	Biological Sorption	Mike Hosea 505-523-0405 800-697-2001	Emerging Technology Program	Completed, 1990
	Sandia National Laboratories Albuquerque, NM	Electrokinetic Extraction in Unsaturated Soils		Demonstration Program	Ongoing
	TMA Eberline (Thermo Analytic)	Segmented Gate System for Radioactive Materials	Edward Bramlett 505-345-9931	Emerging Technology Program	Ongoing
New York	Andco Environmental Processes, Inc., Amherst, NY	Electrochemical In Situ Chromate Reduction and Heavy Metal Immobilization	Michael Brewster 716-691-2100	Demonstration Program	Ongoing
	Electro-Pure Systems, Inc., Amherst, NY	Alternating Current Electrocoagulation Technology	James LaDue 716-691-2610	Emerging Technology Program	Completed, 1992
	Photovac International, Inc. Deer Park, NY	Photovac 10S PLUS	Mark Collins 516-254-4199	Monitoring and Measurement Technologies Program	Completed, January 1992
	State University of New York at Oswego, Oswego, NY	Photocatalytic Treatment for Sediments	Ronald Scrudato 315-341-3639	Emerging Technology Program	Ongoing
	Texaco Syngas Inc., White Plains, NY	Entrained-Bed Gasification	Richard Zang 914-253-4047	Demonstration Program	Completed, 1994

State	Developer	Technology	Technology Contact	Program	Status
New York	Xerox Corp. Webster, NY	Groundwater Extraction	Ron Hess 716-422-3694	Demonstration Program	Ongoing
North Carolina	Ensys Incorporated, Research Triangle Park, NC	Immunoassay for PCP	Stephen Friedman 914-941-5509	Monitoring and Measurement Technologies Program	Completed, September 1989
	Ensys Incorporated, Morrisville, NC (2 Demonstrations)	Immunoassay for PCP PENTA™ RISC Test Kit	Aisling Scallen 919-941-5509	Monitoring and Measurement Technologies Program	Completed
					Completed
Ohio	Babcock and Wilcox Co., Alliance, OH	Cyclone Furnace	D.K. Haidet 216-821-9110	Emerging Technology Program Demonstration Program	Completed 1992 Completed, November 1991
	Battelle Memorial Institute, Columbus, OH	In Situ Electroacoustic Soil Decontamination	Satya Chauhan 614-424-4812	Emerging Technology Program	Completed
	Ferro Corporation, Independence, OH	Waste Vitrification Through Electric Melting	Tack Whang 216-641-8580	Emerging Technology Program	Completed
	IT Corporation Cincinnati, OH	Chelation/Electro-deposition of Toxic Metals from Soils	Curtis Kellogg 513-782-4700	Emerging Technology Program	Ongoing
	OHM Remediation Services Corporation, Findlay, OH	Oxygen Microbubble In Situ Bioremediation	Douglas Jerger 419-423-3526	Emerging Technology Program	Ongoing
	University of Dayton Research Institute, Dayton, OH	Photothermal Detoxification Unit (PDU)	John Graham 513-229-2846	Emerging Technology Program	Completed, 1994
	U.S. EPA Risk Reduction Engineering Laboratory and ETG Environmental Cincinnati, OH	Base-Catalyzed Dechlorination Process	Yei-Shong Shieh 215-832-0700	Demonstration Program	Completed, August 1993
	U.S. EPA Risk Reduction Engineering Laboratory Cincinnati, OH	Bioventing	Paul McCauley 513-569-7444	Demonstration Program	Ongoing
		Volume Reduction Unit	Richard Griffith 908-321-6629	Demonstration Program	Completed, November 1992

State	Developer	Technology	Technology Contact	Program	Status
Ohio	U.S. EPA Risk Reduction Engineering Laboratory and IT Corporation, Cincinnati, OH	Debris Washing System	Michael Taylor or Majid Dosani 513-782-4700	Demonstration Program	Completed, August 1990
	U.S. EPA Risk Reduction Engineering Laboratory and USDA Forest Products Laboratory, Cincinnati, OH	Fungal Treatment Technology	Richard Lamar 608-231-9469	Demonstration Program	Completed, November 1992
	U.S. EPA Risk Reduction Engineering Laboratory and University of Cincinnati, Cincinnati, OH	Hydraulic Fracturing	Larry Murdoch 513-556-2526	Demonstration Program	Completed, September 1992
Oklahoma	Geo-Microbial Technologies Ochelata, OK	New Technology for Metals Release and Removal from Wastes	Donald Hitzman 918-535-2281	Emerging Technology Program	Ongoing
	Terra-Kleen Corporation, Oklahoma City, OK	Soil Restoration Unit	Alan Cash 405-728-0001	Demonstration Program	Completed, 1994
Oregon	Mebrex, Inc. Bend, OR	Field Portable X-ray Fluorescence (FPXRF)	Jim Pasmore 503-385-6748	Monitoring and Measuring Technologies Program	Ongoing
Pennsylvania	Aluminum Company of America (formerly Alcoa Separations Technology, Inc.), Pittsburgh, PA	Bioscrubber	Paul Liu 412-826-3711	Emerging Technology Program	Completed 1993
	Center for Hazardous Materials Research Pittsburgh, PA	Acid Extraction Treatment System	Stephen Paff 412-826-5320	Emerging Technology Program	Completed 1992
		Lead Smelting			Completed 1993
		Organics Destruction and Metals Stabilization	A. Bruce King 412-826-5320	Emerging Technology Program	Ongoing
	Horsehead Resource Development Co., Inc., Monaca, PA (2 demonstrations)	Flame Reactor	Regis Zagrocki 412-773-2289	Demonstration Program	Completed, March 1991; Ongoing
	Lewis Environmental Services, Inc. Pittsburgh, PA	Soil Leaching Process	Tom Lewis III 412-322-8100	Emerging Technology Program	Ongoing

State	Developer	Technology	Technology Contact	Program	Status
Pennsylvania	Ohmicron Corp. Newtown, PA	Immunoassay for PCP	Dave Hertzog 215-860-5115	Monitoring and Measurement Technologies Program	Completed
	R.E. Wright Middletown, PA	Bioventing, Air Sparging, Biological Treatment for groundwater (Multi-developer project with state of New York)	Richard Cronce 717-944-5501	Demonstration Program	Ongoing
	Remediation Technologies, Inc., (formerly MoTec Inc.), Pittsburgh, PA	Slurry Biodegradation	David Nakles 412-826-3340	Demonstration Program	Ongoing
	Roy F. Weston, Inc., West Chester, PA	Low Temperature Thermal Treatment System	Mike Cosmos 215-430-7423	Demonstration Program	Completed, December 1992
		Steam Regeneration Adsorption System (Ambersorb™)	Russ Turner 215-43-3097	Emerging Technology Program	Ongoing
	Vortec Corporation, Collegeville, PA	Oxidation and Vitrification Process	James Hnat 215-489-2255	Emerging Technology Program Demonstration Program	Completed, 1993 Ongoing
South Carolina	University of South Carolina, Columbia, SC	In Situ Mitigation of Acid Water	Frank Caruccio 803-777-4512	Emerging Technology Program	Ongoing
Tennessee	Bergmann USA, Gallatin, TN	Soil and Sediment Washing Technology	Richard Traver 615-452-5500	Demonstration Program	Completed, May 1992
	IT Corporation, Knoxville, TN	Batch Steam Distillation and Metal Extraction	Ed Alperin 615-690-3211	Emerging Technology Program	Completed, 1992
		Eimco Biolift™ Slurry Reactor	Kandi Brown 615-690-3211	Emerging Technology Program	Ongoing
		Mixed Waste Treatment Process	Ed Alperin 615-690-3211	Emerging Technology Program	Ongoing
		Photolytic and Biological Soil Detoxification	Robert Fox 615-690-3211	Emerging Technology Program	Completed, 1993

State	Developer	Technology	Technology Contact	Program	Status
Tennessee	Illinois Institute of Technology/ Halliburton NUS, Oak Ridge, TN	Radio Frequency Heating	Clifton Blanchard 615-483-9900	Demonstration Program	Completed, August 1993
	KAI/Halliburton NUS, Oak Ridge, TN	Radio Frequency Heating	Clifton Blanchard 615-483-9900	Demonstration Program	Completed, 1994
	WASTECH Inc., Oak Ridge, TN	Solidification and Stabilization	E. Benjamin Peacock 615-483-6515	Demonstration Program	Completed, August 1991
Texas	ASOMA Instruments Austin, TX	Portable X-ray Fluorescence Spectrometer	Phillip Almquist 512-258-6608	Monitoring and Measuring Technologies Program	Ongoing
	EET, Inc. Bellaire, TX	PCB/Metals Extraction from Porous Services	Tim Tarrillion 713-662-0727	Demonstration Program	Ongoing
	ENSR Consulting Engineering and Larson Engineering Houston, TX	Bioventing, Air Sparging, Biological Treatment for groundwater (Multi-developer project with state of New York)	Gil Long (ENSR) 713-520-9900	Demonstration Program	Ongoing
	Filter Flow Technology, Inc., League City, TX	Heavy Metals and Radionuclide Sorption Method	Todd Johnson 713-334-6080	Demonstration Program	Completed, September 1993
	Funderburk and Associates), Fairfield, TX	Dechlorination and Immobilization	Paul DePercin (US. EPA) 513-569-7809	Demonstration Program	Completed, October 1987
	Hrubetz Environmental Services, Inc., Dallas, TX	HRUBOUT® Process	Michael Hrubetz or Barbara Hrubetz 214-363-7833	Demonstration Program	Completed, February 1993
	Soliditech, Inc., Houston, TX	Solidification and Stabilization	Bill Stallworth 713-497-8558	Demonstration Program	Completed, December 1988
	TN Technologies, Inc. Round Rock, TX	Portable X-ray Fluorescence Spectrometer	Margo Meyers 512-388-9200	Monitoring and Measuring Technologies Program	Ongoing

State	Developer	Technology	Technology Contact	Program	Status
Texas	TechTran Environmental, Inc., Houston, TX	Combined Chemical Precipitation, Physical Separation, and Binding Process for Radionuclides and Heavy Metals	E.B. (Ted) Daniels 713-688-2390	Demonstration Program	Ongoing
	University of Houston Houston, TX	Concentrated Salt Extraction of Lead	Dennis Clifford 713-743-4250	Emerging Technology Program	Ongoing
	Western Product Recovery, Group, Inc., Houston, TX	CCBA Physical and Chemical Treatment	Donald Kelly 713-493-9321	Emerging Technology Program	Completed, 1994
Virginia	BioGenesis Enterprises, Inc., (formerly BioVersal USA), Fairfax Station, VA	PCB Sediment Washing	Thomas Rogeux 703-913-9700	Demonstration Program	Ongoing
		BioGenesis™ Soil Washing Process	Charles Wilde 703-250-3442 or Mohsen Amiran 708-827-0024	Demonstration Program	Completed, November 1992
	Dynaphore, Inc. Richmond, VA	Removal of Dissolved Heavy Metals via FORAGER Sponge	Norman Rainer 804-288-7109	Demonstration Program	Completed, April 1994
	RKK Ltd. Arlington, VA	CRYOCELL Freeze Barrier	Christopher Reno 206-653-4844	Demonstration Project	Ongoing
Washington	ECOVA Corporation, Redmond, WA	Bioslurry Reactor	Alan Jones 206-883-1900	Demonstration Program	Completed, September 1991
	Geosafe Corporation, Richland, WA	In Situ Vitrification	James Hansen 509-375-0710	Demonstration Program	Completed, 1994
	Remediation Technologies, Inc., (ReTec) Seattle, WA	Methanotrophic Biofilm Reactor	Hans Stroo 206-624-9349	Emerging Technology Program	Ongoing
	Resources Conservation Co., Bellevue, WA	BEST Solvent Extraction	Lanny Weimer 301-596-6066	Demonstration Program	Completed, July 1992
	University of Washington, Seattle, WA	Adsorptive Filtration	Mark Benjamin 206-543-7645	Emerging Technology Program	Completed, 1992

State	Developer	Technology	Technology Contact	Program	Status
Wisconsin	Allis Mineral Systems, Inc., (formerly Boliden Allis, Inc.), Oak Creek, WI	Pyrokiln Thermal Encapsulation Process	John Lees 414-798-6265 Glenn Heian 414-762-1190	Emerging Technology Program	Completed, 1993
	Scitec Corporation Richland, WA	Field Portable X-ray Fluorescence	Chester Dilday 1-800-466-5323	Monitoring and Measurement Technologies Program	Ongoing
	Zimpro Passavant Environmental Systems, Inc., Rothschild, WI	PACT® Wastewater Treatment System	William Copa 715-359-7211	Demonstration Program	Ongoing
Wyoming	Western Research Institute, Laramie, WY	Contained Recovery of Oily Wastes (CROW™)	Lyle Johnson 307-721-2011	Emerging Technology Program Demonstration Program	Completed, 1991 Ongoing

International Participants

Location	Developer	Technology	Technology Contact	Program	Status
Canada	Atomic Energy of Canada, Limited, Chalk River, ON	Ultrasonic-Acid Leachate Treatment for Mixed Wastes	Shiv Vijayan 613-584-3311 ext. 3220	Emerging Technology Program	Ongoing
		Chemical Treatment and Ultrafiltration	Leo Buckley 613-584-3311	Emerging Technology Program	Completed, 1993
	ConeTech Investigations Vancouver, BC	Resistivity, pH, Seismic, Temperature, Cone Penetrometer	Ward Phillips 604-327-4311	Monitoring and Measuring Technologies Program	Completed
	ELI Eco Logic International, Inc., Rockwood, ON (2 demonstrations)	Thermal Gas Phase Reduction and Thermal Desorption Process	Jim Nash 519-856-9591	Demonstration Program	Completed, December 1992
	EnviroMetal Technologies, Inc.,	Metal Enhanced Abiotic Degradation	John Quayle 514-827-0432	Demonstration Program	Ongoing
	Grace Dearborn, Inc., Mississauga, ON	Daramend™ Process	Alan Seech	Demonstration Program	Completed, 1994

Location	Developer	Technology	Technology Contact	Program	Status
Canada	Matrix Photocatalytic Ltd. (formerly Nutech Environmental), London, ON	TiO_2 Photocatalytic Treatment of Aqueous Waste Streams	Bob Henderson 519-660-8669	Emerging Technology Program Demonstration Program	Completed, 1993 Ongoing
		TIO_2 Photocatalytic Air Treatment	Bob Henderson 519-660-8669	Emerging Technology Program Demonstration Program	Completed 1994 Ongoing
	Toronto Harbor Commission, Toronto, ON	Soil Recycling	Dennis Lang 416-863-2047	Demonstration Program	Completed, April-May 1992
	TriWaste Reduction Services, Inc. Calgary, AB	Thermal Phase Separator and TRACE Soil Washing Unit	Phil Carson 403-234-3229	Demonstration Program	Ongoing
	Wastewater Technology Centre, Burlington, ON	Cross-Flow Pervaporation System	Chris Lipski 416-336-4689	Emerging Technology Program	Completed, 1992
	Zenon Environmental Systems Inc., Burlington, Ontario	Cross-Flow Pervaporation System	Phil Canning 416-639-6320	Demonstration Program	Ongoing
		ZenoGem™ Process	Chris Lipski 416-639-6320	Demonstration Program	Ongoing
United Kingdom	Davy Research and Development, Limited, Cleveland, UK	Chemical Treatment	Graham Wightman 44-642-607108	Emerging Technology Program	Ongoing
	AEA Technology (formerly Warren Spring Laboratory), Stevenage Hertsfordshire, UK	Physical and Chemical Treatment	Peter Wood 44-0235-463040	Emerging Technology Program	Completed, 1994
	Graseby Ionics, Ltd., Waterford Herts, UK	Ion Mobility Spectrometry	John Brokenshire 011-44-923-816166 Martin Cohen 407-683-0507	Measuring and Monitoring Technologies Program	Completed Summer 1990 and Fall 1990
Italy	Gruppo Italimpresse, (developed by Shirco Infrared Systems, Inc.), (Formerly ECOVA) Rome, Italy (2 Demonstrations)	Infrared Thermal Destruction	Gruppo Italimpresse Rome: 011-39-06-8802001 Padova: 011-39-049-773490 (No longer available from U.S. vendors)	Demonstration Program	Completed, August 1987 and November 1987
Puerto Rico	Terra Vac, Inc., San Juan, PR	In Situ Vacuum Extraction	James Malot 809-723-9171	Demonstration Program	Completed, December 1987-April 1988

APPENDIX B
PUBLICATIONS AND VIDEOTAPES

Documents Available from the U.S. EPA Risk Reduction Engineering Laboratory Superfund Technology Demonstration Division[1]

General Publications

- ❑ SITE Program: Annual Report to Congress 1993 (EPA/540/R-94/518)
- ❑ SITE Profiles, Seventh Edition (EPA/540/R-94/526)
- ❑ Survey of Materials Handling Technologies Used at Hazardous Waste Sites (EPA/540/2-91/010)
- ❑ Interim Status Report U.S. and German Bilateral Agreement on Remediation of Hazardous Waste Sites (EPA/540/R-94/500)

Demonstration Project Results

Accutech Pneumatic Fracturing Extraction and Hot Gas Injection, Phase I

- ❑ Technology Evaluation (EPA/540/R-93/509) PB93-216596
- ❑ Technology Demo. Summary (EPA/540/SR-93/509)[3]
- ❑ Demonstration Bulletin (EPA/540/MR-93/509)[3]
- ❑ Applications Analysis (EPA/540/AR-93/509) PB94-117439

American Combustion—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]

Augmented In-Situ Subsurface Bioremediation Process, Bio-Rem, Inc.

- ❑ Demonstration Bulletin (EPA/540/MR-93/527)[3]

AWD Technologies, Inc.—Integrated Vapor Extraction and Steam Vacuum Stripping

- ❑ Applications Analysis (EPA/540/A5-91/002) PB92-218379
- ❑ Demonstration Bulletin (EPA/540/M5-91/002)[3]

Babcock and Wilcox—Cyclone Furnace Vitrification

- ❑ Technology Evaluation Vol. I (EPA/540/R-92/017A) PB92-222215
- ❑ Technology Evaluation Vol. II (EPA/540/R-92/017B) PB92-222223
- ❑ Applications Analysis (EPA/540/AR-92/017) PB93-122315
- ❑ Technology Demo. Summary (EPA/540/SR-92/017)[3]
- ❑ Demonstration Bulletin (EPA/540/MR-92/011)

Bergmann USA—Soil/Sediment Washing System

- ❑ Demonstration Bulletin (EPA/540/MR-92/075)

Bescorp Soil Washing System Battery Enterprises Site—Brice Environmental Services, Inc.

- ❑ Demonstration Bulletin (EPA/540/MR-93/503)

Biogenesis Soil Washing Technology

- ❑ Demonstration Bulletin (EPA/540/MR-93/510)
- ❑ Innovative Technology Evaluation Report (EPA/540/R-93/510)
- ❑ Site Technology Capsule (EPA/540/SR-93/510)[3]

Biotrol—Biotreatment of Groundwater

- ❑ Technology Evaluation (EPA/540/5-91/001) PB92-110048
- ❑ Applications Analysis (EPA/540/A5-91/001)
- ❑ Technology Demo. Summary (EPA/540/S5-91/001)
- ❑ Demonstration Bulletin (EPA/540/M5-91/001)

Biotrol—Soil Washing System

- ❑ Technology Evaluation Vol. I (EPA/540/5-91/003a) PB92-115310

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

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